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ENVIRONMENTAL ASSESSMENT

INSTALLATION AND OPERATION OF WIND TURBINE AT THE 200TH RED HORSE SQUADRON

OHIO AIR NATIONAL GUARD
CAMP PERRY AIR NATIONAL GUARD STATION
PORT CLINTON, OHIO

ASSET MANAGEMENT DIVISION
NATIONAL GUARD BUREAU

July 2016

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ACRONYMS AND ABBREVIATIONS

200 RHS	200th RED HORSE Squadron
ANGRC	Air National Guard Readiness Center
ANGS	Air National Guard Station
ACP	Advanced Conservation Practices
AFOSH	Air Force Occupational and Environmental Safety, Fire Protection, and Health
APE	Area of Potential Effects
BA	Biological Assessment
BGEPA	Bald and Golden Eagle Protection Act
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
dBA	A-weighted decibels
DoD	Department of Defense
EA	Environmental Assessment
ECP	Eagle Conservation Plan
ECPG	Eagle Conservation Plan Guidance
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act of 2007
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FONSI	finding of no significant impact
ft/s	feet per second
GHG	greenhouse gas
hr	hour
INRMP	Integrated Natural Resources Management Plan
km	kilometer
kW	kilowatts
kWh	kilowatt hours
LED	light-emitting diode
LID	low-impact development
m/s	meters per second
m^2	square meters
MBTA	Migratory Bird Treaty Act
MW	megawatt
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NOA	Notice of Availability
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
ODNR	Ohio Department of Natural Resources
OHANG	Ohio Air National Guard
OHPO	Ohio Historic Preservation Office
ONWR	Ottawa National Wildlife Refuge
OSHA	Occupational Safety and Health Administration
RED HORSE	Rapid Engineer Deployable Heavy Operational Repair Squadron Engineering
SF	square feet
SHPO	State Historic Preservation Officer
U.S.	United States
UFC	Unified Facilities Criteria
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WEG	Wind Energy Guidelines

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)
FOR INSTALLATION AND OPERATION OF WIND TURBINE AT THE 200TH RED HORSE SQUADRON

The National Guard Bureau (NGB) has prepared this Environmental Assessment (EA) to consider the potential consequences to the human and natural environment associated with the installation and operation of a single 600-kilowatt (kW) wind turbine at the 200th RED HORSE Squadron (200 RHS) of the Ohio Air National Guard (OHANG), Camp Perry Air National Guard Station (ANGS), Port Clinton, Ohio. This EA also identifies applicable management actions, mitigation measures, and best management practices to avoid or minimize impacts related to the implementation of the Proposed Action and No Action Alternative.

The NGB has prepared this EA pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] 4321–4347), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] §§ 1500–1508), and 32 CFR 989, et seq., *Environmental Impact Analysis Process* (formerly promulgated as Air Force Instruction [AFI] 32-7061). The NEPA lead agency is NGB.

PURPOSE/NEED: The purpose of the Proposed Action is to install and operate a wind turbine in order to study certain impacts of wind energy, while at the same time assist Camp Perry ANGS with its move towards generating more of its energy on base through renewable resources. Specifically, the project would provide opportunities for scientific research that could result in improved design and conservation measures for wind turbines near migratory bird routes. In fiscal years 2006–2008, the U.S. House of Representatives passed a defense appropriations bill that funded the wind turbine project.

Should the project be approved and constructed, Camp Perry ANGS would work with local universities, including the University of Toledo and University of Bowling Green, to study the impacts that construction and operation of this wind turbine will have on local Lake Erie natural resources for two years after construction has been completed. Joint studies with the universities would include monitoring avian and bat mortality rates. Results of the monitoring data would be used to make recommendations on wind turbine operational modifications to reduce potential impacts to bird and bat populations at Camp Perry and perhaps elsewhere.

Additionally, the Proposed Action would assist in implementing Federal Executive Orders by generating on-base renewable energy production during times when the turbine is in operation. The energy produced would not be enough to sustain the Base, particularly when the turbine is operating at reduced speed or is non-operational as a proposed mitigation measure. However, any energy produced would help offset energy consumption at Camp Perry ANGS, assisting the

Base, to a limited degree, in meeting directives established Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, and the Energy Independence and Security Act of 2007.

PROPOSED ACTION: Under the Proposed Action, the 200 RHS would install and operate the wind turbine, which would be located entirely within the Camp Perry ANGS property boundary.

