DOE/EA-1800

FINAL
ENVIRONMENTAL ASSESSMENT

FOR

MONARCH
WARREN COUNTY WIND TURBINE PROJECT

LENOX TOWNSHIP
WARREN COUNTY, ILLINOIS

US 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: Monarch Warren County Wind Turbine Project, Lenox Township, Warren County, Illinois* (DOE/EA-1800)

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ABSTRACT: The U.S. Department of Energy (DOE) has provided Federal funding to the Illinois Department of Commerce and Economic Opportunity (DCEO) under the State Energy Program (SEP). DCEO is seeking to provide $5 million of its SEP funds to Monarch Wind Power (MWP), who would use these funds for the design, permitting, and construction of 12, 1.6-megawatt wind turbines, for a combined generation capacity of 19.2 megawatts.

Before DOE decides whether to authorize DCEO to provide SEP funds to the Monarch Warren County Wind Turbine Project (proposed project), DOE must first complete review under the *National Environmental Policy Act* (NEPA). This EA analyzes the potential environmental impacts of the construction, operation, and decommissioning of the proposed project and the alternative of not implementing this project (the No-Action Alternative).

DOE has authorized DCEO to use a percentage of the Federal funding for preliminary activities, which include the EA preparation and studies. Such activities are associated with the Proposed Action 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.

The proposed project would provide 64,551 megawatt-hours of renewable energy per year that is currently obtained from primarily fossil fuel sources. MWP has selected the General Electric 1.6xle turbine model with a 271-foot rotor diameter and a 328-foot tower height. Overall, the turbine would stand 464 feet at its tallest blade extent. The project would include approximately 2.3 miles of access roads, an electrical substation, and 2.5 miles of underground electrical transmission cables to connect the project to an existing distribution line that intersects the site. The turbines and associated infrastructure would be owned by MWP, and the proposed project

would be located on approximately 600 acres of land leased from Warren County and private landowners in Lenox Township, Warren County, Illinois.

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

ACRONYMS AND ABBREVIATIONS

APE	area of potential effect
BMP	best management practice
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
dBA	Decibel on an A-weighted scale, used to approximate the human ear's response to sound
DCEO	Department of Commerce and Economic Opportunity
DNL	Day-Night Average Sound Level
DOE	U.S. Department of Energy
EA	Environmental Assessment
EcoCAT	Ecological Compliance Assessment Tool
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
GE	General Electric
GHG	greenhouse gas
GPS	global positioning system
IDNR	Illinois Department of Natural Resources
IDOA	Illinois Department of Agriculture
IHPA	Illinois Historic Preservation Agency
IPCB	Illinois Pollution Control Board
MBTA	*Migratory Bird Treaty Act*
MWP	Monarch Wind Power
MWTP	Monarch Warren County Wind Turbine Project
NEPA	*National Environmental Policy Act*
NHPA	*National Historic Preservation Act*
NOA	Notice of Availability
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
OSHA	Occupational Safety and Health Administration
SEP	State Energy Program
SHPO	State Historic Preservation Office(r)
Recovery Act	*American Recovery and Reinvestment Act of 2009*
TCNS	Tribal Consultation Notification System
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 and Related Requirements

The *National Environmental Policy Act* (42 U.S.C. 4321 *et seq*.; NEPA), the Council on Environmental Quality's (CEQ's) NEPA regulations [40 *Code of Federal Regulations* (CFR) Parts 1500 to 1508], and the U.S. Department of Energy (DOE) NEPA implementing procedures (10 CFR Part 1021) require that DOE consider the potential environmental impacts of the proposed wind project before deciding whether to authorize Federal funding for the project. 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 project. 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

Monarch Wind Power (MWP) proposes to construct, operate, and eventually decommission a 12-turbine, 19.2-megawatt wind energy project on approximately 600 acres of land leased in Warren County, Illinois, in collaboration with General Electric (GE) Energy (the turbine supplier) and WPCS International Incorporated (the development and installation contractor). The site is about 4 miles south of Monmouth in west central Illinois along both sides of U.S. Highway 67 (Figure 1-1). The entire 19.2-megawatt facility would be interconnected to an existing Ameren (the local utility) radial 69-kilovolt distribution line that runs along Highway 67 (line #6630) and traverses the site; no new transmission lines would be required. Each wind turbine would have a hub height of approximately 328 feet and a rotor diameter of roughly 271 feet, for a total overall wind turbine height of 464 feet.

The current estimated project cost is approximately $37 million. The Illinois Department of Commerce and Economic Opportunity (DCEO) selected MWP to receive a $5 million grant for this project. This grant would come from Federal funds that Illinois received from the DOE State

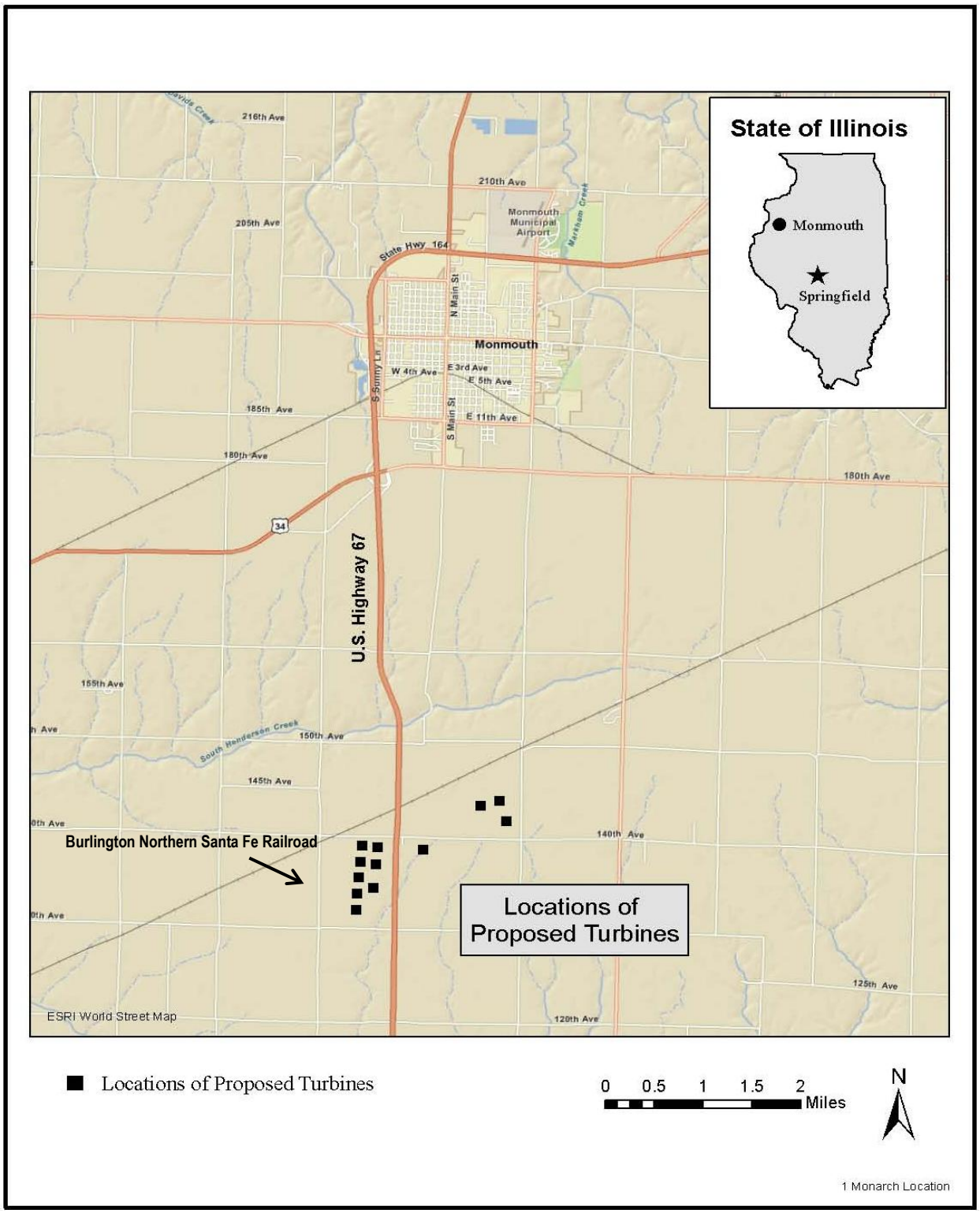

Figure 1-1. Project Location

Energy Program (SEP) under the *American Recovery and Reinvestment Act of 2009* (Pub. L. 111-5, 123 Stat. 115; Recovery Act).

The purpose of the DOE 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 the Recovery Act, Congress appropriated $3.1 billion to the DOE SEP, and the State of Illinois received $101,321,000 pursuant to a Federal statutory formula for distributing these funds.

The State of Illinois selected the Monarch Warren County Wind Turbine Project (MWTP) because it meets SEP criteria for selection by reducing fossil fuel use and deploying renewable energy technologies. The potential use of Federal SEP funds to assist in the financing of this project constitutes a Federal action subject to review under NEPA.

In compliance with NEPA regulations, this EA examines the potential environmental impacts of DOE's Proposed Action (authorizing funding for the design, permitting, and construction of the MWTP) and the No-Action Alternative. This EA also describes options that MWP (sub-recipient) considered during development of its application to the State of Illinois, the recipient of Federal funding under the DOE SEP. This EA will provide DOE with the information needed to make an informed decision about whether allowing the recipient to provide some of its Federal funds for the proposed project may 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 Illinois SEP grant to MWP would partially satisfy the need of the DOE 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 and/or reduce future increases in the generation of 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 the Recovery Act 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 ILLINOIS' PURPOSE AND NEED

Illinois' 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 the Recovery Act to reduce energy costs, reduce reliance on imported energy, and to preserve and create jobs.

1.4 Illinois' SEP Selection Process

The Illinois SEP is using its Recovery Act funding for programs to increase the energy efficiency of businesses and industry while promoting deployment of clean energy projects that will help improve the cost effectiveness and economic stability of businesses and industry in the state. The Illinois DCEO is using its Recovery Act funds for four sub-programs:

- Energy Efficiency Development
- Renewable Energy Development
- Green Manufacturing
- Biofuels Development

Illinois DCEO issued a Request for Proposal for the "Renewable Energy Development" sub-program on August 20, 2009, and used the following criteria for selection: project readiness; matching capabilities, financing, and cost effectiveness; economic impact for Illinois; 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 to Illinois is that funds must be obligated by September 30, 2010, and fully expended by March 31, 2012. The MWTP was one of many renewable energy grant applicants the Illinois DCEO selected for SEP funds in 2009. For this proposed project, DOE is the Federal agency proposing to provide financial assistance, while the Illinois DCEO is the recipient of Federal funding and MWP is the sub-recipient of this funding. The project would be implemented on land leased from private landowners and from Warren County.

1.5 Public and Agency Involvement

1.5.1 DOE PUBLIC SCOPING PROCESS

On September 14, 2010, DOE sent notices of public scoping to stakeholders and interested parties including local, State, and Federal agencies and organizations; tribes; and neighboring landowners to solicit comments on the scope of potential environmental issues to be examined in the EA. The scoping letter described the Proposed Action and requested assistance in identifying potential issues to be evaluated in this EA. DOE published the scoping letter on the DOE Golden Field Office Public Reading Room Website to solicit comments. The notice of public scoping and stakeholder mailing list are included in Appendix E, Attachment E-2. The comment period was originally scheduled to last 15 days and end on September 28, 2010. DOE received a request to extend the comment period, and DOE extended the scoping period until October 8, 2010. In response to the scoping letter, DOE received seven comment letters (Appendix E, Attachment E-3). The comments received are also summarized in Table 1-1.

Table 1-1. Scoping Comments and Responses

Issue Raised in Public Comment	**DOE Response**
Turbine ice buildup and shedding	The turbines that would be used (GE 1.6xle) include sensors that would register the presence of ice; the turbine would not operate until ice has melted. See Section 3.2.2.7.
Prime farmland	An agricultural study conducted by the Illinois Department of Agriculture concluded that the project complies with the Illinois Farmland Preservation Act. See discussion in Section 3.2.2.1.
Surface water/runoff	MWTP structures would not be large enough to substantially alter surface water flows other than on the leased property. A National Pollutant Discharge Elimination System construction permit from the Illinois Environmental Protection Agency would be obtained prior to construction to ensure protection of surface water resources. See discussion under the subheading "Surface Water" in Section 3.2.1.1.
Electromagnetic field (EMF) effects	Available scientific literature does not support concerns regarding EMF effects. The MWTP collection lines would be underground; no new aboveground lines are proposed. See Section 3.2.2.7.
Soil chemistry impacts due to road materials	The road materials that would be used are commonly used in agricultural areas, and effects would be limited to the property being leased for the project.
Soil compaction	Soil would be compacted at location of structures and roads; all other soil compacted during construction would be plowed and returned to original use. See Section 2.2.2.
Aerial application of pesticides	MWP has committed to reimburse certain land owners for any additional cost, not to exceed 50 percent of the standard fee, incurred due to the presence of the wind farm. See Section 3.2.2.1.
Lightning strikes	Appropriate lightning protection would be included on all equipment. See Section 3.2.2.7.
Driver distraction due to wind turbine presence	Available scientific literature did not indicate that vehicular accidents commonly result from the simple presence or operation of turbines near roads.
Rescue helicopter operations	Helicopter landings would be practicable around the periphery of the MWTP, though maybe not within a "cluster" of turbines. Given the relatively small size of the facility, no effect on emergency operations is anticipated.
Blasting	The proposed project does not involve blasting.

Table 1-1. Scoping Comments and Responses (continued)

Issue Raised in Public Comment	**DOE Response**
Acoustics	As a condition to the Special Use Permit, MWP has committed to comply with all applicable Illinois Pollution Control Board regulations. A detailed discussion of potential noise-related impacts is provided in Section 3.2.2.4.
Property values	There is no supporting evidence that the installation of wind turbines negatively impact property values of the wind turbine site or adjacent properties. Property values are discussed in Section 3.2.2.9.
Radio/television interference	While turbines can cause some radio and/or television interference, such interference would not likely be widespread or severe due to the facility's small size. The National Telecommunications and Information Administration indicated no concerns regarding blockage of radio frequency transmissions. This is further discussed in Section 3.2.2.12.
Interference with radar and global positioning systems.	The MWTP is not expected to interfere with any radar or global positioning systems. Potential radar and global positioning system interference is addressed in Section 3.2.2.9.
Shadow flicker	Based on the shadow flicker assessment prepared for this project, shadow flicker is not expected to exceed 22 hours per year for any potential receptor. A detailed discussion of shadow flicker is provided in Section 3.2.2.2.

In addition, DOE contacted the following agencies and organizations regarding the proposed project:

- U.S. Fish and Wildlife Service (USFWS)
- U.S. Department of Commerce – National Telecommunications and Information Administration (NTIA)
- Illinois Historic Preservation Agency (IHPA)
- Illinois Environmental Protection Agency
- The 21 tribal representatives that indicated a geographical preference for Warren County

Other agencies were contacted by MWTP, as discussed in Section 1.5.2.

1.5.2 MWP PUBLIC INVOLVEMENT

Three public hearings were held by local authorities on the MWTP. The first meeting was held at Monmouth Roseville High School (325 W. 1st Avenue Monmouth, Illinois) on May 18, 2010, and was hosted by the Warren County Zoning Board (Chairman Ron Moore). The second meeting was held at the Warren County Courthouse (100 W. Broadway Monmouth) on June 21, 2010, and was, again, hosted by the Warren County Zoning Board. At both of these meetings, members of the public were invited to provide oral comments regarding the project. A third meeting was held at the Warren County Courthouse on June 22, 2010, as a continuance of the

June 21 meeting. On June 22, 2010, members of the public were invited to attend, but public statements on the record were not accepted. At the end of the June 22nd meeting, the County Zoning Board voted to recommend the project to the County Board for approval. On August 5, 2010, the County Board voted to approve the special use permit for the project.

In February 2010, representatives of MWP sent letters providing notice of the proposed project to Federal, State, and local agencies and tribal governments. A public notice inviting the public to comment on any potential effects to historic properties was published in the Monmouth, Illinois *Daily Review Atlas* in the July 31, 2010 edition. One comment was received as a result of the MWP notifications. The comment from the Illinois Environmental Protection Agency stated that it had no objections to the project (Appendix C, Attachment C-7).

MWP or its representatives have contacted the following agencies and organizations:

- USFWS
- Federal Aviation Administration (FAA)
- U.S. Department of Agriculture – Natural Resources Conservation Service
- IHPA
- Illinois Environmental Protection Agency
- Illinois Department of Natural Resources (IDNR), Division of Ecosystems and Environment
- Illinois Department of Transportation, Division of Aeronautics
- Western Illinois Economic Development Partnership
- Warren County Zoning Office

On June 22, 2010, a letter was submitted to 21 tribes that have indicated a geographical preference for the area. To date, the Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas, the Ottawa Tribe of Oklahoma, the Peoria Tribe of Indians, the Shawnee Tribe of Oklahoma, the Iowa Tribe of Kansas and Nebraska and the Winnebago Tribe of Nebraska have stated they have no objections to the proposed project. Responses from the tribes have been included in Appendix E, Attachment E-6.

1.5.3 DRAFT ENVIRONMENTAL ASSESSMENT

A Notice of Availability (NOA) for the Draft EA and public comment procedures for the EA were prepared and sent to Federal, State, tribal, and local agencies, as well as members of the public. The EA and NOA were posted on the DOE Golden Field Office Reading Room Website (http://www.eere.energy.gov/golden/Reading_Room.aspx) and DOE's NEPA Website (http://nepa.energy.gov/draft_environmental_assessments.htm) on February 28, 2011, and was open for public comment for 30 days. Additionally, the NOA was published in the Monmouth, Illinois *Daily Review Atlas* on March 1, 2011.

DOE received eight comment documents from individuals during the 30-day public comment period. This section addresses comments in two groups: those comments that resulted in revisions to the EA and those that did not generate specific changes to the EA, but that warranted discussion.

1.5.3.1 Comments Resulting in Revisions to the EA

Comments that resulted in changes to the EA are summarized below by general topic along with short descriptions of the changes and where in the document they were made.

Project Selection

Comment Summary – Several comments questioned the selection of this project, stating that it did not meet DOE, SEP, or State goals and objectives; would not decrease greenhouse gas emissions; and suggested that the funding could go to more deserving projects or to conventional energy projects.

Response/Revisions – DOE addressed these comments by adding text to Sections 1.3.1, 2.3.2, and 3.2.2.10 to clarify that the proposed project would not result in a net decrease in greenhouse gas emissions, but would at a minimum reduce the rate of increase of such emissions. The State of Illinois was granted SEP funds through a statutory formula grant. States solicit and select projects to receive a portion of their respective SEP funding. The State presents those projects to the DOE for environmental review and NEPA compliance. Pending the outcome of DOE's environmental analysis, States may provide SEP funding to the projects they select, provided the projects are eligible under the SEP Funding Opportunity Announcement and meet the goals of the Recovery Act.

Proposed Action

Comment Summary – One commenter expressed concerns that the cost of decommissioning would be incurred by Warren County because the County would own the turbines. That commenter also expressed concerns that County residents would be required to pay for installation of transmission lines.

Response/Revisions – The County would not own the turbines; rather, some of the turbines would be located on land leased from the County but would remain the property of MWP. DOE addressed this comment by revising text in the Abstract, Section 1.4, and Section 2.2.1 to emphasize that turbines would be owned by the recipient. DOE also added text to Sections 1.2 and 2.2 to explicitly state that no new transmission lines would be required.

Land Use

Comment Summary – One commenter questioned the number of residences in the immediate vicinity of the proposed project, and whether three sections of land in Lenox Township should be considered the "project vicinity."

Response/Revisions – For purposes of NEPA, the area affected by a project varies depending on the resource area being examined (such as air quality, biological resources, and transportation). In this EA, the definition of project vicinity varies by the resource area and is not merely confined to specific sections of Lenox Township. DOE revised text in Section 3.2.2.1 to more clearly characterize the project vicinity and revised the text to correct the number of residences. It should be noted that residences adjacent to each other and collocated on a single property were considered a single residence for the analyses.

Comment Summary – Two commenters expressed concerns regarding the potential that project operations would preclude application of agricultural chemicals on adjacent properties.

Response/Revisions – DOE added text to Section 3.2.2.1, demonstrating that conditions would still exist under which aerial application of agricultural chemicals on adjacent properties could be performed.

Water Resources – Surface Water

Comment Summary – One commenter maintained that offsite impacts to surface water would result from interruption of surface water flow by site features and compaction of soils by construction equipment.

Response/Revisions – DOE added new text to the water resources discussion in Section 3.2.1.1 to clarify the reasons that impacts to surface water flow would be negligible.

Visual Resources

Comment summary – One commenter expressed concerns that the visual simulations did not provide a representation of turbines as they would appear from his residence.

Response/Revisions – No changes were made to the EA itself. One of the visual simulations included two turbines that were photographed approximately the same distance as that between the commenter's residence and the nearest turbine. As a result of reviewing the figure, several minor changes were made to provide a better representation of the turbines as seen from the location at which the photograph was taken.

1.5.3.2 Comments Not Generating EA Changes but Warranting Discussion

Comments warranting a response but which did not otherwise result in changes to the EA are summarized and addressed below by general topic.

General Concerns

Comment summary – One commenter expressed concern that public funds were being inappropriately applied to renewable energy projects and/or that funds should be applied to conventional energy enterprises.

Response – Congress directed DOE to apply the funds to renewable energy projects, and DOE does not have the authority to apply the funds to the nuclear and coal energy sectors. States select projects and submit the selected projects to DOE for consideration.

Comment summary – One commenter expressed concern regarding whether proper procedure was followed during public meetings held by Warren County.

Response – DOE has no authority over State statutes regarding open meetings and/or open records. DOE provided opportunities for public input through the NEPA public scoping process prior to completion of the Draft EA and the public comment process following its issuance.

Noise

Comment summary – One commenter questioned the appropriateness of performing ambient noise measurements during harvest season.

Response – Review of photographs taken at the time of the second noise monitoring study (September 27 to October 2, 2010) indicates that crops had already been harvested. One of the project personnel present at the site confirmed that crops were being harvested on September 23, 2010. Therefore, there would have been no need for tractors to be in operation during the time noise measurements were taken. Initial readings taken in August 2010 were similar to those taken in the detailed noise study performed in September.

Transportation – Road Agreement

Comment Summary – One commenter stated that no Road Agreement had been signed by the Lenox Township Road Commissioner.

Response – MWP executed a Road Agreement with Lenox Township, which was signed by the Lenox Township Road Commissioner on October 18, 2010. Prior to construction, the agreement requires MWP to take pictures of the road and provide the Road Commissioner with an assessment of existing conditions. MWP would repair any roads damaged by the construction or maintenance of the MWTP to their existing conditions, in accordance with the Road Agreement. Transportation impacts are discussed in more detail in Section 3.2.2.8 and the signed Road Agreement is now included in Appendix D, Attachment D-6.

Cultural Resources

Comment summary – One commenter questioned the number of buildings greater than 50 years of age within the 0.75 mile area of potential effect.

Response – The cultural resources survey identified seven buildings more than 50 years of age; however, four of the buildings were determined to be ineligible for the National Register of Historic Places. It is not clear from the comment which buildings the commenter believed may have been omitted.

Socioeconomics – Jobs

Comment Summary – One commenter raised the objection that many of the jobs created by the MWP project would not be located in the project vicinity, but in other areas. Another questioned whether any jobs would be created at all.

Response – The program under which the MWP project would be funded does not mandate the locations for jobs created under the project. Since the project includes acquisition of products that are not manufactured in Warren County, these products would indeed be obtained from other locations. Benefits to the local economy include lease payments to private landowners and Warren County, as well as funding for Monmouth College to conduct biological resources monitoring. Job creation is discussed in Section 3.2.2.9.

Comment Summary – One commenter expressed concern that the project took advantage of farmers.

Response – Both Warren County and the private landowners would be entering into lease agreements with the sub-recipient voluntarily, and would be compensated according to those agreements. Payments to the County would amount to at least $4.35 million over the life of the project, which could benefit all County residents, including farmers.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 DOE's Proposed Action

DOE has provided a grant to the State of Illinois under the DOE SEP. DCEO, which administers the State of Illinois SEP, selected MWP to receive a sub-grant for its MWTP, a proposed 19.2-megawatt wind facility located 4 miles south of Monmouth in Warren County, Illinois. DOE is proposing to authorize the State of Illinois to expend such Federal funding to design, permit, and construct the Monarch Warren County Wind Turbine Project. DOE has already authorized Illinois DCEO to allow MWP to use a percentage of the Federal funding for preliminary activities, including the preparation of this EA and associated analyses. These activities are associated with the Proposed Action 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 Illinois' Proposed Project

The DCEO selected MWP for a $5 million grant based on the following criteria: project readiness; matching capabilities, financing, and cost effectiveness; economic impact for Illinois; project characteristics and potential for innovation; and the project's ability to: (1) provide emission-free energy; and (2) create jobs during the construction of the project. The project would be implemented on land leased from Warren County and private landowners in Warren County, Illinois.

The project would involve the construction, operation, and eventual decommissioning[1] of 12, 1.6-megawatt wind turbines along with 2.5 miles of underground electrical transmission cables and an electrical substation. The substation and surrounding fencing would occupy 1.5 acres. A 16-foot-wide road to each turbine would be constructed, for a total of 4.4 acres of new roads. The 2.5 miles of electrical cables would be installed underground and would connect to an existing 69-kilovot Ameren distribution line that intersects the site on the western side of U.S. Highway 67. No new transmission lines would be needed. Figure 2-1 provides a site plan depicting the turbine locations, access roads, and the substation location.

The project originally included 13 turbines; however, one (Turbine 12) was subsequently eliminated due to technical concerns. The remaining turbines are numbered 1 through 13, with the number 12 omitted to be consistent with FAA review/approval documentation and documents associated with other regulatory compliance processes.

MWP has chosen the GE 1.6xle turbine model for the proposed project. The proposed turbine configuration would include 328-foot towers, and the rotor diameter would be 271 feet, resulting in an overall configuration that would reach approximately 464 feet above the land surface at its tallest extent. The proposed monopole towers would be made of tubular conical steel sections

1. DOE's Proposed Action includes the design, permitting, and construction of the MWTP, whereas the MWP project also includes the operation and decommissioning of the project. While the DOE Proposed Action does not include authorizing Federal funding for operation and decommissioning, this EA analyzed those actions as connected actions.

that are self-supporting without guy wire support. This would eliminate a potential hazard for birds and bats, since they have difficulty locating and maneuvering around guy wires. The proposed turbine design does not involve the use of self-supporting lattice towers, which at other wind projects have been attractive roosting sites for birds, further reducing potential for adverse impacts to birds.

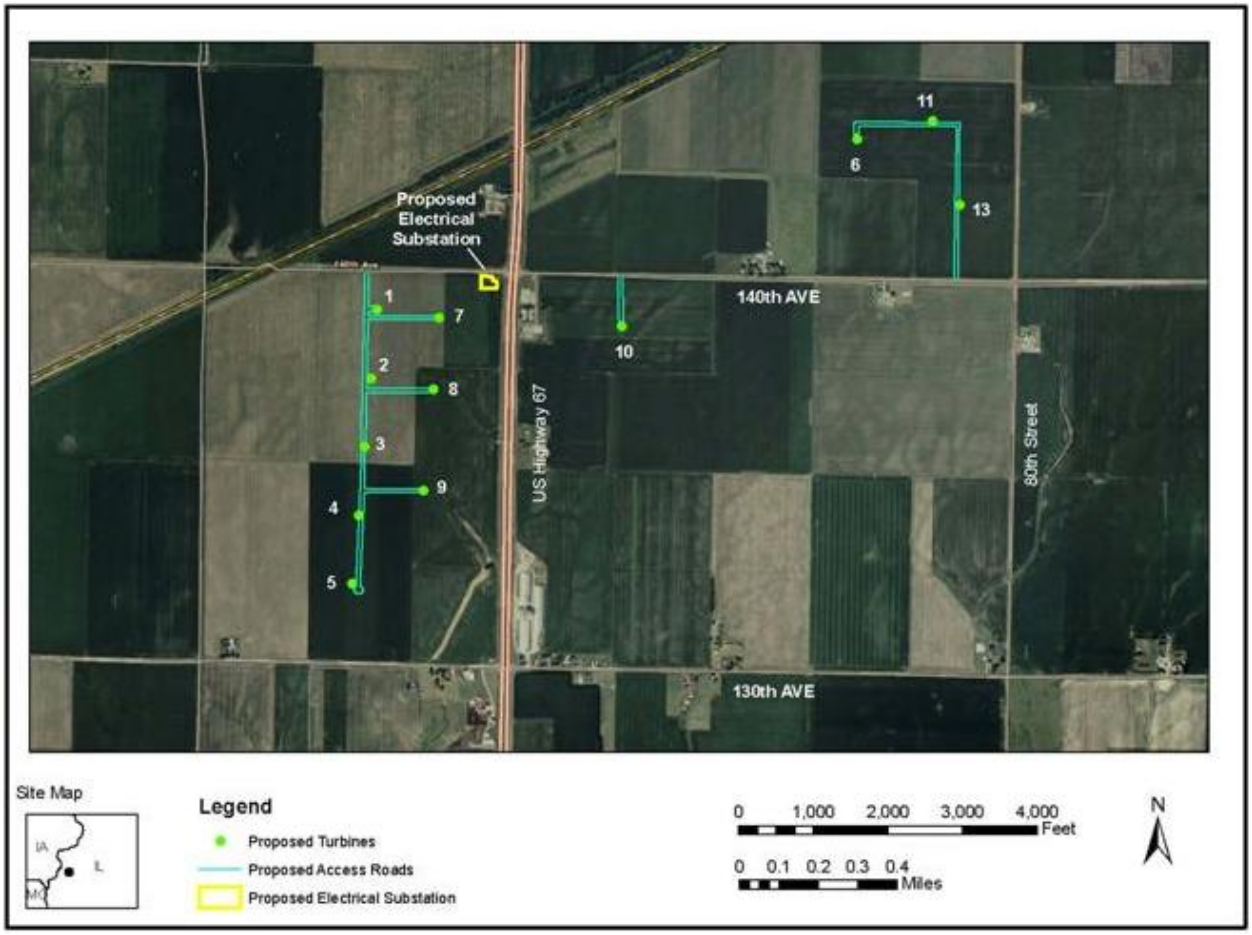

Figure 2-1. Site Plan

Turbine heights are driven by two primary factors that influence efficiency: laminar air flow and higher wind speeds. Laminar air flow occurs when air moves essentially in a uniform, horizontal direction, making it a high-efficiency condition for wind turbines. When turbulence is introduced into the wind environment, both the vertical and horizontal directions of wind may fluctuate rapidly; in such conditions, turbines operate at lower efficiency. Manmade structures and natural features of the landscape create turbulence, and raising the height of the turbine above the land surface decreases the influence of disturbances caused by surface-level obstructions. In addition, mounting the turbine on a tall tower takes advantage of higher wind speeds, which occur at greater heights above the ground. Power generated by a wind turbine increases exponentially with wind speed, and wind speed generally increases substantially as height above land surface increases.

2.2.1 PROJECT LOCATION

The proposed project would be located on 600 acres of land in Sections 20, 29, and 30 of Lenox Township, Warren County, Illinois. The project would be located south and northeast of the intersection of U.S. Highway 67 and 140th Avenue, 4 miles south of Monmouth. The approximate center point of the project area is 40º50′1″ north latitude and 90º39′29″ west longitude. MWP would construct seven turbines on land leased from private landowners and five turbines on Warren County property. All turbines would be owned by MWP. The proposed project area is located within existing agricultural fields (currently planted with row corn and soybeans), and has been extensively disturbed by human activity. The site is bounded on the north by the Burlington Northern Santa Fe Railroad, and is surrounded by agricultural land in every direction. Highway 67, a four-lane highway, intersects the site. Areas of ground disturbance would be limited to a total of 16 acres, including access roads and equipment staging/laydown areas. Once installed, the final ground level footprint of the project, including the turbine foundations, access roads, substation, and associated electrical wiring, would be approximately 7 acres.

2.2.2 CONSTRUCTION AND INSTALLATION

Site construction would include installation of the turbine, tower, tower foundation, transformers, electrical distribution equipment, access roads and road improvements, crane pads, concrete truck/equipment staging areas, and fencing.

The site would be surveyed and a soil boring would be completed at each of the 12 wind turbine locations. MWP would clear and grub the substation area and construct a temporary crane pad, consisting of compacted soil and measuring approximately 50 by 100 feet, approximately 50 to 100 feet from the base of each turbine site. In addition, MWP would construct a 16-foot-wide gravel access road to each turbine site, for a total of approximately 2.5 miles of access roads. Tower foundations, each 55 feet in diameter and 15 feet deep, would be installed. Trenching for electrical lines would occur throughout the property, though surface activities could continue once the lines were in place. MWP would install construction fencing around each turbine site during construction and would remove it after the turbines were installed. Fencing surrounding the electrical substation would remain in place. After the completion of construction activities, MWP would reclaim construction laydown and crane pad areas as appropriate and restore surrounding agricultural fields to their previous condition.

The turbine towers and blades would be transported to the site by tractor-trailers. The turbine nacelle (the housing which contains the generator, heat exchanger, parking brake, drives, shafts, gearbox, and other generating components) would be delivered from Greensboro, North Carolina by tractor-trailers. Access to each turbine site would be via a proposed access drive, to be constructed at the start of the project. The tractor-trailers would continue on these access drives to each proposed turbine site. All other construction vehicles would access the site via U.S. Highway 67 or 140th Avenue. All material staging would be at each turbine site at concrete truck staging areas.

The electrical system of the GE turbines would consist of a full converter system, and power would be sent to the substation where it would be transferred to the distribution line to be

available for use.[2] A unit substation, located outside each turbine base at ground level, would transform the turbine output from 138 kilovolts to 69 kilovolts. A remote communications facility would be necessary at this site for metering and relaying the transfer-trip scheme [if a problem occurred with a transmission line or grid, the transfer-trip scheme would allow the power to be transferred from one transmission line to another or to signal the control system to trip the turbine – as in "trip the breaker" (turn off the turbine)]. Ameren, the local electrical utility, would specify detailed requirements for metering and electrical telemetry. A substation to be located on the southwest corner of 140th Street and U.S. Highway 67 would connect the MWTP to an existing 69-kilovolt distribution line on the western side of Highway 67.

All construction activities are contingent on temperature and weather conditions. Turbine nacelle and blade installation require calm wind conditions. These and similar factors determine the final construction timeline. The turbine installation timeline, including site preparation, tower erection, commissioning, generator installation, and system tie-in and start-up would be scheduled for completion 12 months after initial groundbreaking.

2.2.3 AVIATION MARKING

Aviation marking would be in compliance with the FAA standards (FAA 2007). In accordance with the FAA Determination of No Hazard to Air Navigation (Appendix C, Attachment C-1) for each turbine, synchronized red lights would be used for the eight turbines on the perimeter of the project. Flash intervals of any lighting scheme for these turbines would be synchronized over the entire project. Lighting would not be installed on the remaining four turbines to minimize visual impacts to nearby receptors. Although daytime lighting of wind turbine farms is not required, FAA recommends that turbines be painted with bright white or light off-white paint (FAA 2007). All turbines in the MWTP would be painted in accordance with this requirement.

2.2.4 OPERATIONS AND MAINTENANCE

The GE 1.6xle turbines would be operated year-round, 24 hours a day (except during maintenance), when wind speeds are suitable. The turbines are designed to start operating at a minimum wind speed of 6.7 miles per hour and to shut down when wind speeds exceed 74 miles per hour. MWP would operate and maintain the wind energy project according to operating, maintenance, and safety procedures and requirements specifically recommended by GE. Routine maintenance of the turbine would be needed for maximum performance and identification of potential problems or maintenance issues. Each turbine would be monitored on a daily basis to ensure that they were operating efficiently. This would be accomplished by having an MWP employee trained in wind turbine maintenance visit the site and conduct an auditory and visual inspection of the turbines. In addition, the turbine would be remotely monitored continuously (24 hours per day, 7 days per week) from the GE office in New York. Turbines could be shut down remotely from New York if necessary, and any problems would be reported to MWP operations and maintenance personnel. Most servicing would be performed without a crane, by accessing

2. To prevent island creation, anti-island protection would be required at this site. Island creation occurs when the grid is not receiving electricity and the turbines continue to create energy, creating an "island" of energy between the turbine and the distribution line. To prevent this, the control system at each turbine would contain software to turn off the turbine if the distribution line is not functioning correctly.

the nacelle up-tower, through a ladder located within the tubular tower. A crane would only be required for large-scale repairs, such as a broken blade. Should use of a crane be required, concrete "crane mats" would be transported to the site, placed near the turbine, and removed upon completion of repair activities. All access roads would be regularly inspected and maintained to minimize erosion.

2.2.5 DECOMMISSIONING

Megawatt-scale wind turbine generators typically have a life expectancy of 20 to 25 years. It is in MWP's long-term financial interest to maximize the operational lifespan of the wind turbine generators. MWP would employ a proactive maintenance regime to ensure the turbines were in good repair for at least the full 20 years of expected life. As the turbines approached the anticipated end of life, technological advances would likely make it advantageous to replace the existing turbines with newer models.

Decommissioning would occur at the end of the project life or facility abandonment. For this EA, "facility abandonment" means the ceasing of electricity generation for a period of 12 continuous months or more, unless MWP produced evidence of mitigating circumstances beyond its control (for example, long delays in spare parts procurement, natural disasters, strikes or labor disputes, and war).

The decommissioning and restoration process would include the removal of aboveground structures (turbines, transformers, aboveground electrical collection lines, and the substation); removal of belowground structures (foundations and underground cables); restoration of topsoil; and return to original condition. MWP would be responsible for carrying out the decommissioning and restoration processes consistent with the steps set forth in Sections 2.2.5.1 through 2.2.5.5 of this EA.

2.2.5.1 Aboveground Structures

Wind Turbines

Dismantling the wind turbines would require the use of cranes and heavy equipment. Electronic components, controls, and internal cables would be disconnected and removed. The rotor and nacelle would be lowered to the ground for disassembly. The tower sections would be lowered to the ground where they would be further disassembled for transporting. MWP would attempt to identify a purchaser of the intact wind turbine components. If a buyer could not be found, the rotor, nacelle, and tower sections would be reduced to shipping dimensions for transport to an offsite facility for reconditioning, salvage, recycling, or disposal. If resold and not scrapped, tower sections and rotors would be transported in the same manner as that used for delivery to the site.

Transformers

Transformer removal would consist of disconnecting the electrical connection system from the base transformer. Any sellable components would be removed and transported offsite. Aboveground cables would be removed and the copper conductor materials possibly would be salvaged for scrap value.

Aboveground Electrical Collection Lines

Any aboveground electrical collection lines and associated components would be dismantled and the materials would be disposed of, recycled, or sold. Poles would be removed and holes backfilled with clean topsoil.

Substation

At the end of the project lifespan, the county or MWP may elect to keep the substation for alternative use, in which case the substation would not be decommissioned. However, in the event the entire facility was decommissioned, components and materials would be sold, reused, or recycled to the extent practicable, and remaining solid waste would be transported offsite for disposal.

2.2.5.2 Belowground Structures

Turbine Foundations

Turbine foundations would be excavated to a depth of 36 inches below grade (48 inches in agricultural fields) or to bedrock, whichever is less, to sufficiently expose and remove all anchor bolts, rebar, conduits, and concrete. The excavation would be filled with clean below-grade material, compacted to a density similar to surrounding sub-grade material, and finished with topsoil.

Underground Cables

All underground cables at depths less than 4 feet below finished grade would be removed. All underground cables at depths greater than 4 feet below finished grade would be abandoned in place if MWP determined that their presence does not adversely impact land use and they do not pose a safety hazard.

2.2.5.3 Soil Restoration

Once all of the above- and belowground components designated for disposal or salvage had been removed, the remaining decommissioning work would consist of grading and reseeding disturbed areas. All disturbed areas would be restored to conditions and contours existing at that time.

2.2.5.4 Road Materials

All project-related access roads and town, county, or state roads impacted by project decommissioning activity, if any, would be restored to original condition upon completion of decommissioning.

2.2.5.5 Access

During decommissioning activities, Warren County would have access to the site, pursuant to reasonable notice, to inspect the results of complete decommissioning. All decommissioning and restoration activities would be in accordance with all applicable Federal, State, and local permits and requirements.

A copy of the Decommissioning Plan is included in Appendix D, Attachment D-5.

2.3 Alternatives

2.3.1 DOE ACTION ALTERNATIVE

The State of Illinois' Recovery Act SEP funds intended for this project are from a formula grant – the amount of which is determined pursuant to a formula established in the DOE 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 DOE's Proposed Action (authorizing the expenditure of Federal funding for the design, permitting, and construction of the wind turbine project) and the No-Action Alternative. This EA also describes options that MWP (the sub-recipient) considered during the development of its application to the State of Illinois, which is the recipient of Federal funding under the SEP. This EA provides DOE with the information needed to make an informed decision about whether authorizing the State of Illinois to provide some of its Federal funds for the proposed project may result in significant environmental impacts.

2.3.2 DOE NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would not authorize Illinois to use its SEP funds for the proposed project. For purposes of this EA, DOE assumes that the project would not proceed without Federal 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 operations and energy usage of the nearby community would continue as otherwise planned but without the proposed wind project; therefore, the community would continue to use electricity primarily generated using fossil fuels and the potential reduction in future generation of greenhouse gases would not be realized. The ability of the State of Illinois to use its SEP funds for energy efficiency and renewable energy activities would be impaired, as would its ability to create jobs and invest in the nation's infrastructure in furtherance of the goals of the Recovery Act.

2.3.3 SITING OPTIONS MWP CONSIDERED

For the proposed project, MWP considered the following for site selection:

- Warren County support for the project location;
- Ease of access and adequate room for construction and maintenance;
- Minimizing disturbance to existing site activities;
- Minimizing wind turbulence from surrounding structures, adjacent turbines, and natural vegetation;
- Adequate room for a winter ice clear;
- Absence of residential structures within 1000 feet of any turbine location; and
- Ideal location for wind energy based on topography/absence of surrounding interferences.

No other locations for the wind farm were considered, as the initial proposed location was optimal based on siting criteria. The proposed project area is situated within existing agricultural fields, with minimal to no vegetation taller than 8 feet above ground level. After site restoration, the proposed turbine locations would be compatible with the existing land use, creating only a minimal disturbance to the agricultural use of the properties. Additionally, the proposed turbine locations are situated to minimize interference with each other and are in line with the prevailing winds of the area. A map depicting the proposed turbine locations is included in Figure 2-1.

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 completed permit documentation and approval letters are contained in Appendix C.

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

Agency	Permit Approval/Type
Federal	
FAA	FAA Aeronautical Determination (issued September 9, 2010)
USFWS	Compliance with the *Endangered Species Act*, the *Migratory Bird Treaty Act*, and the *Bald and Golden Eagle Protection Act* (in process)
NTIA	Radio Frequency Transmission Approval (received October 19, 2010)
State	
Illinois Department of Transportation	Utility Access Permit (to be obtained prior to construction)
	Highway Access Permit (to be obtained prior to construction)
IDNR	State Threatened or Endangered Species consultation and natural resource review (letter received March 19, 2010)
Illinois Environmental Protection Agency	NPDES Storm Water Permit (to be obtained prior to construction)
IHPA	Compliance with the National Historic Preservation Act (letter received September 23, 2010)
County/Township	
Lenox Township	Road Agreement (executed October 18, 2010)
Warren County	Conditional Use Permit (approved August 15, 2010)
	Building Permit (received August 15, 2010)

2.5 Project Proponent-Committed Practices

MWP 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 the USFWS and IDNR concerning the project's location and potential impacts on birds, bats, and other wildlife; rare, threatened, and endangered species; and other protected natural features.

MWP would consider 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 a previously developed site, a smooth monopole tower, absence of guy wires in turbine design, choice of lighting equipment and operation procedures, placement of turbines in group configuration, installment of all electrical collection equipment underground, 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.

In compliance with Section 7 of the *Endangered Species Act*, DOE prepared a Biological Assessment to examine potential impacts of the project on the Federally-listed endangered Indiana bat. The U.S. Fish and Wildlife Service issued a Biological Opinion for the MWTP on June 27, 2011. The Biological Opinion contained reasonable and prudent measures (conservation measures) that were agreed to by MWP in order to reduce potential impacts of the proposed project on the Indiana bat. MWP has committed to implement the following measures:

1. The proposed project would implement cut-in speeds of 5.0 m/s.

2. Turbine blades will be feathered at wind speeds below 5.0 m/s.

3. Raised cut-in speeds and blade feathering will be used from 0.5 hours before sunset until 0.5 hours after sunrise during the fall migration period, from August 1 to September 30.

4. Spring fatality monitoring will occur in operation years 1, 2, and 3 using protocols designed in conjunction with the USFWS and as outlined in Biological Opinion for the proposed project (Appendix F, Attachment F-2).

5. Fall fatality monitoring will occur in operation years 1, 2, 3, 8, 13, 18, and 23 using protocols designed in conjunction with the USFWS and as outlined in Biological Opinion for the proposed project (Appendix F, Attachment F-2).

A complete list of the reasonable and prudent measures agreed to by MWP for the MWTP is contained in Appendix F, Attachment F-2.

2.5.2 HUMAN HEALTH AND SAFETY

The construction contractor and MWP would prepare a health and safety plan per Occupational Safety and Health Administration (OSHA) requirements, and all construction would be performed in compliance with this plan and the GE guidelines. Construction facilities would be marked by fencing and “no trespassing” signs. The construction of the proposed wind energy project would comply with all applicable Federal, State, and local requirements.

The proposed turbines would be equipped with lightning receptors in the turbine blades and would be grounded and shielded to protect against lightning. The turbines would have an automated shut-off capability in the event of a fire. MWP would develop a fire protection plan and would meet with all fire departments responsible for providing fire protection to the wind farm prior to beginning construction.

2.5.3 NOISE

All construction activities, with the exception of equipment delivery and tower, nacelle, and blade installation, would occur between the hours of 6 a.m. and 9 p.m. to avoid noise and other disturbances to surrounding areas. If noise becomes a source of complaint, MWP has agreed to mediate complaints regarding turbine noise as a condition of the special use permit. MWP would comply with all applicable Illinois Pollution Control Board (IPCB) regulations.

2.5.4 HISTORIC, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Discussed further in Section 3.2.2.4, historical maps indicate the previous existence of the Warren County Alms House cemetery located on the southwest corner of U.S. Highway 67 and 140th Avenue. This former cemetery was near the location of the proposed electrical substation. The cemetery burials were relocated to the Lenox Union Cemetery in 1991 prior to the widening of Highway 67 to a four-lane divided highway. In response to a request from IHPA, MWP has committed to having an archaeologist present during the clearing, excavation, and construction work performed for the proposed electrical substation to ensure that any human remains (if discovered) are appropriately managed in accordance with the *Human Skeletal Remains Protection Act*.

2.5.5 SOIL

MWP would use best management practices (BMPs) and employ erosion-control techniques required under the National Pollutant Discharge Elimination System (NPDES) permit during construction and operation to protect topsoil and to minimize soil erosion. Construction would be performed in accordance with a soil and erosion control plan (to be developed during detailed engineering design) and in compliance with all other Federal, State, and local requirements. BMPs would include the following: containing excavated material, protecting exposed soil, stabilizing restored material, and revegetating disturbed areas. An NPDES permit would be obtained prior to the initiation of construction activities.