NO ACTION ALTERNATIVE: The CEQ regulation 40 CFR 1502.14(d) specifically requires analysis of a no action alternative in all NEPA documents. Under the No Action Alternative, Camp Perry ANGS would not install the proposed wind turbine. The No Action Alternative also would not execute the Research, Development, Test, and Evaluation appropriation, which specifically outlines analysis of wind technologies in the area of the Camp Perry ANGS. Finally, beneficial impacts would not be realized because energy efficiency measures would not be implemented, affecting the Base's ability to comply with EO 13693.

SUMMARY OF FINDINGS

Potential impacts associated with the Proposed Action have been assessed with regard to the following environmental resource areas:

BIOLOGICAL RESOURCES – No significant impacts to biological resources are anticipated under the Proposed Action. The following discusses potential impacts for specific resources.

***Vegetation Communities* –** The Proposed Action area is composed primarily of mowed grass and paved surfaces and encompasses a portion of State Route 2, a four-lane highway owned by the Ohio Department of Transportation. Other habitats within the Base's 59 acres include five natural vegetation communities, including pink oak forest, old field, forested wetland, emergent wetland, and beach habitat. Since the base of the turbine has already been installed, significant ground disturbance is not expected. No effects to vegetation communities are anticipated under the Proposed Action.

***Wildlife* –** Due to Camp Perry ANGS's highly developed nature, the Base provides limited natural habitat for birds, small mammals, fish, reptiles, and amphibians. The habitat present is frequently disturbed by noise from highway traffic, training activities, and maintenance work such as mowing. Camp Perry ANGS provides limited nesting habitat for the majority of Ohio's breeding bird species; however, the Base may serve as a stopover habitat for numerous avian migrant species. Camp Perry ANGS is located adjacent to the Ottawa National Wildlife Refuge (ONWR) Darby Unit, which is known for its high diversity of birds, particularly during spring migration. No effects to wildlife are anticipated under the Proposed Action.

***Federally Proposed, Candidate, Threatened, and Endangered Species* –** The proposed turbine location lies within the range of the Federally listed rufa red knot (*Calidris canutus rufa*), piping plover (*Charadrius melodus*), Kirtland's warbler (*Setophaga kirtlandii*), Indiana bat (*Myotis*

sodalis), northern long-eared bat (*Myotis septentrionalis*), and bald eagle (*Haliaeetus leucocephalus*). The Proposed Action area lacks suitable habitat for these species, but there is the potential that listed birds or bats may collide with the proposed turbine as they fly through the airspace surrounding Camp Perry ANGS.

Red Knot, Piping Plover, and Kirtland's Warbler

Red knots and piping plovers are annual migrants in small numbers in Ohio. The vast majority of observations of these species in Ohio are from along the shoreline of Lake Erie. Other observations are along large waterbodies such as lakes and reservoirs. Red knots have a prolonged migration and may occur in Ohio anytime between 1 April and 31 October. Red knots have been documented in Ottawa County, along the shore of Lake Erie within 1.2 miles of the project area.

Piping plovers typically pass through Ohio between 1 April and 31 May, and between 15 July and 31 October. Piping plovers have been documented in Ottawa County, along the shore of Lake Erie within 1.3 miles of the project area.

Kirtland's warblers do not breed within Ohio, but outside of Michigan, Ohio has the highest number of Kirtland's warbler observations during migration, signifying that a significant portion of the population passes through Ohio on their way to and from the Bahamas. Kirtland's warblers typically pass through Ohio between 22 April and 1 June, and between 15 August and 15 October. Kirtland's warblers have been documented in Ottawa County, within 5.2 miles of the project area.

On 8 March 2016, the U.S. Fish and Wildlife Service (USFWS) issued a *Final Biological Opinion (BO) and Incidental Take Statement for the Proposed Wind Turbine on the Ohio Air National Guard Station, Camp Perry, Ohio*. Using post-construction monitoring data (conducted at 116 wind energy facilities), the USFWS BO calculated estimates for red knot, piping plover, and Kirtland's warbler mortality over the life of the proposed turbine. The USFWS BO concluded the estimated take of one red knot, one piping plover, and one Kirtland's warbler over a 25-year period is unlikely to effect the distribution or reproductive success, or significantly impact the number of individuals within the populations of these species. No adverse effects to the red knot, piping plover, and Kirtland's warbler are anticipated under the Proposed Action.