2.5.6 WASTE MANAGEMENT

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

2.5.7 LAND USE

Implementation of the proposed project could result in a reduction, delay, or elimination of aerial application of agricultural chemicals due to applicators charging additional fees, assigning higher priority to crops without wind turbine sites, or refusing to treat crops on and adjacent to wind turbine sites. MWP has committed to reimburse certain land owners who own parcels of land identified by the 18 tax identification numbers listed in the special use permit conditions (Appendix D, Attachment D-3). The reimbursement would be for any additional cost related to the application of agricultural chemicals, not to exceed 50 percent of the standard fee, incurred due to the presence of the wind farm. MWP would also provide a notification form and map of

the turbine locations to the Illinois Agricultural Aviation Association and all aerial spraying companies who have operated in the area in the past five years.

2.5.8 TRANSPORTATION

MWP would repair any roads or other infrastructure damaged by the construction or maintenance of the MWTP, in accordance with the Road Agreement that has been executed with the Lenox Township Road Commissioner.

2.5.9 FLICKER EFFECTS

Based on the shadow flicker assessment prepared for this project, shadow flicker is not expected to exceed 22 hours per year for any potential receptor. However, if shadow flicker exceeds 30 hours per year for any residence whose owner is not a participant in the project, MWP would use commercially, reasonable efforts to remedy the problem on a case-by-case basis by undertaking measures such as planting trees or installing awnings.

3. AFFECTED ENVIRONMENT & ENVIRONMENTAL IMPACTS

This chapter examines in detail the potential environmental impacts of the proposed project and the No-Action Alternative for the affected environmental resources 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 MWTP; therefore, there would not be any impacts to the resource areas analyzed in this EA. For the purposes of this EA, DOE assumes that the project would not proceed without SEP funding. The No-Action Alternative would result in the continued use of fossil fuel energy to meet the electricity demands of the nearby community. Without the proposed project, the nearby community would continue receiving electricity from Ameren Energy. Ameren currently generates or purchases electricity from the following fuel sources (EPA 2005):

- Coal: 83.2 percent (compared with 49.6 percent nationally)
- Nuclear: 11.9 percent (compared with 19.3 nationally)
- Oil: 0.3 (compared with 3.0 nationally)
- Gas: 3.5 percent (compared with 18.8 nationally)
- Hydropower: 1.0 percent (compared with 6.5 nationally)
- Non-Hydropower renewable: 0.1 percent (compared with 2.1 nationally)

If the MWTP was not implemented, the 64,551 megawatt-hours per year that could be provided by the project would continue to be provided by the sources listed above. Carbon dioxide emissions from electricity generation to serve the region would remain at current levels under the No-Action Alternative, and neither the Illinois DCEO nor MWP would meet its objective of providing renewable energy.

The jobs created by construction and operation of the wind turbine would not be realized and the local area would forego the economic benefit associated with these new jobs. Local landowners, including Warren County, would not receive lease payments for the turbine sites.

3.2 Illinois' Proposed Project

3.2.1 CONSIDERATIONS NOT CARRIED FORWARD FOR FURTHER ANALYSIS

Consistent with the CEQ and DOE 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, and therefore these resources are not carried forward for further analysis.

3.2.1.1 Water Resources

MWP requested natural heritage information, including the presence of any State- or Federally designated Wild and Scenic Rivers in the project vicinity from the IDNR Ecological Compliance

Assessment Tool (EcoCAT) system. The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project (Appendix C, Attachment C-3).

Wild and Scenic Rivers

The closest Illinois State-designated scenic river is the Mississippi River, which is in Henderson County (approximately 17 miles west of the proposed project site at its closest point) and the closest national scenic river is the Middle Fork of the Vermilion River, located in Vermilion County, approximately 160 miles from the proposed project site. Based on the distance between the project site and the two water bodies, the proposed project would not impact any State- or Federal-designated wild and scenic rivers.

Groundwater

Surficial materials in Warren County are primarily glacial drift deposits. The upper bedrock surface consists principally of beds of limestone and shale. Surficial deposits are underlain by the Burlington-Keokuk Limestone in much of the west-central part of the County; this formation may be capable of yielding adequate water for domestic and farm use and, in places, small community systems. It is underlain by the New Albany Shale Group, which separates it from deeper water-yielding units. The City of Monmouth obtains its water supply from deeper wells (Woller et al. 1978).

The proposed project would not affect groundwater resources. Excavation activities would be very limited, both in terms of surface area and depth, and operations would not require use of water or discharge of liquid effluents. Any fuel storage vessels kept onsite during construction and/or operations would be held with secondary containment.

Surface Water

In compliance with the *Clean Water Act*, MWP investigated the proposed project site for surface water. The nearest surface water body is South Henderson Creek, located more than 1 mile to the north of the closest turbine. There are no surface water sources such as ponds, wetlands, streams, or drainage channels at or immediately adjacent to the proposed turbine locations. No runoff or discharges from the proposed project construction area would directly enter South Henderson Creek. Since ground-disturbing activity would exceed 1 acre, MWP would obtain an NPDES permit prior to any construction-related earthwork. The construction would be carried out in accordance with an approved soil erosion and sedimentation control plan and the associated NPDES permit, and in compliance with all other applicable requirements, regulations, and sediment and erosion pollution control BMPs. Turbine foundations would be small (approximately 0.05 acre, for a total of 0.95 acre) in comparison with the overall property size. Similarly, the total permanently developed area, approximately 7 acres, represents a *de minimus* percentage (1.2 percent) of the property occupied by the proposed project. Further, each of the turbines would be surrounded by land used for agricultural production, and any runoff from the turbines in their foundations would infiltrate into the adjacent soil. Given the small size of the turbine footprint and the fact that the land is graded flat for agricultural purposes, no effect on surface water flow is anticipated to occur as a result of the proposed project.

3.2.1.2 Waste Management

Solid wastes 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 anticipated to be generated during decommissioning include dismantled equipment and construction-type 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, and disposed of in accordance with all applicable Federal, State, and local regulations. All used oil from the wind turbine would be handled, collected, transferred, and reused/recycled in accordance with applicable Federal, State, and local regulations.

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 this wind energy 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 to human life, heath, or safety. Impacts resulting from intentional destructive acts would be those resulting from the acts themselves, and would not be magnified by any aspect of the proposed project or alternatives.

3.2.2 CONSIDERATIONS CARRIED FORWARD FOR FURTHER ANALYSIS

This section examines the potential environmental impacts of the proposed project for the following resource areas:

- Land Use
- Visual Quality
- Noise
- Historic, Architectural, Archaeological, and 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 within the immediate vicinity of the Burlington Northern Santa Fe Railroad, U.S. Highway 67, and 140th Avenue. In addition, a large-scale grain distribution operation is located at the intersection of Highway 67 and 130th Avenue. Seven residences are located within the immediate vicinity of the proposed project. Each turbine would be located more than 1,500 feet from these residences.

The area of the proposed project is currently used as agricultural fields (row corn and soybeans), and Warren County has zoned the project area and surrounding land for agricultural use. The proposed project area encompasses about 600 acres, but areas of ground disturbance would be limited to approximately 16 acres. Much of this acreage could be reclaimed for agricultural purposes after construction activities, as the area of the wind turbine site, associated access drives, and substation would only occupy a total of approximately 7 acres. The land is considered to be prime farmland, and MWP filed Form AD-1006 (Farmland Conversion Impact Rating) with the Warren County Soil and Water Conservation District. Additionally, the Illinois Department of Agriculture (IDOA) conducted a Study of Agriculture Impacts for the proposed project (Appendix C, Attachment C-4), concluding that the MWTP would be consistent with the DCEO Agricultural Land Preservation Policy and complies with the *Illinois Farmland Preservation Act*.

Aerial application is a common practice used to seed fields, apply fertilizer, and apply chemicals to protect crops from pests and disease (NAAA 2010a). Aerial application is preferred in some situations over ground spray application because aerial application can quickly cover substantial areas without disturbing the soil or crops (NAAA 2010b). Aerial application can be impacted by wind tower and turbine sites in several ways, including increased obstacles to navigate, visual distractions and wake turbulence caused by rotating blades, and unlighted/unpainted meteorological data collection towers.

The Warren County Zoning Board held a public hearing on May 18, 2010, to discuss MWP's Variance and Special Use Exception application to install 13 wind turbines (one of which has subsequently been removed from the project scope due to potential wind interference among the turbines), construct access and maintenance roads, install underground and aboveground electrical cables, and construct one electrical substation on the proposed project site. The Zoning Board voted on June 22, 2010, to recommend the project for final approval to the Warren County Board. On August 5, 2010, the Warren County Board voted to approve the Zoning Board recommendation for a special use permit for the project. A copy of the Warren County Board meeting minutes is included Appendix E, Attachment E-1.

Direct and Indirect Impacts

Implementation of the proposed project would commit a total of approximately 7 acres of previously disturbed agricultural land to wind energy development for the life of the project. This includes foundations, access drives, and the proposed substation. Each of the project's turbine pad sites and access roads have been designed to acquire and convert the least possible amount of agricultural land.

Implementation of the proposed project could result in a reduction, delay, or elimination of aerial application of agricultural chemicals due to applicators charging additional fees, assigning higher priority to crops without wind turbine sites, or refusing to treat crops on and adjacent to wind turbine sites (NAAA 2010c). The principal issue is potential turbulence downwind of the turbines. It should be noted that aerial application is typically performed when wind speeds are between 2 and 10 miles per hour. Spraying at wind speeds above 8 miles per hour may result in substantial drift losses (Sumner 1996). The GE 1.6xle turbines proposed for use by MWP "cut in" or begin operation at 3 meters per second, which is equivalent to approximately 6.7 miles per hour. Aerial application downwind of the turbines could be accomplished within the range of 2

to 6.7 miles per hour, and application upwind of the turbine locations would be unaffected at any otherwise-acceptable wind speed. Ground-based methods would also continue to be available and would not be impacted by the MWP turbines.

Options are available to reduce the impact of wind turbine sites to aerial application and include, but are not limited to, placing towers in linear fashion rather than in clusters, properly marking wind towers and meteorological towers (lights and paint), and providing precise location information to aerial applicators (NAAA 2010b). In addition to implementing the options listed above, MWP has also committed to pay increases in application costs up to 50 percent of the applicator's standard fee.

The overall use of the general area is and would continue as agricultural. The IDOA Agricultural Study concluded that the project is consistent with DCEO Agricultural Land Preservation Policy and complies with the *Illinois Farmland Preservation Act*. Additionally, the IDOA study found that the conversion of agricultural land from the proposed project would result in a potential loss of $9,854 cash receipts from crops and livestock (Appendix C, Attachment C-4).

3.2.2.2 Visual Resources

Visual resources include natural and manmade physical features that provide the landscape its character and value as an environmental resource. The proposed project site is located south and northeast of the intersection of U.S. Highway 67 and 140th Avenue, in Lenox Township, Warren County, Illinois. The proposed turbine locations are shown in Figure 2-1. Highway 67 transverses the project site from north to south. The Burlington Northern Santa Fe Railroad transverses the project area from the southwest to the northeast.

The area consists primarily of relatively flat agricultural land. Agricultural developments, typically consisting of a residence and several agricultural buildings (e.g., sheds, silos), are scattered throughout the area. Aboveground power lines are present along the majority of the roadsides. The most prominent power lines in the vicinity run along U.S. Highway 67. A large commercial grain elevator (approximately 60 feet tall) is situated at the northeast corner of Highway 67 and 130th Avenue. Deciduous trees are present intermittently throughout the area; however, there are no large patches of trees. No other notable vertical structures are present in the area.

The nearest populated areas are the cities of Monmouth (to the north), Kirkwood (to the west-northwest), Smithshire (to the west-southwest), Media (beyond Smithshire to the west-southwest), Roseville (to the south), Cameron (to the northeast), and Berwick (to the southeast). Seven residences are located between 1,500 and 2,000 feet from any proposed turbine. Section 3.3.2.4 describes the historic, architectural, archaeological, and cultural resources near the proposed project.

There are no existing wind farms within the vicinity to the proposed project. The nearest wind farms are located at the Marshall and Stark county line and in Bureau County, approximately 50 to 60 miles to the northwest.

Shadow Flicker

Shadow flicker is defined as alternating changes in light intensity caused by a moving object (such as a spinning rotor blade) casting shadows on another object. Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an annoyance when cast on nearby receptors, such as residences, schools, and hospitals. The spatial relationship between a wind turbine and a receptor; the location of trees, topography, buildings, and other obstacles; and weather characteristics such as wind speed/direction, and cloud cover are key factors related to shadow flicker impacts. The effect is most pronounced when the sun is at a low angle.

The farther an observer is from the wind turbine, the smaller the portion of the sun being blocked and, as a result, the weaker the shadows. Efforts to model shadow flicker are generally limited to an area within about 3,280 feet of the wind turbines and many references set 10 rotor diameters as the distance beyond which shadow flicker is of little concern. The wind turbines MWP selected for the proposed project (the GE 1.6xle) have a rotor diameter of 271 feet; therefore, the impact area of primary concern would lie within about 2,707 feet of the proposed turbines. This distance would put several individual residences in the project area but none of the populated areas listed above within the vicinity of the project.

Shadow flicker may be considered annoying by those exposed. The locations where shadow flicker would occur are dependent on the relative positions of the sun and the wind turbine. Further, impacts depend on the position of observers relative to the line of sight to the sun through the turning rotor. Once a wind turbine location is set, the changing position of the sun by time of day and time of year can be used along with geometric relationships to determine the locations and duration of shadow flicker under ideal conditions for flicker generation. These ideal conditions (or worst-case conditions in terms of impacts) include no cloud cover or fog (that is, the sun is shining), a continuously rotating turbine, and the wind direction relative to the wind turbine directly into or away from the sun. If the wind is blowing at a 90-degree angle to the sun's relative position, for example, the sun would shine on the narrow side or silhouette of the rotor, and no moving shadow would be generated. Software programs have been developed to generate predictions of shadow flicker and can be used to support analyses at various levels of detail. A shadow flicker analysis was conducted for the MWTP (Appendix B, Attachment B-2).

Direct and Indirect Impacts

The proposed project would cause minor, short-term visual impacts resulting from ground disturbance; the presence of workers, vehicles, and equipment; and the generation of dust and vehicle exhaust associated with construction. Areas of ground disturbance would be limited to approximately 16 acres, including access roads and equipment staging/laydown areas. MWP estimates the construction period would last 12 months. Once construction was complete, reclamation of disturbed areas would remove these visual impacts.

In the long term, the proposed project would introduce a strong vertical element into the landscape, as the surrounding area is predominantly level. The construction of 12 wind turbines would introduce structures substantially taller than any currently found within the immediate vicinity into the viewshed.

The proposed wind turbine configuration would include 328-foot towers, a rotor diameter of 271 feet, resulting in an overall height of 464 feet above the land surface at its tallest extent. The perceived dominance of the turbine on the landscape would vary during time of day, time of year, and weather conditions. When the angle of the sun is lower, sunlight striking the turbines would make them more visible. Reactions to the turbine would likely vary. Some people would prefer the setting as it now exists without the turbines. Others may consider the turbines to be points of visual interest on the landscape.

To illustrate the potential visibility of the MWTP, a visual resources analysis was conducted (Appendix B, Attachment B-1). The visual resources analysis includes photo simulations depicting the turbines as they would be seen from several locations. The visual simulations contained within the report illustrate unmasked visibility of the turbines from various locations throughout the area. Locations for the simulations were chosen at major intersections within approximately 1 mile of any turbine and from several residential dwellings within the immediate vicinity. From approximately 2 to 3 miles from the proposed turbines, simulations were created for views that would encompass the entire wind farm in one view from three locations. Visual simulations were also created to simulate the view from populated municipalities within the surrounding area including Monmouth, Kirkwood, Smithshire, Roseville, Berwick, and Cameron. In addition, a simulation was created for the intersection of State Highway 116 and Highway 15, approximately 10 miles from the proposed turbines. As shown by the simulations, the absence of mature trees in the surrounding area would allow views of the wind turbines in excess of 5 miles.

The wind turbines would be lit at night due to required FAA lighting. In accordance with FAA requirements, synchronized red lights would be used for the 8 turbines on the perimeter of the project. Flash intervals of any lighting scheme would be synchronized over the entire project. Lighting would not be installed on the remaining four turbines to minimize visual impacts to nearby receptors.

Shadow Flicker

At certain times during the evening, as the sun sets, there may be a flickering effect of the turning wind turbine blades if viewed from the nearest residences located between 1,500 and 2,000 feet from any turbine. MWP has sited the turbines to reduce the possibility of shadow flicker affecting surrounding inhabited structures. MWP conducted a shadow flicker study using worst-case assumptions that showed minimal or no effects on the seven neighboring residences, all located over 1,500 feet from the nearest turbine. Two of the five houses had zero flicker (that is, shadow flicker would not be possible); the remaining three houses would experience 0 to 22 hours per year of flicker (assuming no cloudy days and unvarying wind conditions that positioned blades in constant juxtaposition to each residence). The blades were modeled as an opaque disk with the blade sweep as the diameter. Although there is no established maximum standard for acceptable levels of exposure to shadow flicker, the Danish Wind Industry Association cites a court case in which the judge determined that 30 hours of shadow flicker per year is a tolerable level of shadow flicker (DWIA 2003). Therefore, shadow flicker effects would be below the threshold of potential concern at the closest receptor locations.

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 GE 1.6xle wind turbine selected for this project operates within the range of 9.8 to 18.7 revolutions per minute (GE 2010). This puts the flicker frequency created by this wind turbine well below rates identified with photosensitivity issues.

Based on the shadow flicker assessment prepared for this project, shadow flicker is not expected to exceed 22 hours per year for any potential receptor. However, if shadow flicker exceeded 30 hours per year for any residence whose owner is not a participant in the project, MWP would make reasonable efforts to remedy the problem by planting trees or installing awnings on a case-by-case basis.

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, it 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.

The standard unit of measure for sound pressure levels is the decibel. A decibel is a unit describing the amplitude 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 deemphasizes 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). Figure 3-1 shows common outdoor and indoor sound sources and associated A-weighted noise levels.

Background Information on Wind Turbines

An operating wind turbine generator can generate two types of sound: mechanical sound from components such as gearboxes, generators, yaw drives, and cooling fans, and 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 2005b).

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 (generally outside of the range of human hearing). 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).

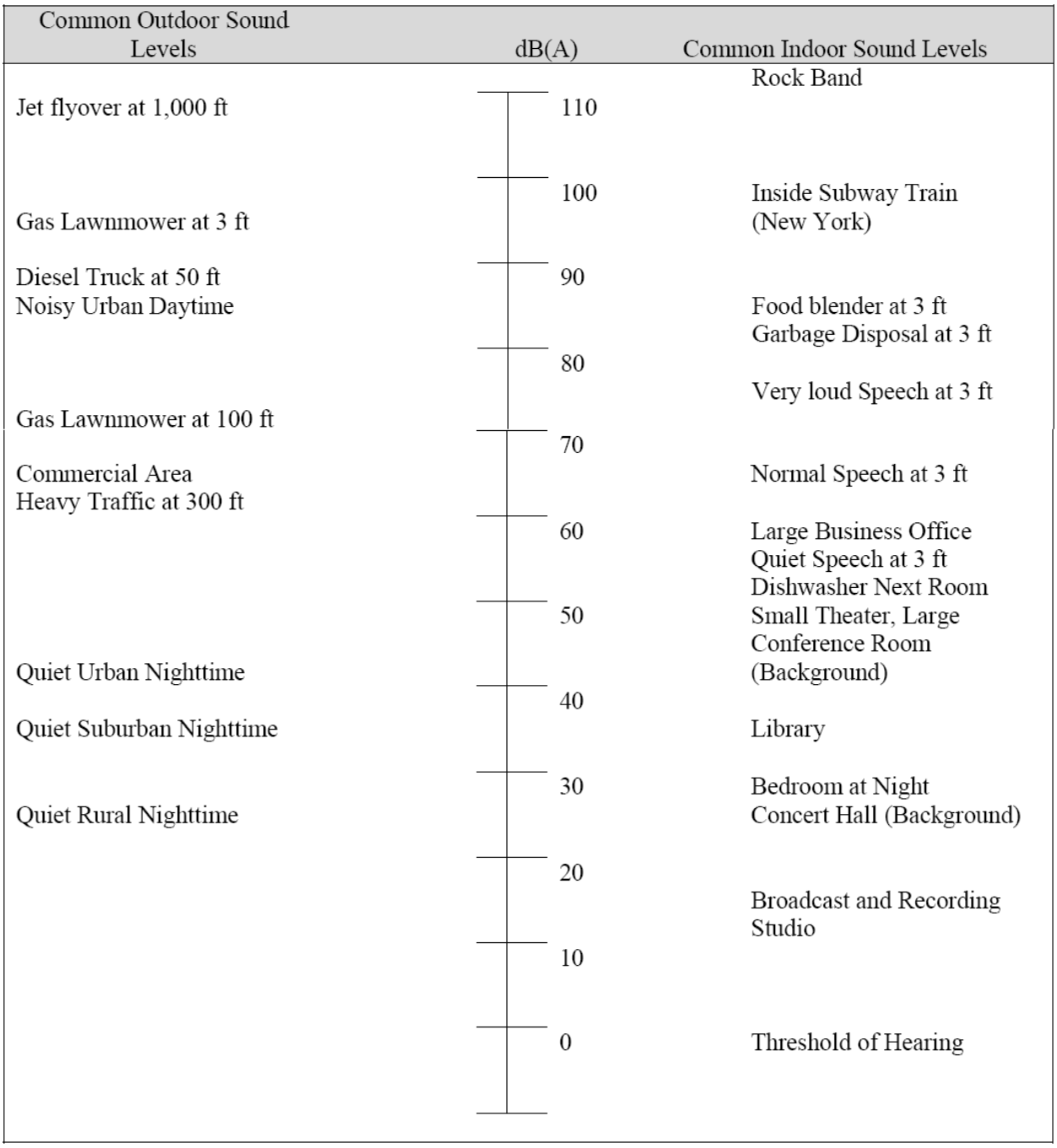

Figure 3-1. Common Outdoor and Indoor Sound Sources

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 broadband sound emission that includes low-frequency sounds, but not at substantially high levels. A primary cause for low-frequency sounds in modern turbines is the blade passing through the change in airflow at the front of the tower, which can be aggravated by unusually turbulent wind conditions.

The University of Massachusetts at Amherst reported (Rogers 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 composed 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

The project site is located within the immediate vicinity of the Burlington Northern Santa Fe Railroad, U.S. Highway 67, and 140th Avenue. In addition, a large-scale grain distribution operation is located at the intersection of Highway 67 and 130th Avenue.

Industrial facilities and businesses along U.S. Highway 67 are major contributors to overall ambient noise levels. During daytime hours, local traffic and agricultural work in the area also contribute to ambient noise levels. Summertime noise sources also include insects and birds during the day and evening.

The study area has several neighboring residences. MWP conducted baseline ambient (without wind turbines) noise measurements in the study area. Baseline noise measurements are important for two reasons: (1) noise impact is in part based on the extent to which project noise would exceed ambient noise, and (2) audibility of wind turbine noise depends on its relationship to ambient noise. For example, if wind turbine noise levels are sufficiently below ambient noise levels, wind turbine noise would not be audible.

Environmental noise monitoring and sampling account for spatial and temporal variation. Spatial sampling would include receptors in the vicinity of the turbine as well as a variety of ambient noise environments. Twenty-four-hour monitoring is typical for environmental noise studies in order to report the Day Night Average Sound Level (DNL) as well as determine low L_{90} values during the nighttime hours. (L_{90} is the level exceeded 90 percent of the time within the measurement period.) Ambient noise measurements were conducted for 24 hours at three locations and for 1 hour at six additional locations (two at which monitoring was conducted during an initial study, and four that were monitored during the same study as that in which the 24-hour measurements were taken). Figure 3-2 shows the locations of the noise measurements relative to residences and proposed wind turbine locations. Appendix B, Attachment B-3 contains the results of this measurement program.

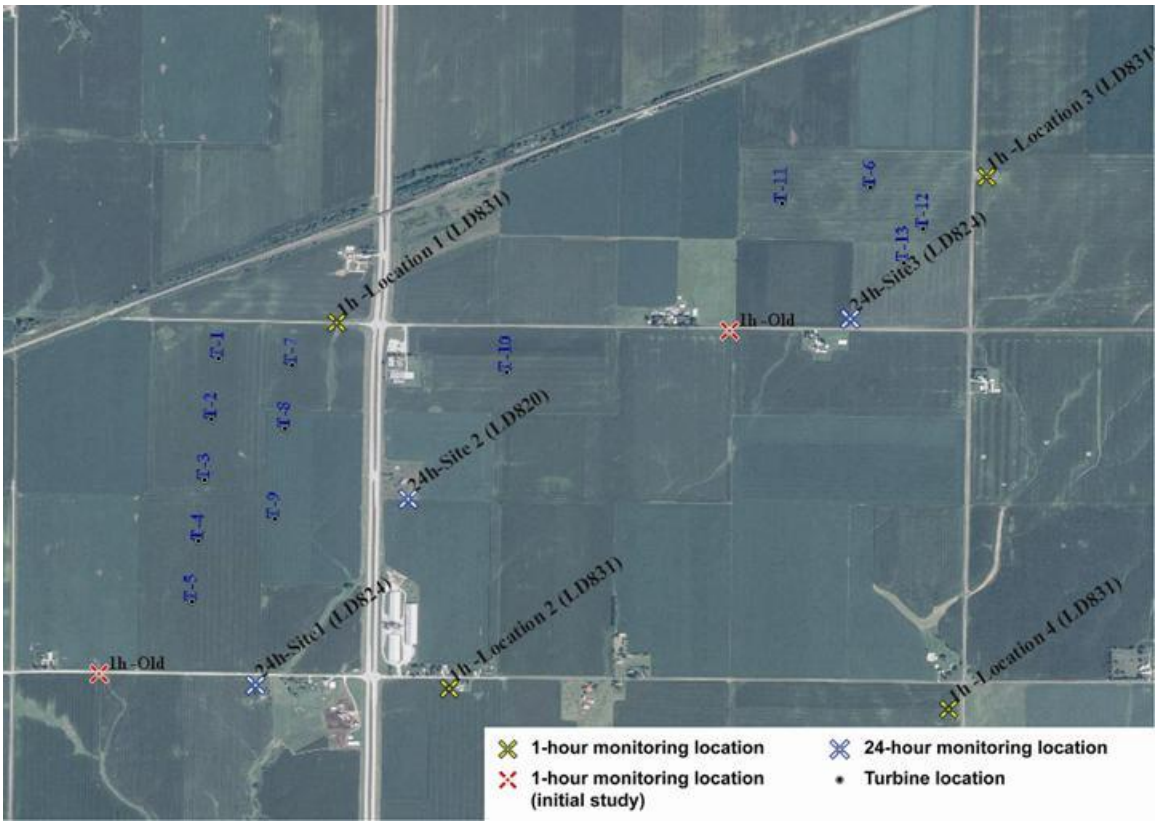

Figure 3-2. Noise Measurement Locations

Direct and Indirect Impacts

Noise Guidelines and Regulations

The U.S. Environmental Protection Agency (EPA) has an existing design goal DNL less than or equal to 65 dBA and a future design goal DNL of 55 dBA for exterior sound levels for residential areas (EPA 1977). The EPA noise guidelines are design goals and not enforceable regulations.

Formerly regulated by the EPA, noise is now regulated by State and local governments. EPA recommendations are, however, still useful for assessing the affected environment. EPA has also evaluated general public response to changes in noise levels. An increase of ambient noise levels of less than 3 dBA is generally considered inconsequential. In general, an increase to ambient or average noise levels of 5 decibels would be noticeable to most people and would be expected to elicit widespread complaints. An increase of 20 decibels would be expected to result in vigorous community response (EPA 1974).

The IPCB has developed a comprehensive approach to the measurement and assessment of commercial and industrial noise, and this approach is relevant to the development and operation of wind energy projects, with maximum allowable noise levels specified for each octave band within the audible frequency range. The spectrum is split into ten octave frequency bands, which span from 31 to 8,000 hertz. The A-weighted octave band values add logarithmically to a single overall A-weighted decibel value. The frequency for each octave band is approximately twice

that of the next lower octave band and half that of the next higher octave band. Table 3-1 shows the IPCB daytime and nighttime octave band noise level limits.

Table 3-1. Illinois Pollution Control Board Noise Standards

Frequency (hertz)	31	63	125	250	500	1,000	2,000	4,000	8,000
Daytime Standard	75	74	69	64	58	52	47	43	40
Nighttime Standard	69	67	62	54	47	41	36	32	32

Construction Noise

Construction of the MWTP would result in a temporary increase in noise and vibration. Construction of the turbine would involve the use of heavy equipment, including some of the equipment listed in Table 3-2. Table 3-2 also shows typical noise levels (expressed as equivalent continuous sound level or L_{eq}) produced by this equipment.

Table 3-2. Typical Construction Noise Emission Levels

Equipment	Typical Noise Level (L_{eq})
Compactor (ground)	76
Dozer	78
Dump Truck	72
Excavator	77
Generator	78
Grader	81
Pickup Truck	71
Warning Horn	70
Crane	73

L_{eq} = equivalent sound level.

Construction noise would likely be audible in the project area, but it would also be temporary and intermittent and, therefore, not consequential.

Wind Turbine Generator Noise Modeling

The GE 1.6xle wind turbine selected for this project has a 3-blade rotor, is 271 feet in diameter, and mounted on a tubular steel monopole with a hub height of 328 feet. The overall height of the wind turbine is 464 feet. According to the manufacturer's specifications, the maximum sound power level at the nacelle is 104 decibels. The MWTP would involve installation of 12 wind turbines in the area.

MWP performed noise modeling using WindFarmer software to assess the potential noise impacts as a result of the operation of the proposed project. Figure 3-3 shows predicted noise contours based on the manufacturer's Sound Power Level data. The contour interval for the figure is 1 decibel, meaning that each line represents a decrease of 1 decibel as distance from the turbines increases.

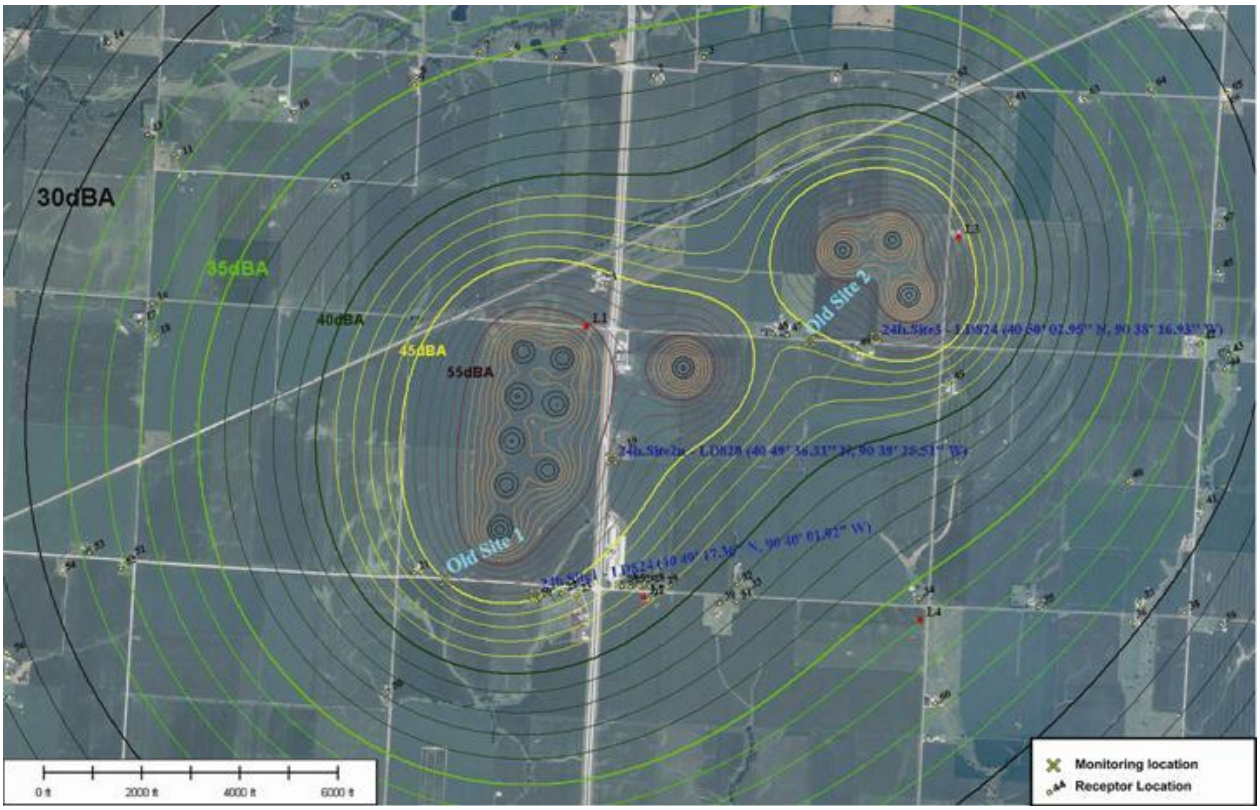

Figure 3-3. Predicted Wind Turbine Noise Level Contours

Comparison of predicted turbine noise levels to ambient L_{90} data indicates that wind turbine noise could be audible at times, particularly at certain times at night, in the project area. However, in general, since turbine noise levels increase as a function of wind speed, wind noise tends to increase ambient noise levels and mask turbine noise.

WindFarmer software accounts for atmospheric absorption in an approximate fashion by subtracting a single overall value, and this approach is accurate from an overall A-weighted noise level perspective. However, high frequencies actually attenuate (decrease) much more than this method would indicate. Using the WindFarmer atmospheric absorption approach, five receptors would slightly exceed the nighttime IPCB standard at certain mid to high frequencies. Table 3-3 shows a more detailed breakdown of these five receptors. ANSI S1.26 – 1995 provides the detailed octave band atmospheric absorption coefficients for a wide range of temperatures and humidity. Assuming "standard day" meteorology (15 degrees Celsius and 50 percent humidity), mid- to high-frequency atmospheric absorption would substantially reduce the predicted mid- to high-frequency turbine noise levels shown in Table 3-3. Accounting for this would result in the noise level of all receptors except Receptor 19 being consistently below the IPCB standards. With regard to Receptor 19, only the predicted wind turbine noise level at 1,000 hertz would be slightly above the nighttime IPCB standard (43.2 decibels versus 41 decibels). All other frequencies would be below the IPCB standard at this location.

Table 3-3. Detailed Noise Data at Five Receptor Locations

Monarch Wind - Ambient to WTG noise comparison Day/Night/Total

WES Engineering Inc.
10/21/2010

Day Time is assumed to be from 7:00am to 9:59pm
Night Time is from 10:00pm to 6:59am

Record #	Receptor ID	Distance to the Nearest Turbine		dBA										IPCB Limit by Day and Night																
				Day Time			Night Time			TOTAL			TOTAL	Day Time - from 7:00am to 9:59pm									Night Time - from 10:00pm to 6:59am								
														Hz	31.5	63	125	250	500	1000	2000	4000	8000	31.5	63	125	250	500	1000	2000	4000	8000
														PCB-dBA	36	47.8	52.9	55.4	54.8	52	48.2	44	38.9	30	40.8	45.9	45.4	43.8	41	37.2	33	30.9
															Modeled Maximum WTG Noise / Ambient Noise										Modeled Maximum WTG Noise / Ambient Noise								
		[m]	[ft]	WTG LAeq	Ambient LAeq	Ambient L90	WTG LAeq	Ambient LAeq	Ambient L90	WTG LAeq	Ambient LAeq	Ambient L90	Ambient Increase	Hz	31.5	63	125	250	500	1000	2000	4000	8000	31.5	63	125	250	500	1000	2000	4000	8000
1	19	471.5	1546.52	48.15	57.8	48.4	48.15	52.62	43.8	48.14	56.49	47.2	0.5927	WTG.dBA	-12.5	3.7	22.6	35.7	42.7	44.2	41.1	34.1	30.2	-12.5	3.7	22.6	35.7	42.7	44.2	41.1	34.1	30.2
														Ambient	24.9	38.4	44.4	46.7	50.4	54.0	50.5	45.3	41.3	28.8	36.1	40.5	44.3	47.9	47.8	41.7	33.5	25.0
														SUM	24.9	38.4	44.4	47.1	51.1	54.5	51	45.6	41.7	28.8	36.1	40.5	44.8	49.1	49.4	44.4	36.8	31.3
														Increase	0.0	0.0	0.0	0.3	0.7	0.4	0.5	0.3	0.3	0.0	0.0	0.1	0.6	1.1	1.6	2.7	3.3	6.3
2	1	530.2	1739.06	45.81	54.38	49.1	45.81	49.2	44.4	45.81	53.07	47.8	0.7479	WTG.dBA	-14.8	1.4	20.3	33.4	40.4	41.9	38.8	31.8	27.9	-14.8	1.4	20.3	33.4	40.4	41.9	38.8	31.8	27.9
														Ambient	21.5	35.0	41.0	43.3	47.0	50.6	47.1	41.8	37.9	25.4	32.7	37.0	40.9	44.5	44.4	38.3	30.1	21.6
														SUM	21.5	35	41	43.7	47.8	51.1	47.7	42.3	38.3	25.4	32.7	37.1	41.6	45.9	46.3	41.6	34	28.8
														Increase	0.0	0.0	0.0	0.4	0.9	0.5	0.6	0.4	0.4	0.0	0.0	0.1	0.7	1.4	1.9	3.2	3.9	7.2
3	20	496.6	1628.85	44.76	54.88	44.6	44.76	49.7	39.9	44.76	53.57	43.3	0.5366	WTG.dBA	-15.9	0.3	19.2	32.3	39.3	40.8	37.7	30.7	26.8	-15.9	0.3	19.2	32.3	39.3	40.8	37.7	30.7	26.8
														Ambient	22.0	35.5	41.5	43.8	47.5	51.1	47.6	42.3	38.4	25.9	33.2	37.5	41.4	45.0	44.9	38.8	30.6	22.1
														SUM	22	35.5	41.5	44.1	48.1	51.5	48	42.6	38.7	25.9	33.2	37.6	41.9	46.1	46.3	41.3	33.7	28.1
														Increase	0.0	0.0	0.0	0.3	0.6	0.4	0.4	0.3	0.3	0.0	0.0	0.1	0.5	1.0	1.4	2.5	3.1	6.0
4	22	554.2	1817.78	44.48	54.88	44.6	44.48	49.7	39.9	44.48	53.57	43.3	0.5050	WTG.dBA	-16.2	0.0	18.9	32.0	39.0	40.5	37.4	30.4	26.5	-16.2	0.0	18.9	32.0	39.0	40.5	37.4	30.4	26.5
														Ambient	22.0	35.5	41.5	43.8	47.5	51.1	47.6	42.3	38.4	25.9	33.2	37.5	41.4	45.0	44.9	38.8	30.6	22.1
														SUM	22	35.5	41.5	44.1	48	51.5	48	42.6	38.7	25.9	33.2	37.6	41.8	46	46.2	41.2	33.5	27.9
														Increase	0.0	0.0	0.0	0.3	0.6	0.4	0.4	0.3	0.3	0.0	0.0	0.1	0.5	1.0	1.4	2.4	2.9	5.8
5	48	595.6	1953.57	44.35	50.31	43.1	44.35	54.4	38.6	44.35	52.31	41.9	0.6444	WTG.dBA	-16.3	-0.1	18.8	31.9	38.9	40.4	37.3	30.3	26.4	-16.3	-0.1	18.8	31.9	38.9	40.4	37.3	30.3	26.4
														Ambient	21.4	31.2	37.3	38.1	44.3	44.7	38.5	43.3	39.5	27.8	35.6	39.1	43.8	50.7	50.3	40.9	29.3	22.8
														SUM	21.4	31.2	37.3	39	45.4	46.1	40.9	43.5	39.7	27.8	35.6	39.2	44.1	51	50.7	42.5	32.9	28
														Increase	0.0	0.0	0.1	0.9	1.1	1.4	2.5	0.2	0.2	0.0	0.0	0.0	0.3	0.3	0.4	1.6	3.5	5.2

Note: The predicted high WTG in the high frequency range is due to the used assumption that all frequencies have the same absorption in air. In reality the higher frequencies will experience higher absorption in air and at such significant distance will be greatly reduced. Consequently, the wind turbines will be in compliance with the IL PCB standards and will not significantly increase the ambient noise level at the receptors.

In the table above where the assumption that all frequencies have the same absorption in air was used, It can be seen in the frequencies where the WTG exceeds the IL PCB limit, the ambient noise level exceeds it as well (Red Numbers).

Table 3-4 shows the two worst-case receptors (closest to the wind turbines), Receptors 19 and 20. The first part of the calculation is to undo the atmospheric absorption calculation in WindFarmer by adding 2 decibels per kilometer (0.6 mile) (WindFarmer subtracts 2 decibels per kilometer). The second step is to subtract the ANSI atmospheric attenuation coefficients, which increase as a function of frequency.

The results show that only Receptor 19 would be slightly above the nighttime IPCB standard at 1,000 hertz. Receptor 20 would be below the standard as well as Receptors 1, 22, and 28 since wind turbine noise levels at those locations would be lower than those of Receptor 20.

Table 3-4. Noise levels at Receptors 19 and 20 (corrected for atmospheric absorption)

	Frequency(hertz)								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
Receptor 19	**12.5**	**3.7**	**22.6**	**35.7**	**42.7**	**44.2**	**41.1**	**34.1**	**30.2**
Add 2 dB/km from WindFarmer results (global assumed atm. Absorption)	**11.6**	**4.6**	**23.5**	**36.6**	**43.6**	**45.1**	**42.0**	**35.0**	**31.1**
ANSI Atmospheric Absorption	0	0.142	0.479	1.22	2.24	4.16	10.8	36.2	129
Decibel attenuation	0.0	0.1	0.2	0.6	1.1	2.0	5.1	17.1	60.8
	11.6	4.6	23.3	36.1	42.6	43.2	36.9	18.0	-29.7
IPCB Nighttime Standard	**30**	**40.8**	**45.9**	**45.4**	**43.8**	**41**	**37.2**	**33**	**30.9**
Receptor 20	**15.9**	**0.3**	**19.2**	**32.3**	**39.3**	**40.8**	**37.7**	**30.7**	**26.8**
Add 2 dB/km from WindFarmer results (global assumed atm. Absorption)	**14.9**	**1.3**	**20.2**	**33.3**	**40.3**	**41.8**	**38.7**	**31.7**	**27.8**
ANSI Atmospheric Absorption	0	0.142	0.479	1.22	2.24	4.16	10.8	36.2	129
Decibel attenuation	0.0	0.1	0.2	0.6	1.1	2.1	5.4	18.0	64.1
	14.9	1.2	20.0	32.7	39.2	39.7	33.3	13.7	-36.3
IPCB Nighttime Standard	**30**	**40.8**	**45.9**	**45.4**	**43.8**	**41**	**37.2**	**33**	**30.9**

ANSI = American National Standards Institute.
dB/km = decibel per kilometer.
IPCB = Illinois Pollution Control Board.

Noise Effects

The degree of intrusiveness of a new environmental noise source is measured in terms of "absolute" and "relative" noise impact. Absolute impacts refer to a new noise source exceeding a certain local, state, or Federal noise standard stated in terms of an absolute numeric limit (in decibels). Relative impacts refer to the degree to which the new noise source exceeds existing ambient noise levels.

In a 2009 study commissioned jointly by the American Wind Energy Association and the Canadian Wind Energy Association, a panel of seven independent experts reached the following conclusions (Colby et al. 2009):

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.

- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.

The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences. The data show that wind turbine noise levels would exceed the nighttime IPCB standard only at one receptor and only slightly at one frequency (1,000 hertz). However, ambient noise levels (without the turbines) already exceed the IPCB standards at this location (as well as the other four receptor locations shown in Table 3-3). In addition, the analysis shows that predicted wind turbine noise levels would increase ambient noise levels at these locations by less than 1 decibel (1 dBA). A 3-decibel change is the threshold of perception of change for most people, so noise generation resulting from turbine operations would not noticeably increase ambient noise levels and would not likely be intrusive from the standpoint of relative noise impact (EPA 1974). It should be noted that the modeling results are based on the turbines operating at maximum speed. Further, modeling is an approximation of potential real-world conditions that may result from MWP's operations. As a condition to the Special Use Permit, MWP has committed to comply with all applicable IPCB regulations; therefore, adverse impacts associated with the proposed project are not anticipated.

3.2.2.4 Historic, Architectural, Archaeological, and Cultural Resources

The *National Historic Preservation Act of 1966* (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 the State Historic Preservation Officer (SHPO).

On August 28, 2009, DOE executed a Memorandum authorizing its Recovery Act grant applicants under the Energy Efficiency and Conservation Block Grant Program, Weatherization Assistance Program, and SEP to initiate Section 106 consultations pursuant to 36 CFR 800.2(c)(4) (DOE 2009). On May 6, 2010, the Illinois Programmatic Agreement was executed with the DOE, which further solidified a recipient's ability to initiate consultation with the SHPO. As of that date, applicants and their authorized representatives could consult with the SHPOs to initiate the review process established under 36 CFR Part 800. In accordance with this authorization, representatives of MWP initiated Section 106 consultation with IHPA on February 12, 2010.

Archaeological and Aboveground Area of Potential Effect

The area of potential effect (APE) is the geographic area or areas within which the project may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist. For the MWTP, the following APEs were established to examine the potential impacts to aboveground historic and archaeological properties:

- For aboveground resources, the APE was developed based on a recommendation by the IHPA during a telephone conversation.

- For archaeological resources, the APE is defined as the footprint of the wind turbine foundations, substations, and access roads, as well as any surrounding area that would be potentially disturbed during construction or installation of electrical wiring.

Aboveground Historic Resources

In response to MWP's initial submission, the IHPA requested that an architectural survey be completed for the proposed project (Appendix B, Attachment B-5). From May 24 to June 18, 2010, MWP commissioned a field survey and records review of the area within a 0.75-mile radius collective visual APE from each proposed turbine location. In addition, MWP examined the National Register of Historic Places (NRHP), National Historic Landmark, and Historic Architectural and Archaeological Resources Geographical Information System records, as well as historic plat maps to identify the origins of historic buildings. Additionally, photographs of the principle façade and unique building elements were taken of buildings older than 50 years of age or for which an age could not be determined.

The survey identified seven buildings older than 50 years in the collective visual APE. Four of these buildings were determined to be ineligible for inclusion on the NRHP because the buildings are not a good example of a particular architectural style and/or because modifications have resulted in a loss of architectural characteristics (modified resources). The remaining three buildings (architectural resources) may be eligible for listing on the NRHP under criterion C (properties that "embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction").

An evaluation of the potential visual effects of the proposed wind turbines on the three remaining properties determined that an observer on the public right-of-way viewing the primary façade of two structures would have no view of the proposed turbine locations. It was therefore concluded that the proposed project would have no effect on these properties. The remaining architectural resource is located on 130th Avenue immediately south of Turbine 10. While viewing the primary façade of this building, Turbine 10 would be visible in the background. However, due to the significant distance between this property and Turbine 10 (over 4,500 feet), the turbine would not be a dominant element in the viewshed of this property. Additionally, the siding and roof of this property do not appear to be original, and may exclude this building from being eligible for listing in the NRHP.

Belowground Archaeological Resources

From May 24 to June 17, 2010, MWP commissioned a phase 1 literature review and archaeological reconnaissance survey to assess the potential for intact archaeological deposits located within the boundaries on the proposed project (Appendix B, Attachment B-4). As part of this survey, early plats, atlases, regional histories and soil surveys were consulted, and a site survey consisting of a site walk-through was conducted. Historical maps indicate the previous existence of the Warren County Alms House cemetery located on the southwest corner of U.S. Highway 67 and 140th Avenue, near the location of a proposed electrical substation.