Northern Long-eared Bat and Indiana Bat

Camp Perry ANGS is located at the northern edge of both the northern long-eared bat's and the Indiana bat's known ranges (although no record has been found for Indiana bats occurring in Ottawa). No winter hibernacula are known to occur in or near the Proposed Action area for either species. Suitable foraging habitat and roosting substrates may exist in the wooded area northwest of the Base. The site consists of mature lowland deciduous forest with pin oak, bur oak, red maple, and shagbark hickory.

The USFWS BO concluded that the minimization measures proposed in the EA are sufficient to avoid take of the species and concur with the determination that the Proposed Action is not likely to adversely affect the northern long-eared bat or the Indiana bat. These measures include operating the turbine only during daylight hours through the migration seasons. Should, during the term of this action, additional information on these species or their critical habitats become available, or if new information reveals effects of the action that were not previously considered, consultation with USFWS would be reinitiated to assess whether the determinations are still valid.

Bald Eagles

Since 1995, a known bald eagle pair has resided just outside Camp Perry ANGS, within a woodlot located on the grounds of the Camp Perry Joint Regional Training Center. The bald eagle pair has maintained a frequently active nest in a cottonwood tree on the edge of the woodlot facing the south range. However, in 2011 the pair built a nest in a tree farther inside the installation boundaries, approximately 940 meters northwest of the proposed wind turbine site. Bald eagle mortality may result as a consequence of collisions with the wind turbine and its rotating blades. As such, Camp Perry ANGS has committed to developing an Eagle Conservation Plan in collaboration with USFWS (discussed in the Mitigations section).

Migratory Birds – The Black Swamp Bird Observatory along the Lake Erie shore has documented over 10,000 raptors each year migrating around and through the Camp Perry area in 2006, 2008, and 2009. The Black Swamp Bird Observatory has conducted surveys for migratory birds within the neighboring ONWR from 2008–2014, and in the spring of 2014 the observatory recorded 139 species and 21,154 individuals during 46 days of point count surveys at the Navarre Unit. Northern cardinal, red-winged blackbird, common grackle, tree swallow, song sparrow, and American robin were observed on each count day. The most abundant species recorded was red-winged blackbird (3,838) followed by Canada goose (1,989), tree swallow (1,516), blue jay (1,444), and common grackle (983). Camp Perry ANGS has also committed to implement minimization measures that will reduce adverse effects by the wind turbine on migratory birds (discussed in the Mitigations section).

Critical or Other Protected Habitat – No critical habitat designated for a Federally listed species occurs within the action area. No effects to critical habitats are anticipated under the Proposed Action. Additionally, no impacts to the Lake Erie shoreline or the ONWR Darby Division are anticipated under the Proposed Action.

CULTURAL RESOURCES – No impacts to cultural resources are anticipated under the Proposed Action. As part of a previous EA for this project, the 200 RHS consulted with the Ohio Historic Preservation Office (OHPO). Based on a review of the project description, the OHPO, in a letter dated 8 June 2012, determined that the proposed project would have no adverse effect on historic properties. The OHPO stated that no further coordination is required unless there were changes to the project scope. No such changes have occurred.

The concrete pad for the proposed wind turbine has already been constructed; however, there might be additional, limited digging and trenching activities associated with the installation of power lines. As there are no identified subsurface cultural resources, no adverse effects to cultural resources are anticipated during implementation of the Proposed Action; however, in the event of an inadvertent discovery during ground-disturbing operations, the 200 RHS would cease work immediately, contact a professional archaeologist, and notify the OHPO.

Impacts to Native American traditional resources from the Proposed Action are not anticipated. In accordance with 36 CFR Part 800.2, the 200 RHS is seeking to include interested Native American tribes. Even though no traditional cultural properties or sacred sites have been identified at the Base, Camp Perry ANGS and has provided consultation correspondence to Native American tribes with potential interest in the proposed undertaking.

ELECTRICAL POWER SUPPLY – The Proposed Action would have a positive impact on the existing electrical power supply. Currently, the Base consumes an average of approximately 810,000 kilowatt hours (kWh) annually of electricity, with approximately 72 percent (585,000 kWh) supplied by the local utility, Ohio Edison. Based on a net total 5,988 hours of projected annual operation (which considers proposed limits due to bird/bat species conservation measures), approximately 273,425 kWh of electricity would be generated annually from wind turbine operations. This means that approximately 62 percent of the electricity consumed on the Base would be generated by renewable energy sources (28 percent from the existing solar farm and 34 percent from the proposed wind turbine). This would also result in an additional annual decrease in greenhouse gas emissions of approximately 288 tons. This would further facilitate the Base's ability to comply with the requirements of EO 13693.