This cemetery was relocated prior to the widening of U.S. Highway 67 to a four-lane highway in 1991. Though 105 cemetery burials were removed from this location and reinterred at the Lenox Union Cemetery, there is still potential for unmarked graves to be located at the project site.

Tribal Consultation

MWP used the Tribal Consultation Notification System (TCNS) to identify tribes that have indicated a geographical preference for Warren County. The TCNS is an interactive, login and password-protected system that enables tower builders to notify tribal governments and Native Hawaiian Organizations of proposed construction, and provides a means for these governments and organizations to reply to tower builders. When a project is uploaded to TCNS, a list of tribes who have selected the area as within their area of geographic preference is returned. This list was cross-referenced with the Native American Consultation Database for any additional tribes that may not subscribe to TCNS. On September 14, 2010, DOE sent a notice of scoping to each tribe identified through the above two methods. MWP also sent letters to each of the tribal representatives on June 22, 2010. An example letter and a copy of the mailing list are included in Appendix E, Attachment E-4. The list of tribes is as follows:

- Absentee-Shawnee Tribe of Indians
- Citizen Potawatomi Nation
- Forest County Potawatomi Community of Wisconsin
- Hannahville Indian Community of Michigan
- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Keweenaw Bay Indian Community
- Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
- Kickapoo Tribe of Oklahoma
- Menominee Indian Tribe of Wisconsin
- Miami Tribe of Oklahoma
- Ottawa Tribe of Oklahoma
- Peoria Tribe of Indians
- Pokagon Band of Potawatomi Indians
- Prairie Band Potawatomi Nation
- Sac & Fox Tribe of the Mississippi in Iowa
- Sac and Fox Nation of Missouri
- Sac and Fox Nation of Oklahoma
- Shawnee Tribe
- Winnebago Tribe of Nebraska
- Wyandotte Nation

To date, the Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas, the Ottawa Tribe of Oklahoma, the Peoria Tribe of Indians, the Shawnee Tribe, and the Winnebago Tribe of Nebraska have responded with no objections to the proposed project (Appendix E, Attachment E-6).

Direct and Indirect Impacts

The proposed project is not anticipated to result in adverse impacts related to historical, architectural, archaeological, or cultural resources. An examination of potential historic properties within the cumulative visual APE identified three properties that may be eligible for listing on the NRHP. However, to an observer on the public right-of-way facing these structures, the turbine would not be visible at two locations and scarcely visible at the third.

Additionally, although the former Warren County Alms House cemetery is located on the northeastern corner of the project site, the removal of 105 deceased individuals was carefully monitored by State and county officials, and it is unlikely that unmarked graves would be encountered during installation of the substation. However, in response to a request from IHPA, MWP has committed to having an archaeologist present during the excavation at the northeast portion of the lease area to ensure that any human remains (if discovered) are appropriately managed in accordance with the *Human Skeletal Remains Protection Act* (20 ILCS 3440; 17 IAC 4170).

In a letter dated September 23, 2010 (Appendix C, Attachment C-5), the IHPA stated that agreement to and implementation of archaeological monitoring of the construction of the proposed substation constitutes compliance with Section 106 of NHPA. Based on the responses received from IHPA and on the analysis conducted by MWP, DOE has concluded that the proposed project would not have an adverse effect on historic or archaeological resources.

3.2.2.5 Geology and Soils

The project site is located on a loess-covered till plain, part of the Winnebago formation of the Illinois Episode of glaciation (Edge Consulting 2010). The depth to bedrock is greater than 6 feet. Bedrock is commonly sedimentary rock of the Pennsylvanian Age (NRCS 2010).

Native soils typically consist of Muscatine silt loam (51A). This soil type is typically gently sloping and is poorly drained. Other soils within the project area include 68A (Sable silty clay), 86B (Osco silt loam), 86B2 (Osco silt loam), and 86C2 (Osco silt loam) (NRCS 2010). All soils with the exception of one portion of the Osco silt loam (86C2) are considered prime farmland. Prime farmland is defined in part as land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops and that is available for these uses (USDA/NRCS 2011). Congress enacted the *Farmland Protection Policy Act* as a subtitle of the 1981 Farm Bill to minimize the extent to which Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. MWP submitted a request for an evaluation of impacts to prime farmland at the MWTP location to the IDOA and filed Form AD-1006 with the Warren County Soil and Water Conservation District.

There is not a significant risk of damaging seismic activity in Warren County. Illinois has experienced approximately 200 earthquakes since 1795, only nine of which were strong enough to even cause minor damage. The majority of these earthquakes occurred in Southern Illinois. The largest earthquake ever recorded in Illinois occurred November 9, 1968, with a magnitude 5.4 on the Richter scale (ISGS 1995).

Direct and Indirect Impacts

Soil disturbance would occur as a result of site preparation and project construction. The MWTP would permanently commit approximately 7 acres of prime farmland to project uses during the lifetime of the project. Foundations for the towers would extend to a depth of approximately 15 feet below land surface. After construction, land not committed to MWTP operations would be graded and returned to agricultural use. The locations proposed for the site features (towers, roads, and substations) are currently used for agriculture and have been repeatedly plowed and planted, eliminating surface soil features to a substantial degree, and the area to be disturbed is relatively minor; therefore, few if any impacts to soils are anticipated. The response from IDOA concludes that the MWTP would be consistent with the DCEO Agricultural Land Preservation Policy and complies with the *Illinois Farmland Preservation Act*. The IDOA response and Form AD-1006 are in Appendix C, Attachment C-4 of this EA.

The depth of foundations is similarly limited and of limited surface area; therefore, no impacts to geologic features would result from the proposed project. A review of information managed by the Illinois State Geological Survey concluded that the risk of seismic activity in Warren County that could jeopardize the structural integrity of the wind turbines and foundations is low.

3.2.2.6 Biological Resources

Biological resources include plants, animals, and other organisms, as well as the various habitats, ecological communities, and ecosystems, within the region of a proposed project. The information in this section is partially based on a report by biologist Dr. Kenneth Cramer, who conducted a site visit in June 2010 and performed a wildlife assessment of the proposed project area (Appendix B, Attachment B-6). The Phase I Archaeological Reconnaissance Survey (Appendix B, Attachment B-4) also served as an ancillary source of information.

The topography of Warren County consists of gently rolling upland plains, resulting from glacial deposition, and dissected valley sides and floodplains, which resulted from postglacial stream erosion. The proposed project site consists of 600 acres of highly disturbed land, mainly of existing agricultural fields (currently planted with row corn and soybeans), with a small amount of pasture and small drainages. Located south and northeast of the intersection of U.S. Highway 67 and 140th Avenue in Lenox Township, slightly north of central Warren County in western Illinois, the project area is in an area heavily utilized for agriculture. The proposed project area sits approximately 15 miles east of the Mississippi River and approximately 45 miles west of the Illinois River. Both of these major rivers are situated roughly north-to-south (flowing generally southward) and represent important landscape features for resident and migratory wildlife, despite their heavy historical use by humans.

Vegetation

As with much of Warren County, the proposed project site lies in the Western Forest-Prairie Natural Division, Galesburg Section, one of 14 natural divisions in Illinois classified based on rainfall and water availability, the kinds of native animals and plants present, topography, and types of geologic materials visible near the surface. This division is typified by a strongly dissected glacial till plain with open woodland as predominant vegetation and considerable prairie on level uplands. The division is characterized by well-developed natural drainage systems consisting of major streams that have substantial floodplains. Native vegetation consists

of forest in the river and creek valleys with open forest patches of trees, including oaks and hickories, and prairie on the uplands. The soil composition corresponds to past vegetation at the project site, most likely consisting of native plants of the tall grass prairie ecoregion.

Most of the 600 acres of proposed project area is currently developed agricultural land, predominantly planted in row crops of corn and soybean. The remainder, less than 12 contiguous acres, contains pasture and small drainages. Agricultural conversion and development of the area have eliminated past vegetation on the project site where pasture row crops now dominate. Vegetation on the proposed project site currently consists of a mowed mixture of grasses and other roadside herbaceous plants.

Wetlands and Other Waters of the United States

Wetlands are classified by the U.S. Army Corp of Engineers based on three criteria: hydrology, soil type, and vegetation. Specifically, wetlands are defined as those areas that are saturated or inundated by water that is sufficient to support vegetation typically adapted to saturated soils (USACE 1987). Wetlands and other surface water features, which may include intermittent and perennial streams, are generally considered "waters of the United States" by the U.S. Army Corps of Engineers, and, under its definition of jurisdictional waters/features, are protected under Section 404 of the *Clean Water Act*. Pursuant to 10 CFR Part 1022, which requires that DOE consider potential impacts to floodplains and wetlands, DOE reviewed the U.S. Geological Survey wetland maps, the USFWS National Wetlands Inventory maps, and Federal Emergency Management Agency floodplain maps for this site location, and initiated consultation with the IDNR through EcoCAT (Appendix C, Attachment C-3), an online system that uses databases, geographic information system mapping, and a set of programmed decision rules to determine if a proposed project may be in the vicinity of protected natural resources. Copies of the IDNR correspondence are provided in Appendix C, Attachment C-3 of this EA.

DOE's review of the National Wetlands Inventory indicated known wetlands within 250 feet of the property boundary. Additional information from the National Wetland Inventory showed freshwater emergent and freshwater forested/scrub wetlands north of the proposed project site (USFWS 2010a). While the National Wetlands Inventory map depicts wetlands along the railroad tracks near the property boundary (Figure 3-4), all construction and operating activities would be performed in areas currently utilized for agricultural purposes, and the construction activities closest to these wetlands (associated with the substation) would be approximately 1,400 feet from the designated wetlands. However, in June 2010, Dr. Kenneth Cramer conducted field reconnaissance and verified the absence of wetlands and surface water at locations where turbines would be placed.

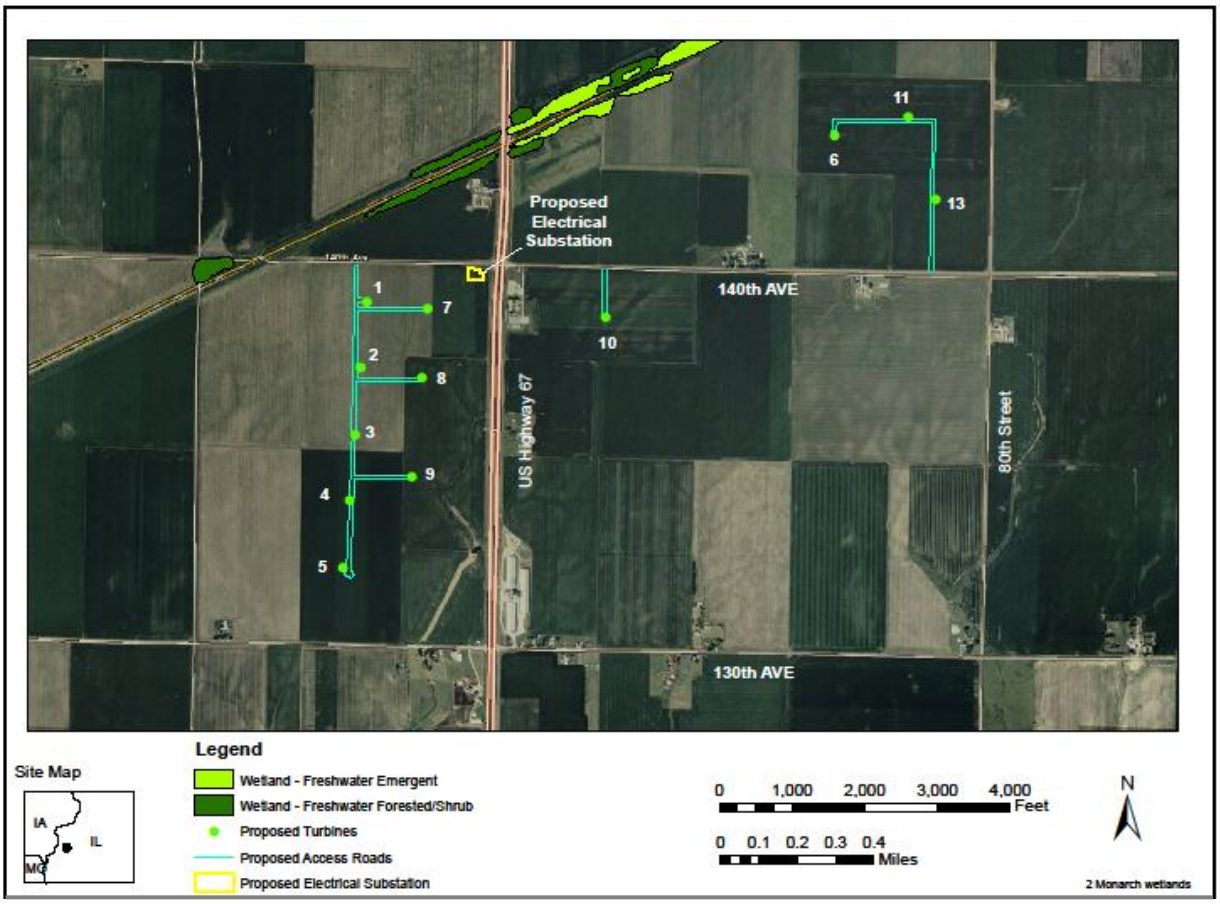

Figure 3-4. Wetlands in the Project Vicinity

Wildlife

This section discusses the wildlife that is known to exist in the vicinity of the proposed project area. The IDNR indicated that, as with most wind power projects, migratory birds and bats are the primary concern. Therefore, this section analyzes the flying vertebrates with special consideration.

Amphibians and Reptiles

According to the Illinois Natural History Survey, 13 species of amphibians and reptiles are known from 30 herpetological collections across the country to occur in Warren County: tiger salamander (*Ambystoma tigrinum*), American toad (*Bufo americanus*), cricket frog (*Acris crepitans*), western chorus frog(*Pseudacris triseriata*), plains leopard frog(*Rana blairi*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), northern leopard frog (*Rana pipiens*), snapping turtle (*Chelydra serpentina*), fox snake (*Elaphe vulpina*), northern water snake(*Nerodia sipedon*), common garter snake(*Thamnophis sirtalis*) and massasauga (*Sistrurus catenatus*) (Illinois Natural History Survey 2009a).

Non-Flying Mammals

Non-flying mammals include all mammal species except bats, which are addressed in a separate section below. While no direct field studies were conducted to determine the presence of non-flying mammals, the mammals that are likely to reside on or visit the proposed project area

include red fox (*Vulpes vulpes*), raccoons (*Procyon lotor*), opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), rabbit (*Sylvilagus floridanusf*), coyote (*Canis latrans*), skunk (*Mephitis mephitis*), and other small mammals. All of the non-flying mammalian species that could possibly occur on or near the project site are those that have adapted to high levels of disturbance from agriculture. Small mammals serve as food for raptors, snakes, coyote, and fox.

Migratory Birds and Bald Eagles

The *Migratory Bird Treaty Act* (16 U.S.C. 703-7012; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possessing, transporting, or 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).

Both migratory and resident (non-migratory) birds could be associated with the proposed site and its surroundings. The proposed project lies within the Mississippi migratory flyway (Figure 3-5), a very important corridor for large numbers of migrating birds in spring and fall. Migrants may pass over the proposed site and some could descend, but in average weather conditions, they would not likely descend or attempt a rest stop due to the lack of attractive natural habitat such as ponds or forest. During inclement weather, migrating birds may fly lower or attempt to stop on the site.

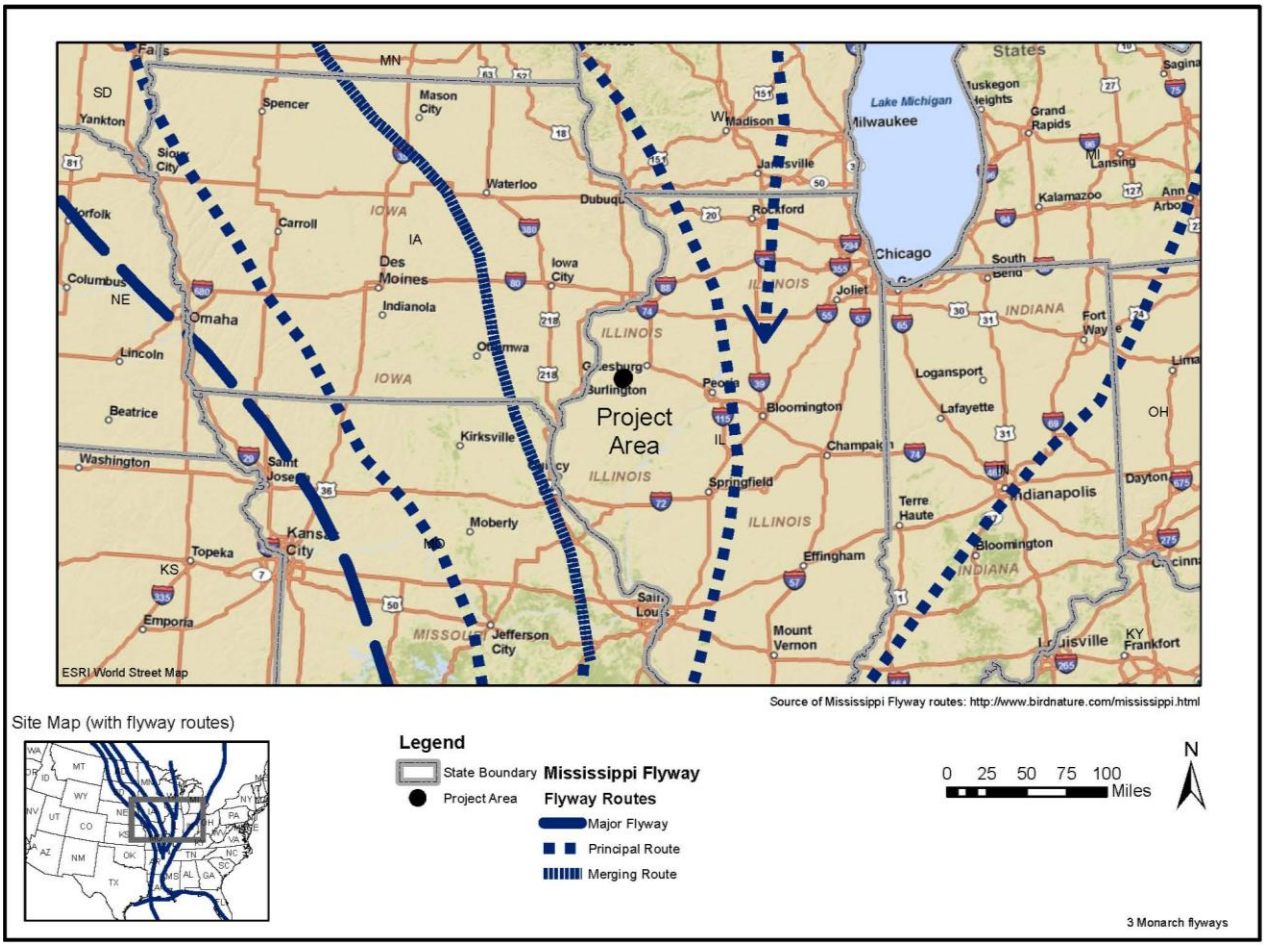

Figure 3-5. Major Migratory Bird Flyways, Principal Routes, and Merging Routes in the Project Vicinity

According to the Illinois Natural History Survey (2009b), 72 bird species are known to or are likely to breed in north-central Warren County. It is possible that some of these birds breed on or near the site or could traverse the proposed project site in their normal travels. Of these species, there is a possibility that some species of concern, particularly ground-nesting grassland birds, could nest in the area where the groundcover is pasture (rather than plowed row crops) or on land recognized under the Natural Resources Conservation Service Conservation Reserve Program. These species include Henslow's sparrow (*Ammodramus henslowii*), northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), and upland sandpiper (*Bartramia longicauda*) (Herkert 1992). Since Henslow's sparrow, northern harrier, and short-eared owl all require areas of pasture or grassland greater than 50 hectares (124 acres) for breeding, and since no fragments approaching this size exists within the project area, individuals of these species are unlikely to occur there. Although upland sandpipers are more commonly found in grasslands greater than 50 hectares in size (USFWS 2001), they typically use smaller patches of grassland, pasture, or idle cropland; therefore, this species could be found within the vicinity of the proposed project. However, upland sandpipers do not nest in row crop agriculture (NBII 2011), thus most of the proposed project area would not support them and they are unlikely to be present.

Other species of note could be present in the vicinity of the proposed project. Loggerhead shrike (*Lanius ludovicianus*) nest in hedgerows, primarily with Osage orange (*Maclura pomifera*), multiflora rose (*Rosa multiflora*), or other spiny or thorny plants. In addition, red-shouldered hawk (*Buteo lineatus*) and Swainson's hawk (*Buteo swainsoni*) are protected raptors potentially migrating through the area, though they are generally associated with forested areas in the eastern part of the state. No records of bald eagle nesting in Warren County were identified.

Bats

Twelve species of bats regularly occur in Illinois, though not all may be present in the vicinity of the proposed project area (University of Illinois Extension 2010). Two of the species are Federally endangered; however, only one species, the Indiana bat (*Myotis sodalis*), may potentially occur in Warren County and is discussed below. The southeastern bat (*M. austroriparius*) and Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) are State-listed species but do not occur in Warren County.

Those species known to hibernate within the state and that are year-round residents include little brown bat (*M. lucifugus*), northern long-eared myotis (*M. septentrionalis*), eastern pipistrelle (*Pipistrellus subflavus*), and big brown bat (*Eptesicus fuscus*). Of these species, the northern long-eared myotis and eastern pipistrelle mostly use caves for roosting, although maternal colonies of the northern long-eared myotis can also be found in hollows and loose bark of trees. Caves in Illinois are associated with karst type geology, which occurs in several places in the state, but not in Warren County, although there are two sites in Henderson County, just to the west of Warren County (ISGS 2010). Bat species that obligatorily use caves during any part of their life history may therefore be in the vicinity of the proposed project area while migrating but not during hibernation. The other two Illinois resident species rely on trees for summer nursery colonies and, although required habitat is limited to parts outside the proposed project area, these species may traverse the area during migration.

Two bat species are considered potential year-round residents in Illinois: eastern red bat (*Lasiurus borealis*) and silver-haired bat (*Lasionycteris noctivagans*). During the winter, some individuals of these species hibernate in Illinois while the rest migrate to adjacent states or farther south. These two species mainly roost in tree cavities, although the silver-haired bat occasionally occupies buildings or caves during the winter (University of Illinois Extension 2010). These species are not likely to occur on the proposed project site but may migrate through the area.

The hoary bat (*Lasiurus cinereus*) and the evening bat (*Nycticeius humeralis*) migrate seasonally and are found in Illinois in the summer roosting in trees. These species are typically not found in Illinois during the winter (University of Illinois Extension 2010). The scarcity of trees surrounding the proposed project site reduces the probability of summer roosting. Since (1) no endangered bats have been recorded in Warren County, and (2) the intensively farmed area of the proposed project area and vicinity has few roosting sites, a survey for bats in the project area was unwarranted. The Indiana bat, a Federally listed endangered species, is discussed below.

Federally and State-Listed Species

The USFWS administers the *Endangered Species Act of 1973*, as amended. This law provides Federal protection for species designated as Federally endangered or threatened. An endangered species is "in danger of extinction throughout all or a significant portion of its range," and a threatened species "is likely to become an endangered species within the foreseeable future" (USFWS 1988). Two protected species known to occur or potentially occur in Warren County (Appendix C, Attachment C-6) are the Federally listed endangered Indiana bat (*Myotis sodalis*) and Federally listed threatened eastern prairie fringed orchid (*Platanthaera leucophaea*). Additionally, although not included on the list of threatened, endangered, and candidate species that could occur in Warren County, a nonessential experimental population of whooping crane (*Grus americana*) can occur statewide during migration.

Indiana Bat

As part of formal Section 7 consultation under the *Endangered Species Act* initiated by DOE for the proposed project, DOE prepared a Biological Assessment to determine potential impacts to the Indiana bat and identify avoidance and minimization measures for the proposed project. DOE submitted a draft Biological Assessment to the USFWS on January 18, 2011. On January 21, 2011 the USFWS provided comments on the draft Biological Assessment and DOE submitted a revised final Biological Assessment to USFWS on February 22, 2011 (See Appendix F, Attachment F-1). The following information is based on both the Biological Assessment and Biological Opinion (Appendix F, Attachment F-2) for the proposed project.

The Indiana bat is present in Illinois throughout the year and is known to hibernate at sites within the state. Though it is a migratory species, females may stay close to their hibernacula (typically caves, in which the bats hibernate) or migrate great distances to their summer habitat. Breeding individuals are colonial, with both sexes roosting in caves and mines during winter. During the summer, females form small maternity colonies and roost underneath exfoliating bark of trees. Infrequently, they may also use artificial roosts, such as utility poles with crevices or brackets, and are rarely found in buildings or bat houses (University of Illinois Extension 2010). Most maternity colonies that are known exist in fragmented landscapes with low to moderate forest cover, including agricultural areas. However, Indiana bats are more likely to occur in areas with higher densities of potential roost trees. They travel up to 5 miles (most stay within 2 miles) each evening to forage areas, using the same areas throughout the season and year after year, and commuting preferentially along tree-lined paths (or other linear features) rather than crossing large, open areas (USFWS 2007). Indiana bats appear to forage preferentially within 150 feet of a forest edge, rather than over expansive open areas (Brack 1983; Menzel et al. 2001) and typically forage at a height of 6.5 to 98.4 feet (USFWS 2007). During migration, they appear again to follow tree lines, avoid open areas, and fly at low altitudes (Turner 2007).

According to the USFWS Draft Recovery Plan (USFWS 2007), Warren County, Illinois is not considered a priority area for conservation of this species due to the lack of documented hibernacula. There is a record of a maternity colony in adjacent Henderson County, and adult males are found throughout the range of the species (USFWS 2007). Blackball Mine is listed as critical habitat and is located about 100 miles east northeast of the project site. Indiana bat use of Blackball Mine has almost doubled in the past ten years with an estimated 2,500 Indiana bats hibernating there in 2009. At this time, however, Blackball Mine remains a Priority 2 hibernaculum (USFWS 2007) and its population contributes less than 4 % of the total estimated

population of the Ozark Central Recovery Unit (Appendix F, Attachment F-2). The closest known Indiana bat hibernaculum is a Priority 4 cave, Burton Cave, 72 miles southwest of the project site in southern Adams County, Illinois (USFWS 2007). The Illinois State Geological Survey (2010) has also identified a cave site in adjacent Henderson County, approximately 13 miles west-northwest of the project site. Even though USFWS has not identified this cave as providing a hibernaculum, its potential for use as a hibernaculum cannot be ruled out.

Roost tree habitat is not available on the proposed project site. The only stand of trees near the proposed project site lies along the rail line, approximately 0.3 mile from the nearest turbine location. This stand of trees is isolated from other stands of trees, such as those located on Henderson Creek, by more than 4,000 feet. The stand of trees along Henderson Creek, north of the proposed project area, is small and isolated; very few other trees exist along the creek within 1 mile of that stand. The only other trees in or near the proposed project area are those found at or near residences or barns.

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid occurs in a variety of habitats ranging in moisture from mesic (essentially "moderately moist") prairie to sedge meadows and bogs, none of which are found in or near the proposed project site. Its decline has resulted from a loss of habitat, particularly conversion of natural habitats to cropland and pasture, and, more recently, due to intrusion of woody vegetation, competition from nonnative species, and over-collection (USFWS 2010b).

Whooping Crane

The nonessential experimental population of whooping crane is afforded protection under the *Endangered Species Act*, and Federal agencies are required to informally confer with USFWS on actions that are likely to jeopardize the continued existence of the species. In its letter dated July 12, 2010, USFWS noted the potential presence of the species in Illinois during migration. The experimental population of whooping crane begins its migration in Canada in mid-September toward Florida. Along this migration, the crane may stop at any freshwater feature or agricultural field adjacent to such feature. To date, the species has stopped mainly in wetlands and agricultural areas on the eastern border of Illinois and western Indiana and not in Warren County [USFWS response letter dated July 12, 2010 (Attachment 6, Appendix C)].

State-Listed Species

There are only two State-listed threatened or endangered species in Warren County: bunchflower (*Melanthium virginicum*) and Eastern massasauga or massasauga rattlesnake (*Sistrurus catenatus*) (IDNR 2010). Results from a natural resources review using EcoCAT indicates no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location (Appendix C, Attachment C-3). Additionally, the massasauga is considered a Federal candidate species in some Illinois counties, but is not designated in Warren County.

Indirect and Direct Impacts

This section discusses the potential environmental impacts of the proposed project on the biological resources discussed above. The proposed project would add large, industrial structures with moving parts, within a landscape that is otherwise gently sloping and devoid of such

structures. Direct disturbance would be limited to a cumulative total of 16 acres, though the overall project would span 600 acres.

Vegetation

Potential impacts of the proposed project to vegetation would include loss of small areas of vegetation along the footprint of the project and further disturbance resulting in soil exposure that could favor ruderal (first to colonize disturbed areas), often nonnative, invasive species. Due to the fact that the proposed project area and its surroundings have already undergone intensive agricultural development, impacts to vegetation are expected to be short-term during construction and inconsequential in the longer term.

Wetlands and Other Waters of the United States

In a letter dated March 19, 2010, in response to the EcoCAT review, the IDNR stated that wetlands may exist along the railroads in the area and that "a wetlands delineation needs to be conducted to document baseline conditions." While the National Wetlands Inventory review also identified these wetlands, the existing nearby railroads and associated wetlands are not within the proposed 600-acre project area (USFWS 2010a) and are located approximately 1,400 feet from the nearest proposed construction. Dr. Cramer's follow-up findings also indicate that there would be no construction of roads or pads in the area of forested riparian zones.

Wildlife

Amphibians and Reptiles

Other than loss of a small amount of vegetated area and additional vehicular traffic during construction and occasional maintenance, the proposed project is not expected to substantially impact amphibian and reptile species. However, it is possible for individuals of this species to be killed along the project roads by collision with vehicles. This could be more likely on the side roads stemming from the main road of the southwestern area of the proposed project, as these side roads and the turbines at which they would terminate lie near drainage areas, places where many amphibians and reptiles live or visit regularly.

Non-Flying Mammals

Potential impacts to non-flying mammals could include collision with construction or operational vehicular traffic, habitat loss, or further fragmentation due to the addition of roads. Turbine operation could also adversely affect these mammals. Animals could be driven from the area due to the addition of large, vertical structures perceived as predator roosting sites, the sound that the turbine would emit, the flicker of sunlight on surrounding ground due to the rotation of the blades, or the activity in general. The non-flying mammalian species in this area have been subjected to intensive agricultural activities for decades and are accustomed to intensive human impact. Furthermore, all of these species are common. Therefore, the proposed project is not anticipated to cause substantial adverse impacts to non-flying mammals or the overall population of such mammals.

Migratory Birds and Bats

There is a potential for the wind turbines to adversely impact birds and bats. Since topics related to potential impacts to birds and bats from the proposed project overlap, this section discusses some of the general and common features to both before addressing each separately. While

numerous species of birds and several species of bats could be present at any time in the vicinity of the proposed project, most of the mortality at wind power sites has involved migrating bats and birds, not resident species (Johnson et al. 2002, 2004). Therefore, this analysis considers birds and bats that migrate in addition to residents. Since migration is seasonal, there is a seasonal component to such considerations. Furthermore, each species responds differently to turbine variables (e.g., height, diameter, speed).

Structures that rise suddenly in the landscape, such as wind turbines, communication towers, and skyscrapers, are known to cause mortality to birds and bat due to collision. Birds and bats may be killed or injured if they collide with rotors, tower guy wires, or other structures. They may also be impacted through changes in their behavior such as avoiding wind energy developments or the surrounding area. In addition, such development activities or structures may directly impact bird and bat habitat. Factors that appear to influence bird and bat mortality from wind turbines include placement, local habitats, species present, design of turbine, height, speed, lighting, weather, and season (Schwartz 2004; IDNR 2007).

The proposed turbine would have a 328-foot tower height and a rotor diameter of 271 feet, totaling 464 feet above ground level at its tallest extent. The project was designed to include certain features known to reduce bird mortality; namely, the monopole steel tube that lacks guy wires, both of which deter birds from approaching to perch. The GE 1.6xle turbine model is designed for a monopole mounting application. The proposed monopole tower would be made of tubular conical steel sections. This design eliminates the need for guy wire support of the proposed tower structure. Guy wires can be a challenge for birds and bats to locate and maneuver around, and collisions with the wires can lead to injury or death. The proposed turbine design also does not involve the use of self-supporting lattice towers, which have been used as roosting sites for birds at other wind projects. The GE 1.6xle turbine model has a relatively large rotor, which have been associated with a higher mortality of raptors (Smallwood and Thelander 2004), though rotor diameter does not appear to relate to bat mortality (Horn et al. 2008). In addition, higher turbine heights are related to increased bird mortality (Winegrad 2004) and turbine tower heights above 213 feet are associated with an exponential increase in bat mortality (Barclay et al. 2007).

Rotor speed is another important factor in bird and bat mortality. In general, very high rotor speeds are associated with greater bird mortality and very low speeds are associated with higher bat mortality. While rotor speeds have become slower with technological advancements, the turbines have generally become larger with longer blades, resulting in blade tip speeds that are still very fast. Relatively slow turbines may operate at rotor speeds below 30 revolutions per minute, but blade tips on large turbines, such as those proposed, can reach speeds in excess of 200 miles per hour under windy conditions, making the blades deceptively transparent, and causing birds to attempt to fly through the arc and be struck and killed (USFWS 2003). Rotor speed adjustment can reduce potential impacts by considering which species are likely to be present, the conditions and time of year, and what speed would minimize risks to the various species of birds and bats likely to be present.

While lighting does not appear to have an effect on bats (e.g., Horn et al. 2008), lighting can have adverse impacts on birds. Lighting choices include either white or red lights, and either pulsating (strobe) or solid (steady). The USFWS (2003) guidelines regarding lighting on turbines

specify that only white strobe lights be used at night, and that only a minimum number, intensity, and frequency of flashes allowable by FAA be used. Erickson et al.(2005) suggest that red lights, both solid and pulsating, appear to be more attractive to birds at night when the weather is inclement than white strobe lights. However, more recent research on guyed communication towers and wind turbines within the height range of the proposed Monarch turbines has demonstrated that avian fatalities can be reduced, possibly by 50 to 71 percent, by using only flashing lights and not using any solid or steady lights (Gehring et al. 2009). While Gehring et al. (2009) advocate using flashing lights of red or white, Kerlinger et al. (2010) strongly suggest that wind turbines be equipped only with flashing red lights and that steady, burning red lights not be used on turbines. They further report no significant difference in mortality between unlit towers and towers fitted only with flashing red lights and note that the FAA does not require all turbines to be fitted with lights. Therefore, limiting the project's lighting to flashing red lights on the eight turbines at the perimeter of the project is in keeping with current knowledge on minimizing avian mortality. In addition to lighting, other visual deterrents could include painting one of the blades, or part of a blade, or a rotor, a substantially different color than the rest of the turbine, such as black, or installing noise-making devices such as infrasound, or devices that frighten birds, such as certain buoys (USFWS 2003).

Birds may be impacted by wind energy development through collision, electrocution on power lines, or through behavioral avoidance of the development (Winegrad 2004). Taller towers, larger rotor diameters, and slow to intermediate tip speeds are also associated with high risk to many kinds of birds, notably certain raptors (Smallwood and Thelander 2004). The availability of perching spots on turbine towers appears less important than previously believed. Studies also suggest that higher raptor mortality is associated with the presence of rock piles left near turbines during construction. The rock piles serve as habitat for small mammals, which attract predatory raptors, which can then collide with the turbine (Thelander 2004). Since MWP would reclaim as much of the land as possible after construction and no large rock piles are expected to remain on the sites during operation, increased attraction by predators to the site is not expected.

Birds migrating along the Mississippi flyway could pass over the proposed project area and could potentially attempt to stop and rest on or near the site. This is not highly likely because, in this section of the flyway, birds tend to adhere close to the river on the eastern side of the Mississippi (Birdnature.org 2011), and the proposed project lies 15 miles from the Mississippi River. Further, the proposed project area's lack of substantial natural habitat features, such as open water or forest patches in the vicinity, makes the area unenticing as stopover habitat. Compared with average weather conditions, the presence of migrating birds in the project area is more likely during times of inclement weather conditions when birds may fly at lower altitudes and/or seek out a place to rest. Times of inclement weather during migration season, therefore, present higher risk to birds; if migrating birds do descend, they could collide with the wind turbine. However, the substantial distance from the eastern edge of the Mississippi River makes this less likely than if it were in closer range.

Winegrad (2004) advises conducting a thorough review for potential avian mortality and disturbance of critical habitat, habitat fragmentation, and other impacts. Winegrad (2004) specifies that attention be paid to impacts on specific species, not just general numbers of kills, avoiding the use of guy wires, and locating transmission wires underground. The proposed

project design includes underground transmission cables and a tubular tower design that would not use guy wires.

Bats

Most of the bats killed at energy facilities across North America are migratory tree bats, including hoary bats, eastern red bats, and silver-haired bats (Kunz et al. 2007), and the bats were killed during fall migration. While wind energy development in the grassland/agricultural landscape has lower risk of mortality to bats than other landscapes, there is still risk of bat mortality.

In a study of hoary bats in California, the number of migrating bats peaked in autumn and increased with increasing cloud cover, decreasing wind speeds, and the presence of moonlight (Cryan and Brown 2007). Another study found that spring bat migration was higher on days with lower wind speeds and warmer weather (Reynolds 2006). Unlike birds, bat mortality does not seem to be related to aviation lighting or ultraviolet paint. Bat mortality is affected by turbine height, geographic location, seasonality, weather, and wind speed, with high mortality on nights with low wind speeds. One study found higher bat mortality during fog than clear skies (Kerns and Kerlinger 2004). In addition, more bat fatalities occur at low wind speeds, which may be explained by new evidence suggesting that bats die from barotrauma, in which their lungs burst due to a sudden drop in air pressure as they arrive within a meter or two of the moving turbine (Baerwald et al. 2009). Why the bats are especially attracted to the turbines when the rotors are turning relatively slowly is not understood; they may simply be foraging or they may see the structures as potential roosting or mating sites and come to investigate. Whatever the cause of the attraction, stopping the blades from moving at low wind speeds (increasing cut-in speeds) reduces mortality and, by increasing the wind speed threshold required to start the turbines, it was shown that bat mortality can be reduced 56 to 92 percent (Baerwald et al. 2009; Caputo 2009). Bat mortality also increases exponentially with increasing height of the turbine above 213 feet. In addition, recent research shows that bat mortality may be reduced up to 53 percent by installing ultrasonic speakers on the turbines, which floods the turbine area with white high frequency noise, deterring bats (Curry 2010).

As part of the formal Section 7 consultation initiated by DOE with the USFWS for Indiana bat, the USFWS determined overall bat mortality rates for the proposed project would be similar to other wind developments in highly agricultural areas of the Midwest. Two of the most complete and thorough studies conducted to date in the Midwest occurred at Fowler Ridge Wind Farm in west-central Indiana (Good et al. 2011), and Twin Groves Wind Farm in central Illinois (Johnson et al. 2010). The results of these studies were used to ascertain a baseline bat mortality prediction for the proposed project because of landcover similarities these sites and, because the metrics and protocols used were nearly identical between studies (Appendix F, Attachment F-2). The most robust data sets attained from the Fowler Ridge (136 of 355 turbines surveyed) and Twin Groves (39 of 240 turbines surveyed) Wind Farms were collected in their second year of study, and documented 774 and 378 bat fatalities for this one year period, respectively. Dividing the bat fatalities by the number of turbines studied yields an average bat mortality at these sites to be 5.69 (Fowler Ridge Wind Farm) and 9.69 (Twin Groves Wind Farm) bats/turbine/study period. However, these data only represent the number of bat fatalities found near surveyed turbines during a limited period of searching time. Adjusted fatality estimates are necessary to account for the likelihood of scavenging, searcher efficiency, wounded individuals that may remove

themselves from the search plot, bats that may fall outside the search plot, and fatalities that occur outside the study window. The final adjusted fatality estimates for the Fowler Ridge and Twin Groves Wind Farms, accounting for the above, are 22.20 and 19.47 bats/turbine/year, respectively. The annual mortality rate per turbine for the proposed project was assumed by the USFWS to be near the mean of the Fowler Ridge Wind Farm and Twin Groves Wind Farm data, 20.84 bats. To calculate the average yearly mortality of bats for the proposed project the predicted mortalities per turbine, 20.84,was multiplied by the total number of turbines, 12 resulting in an estimated mortality of 251 bats per year (Appendix F, Attachment F-2).Based on site development recommendations from the *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003), impacts to wildlife species are expected to be minimal due to: (1) limited concentration of birds in the area (roosting, migration route); (2) absence of bat roosting or maternal colonies; (3) absence of geological features attractive to wildlife; (4) the grouped turbine spatial configuration (within 16 acres of the 600-acre project site); and (5) location of the proposed site on altered land that does not provide much habitat value.

The most effective way known to date to reduce the number of fatalities at wind turbine sites is through the implementation of operational curtailment. The above-listed bats do not have any formal state or federal protection, however, as part of the Section 7 consultation for Indiana bat, MWP would implement certain minimization measures including curtailment that would be effective in reducing mortality of all bat species. A full discussion of the proposed project's operational curtailment and other minimization measures is located below under the Indiana Bat discussion.

Federally and State-listed Species

Indiana Bat

Although Warren County is within the range of the Indiana bat, there is no suitable roosting, foraging, or hibernating habitat within the MWTP site or surrounding action area. No summer or winter records, hibernacula, or summer reproductive records of Indiana bats have been identified in Warren County (USFWS 2007). It should be noted that lack of summer reproductive records may reflect lack of surveys and not necessarily that the species is not present in the county.

No known maternity colonies occur within the project area or within a two and one-half mile diameter outside the project circumference. Maternity colonies are known to occur in the county directly adjacent and west of the project area in Henderson County and Indiana bats tend to limit their foraging within two and one half miles of their maternity colony based on expert information provided to the Service (Appendix F, Attachment F-2). DOE concludes that there is no suitable roosting or foraging habitat within 2.5 miles of the action area.

However, the location of the known maternity colonies to the west of the project county may influence the presence of migrating Indiana bats in the vicinity of the project area. The project area appears to be within the general line of flight for Indiana bats using Blackball Mine as a hibernaculum and bearing young in maternity colonies to the south and west. Gardner and Cook (2002) reported Indiana bat migration from Blackball Mine to a Missouri maternity roost just west of Adams County, Illinois. Although the exact flight path is unknown, it is likely that similar migrations occur from Blackball Mine west and south to maternity colonies in suitable

habitat along tributaries of the Mississippi River. Indiana bats migrating out of Blackball Mine have also been documented moving east and south to maternity habitat in west central Kentucky (Gardner and Cook 2002). Since no occupied maternity habitat is known north of Blackball Mine or south within one hundred miles, the most likely direction Indiana bats fly out of Blackball Mine seeking maternity habitat is west and southwest, and east and southeast. Based on these facts, potential exists for some proportion of the bats hibernating in Blackball Mine to migrate near or through the project area during their biannual migrations between their summer and winter habitats.

The potential for interactions between operating wind turbines and Indiana bats is present on the project site during Indiana bat's spring and fall migratory periods. Spring migration in northwest Illinois typically occurs during the entire month of April, a shorter time frame than fall migration. The shortened migration during spring may make bats less vulnerable to collision at the project site during this time period. To date, the number of fatalities during the spring migration period significantly lags behind those in reported in summer and fall (Arnett et al. 2008), and no known mortalities of Indiana bats have occurred during spring migration (Johnson et al. 2010, Good et al. 2011, and others). Fall migration may start as early as late July (for males) to mid-August (females) and may extend through mid-October. Two Indiana bat fatalities have been documented at Fowler Ridge Wind Farm (northwest Indiana) in habitat types similar to the proposed project and the USFWS concluded the proposed project poses a similar mortality risk to Indiana bats during fall migration throughout its functioning life (Appendix F, Attachment F-2).

The USFWS concluded that the annual mortality rate for all bats per turbine for the proposed project would be 20.84 X 12 turbines = 251 bats per year. It was assumed that only a small percentage of these mortalities would be Indiana bat. Given the that 251 total bats are projected to be killed yearly at MWTP, the UFSWS estimated 0.087% of these bats would indeed be Indiana bats, equivalent to one Indiana bat taken every five years, with a total projected take over the 25 year life of the proposed project of approximately six Indiana bats, all of which would be assumed to be taken during the fall migratory period. The estimated total amount of take (six Indiana bats) only represents 0.01% of the estimated 2009 winter population within hibernacula in the State of Illinois (53,276 Indiana bats). Loss of this small number of bats would not be sufficient to adversely impact any hibernating populations to which these individuals belong nor is it anticipated to have an adverse impact on the Blackball Mine Critical Habitat hibernaculum since loss of no more than six individuals over a 25 year span would not impair population numbers and will not impact constituent elements of the critical habitat (Appendix F, Attachment F-2).

Minimization of Impacts

As part of the Section 7 Consultation, MWP agreed to certain reasonable and prudent measures (conservation measures) in order to reduce impacts of the proposed project and assist in ensuring the estimated mortality of no more than six Indiana bats over the lifetime of the project is achieved.

The most effective way known to date to reduce the number of fatalities at wind turbine sites is through the implementation of operational curtailment. Recent studies that have raised cut-in

speeds from the factory standards (typically 3.5 - 4.0 meters/second (m/s)) to 5.0 - 6.5 m/s during the fall migratory period (1 August – 1 October) have resulted in a 57-82% reduction in overall fatalities (Baerwald et al. 2009, Arnett et al. 2010) with relatively small impacts to energy production. In an effort to obtain a significant reduction in bat fatalities and the estimated take of no more than six Indiana bats, the proposed project would operate using a raised cut-in speed of 5.0 m/s, during the fall migration period and implement other minimization measures for the lifetime of the project or until new information becomes available and with approval of the USFWS, as follows:

1. The proposed project would implement cut-in speeds of 5.0 m/s.

2. Turbine blades will be feathered at wind speeds below 5.0 m/s.

3. Raised cut-in speeds and blade feathering will be used from 0.5 hours before sunset until 0.5 hours after sunrise during the fall migration period, from August 1 to September 30.

4. Spring fatality monitoring will occur in operation years 1, 2, and 3 using protocols designed in conjunction with the USFWS and as outlined in Biological Opinion for the proposed project (Appendix F, Attachment F-2).

5. Fall fatality monitoring will occur in operation years 1, 2, 3, 8, 13, 18, and 23 using protocols designed in conjunction with the USFWS and as outlined in Biological Opinion for the proposed project (Appendix F, Attachment F-2).

Eastern Prairie Fringed Orchid
As mesic to wet, unplowed tallgrass prairies and meadows, bogs, fens, or sedge meadows do not occur on the project site, no habitat exists for this species. Additionally, there are no existing populations of this species in Illinois (USFWS 2010b). DOE, therefore, determined that the project would have no effect on the eastern prairie fringed orchid.

Whooping Crane
The nearest wetlands or ponds that might be used as stopover habitat by whooping cranes are 1.3 and 1.5 miles northeast of the MWTP site, and all electrical connection lines required for this project would be buried. DOE, therefore, determined that the proposed project would not result in jeopardy to the nonessential experimental population of the whooping crane.[3]

State-Listed Species
None of the State-listed species is present in the project area. Therefore, State-listed species would not be impacted by the proposed project.