VISUAL RESOURCES – No significant impacts to visual resources are anticipated under the Proposed Action. Erie Township in Ottawa County is mostly rural in nature, and a portion of the Army National Guard property surrounds Camp Perry ANGS to the north and west. Various manufacturing facilities are also located to the west of Camp Perry in the Erie Industrial Park, and Waste Management, Inc. (a licensed landfill) is located to the south. A wind turbine is currently located at the nearby Lake Erie Business Park. The proposed turbine would have a maximum height of approximately 200 feet, including the blade height; however, it would be significantly shorter than the existing turbine at the Erie Industrial Park, which has a height of approximately 300 feet. Several tall, steel radio/communications antennas are also located in the general area; consequently, the existing viewshed would not be significantly impacted.

WATER RESOURCES – No significant impacts to water resources are anticipated under the Proposed Action. The concrete pad for the proposed wind turbine has already been constructed; however, there might be additional digging and trenching activities associated with the installation of buried power lines. This EA does not address wetlands as none are present on the Base. The scope of any such activity would be expected to disturb an area well less than 1 acre.

Consequently, stormwater permitting requirements associated with National Pollutant Discharge Elimination System (NPDES) would not apply. Requirements associated with the Energy Independence and Security Act (EISA), Section 438, would also not apply because it would be expected that project would disturb less than 5,000 square feet.

Regardless, the Base would apply applicable best management practices for controlling runoff, erosion, and sedimentation associated with any ground-disturbing activities. These may include using silt fences or straw wattles, minimizing surficial area disturbed, stabilizing cut/fill slopes, minimizing earth-moving activities during wet weather, and covering soil stockpiles. No adverse impacts to water resources from construction activities would result from the Proposed Action. Proposed activities would not alter the existing floodplain; consequently, no impacts would be associated with this resource.

SAFETY – The leading causes of turbine structural failure are vandalism, improper assembly, or exceeding design limits. Because the proposed turbine would be located on Camp Perry, it would be safe from vandalism. It would also be assembled and maintained only by technically qualified personnel. Finally, wind turbines are designed to withstand wind strengths equivalent to hurricane forces—the proposed turbine is designed for a maximum wind speed of approximately 116 miles per hour. Education of on-site personnel would be required regarding proper turbine operational procedures, including emergency shutdown.

There is possibility that ice buildup on the turbine or turbine blades can drop or be "thrown," causing a potential for injury from falling ice. Modern turbines, as the one proposed, are designed to detect ice buildup on the blades and to automatically shut down the turbine in such cases. Education of construction crews and maintenance staff would also be required regarding icing potential, policies, and procedures (shutdown and system reactivation). Additionally, warning signs would be posted around turbine areas where icing potential exists and established setback distances would be enforced to keep all non-authorized personnel from approaching the turbine at all times.

With implementation of the procedures described above, the Proposed Action would not result in significant impacts to public health and safety.

MITIGATION: Because migratory bird mortality may occur during the lifetime operation of the proposed wind turbine, Camp Perry ANGS, in coordination with the USFWS, developed the following avoidance and minimization measures to minimize collision potential:

- Proposing design considerations such as installing the turbine on a single tower without guy wires and installing power lines below ground to reduce the number of perching substrates

- Installing a red flashing light-emitting diode (LED) light on the tower to reduce the attraction of birds to the turbine
- Limiting construction to one turbine to reduce the project footprint and the potential for strikes
- Regular maintenance of the surrounding lawn to help reduce the populations of prey animals that could attract raptors
- Limiting turbine operation to avoid all spring and fall migrations (15 March through 31 October)

Additionally, post-construction monitoring will help Camp Perry ANGS better understand how to reduce potential migratory bird injuries and mortalities. By curtailing the operation of the wind turbine during dawn and dusk in spring and fall migration periods, the installation would greatly reduce the potential impacts on migratory birds. Finally, by implementing all best management practices in the USFWS's *Land-Based Wind Energy Guidelines*, Camp Perry ANGS would minimize the effects of the wind turbine on migratory birds and bats. Based on the planned implementation of these design considerations, conservation measures, and best management practices, the construction and operation of the proposed wind turbine may affect, but is unlikely to adversely affect migratory birds.