3.2.2.7 Human Health and Safety

Workers can be injured or killed during construction, operation, and decommissioning of wind turbines through industrial accidents such as falls, fires, and dropping or collapsing equipment.

3. Jeopardy occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is considerably reduced.

Such accidents are uncommon in the wind industry and are avoidable through implementation of proper safety practices and equipment maintenance.

The fall zone is defined as the approximate area around the base of the turbine that would likely receive the tower and/or turbine if it were to fall. In the event of wind turbine collapse, wind turbine towers tend to buckle or bend prior to collapse. Therefore, for this analysis, the fall-zone radius was determined to be 1.1 times the total turbine height, or approximately 510 feet.

The potential for the proposed turbines to fall over or collapse, causing damage, injury, or death is remote; however, collapses do occur. For example, in March and October 2009, 1.5-megawatt GE turbines collapsed in Altona and Fenner, New York, respectively. GE has indicated that only 5 of the 13,000, or 0.0004 percent, of GE turbines operating globally have collapsed since 2002 (Bogdan 2009). While tower collapses are rare, reported instances have been due to blade strikes, rotor over speed, cyclonic winds, and poor or improper maintenance (Global Energy Concepts 2005). No occupied structures are located within the fall zone of the turbine locations proposed for the MWTP.

Collapse of a turbine or breakage (and throwing) of one or more turbine blades is possible, but very unlikely to occur. MacQueen et al. (1983) estimate the probability of being struck outside of a one-blade diameter (271 feet, in this case) of the tower base is about one chance in ten million (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 ice throw. Ice shedding, or ice throw, 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. Any ice that had 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. 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. Two 100-gallon fuel containers would be stored onsite in a temporary spill containment area.

Electromagnetic fields (EMFs) include both electric fields and magnetic fields, invisible lines of force produced by, but not limited to, power lines, electrical transmission wiring, and electrical devices. Voltage in electrical devices or wires produces electric fields that increase in strength as the voltage increases. Note that the device does not have to be turned on for electrical fields to exist. The flow of electric current through electrical devices or wires produces magnetic fields, which increase in strength as the current increases. The device must be turned on (current flowing) for magnetic fields to exist. Electrically conductive materials and even poor conductors such as structures, plants/trees, and human skin, shield electric fields. Magnetic fields are more difficult to shield as they pass through most materials. EMFs rapidly decrease with distance from the source (NIEHS 2002).

The project area is not located in the immediate vicinity of a local or regional airport or a military air base. The closest airport to the project site is the Monmouth Municipal Airport, roughly 5 to 6 miles away from the proposed turbine sites. All structures more than 200 feet tall must have aircraft warning lights in accordance with requirements specified by the FAA.

Direct and Indirect Impacts

All contractors, subcontractors, and their personnel are required to comply with all Federal and State worker safety requirements, specifically all of the applicable OSHA requirements. Safety procedures specific to the GE 1.6xle turbine would be observed whenever work is being done on the turbine.

No adverse security impacts are anticipated due to the project. The turbines for the proposed project are a monopole design and access to the turbines is through a lockable steel door at the base of the tower. Safety signage would be posted around the towers (where necessary); transformers and other high-voltage facilities would conform with applicable Federal and State regulations. MWP employees would be educated as to security procedures to be observed when in the vicinity of the turbine. As the nearest occupied structure is over 1,000 feet from any turbine, the potential for injury within the fall zone and/or by icing would be minimal. Due to the extreme rarity of tower collapse or blade throw and the fact that Warren County and MWP control the entire blade impact zone and the vast majority of the tower collapse zones, the risks to public safety due to such occurrences could be mitigated by access management within these zones. The same access management strategies could mitigate the risks to public safety due to ice throw or shedding conditions, which are in effect only on a very limited temporal basis.

The potential for fire or explosion from the wind energy facility is minimal. The turbines would be equipped with lightning sensors in the turbine blades and would be grounded and shielded to protect against lightning (GE 2010). The electrical effects of the proposed distribution line can be characterized as current-induced magnetic fields and voltage-induced electrical fields. There are no Federal standards governing electric or magnetic fields; however, no turbine would be closer than 1,500 feet to occupied residential structures where the EMF would be at background levels. EMF sources expected at the Monarch site include interconnection to the power grid, wind turbine generators, electrical transformers, and the underground connector network. The interconnection to the power grid would be the same arrangement as any other connection in the

existing transmission system. EMF levels would be similar to those experienced in common household appliances and are considered negligible (Windrush Energy 2004). Generator windings would be enclosed in conductive metal to reduce effective EMF generated to zero. The EMF generated by the electrical transformer would be negligible a short distance from the transformer and similar to any other transformer encountered (Windrush Energy 2004; Synergy 2009). Underground power lines forming the connector network would generate effectively no EMF due to conductor spacing and shielding (NCCEH 2010; Synergy 2009). Based on the most current research on EMFs, and the distance between any turbine and occupied residences, the turbine would have no impact to public health and safety due to EMFs.

MWP does not anticipate encountering contaminated soils, as the project location is within active agricultural fields that have historically been used for agricultural or residential purposes. Production of hazardous wastes as a result of operation or maintenance of the wind turbine is not expected.

The FAA issued a Determination of No Hazard to Air Navigation for each of the original 13 proposed wind turbines, one of which has subsequently been removed from project consideration. This aeronautical determination issued by the FAA indicated that the 13 originally proposed structures would have no substantial adverse effect on the safe and efficient utilization of navigable airspace by aircraft or on the operation of air navigation facilities.

3.2.2.8 Transportation

The project site is served by U.S. Highway 67 and 140th Avenue. Access to the Interstate transportation system is available at the U.S. Highway 34/Interstate-74 junction just north of Galesburg, 18 miles northeast of the proposed project site. The turbine nacelle would be delivered from Greensboro, North Carolina, via tractor-trailers designed for the proposed loading. Nacelles would be transported via Business I-40W to U.S. Highway 52N. South of Mt. Airy, North Carolina, the trailers would merge onto I-74W, which eventually becomes I-77N. The route would continue by keeping left onto I-64W near Charleston, West Virginia. The trailers would make a right turn onto WV-34, staying on US-35 (left) until Dayton, Ohio, when the trailers would merge onto I-70W toward Indianapolis, Indiana. North of Indianapolis, travel on I-70W would cease and the tractor-trailers would travel on I-65N, I-465S, and I-74W. Northeast of Galesburg, Illinois, the trailers would turn onto U.S. Highway 34 and travel southwesterly into Monmouth, Illinois, where they would merge onto Highway 67 and travel to their final destination near the intersection of Highway 67 and 140th Avenue.

The turbine towers and blades would be transported by tractor-trailers designed for the proposed loading. These trailers would travel to the proposed site via major interstates and highways; the route would be determined once the receiving port is designated.

At the start of the project, MWP would construct a 16-foot-wide, permanent gravel access road leading to each turbine. A total of 192,000 square feet (4.4 acres) of roads would be constructed for this project. The tractor-trailers would continue on these access drives to each proposed turbine site. All other construction vehicles would access the site via U.S. Highway 67 or 140th Avenue.

The site is located approximately 1,400 feet at its closest point from the Burlington Northern Santa Fe Railroad.

Direct and Indirect Impacts

During the peak construction phase of the project, which is anticipated to last approximately four months, MWP anticipates a temporary increase in vehicular traffic on U.S. Highway 67 and 140th Avenue. No long-term or permanent impacts to the local transportation systems would occur as a result of this project.

Large pieces of equipment such as the turbine tower, rotor blade, and nacelle would be designated oversized loads and would temporarily slow traffic on I-74, U.S. Highway 34, and U.S. Highway 67. Some minor disruption of traffic could occur during construction of the access road, particularly the portion that leads to the existing thoroughfare. However, these would be short-term impacts. MWP would inspect and maintain all access roads on a regular basis to minimize erosion.

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." Between 2005 and 2009, the racial makeup of Monmouth was 86.9 percent white with the remainder minorities (Bureau of the Census 2010a), compared with 91.9 percent for Warren County as a whole (Bureau of the Census 2010b). The median household income and median family income in 2009 dollars for a household in Monmouth in 2000 were $29,959 and $36,505, respectively, compared with $38,433 and $46,650, respectively, for Warren County as a whole. About 18.6 percent of Monmouth and 14.5 percent of Warren County residents were below the poverty level in 2009 (Bureau of the Census 2010a, 2010b).

As described in Table 1-1, a concern for stakeholders is the potential for property values of the wind turbine site and adjacent properties to be adversely impacted as a result of implementation of the proposed project. A recent study identified the following categories of concern (DOE 2009):

- Area Stigma: A concern that the general area surrounding a wind energy facility will appear more developed, which may adversely affect home values in the local community regardless of whether any individual home has a view of the wind turbines.

- Scenic Vista Stigma: A concern that a home may be devalued because of the view of a wind energy facility, and the potential impact of that view on an otherwise scenic vista.

- Nuisance Stigma: A concern that factors that may occur in close proximity to wind turbines, such as sound and shadow flicker, will have a unique adverse influence on home values.

Direct and Indirect Impacts

The proposed wind project would be located within an agricultural and residential area and over 1,500 feet from the nearest occupied residential structure. The analysis for this EA did not find any potential high and adverse impacts to human health or environmental resources. Therefore, there would be no disproportionately high and adverse human health or environmental impacts on minority populations or low-income populations.

Results of the 2009 DOE study are strongly consistent in that each model fails to uncover conclusive evidence of the presence of any of the three property value stigmas. Based on the data and analysis presented in the 2009 study, DOE found no evidence that home prices surrounding wind facilities would be consistently, measurably, and adversely affected by either the view of wind facilities or the distance of the home to those facilities (DOE 2009). Note that this study included two wind facilities located in Lee County, Illinois, approximately 100 miles northeast of the proposed project location.

An even more recent publication (Hinman 2010) looks at the Twin Groves wind farm (Phases I and II), located in McLean County, Illinois (approximately 100 miles to the southeast) to examine whether it "has impacted nearby residential property values and whether any impact on nearby property values changes over the different stages of wind farm development." That report found that even before approval was granted, properties located near the proposed wind farm were devalued when compared to other areas. Further, impacts to property values varied based on the development progress, and property values corresponded to perceived levels of risk by the community and homebuyers. However, the report concluded that once the wind farm began operations, and the community members living in close proximity to the wind farm gained information regarding the extent of aesthetic and noise impacts to evaluate their earlier concerns, property values rebounded and soared higher in real terms than they were prior to wind farm approval. Thus, this study presents evidence that demonstrates close proximity to an operating wind farm does not necessarily negatively influence property values or property value appreciation rates (Hinman 2010).

As demonstrated in the above two references, there is supporting evidence that implementation of the proposed project would not negatively impact property values of the wind turbine site or adjacent properties.

MWP estimates that the MWTP would create 89 jobs and result in the retention of 25 jobs (direct and indirect combined). WPCS International, the primary subcontractor for construction, engineering, and post-installation operations and maintenance services, maintains an office in nearby Moline, Illinois. Local subcontractors and professionals would be utilized whenever possible. Upon completion, MWP would hire four to five new professional employees in addition to one to two local operations staff. County revenues associated with the project would amount to about $250,000 at the beginning of operations (plus $100,000 for the special use permit fees) and approximately $200,000 per year (based on current prices for electricity) for the life of the project.

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 dioxide, nitrogen oxides, ozone, and lead. The EPA has established National Ambient Air Quality 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 EPA's online air quality maps and monitoring data, Warren County is in attainment for carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, $PM_{2.5,}$ and PM_{10}, which means that the levels of these pollutants in the air are below the EPA standards.

Electricity generated by the proposed project would be purchased by Ameren, a local utility serving Illinois and Missouri. Currently, Ameren obtains its electricity through the following energy sources: coal (83.2 percent), nuclear (11.9 percent), gas (3.5 percent), hydropower (1.0 percent) oil (0.3 percent) and non-hydropower renewable energy (0.1 percent). Therefore, fossil fuels are the primary source of energy for Ameren customers.

Direct and Indirect Impacts

The proposed project would be a renewable energy generation project that would not degrade air quality. Aside from temporary dust generated during construction and decommissioning, which would be minimized to the extent practicable (for example, by keeping gravel on roads and watering dry, unpaved roads), this project would not result in any adverse impacts to air quality. The project would not require any air permits.

Greenhouse gases (GHGs) such as carbon dioxide contribute to climate change. The proposed project is expected to generate approximately 64,551 megawatt-hours per year of renewable energy that would otherwise be obtained from primarily fossil fuel sources, which emit carbon dioxide. According to RETScreen, a widely used global model provided by the Ministry of Natural Resources of Canada, with calculations and support from the National Aeronautics and Space Agency, United Nations Environmental Programme, and the Renewable Energy and Energy Efficiency Partnership, a 19.2-megawatt project with a net capacity factor of 36 percent would have the potential to offset annual gross GHG emissions by 36,582 tons of carbon dioxide, if replacing a mix of energy sources (coal, petroleum, natural gas, other gases, nuclear, hydroelectric conventional, wind, wood and wood derived fuels, other biomass), or as much as 61,725 tons of carbon dioxide, if replacing coal-only power plants. These numbers are equivalent to taking 6,700 and 11,305 cars and trucks off the road, respectively. Thus, future GHG and carbon dioxide emissions from electricity generation to serve the region would be higher without the proposed wind project.

3.2.2.11 Utilities and Energy

The MWTP would produce 64,551 megawatt-hours of clean renewable energy per year. Based on information from the Energy Information Administration's statewide aggregates, the current annual retail electricity sales in Warren County total approximately 63.5 million kilowatt-hours, almost identical to MWP's expected production. Because of a large number of other sources of energy consumption (i.e., line losses, the commercial and industrial sectors), per capita total

energy use in the area is actually higher. Because the electricity from the proposed project would feed into the nearest node, which is in Galesburg, the pool of energy to which it would be added is much larger than Warren County, or even Lenox Township, alone. The proposed project, while not satisfying all the needs of the nearby community, would potentially make a substantial contribution to the sustainability of the fuel mix in the region.

Communication, Radar, and Navigation Systems

The global positioning system (GPS) consists of a satellite constellation in constantly moving orbit above the earth, transmitting signal information to earth for land, sea, and air based receivers. GPS receivers use the transmitted signal to triangulate an exact location. The use of additional land based transmissions such as Wide Area Augmentation System and Differential GPS allows for improved accuracy. Several sources of potential GPS signal and ultimately positional error exist. Potential GPS signal errors include, but are not limited to, ionosphere and troposphere delays, signal multipath, receiver lock error, orbital error, number of satellites visible, satellite geometry/shading, and intentional signal degradation.

Wind turbines have the potential to impact National Weather Service NEXRAD radar in a number of ways – including the radar base data, algorithms, and derived products – due to movement of turbine blades in the radar line of sight. Additionally, if turbines are located close enough to the radar, they could physically block the radar or reflect the beam back, causing hardware damage. The moving blades of wind turbines in the radar line of sight can potentially reflect radar energy, which would "visually contaminate the reflectivity, velocity, and spectrum width data" used by forecasters to determine storm intensity (NOAA 2010). Furthermore, the radar energy return from wind turbines may resemble that returned from showers or thunderstorms, or may alter the appearance of a return from actual weather activity. The result is visually corrupted data introducing uncertainty to analysis and resulting forecasts. Base reflectivity, velocity, and spectrum width data are used by radar processing algorithms to detect potentially damaging or dangerous weather activity; corrupted return data could potentially result in false or missed alerts. Wind turbines located in close proximity to radar could return energy strong enough to exceed the radar receiver's protector resulting in damage to the receiver. Additionally, wind turbines sited close to radar could shadow or block returns that would otherwise come from behind the turbines, resulting in loss of radar coverage (NOAA 2010).

Electromagnetic interference to electrical devices or systems is caused by EMFs disrupting their operation. EMFs generated at wind facilities can potentially impact television, radio, wireless communications, and private fixed link communication systems.

The NTIA is responsible for managing the Federal electromagnetic 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. While a voluntary process, upon submittal by a wind project proponent, the NTIA provides project-specific information to the members of the Administration's Interdepartmental 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 proposed project is not anticipated to result in adverse impacts related to energy supply, but rather would benefit the environment by potentially reducing reliance on and use of fossil fuels. The turbines would produce up to 19.2 megawatts of electricity, which would be transferred to distribution lines in the project area; therefore, most of the energy produced by the project would likely be consumed locally. The Ameren Feasibility and System Impact Study suggests that most, if not all, of the power from the project would service the local area, especially during the peak periods of electricity demand during the spring and autumn. Currently, almost all of the electricity used by Monmouth residents comes from the Galesburg node. However, if the proposed project is implemented, some of that load would be replaced by electricity generated locally by the project. Supplying energy to the distribution lines in this area may result in some additional benefit by reducing line loss otherwise resulting from transmission of energy from distant sources.

Communication, Radar, and Navigation Systems

Of the potential GPS signal errors, only signal multipath, number of satellites visible, and satellite geometry/shading could potentially be increased by implementation of the proposed project. Signal multipath error results when the transmitted GPS signal is reflected off an object such as a wind turbine prior to reaching the GPS receiver, resulting in increased signal travel time and positional error. The number of satellites visible at a location could be impacted when a GPS receiver is located close to a structure such as a wind turbine, resulting in a loss of view of constellation and available satellites.

GPS signal multipath errors are corrected by the use of sophisticated signal rejection techniques (software) available in modern GPS receivers (Trimble 2010). Errors potentially associated with the number of satellites visible and the satellite geometry/shading are easily avoided by modern GPS receivers tracking multiple satellites simultaneously to use as many available satellites as possible as well as the best satellite geometry available. With the use of modern GPS receivers there would be little to no potential impacts to GPS navigation associated with implementation of the proposed project.

The three closest NEXRAD radar locations to the proposed project include KDVN (Quad Cities, Iowa), KILX (Lincoln, Illinois), and KLSX (St. Louis, Missouri). The FAA "DoD Preliminary Screening Tool" was used to evaluate the proposed project location with respect to the three closest NEXRAD radar locations and their individual radar line of sight. The tool shows that the proposed projects would have minimal to no impact to NEXRAD radar or NEXRAD derived products such as weather alerts (FAA 2010).

Siting towers out of the line of sight of communications services broadcast towers would eliminate interference. Synthetic blade design of modern towers also reduces interference. Several simple mitigation measures are available for those instances when residential units are located in such proximity to towers that interference is unavoidable (higher quality or directional antennas, amplifiers, relocating antennas, repeaters) (EWEA 2009).

On October 19, 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 C-2). 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. An example of an irretrievable resource is 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 7 acres of land would be irreversibly committed during the functional life of the project.

3.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with the proposed project include:

- Long-term loss of approximately 7 acres of agricultural land resulting from the construction of the turbine foundations, substation, and access roads;
- An increase in noise levels during construction and operation; and
- The introduction of dominant vertical elements into the existing viewshed.

These impacts are both temporary, in the case of the construction noise, and long-term in regard to the loss of agricultural land and visual impacts. Overall, impacts of the proposed project on the environment and human health are minimal, as described in the relevant sections in Chapter 3.

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 used here, 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 had reached its useful life, the turbines, towers, and foundations could be decommissioned and removed, and the site reclaimed and returned to agricultural production. The installation of wind turbines 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 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 reviewed information on past, present, and reasonably foreseeable future projects and actions that could result in impacts to a particular resource over the same period and in the same general location as the proposed project. To determine cumulative impacts from past, existing, and reasonably foreseeable projects, DOE conducted online research to identify current and future projects in the vicinity of the MWTP location. No pending or planned projects were identified within the area to be affected by the turbine's land use, visual impacts, or noise impacts. Additionally no past projects were identified that could have a cumulative impact when combined with the impacts of the proposed project.

As the initial step in addressing cumulative impacts, DOE determined that the resource area that encompasses all potential cumulative impacts of the wind energy project would be determined by potential impacts to biological resources, i.e., migratory birds and bats, and threatened and endangered species. To evaluate the cumulative impacts to biological resources, DOE reviewed the USFWS *Indiana Bat* (Myotis sodalis) *Draft Recovery Plan* (USFWS 2007). The Draft Recovery Plan notes that Indiana bat migration and swarming patterns have not been extensively studied and are poorly understood and summarizes existing data (USFWS 2007). Eight fall swarming period studies indicated a migratory range of 0.32 to 30.6 kilometers (0.2 to 19 miles). Eight spring emergence studies indicated a migratory range of 16.1 to 96.6 kilometer (10 to 60 miles) and two spring emergence studies indicated migratory distances of 477 and 575 kilometers (296 and 357 miles) (USFWS 2007). Based on these data, DOE determined that 96.5 kilometers (60 miles) is a reasonable distance for evaluating the potential for cumulative impacts to migrating individuals.

DOE identified the following wind energy projects that are within a 60-mile radius around the site.

Existing Projects (data as of July 24, 2010, from the Illinois Working Group)

- Camp Grove Wind Farm (Marshall and Stark Counties) – Operating 100 wind turbines for a total capacity of 150 megawatts

- Bureau Valley School District (Bureau County) – Operating 1 wind turbine for a total capacity of 660 kilowatts

- Crescent Ridge Wind Farm (Bureau County) – Operating 33 wind turbines for a total capacity of 54.45 megawatts

- AgriWind Wind Farm (Bureau County) – Operating 4 wind turbines for a total capacity of 8.4 megawatts

- Providence Heights Wind Farm (Bureau County) – Operating 36 wind turbines for a total capacity of 72 megawatts

- Sharrod High School Wind Turbine (Rock Island/Mercer County) – Operating 1 wind turbine for a total capacity of 600 kilowatts

- Pigeon Creek Wind Turbine (Adams County) – Operating 1 wind turbine for a total capacity of 900 kilowatts

- City of Genesco Wind Turbines (Henry County) – Operating 2 wind turbines for a total capacity of 3 megawatts

Permitted Projects

- Adams Electric Cooperative II (Brown County) – Operating 1 wind turbine for a total capacity of 900 kilowatts

- Spring Creek Wind Farm (Henry County) – Operating 135 wind turbines for a total capacity of 200 megawatts

- Midland Wind Farm (Henry County) – Operating 70 wind turbines for a total capacity of 104 megawatts capacity

- Bishop Hill Wind Energy Center (Henry County) – Operating 266 wind turbines for a total capacity of 400 megawatts

In addition, two other wind projects are currently proposed for Warren County and were examined in connection with this project with respect to potentially cumulative impacts. The Coldbrook-Alexis Wind Farm would have a 200-megawatt capacity with 134 turbines. The project would be located near Coldbrook Township in Warren, Mercer, and Knox counties, over 10 miles northeast of the proposed project site. The EcoPoint Wind Farm would have a 200-megawatt capacity with 134 turbines. The Coldbrook-Alexis Wind Farm is located in Point Pleasant, Swan and Sciota townships, over 10 miles south and southwest of the proposed MWTP.

4.2 Summary of Cumulative Impacts

4.2.1 CUMULATIVE GREENHOUSE GAS IMPACTS

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 GHGs 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, 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 release of anthropogenic GHGs and their potential contribution to global warming are inherently cumulative phenomena. It was assumed that this wind energy project would displace fossil fuel electricity currently used by the municipality, resulting in potential annual gross GHG reductions of 36,582 tons of carbon dioxide, if replacing a mix of energy sources, or as much as 61,725 tons of carbon dioxide, if replacing coal-only power plants. These numbers are equivalent to taking 6,700 and 11,305 cars and trucks off the road, respectively. The proposed project would neither reduce the concentration of GHGs in the atmosphere nor reduce the annual rate of GHG emissions. Rather, it would potentially decrease the rate at which GHG emissions are increasing every year and contribute to efforts ongoing globally to reduce GHGs and slow climate change.

4.2.2 VISUAL RESOURCES

The proposed project would affect the viewshed in the project area. The turbines would be dominant vertical components in the landscape due to their height, but would not obstruct views in the way that a large building might. Because the proposed site would be within a relatively open, flat setting, visual impacts are anticipated to be substantial. However, because of the developed nature of the area (commercial grain elevator, aboveground utilities, highways and railroads), the wind turbines would fit in with regard to the developed nature of the area. Additionally, the area as a whole is absent of focal points, significant landforms, and converging landscapes, and would therefore have no impact on a unique landscape.

As shown by the visual simulations completed for this project, the absence of mature trees in the surrounding area would allow views of the wind turbines in excess of 5 miles. The proposed Coldbrook-Alexis Wind Farm in Coldbrook Township is located over 10 miles northeast of the proposed project site, and there may be a few isolated locations where turbines from both wind projects are visible. However, due to the significant distance between these properties, the turbines would not be dominant elements in the viewshed of the viewer. None of the other projects listed above could be seen from the MWTP. Thus, cumulative impacts on visual resources are not expected.

4.2.3 BIOLOGICAL IMPACTS

The USFWS lists the entire state of Illinois as potential habitat for the Indiana bat, an endangered species (http://www.fws.gov/midwest/endangered/lists/illinois-spp.html). However, there have been no known occurrences of the Indiana bat in Warren County. The closest known location of an Indiana bat maternal colony and critical habitat is the Blackball Mine, which is approximately 90 miles east-northeast of the proposed project site.

Although some recent studies have shown that Indiana bats may migrate to hibernacula up to 357 miles away, USFWS (2007) also indicates that the Indiana bat's typical migration is within a distance of 60 miles. Based on the existing 241 turbines operating (396 megawatts) and the other reasonably foreseeable projects [estimated to be greater than 900 turbines (1,152 megawatts)] within 60 miles of the proposed project, the potential for cumulative impacts to the Indiana bat

cannot be ruled out. However, the proposed project includes the installation of 12 turbines, which would provide only a small increment to any potential cumulative impact. Additionally, to determine potential impacts to Indiana bats, DOE prepared a Biological Assessment for the proposed project in accordance with Section 7 of the *Endangered Species Act*. USFWS Region 3 office recently began preparation of a Regional Habitat Conservation Plan. Although this plan likely will take several years to complete, it is intended to address cumulative impacts to the Indiana bat and develop avoidance, minimization, and mitigation measures for existing and proposed wind turbines.

The only wildlife species that are likely to be impacted by the proposed project are birds and bats due to the possibility of collisions with the turbine. Birds and bats, but birds in particular, are known to collide with numerous manmade structures such as vehicles, buildings and windows, power lines, communication towers, as well as wind turbines. It has been estimated that from 100 million to more than 1 billion birds are killed annually in the United States due to collisions with manmade structures (Erickson et al. 2001). Bat mortality rates vary from 0.1 to 69.6 bats per turbine per year depending on the habitat type, physical characteristics of the area, and time of year (Arnett et al. 2008). Bat mortalities in open areas like the Midwest usually fall between the low values in the West (1 to 2 bats per turbine per year) and the high values in the Appalachians and Alleghenies (46 or more bats per turbine per year; IDNR 2007); although, recently, higher bat mortality rates were noted (40.7 to 70.7 bats per turbine) in a few Wisconsin studies (Gruver et al. 2009; BHE Environmental 2010; Drake et al. 2010). Avian mortality rates at Midwest sites, particularly agricultural ones, generally average 1 to 2 birds killed per turbine per year (Erickson et al. 2008) but were documented as high as 7 birds per turbine per year at one project site in Wisconsin (Gruver et al. 2009). The proposed project would add 12 more structures into the project area with which birds and bats may collide. The wind generation industry estimates Illinois can provide up to 9,000 megawatts from up to 6,000 turbines (IDNR 2007). Furthermore, the installation of 12 turbines is a small contribution to the projected 900 turbines in the area, and the turbines are scattered across the landscape with the nearest wind facility just more than 10 miles north of the proposed project site. Additionally, although the proposed project lies within the Mississippi flyway, the lack of suitable stop-over habitat and water reduces the likelihood of large concentrations of migratory birds in the area. Therefore, cumulative impacts on biological resources are expected to be minimal.

5. REFERENCES

Arnett, E.B.; Brown, W.K.; Erickson, W.P.; Fiedler, J.K.; Hamilton, B.L.; Henry, T.H.; Jain, A.; Johnson, G.D.; Kerns, J.; Koford, R.R.; Nicholson, C.P.; O'Connell, T.J.; Piorkowski, M.D.; and Tankersley, R.D., Jr. 2008. "Patterns of bat fatalities at wind energy facilities in North America." *Journal of Wildlife Management* 72:61-78.

Australia NHMRC (Australia National Health and Medical Research Council) 2010. *Wind Turbines and Health – A Rapid Review of the Evidence.* July. Available online at: http://www.nhmrc.gov.au/publications/synopses/new0048.htm (accessed September 8, 2010).

Baerwald, E.F.; Edworthy, J.; Holder, M.; and Barclay, R.M.R. 2009. "A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities." *Journal of Wildlife Management*, 1077-1081.

Barclay, R.M.R.; Baerwald, E.F.; and Gruver, J.C. 2007. "Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height." *Can. J. Zool.* 85:381-387.

BHE Environmental 2010. *Post-construction bird and bat mortality study Cedar Ridge wind farm Fond du Lac County, Wisconsin*. Interim Report prepared for Wisconsin Power and Light and submitted to Wisconsin Public Service Commission.

Birdnature.org 2011. "North American Migration Flyways." Available online at: Birdnature.org (accessed February 16, 2011).

Bogdan, J. 2009. "Responsibility for Toppled Turbine Cloudy." *The Observer-Dispatcher*. December 28. Available online at: http://www.uticaodcom/news/x1437795639/Responsibility-for-toppled-turbine-cloudy (accessed January 17, 2011).

Brack, V., Jr. 1983. The non-hibernating ecology of bats in Indiana with emphasis on the endangered Indiana bat, Myotis sodalis. Dissertation. Purdue University, West Lafayette, IN. 280 pp.

Bureau of the Census 2010a. "Monmouth City, Illinois – Fact Sheet – American FactFinder." Available online at: http://factfinder.census.govhttp://factfinder.census.gov (accessed December 20, 2010).

Bureau of the Census 2010b. "Warren County, Illinois – Fact Sheet – American FactFinder." http://factfinder.census.govhttp://factfinder.census.gov (accessed December 20, 2010).

Caputo, J. 2009. "Can Wind Power Be Wildlife Friendly? As birds and bats migrate along windy mountain ridges—the same ridges that are optimum sites for wind turbines--new research aims to stop turbines from killing animals." February 27. Available online at: http://www.smithsonianmag.com/specialsections/ecocenter/energy/Can-Wind-Power-Be-Wildlife-

Friendly.htmlhttp://www.smithsonianmag.com/specialsections/ecocenter/energy/Can-Wind-Power-Be-Wildlife-Friendly.html (accessed September 12, 2010).

CMOH (Ontario Chief Medical Officer of Health) 2010. The Potential Health Impact of Wind Turbines. http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf (accessed September 19, 2010).

Colby, W.D.; Dobie, R.; Leventhall, G.; Lipscomb, D.M.; McCunney, R.J.; Seilo, M.T.; and Søndergaard, B. 2009. Wind Turbine Sound and Health Effects: An Expert Panel Review, prepared for American Wind Energy Association and Canadian Wind Energy Association. Available online at: http://www.awea.org/documents/AWEA_CanWEA_SoundWhitePaper_ExecSumm.pdf

Cryan, P.M. and Brown, A.C. 2007. "Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines." *Biological Conservation* 139:1-11.

Curry, A. 2010. "Hope stemming wind energy's toll on bats." *National Geographic News*. September 15. Available online at: http://news.nationalgeographic.com/news/2010/09/100915-energy-wind-bats/ (accessed January 7, 2011).

DOE (U.S. Department of Energy) 2006. Memorandum. Office of NEPA Policy and Compliance. Need to Consider Intentional Destruction Acts in NEPA Documents. December 1, 2006.

DOE (U.S. Department of Energy) 2009. "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis." Available online at: http://eetd.lbl.gov/EA/EMP

Drake, D.J. Garvin; Grodsky, S.; and Watt, M. 2010. *Post-construction bird and bat monitoring at the Forward Energy Center Second Interim Report*. Interim Report prepared for Forward Energy LLC and submitted to the Wisconsin Public Service Commission.

DWIA (Danish Wind Energy Association) 2003. "Shadow Casting from Wind Turbines." Available online at http://guidedtour.windpower.org/en/tour/env/shadow/index.htm (accessed January 17, 2011).

Edge Consulting 2010. *Phase I Archeological Reconnaissance Survey, Monarch Wind Farm Project, Lenox Township, Warren County, Illinois*.

EPA (U.S. Environmental Protection Agency) 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA Publication No. 550/9-74-004, April 2, 1974. Washington, DC: U.S. Government Printing Offices.

EPA (U.S. Environmental Protection Agency) 1977. *Toward a National Strategy for Noise Control*. U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington D.C., 20460.

EPA (U.S. Environmental Protection Agency) 2005. "How Does the Electricity I Use Compare to the National Average?" Available online at: http://oaspub.epa.gov/powpro/ept_pack.charts (accessed on January 19, 2011).

Epilepsy Foundation (American Epilepsy Foundation) 2010. "Photosensitivity and Epilepsy, photosensitivity and Seizures" Available online at: http://www.epilepsyfoundation.org/about/photsensitivity (accessed January 17, 2011).

Erickson, W.P.; Johnson, G.D.; Strickland, M.D.; Sernka, K.J.; and Good, R.E. 2001. *Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States*. Prepared for the National Wind Coordinating Committee. Available online at: http://www.west-inc.com

Erickson, W.P.; Johnson, G.J.; and Young, D.P. 2005. *A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions*. USDA, Forest Service, General Technical Report PSW-GTR-191, pp 1029-1042. Albany, California.

Erickson, W.G.; Strickland, D.; Young, D.; and Johnson, G. 2008. "A Summary of Avian and Bat Fatality at Wind Facilities in the U.S." In *Proceedings of the NWCC Wind Wildlife Research Meeting VII*. Milwaukee, WI. October 28-29, 2008. Available online at: http://old.nationalwind.org/events/meetings/wildlifeVII.htm

EWEA (European Wind Energy Association) 2009. "Environmental Impacts - Onshore." *Wind Energy – The Facts*. Available online at: http://www.wind-energy-the-facts.org/fr/environment/chapter-2-environmental-impacts/onshore-impacts.html (accessed November 10, 2010).

FAA (Federal Aviation Administration) 2007. "Obstruction Marking and Lighting," *Advisory Circular, AC 70/7460-1K*, Change 2. U.S. Department of Transportation.

FAA (Federal Aviation Administration) 2010. DoD Preliminary Screening Tool. Available online at: https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm (accessed November 5, 2010).

GE (General Electric) 2010. Technical Documentation Wind Turbine Generator Systems. GE 1.6xle- 50 Hz / 60 Hz.

Gehring, J.; Kerlinger, P.; and Manville, A.M. 2009. "Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions." *Ecological Applications* 19:505–514.

Global Energy Concepts 2005. *Public Health and Safety*. NYS Energy Research and Development Authority. Available online at:

http://www.powernaturally.org/programs/wind/toolkit/18_publichealthandsafety.pdf (accessed January 17, 2011).

Gruver, J.; Sonnenburg, M.; Bay, K.; and Erickson, W. 2009. *Post-construction bat and bird fatality study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin*. Final Report submitted to the Wisconsin Public Service Commission by WEST, Inc.

Harding, G.; Harding, P.; and Wilkins, A., 2008. "Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them." *Epilepsia*, 49(6): 1095-1098.

Herkert, J.R. editor. 1992. *Endangered and Threatened Species of Illinois: Status and Distribution*. Volume 2 – Animals. Illinois Endangered Species Protection Board, Springfield, Illinois. 142 pp.

Hinman, J.L. 2010. *Wind Farm Proximity and Property Values: A Pooled Hedonic Regression Analysis of Property Values in Central Illinois*. May. Available online at: http://renewableenergy.illinoisstate.edu/wind/publications/2010%20Wind%20Farm%20Proximity%20and%20Property%20Values.pdfhttp://renewableenergy.illinoisstate.edu/wind/publications/2010%20Wind%20Farm%20Proximity%20and%20Property%20Values.pdf

Horn, J.W.; Arnett, E.B.; and Kunz, T. H. 2008. "Behavioral responses of bats to operating wind turbines." *Journal of Wildlife Management* 72(1):123-132.

IDNR (Illinois Department of Natural Resources) 2007. *The Possible Effects of Wind Energy on Illinois Birds and Bats*. Report of the Illinois Department of Natural Resources to Governor Rod Blagojevich and the 95th Illinois General Assembly. 20 pp.

IDNR (Illinois Department of Natural Resources) 2010. Illinois Natural Heritage Program-Illinois Threatened and Endangered Species by County. Available online at: http://dnr.state.il.us/conservation/naturalheritage/pdfs/et_by_county.pdf.http://dnr.state.il.us/conservation/naturalheritage/pdfs/et_by_county.pdf (accessed September 14, 2010).

Illinois Natural History Survey 2009a. "Herpetology species by county: Warren County." Available online at: http://www.inhs.illinois.edu/animals_plants/herps/counties/warren.html.http://www.inhs.illinois.edu/animals_plants/herps/counties/warren.html (accessed September 14, 2010).

Illinois Natural History Survey 2009b. "Illinois Natural History Survey Breeding Bird Atlas." Available online at: http://www.inhs.uiuc.edu/animals_plants/birds/breeding.php.http://www.inhs.uiuc.edu/animals_plants/birds/breeding.php (accessed September 14, 2010).

IPCC (Intergovernmental Panel on Climate Change) 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp. Available online at: http://www.ipcc.ch/ipccreports/ar4-wg1.htm (accessed August 18, 2010).

ISGS (Illinois State Geological Survey) 1995. *Earthquake Occurrence in Illinois*. *Earthquake Facts*. Issue 1995-3. Available online at: http://www.isgs.illinois.edu/research/earthquake-hazards/pdf-files/qk-fct-occur.pdf (accessed January 18, 2011).

ISGS (Illinois State Geological Survey). Updated 4/16/10. http://www.isgs.illinois.edu/maps-data-pub/publications/geobits/geobit11.shtml, http://www.isgs.illinois.edu/maps-data-pub/publications/geobits/gb11a.shtml.

Johnson, G.D.; Erickson, W.P.; Strickland, M.D.; Shepherd, M.F.; Shepherd, D.A.; and Sarappo, S.A. 2002. "Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota." *Wildlife Society Bulletin* 30(2):879-887.

Johnson, G.E.; Perlik, M.K.; Erickson, W.P.; and Stickland, M.D. 2004. "Bat activity, composition and collision mortality at a large wind plant in Minnesota." *Wildlife Society Bulletin* 32:1278-1288.

Kerlinger, P.; Gehring, J.; Erickson, W.; Curry, R.; Jain, A.; and Guarnaccia, J. 2010. "Night migrant fatalities and obstruction lighting at wind turbines in North America: A review." *Wilson Journal of Ornithology* 122:744–754.

Kerns, J. and Kerlinger P. 2004. *A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia*. Annual Report for 2003, Prepared by Curry and Kerlinger LLC. Cape May Point, NJ 08212.

Kunz, T.H.; Arnett, E.B.; Erickson, W.P.; Hoar, A.R.; Johnson, G.D.; Larkin, R.P.; Strickland, M.D.; Thresher, R.W.; and Tuttle, M.D. 2007. "Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses." *Frontiers in Ecology & the Environment* 5:315–324.

MacQueen, J.F.; Ainslie, J.F.; Milborrow, D.J.; Turner, D.M.; Swift-Hook, D.T. 1983. "Risks associated with wind-turbine blade failures." Abstract. In *IEE Proceedings, Part A - Physical Science, Measurement and Instrumentation, Management and Education, Reviews* (ISSN 0143-702X), vol. 130, pt. A, no. 9, Dec. 1983, pp. 574-586.

Menzel, M.A., J.M. Menzel, T.C. Carter, W.M. Ford, and J.W. Edwards. 2001. Review of the forest habitat relationships of the Indiana bat (Myotis sodalis). USDA, Forest Service, Northeastern Research Station, General Technical Report NE-284:1-21.

NAAA (National Agricultural Aviation Association) 2010a. "Let's Be Fair About Sharing The Air." Available online at: http://www.agaviation.org/content/lets-be-fair-about-sharing-air (accessed November 2, 2010).

NAAA (National Agricultural Aviation Association) 2010b. "Fact Sheet on the Dangerous Effects Towers Pose to the Aerial Application Industry." Available online at: http://www.agaviation.org/sites/default/files/Tower%20Issue%20Paper.pdf

NAAA (National Agricultural Aviation Association) 2010c. "Consequences of Wind Development Aren't Always in Landowners' Control." Available online at: http://www.agaviation.org/content/consequences-wind-development-aren%E2%80%99t-always-landowners%E2%80%99-control (accessed November 2, 2010).

NBII (National Biological Information Infrastructure) 2011. "Upland sandpiper." Available online at: http://www.nbii.gov/portal/server.pt/community/upland_sandpiper/1686 (accessed January 13, 2011).

NCCEH (National Collaborating Centre for Environmental Health) 2010. *Wind Turbines and Health*. January. Available online at: http://www.ncceh.ca/sites/default/files/Wind_Turbines_January_2010.pdf

NIEHS (National Institute of Environmental Health Sciences) 2002. *EMF Electric and Magnetic Fields Associated with the Use of Electric Power*. June. Available online at: http://www.nema.org/gov/ehs/positions/upload/niehsqa.pdf

NOAA (National Oceanic and Atmospheric Administration) 2010. "How Wind Turbines Impact the NEXRAD Doppler Weather Radar." Available online at: http://www.roc.noaa.gov/windfarm/how_turbines_impact_nexrad.asp (accessed on November 9, 2010).

NRCS (Natural Resources Conservation Service) 2010. Soil Map – Warren County, Illinois. National Cooperative Soil Survey, Web Soil Survey. Available onlint at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Reynolds, D.S. 2006. "Monitoring the potential impact of a wind development site on bats in the Northeast." *Journal of Wildlife Management* 70(5):1219-1227.

Schwartz, S.S., ed. 2004. "Understanding and Resolving Bird and Bat Impacts." In *Proceedings of the Wind Energy and Birds/Bats Workshop*. Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., 132 pp.

Smallwood, K.S. and Thelander, C.G. 2004. *Developing methods to reduce bird fatalities in the Altamont Wind Resource Area*. Final Report by BioResource Consultants to the

California Energy Commission, Public Interest Energy Research-Environmental Area, under Contract No. 500-01-019 (L. Spiegel, Project Manager).

Sumner, P.E.1996. *Managing Aerial Spray Drift*. University of Georgia Cooperative Extension Service Report ENG96-006, University of Georgia College of Agricultural and Environmental Sciences, Athens, Georgia.

Synergy (Synergy Wind Pty Ltd 2009. "Wind Farming, Electromagnetic Radiation & Interference." Fact Sheet 10. Available online at: http://www.synergy-wind.com/documents/10Electromagnetic.pdf (accessed November 10, 2009).

Tetra Tech EC, Inc. 2007. "Exhibit 14 - Wind Turbine Ice Blade Throw." Ice Shedding/Blade Throw Analysis. Available online at: http://www.horizonwindfarms.com/northeast-region/documents/under-dev/arkwright/Exhibit14_IceSheddingandBladeThrowAnalysis.pdf (accessed December 15, 2010).

Thelander, C. 2004. "What Can We Learn From Developed Wind Resource Areas? Bird Fatalities in the Altamont Pass Wind Resource Area: A Case Study, Part I." Pp 25-27. In *Schwartz S. S., ed. Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts*. Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., 132 pp.

Trimble (Trimble Navigation Limited) 2010. "How GPS works, correcting errors." Available online at: http://www.trimble.com/gps/howgps-error.shtml (accessed on November 9, 2010).

Turner, G. 2007. Bat migratory behaviors and routes in Pennsylvania and Maryland, pages XX-XX, in Proceedings NWCC Wildlife Workgroup Research Planning Meeting VI, San Antonio, Texas, November 14-15, 2006, The National Wind Coordinating Collaborative.

University of Illinois Extension. 2010. Living with wildlife in Illinois: bats. http://web.extension.illinois.edu/wildlife/directory_show.cfm?species=bat. Accessed 9/12/10.

USACE (U.S. Army Corp of Engineers) 1987. Wetland Delineation Manual. Available online at: http://www.wetlands.com/regs/tlpge02e.htm

USDA/NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service) 2011. Technical Soil Services Handbook, Part 622. Available online at http://soils.usda.gov/technical/tssh/. Accessed 8/9/2011.

USFWS (U.S. Fish and Wildlife Service). 1988. Endangered Species Act of 1973, as amended though the 100th Congress. U.S. Department of the Interior. Washington, D.C.

USFWS (U.S. Fish and Wildlife Service) 2001. "Upland Sandpiper Habitat Model, Gulf of Main Watershed Habitat Analysis." Available online at: http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/upland_sandpiper_model.htm.http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/upland_sandpiper_model.htm (accessed on September 27, 2010).

USFWS (U.S. Fish and Wildlife Service) 2003. "Service Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines." Letter to Regional Directors dated May 13, 2003. Washington, D.C. Available online at: http://www.fws.gov/habitatconservation/wind.pdf (accessed December 15, 2010).

USFWS (U.S. Fish and Wildlife Service) 2007. *Indiana Bat (*Myotissodalis*) Draft Recovery Plan: First Revision*. Available online at: http://ecos.fws.gov/docs/recovery_plan/070416.pdf.http://ecos.fws.gov/docs/recovery_plan/070416.pdf (accessed September 21, 2010).

USFWS (U.S. Fish and Wildlife Service) 2010a. National Wetlands Inventory. Available online at: http://www.fws.gov/wetlands/Data/Mapper.html.http://www.fws.gov/wetlands/Data/Mapper.html (accessed September 27, 2010).

USFWS (U.S. Fish and Wildlife Service) 2010b. *Eastern Prairie Fringed Orchid*. USFWS Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/plants/pdf/epfo-cifo.pdf (accessed September 22, 2010).

Windrush Energy 2004. *The Health Effects of Magnetic Fields Generated by Wind Turbines*. October. Available online at: http://www.windrush-energy.com/update%20Jul%2024/Appendix%20D%20-%20Magnetic%20Field%20Survey/Magnetic%20Field%20Report.pdf

Winegrad, G. 2004. "Wind Turbines and Birds." Pp 22-24. In *Schwartz S. S., ed. Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts*. Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., 132 pp. Available online at: http://www.awea.org/pubs/documents/WEBBProceedings9.14.04%5BFinal%5D.pdfhttp://www.awea.org/pubs/documents/WEBBProceedings9.14.04%5BFinal%5D.pdf (accessed August 23, 2010).

Woller, D.M.; Kunz, K.L.; and Sanderson, E.W. 1978. *Public Groundwater Supplies in Warren County*. Illinois State Water Survey, Urbana, Ilinios.

6. AGENCIES AND PERSONS CONSULTED

Name	Organization
Blaich, Michael	Federal Aviation Administration
Edgett-Baron, Sheri	Federal Aviation Administration
Sailor, Matthew	U.S. Fish and Wildlife Service
Nelson, Richard	U.S. Fish and Wildlife Service
Millar, Jody	U.S. Fish and Wildlife Service
Henry, Joyce	National Telecommunications and Information Agency
Davison, Edward	National Telecommunications and Information Agency
Branham, Michael	Illinois Department of Natural Resources, Division of Ecosystem and Environment
Haaker, Anne	Illinois Historic Preservation Agency
Eggemeyer, Emilie	Illinois Historic Preservation Agency
Chard, Steve	Illinois Department of Agriculture
Salvo, Terry	Illinois Department of Agriculture
Winbigler, Rick	Warren County Soil and Water Conservation District
Bonnett, Lisa	Illinois Environmental Protection Agency
Grady, Alyson	Illinois Department of Commerce and Economic Opportunity