Camp Perry ANGS, in accordance with USFWS's *Land-Based Wind Energy Guidelines* and *Eagle Conservation Plan Guidance* (ECPG), is preparing an Eagle Conservation Plan to ensure that avoidance and minimization measures are implemented into project design and operation; that the project remains in compliance with Bald and Golden Eagle Protection Act requirements; and that mitigation for impacts that cannot be avoided or minimized are addressed through an appropriate program of compensatory mitigation. The Eagle Conservation Plan will establish measures and effects that are "compatible with the preservation of the Bald Eagle as set forth in the ECPG and enable Camp Perry ANGS to apply for a "voluntary" eagle take permit. These measures and effects will include:

- The ANGS would maintain the southern lawn regularly and will not seed the lawn with vegetation that could attract small mammals (prey).
- The ANGS would remove and properly dispose of any carcasses found within 100 meters of the turbine in conformance with local regulations.
- The design of the turbine is a monopole without any lattice structure or guy wires, which will deter perching.
- All electrical lines will be placed underground to reduce perching substrates near the wind turbine.
- The ANGS would conduct post-construction monitoring for two years to document any take of bald eagles based on guidelines accepted by USFWS.

PUBLIC NOTICE: NEPA, 40 CFR 1500-1508, and 32 CFR 989 require public review of the EA before approval of the FONSI and implementation of a proposed action. The Draft EA for this Proposed Action was mailed to nine government agencies and organizations and to representatives from 17 Native American tribes. A Notice of Availability (NOA) of the Draft EA and FONSI was published in the newspaper of record (the Port Clinton *News Herald*) announcing the availability of the EA for review on 25 July 2016. Copies of the EA were also made available to the public at the Ida Rupp Public Library (310 Madison Street, Port Clinton, Ohio). The document was also made available for review at the following website: https://afpims.dma.mil/shared/media/document/AFD-160719-002.pdf. The NOA invited the public to review and comment on the Draft EA. The public and agency review period ended on 22 August 2016.

FINDING OF NO SIGNIFICANT IMPACT/FINDING OF NO PRACTICABLE ALTERNATIVE

Based on my review of the facts and analysis in this EA, I conclude that the Proposed Action would not have a significant impact on the quality of the human or natural environment or generate significant controversy either by itself or considering cumulative impacts. Accordingly, the requirements of NEPA, the CEQ, and 32 CFR 989, et seq., have been fulfilled, and an Environmental Impact Statement is not necessary and will not be prepared.

Additionally, the entire Camp Perry ANGS base is within the 100-year floodplain of Lake Erie. Thus, any placement of the turbine on Camp Perry ANGS will place it within the floodplain. Pursuant to EO 11988, *Floodplain Management*, AFI 32-7064, *Integrated Natural Resources Management*, and the authority delegated by Secretary of the Air Force Order 791.1, and taking the above information into account, I find that there is no practicable alternative to this action and that the Proposed Action includes all practicable measures to minimize harm to the floodplain environments.

_____ _____

BENJAMIN W. LAWLESS, P.E., GS-15 Date
Chief, Asset Management Division

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PRIVACY ADVISORY

Public comments on this Draft Environmental Assessment (EA) are requested. Letters or other written or oral comments provided to the Ohio Air National Guard (OHANG) at Camp Perry Air National Guard Station (ANGS) may be published in the Final EA. As required by law, comments will be addressed in the Final EA and made available to the public. Any personal information provided to OHANG will be used only to identify your intent to make a comment or to fulfill requests for copies of the Final EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final EA. However, only the names of the individuals making comments and their specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the Final EA.

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TABLE OF CONTENTS

FIGURES

TABLES

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1.0 PURPOSE AND NEED FOR THE ACTION

1.1 INTRODUCTION

The National Guard Bureau (NGB) has prepared this Environmental Assessment (EA) to consider the potential consequences to the human and natural environment associated with the installation and operation of a single 600-kilowatt (kW) wind turbine at the 200th RED HORSE Squadron (200 RHS) of the Ohio Air National Guard (OHANG), Camp Perry Air National Guard Station (ANGS), Port Clinton, Ohio.

The information presented in this document will serve as the basis for deciding whether the Proposed Action would result in a significant impact to the human environment, requiring the preparation of an Environmental Impact Statement (EIS), or whether no significant impacts would occur, in which case a Finding of No Significant Impact (FONSI) would be appropriate.

NGB has prepared this EA pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4331 et seq.), the regulations of the President's Council on Environmental Quality (CEQ) that implement NEPA procedures (40 Code of Federal Regulations [CFR] 1500-1508), the Air Force Environmental Impact Assessment Process Regulations at 32 CFR Part 989, and Air Force Instruction (AFI) 32-7061 (Secretary of the Air Force 2003).

1.2 PURPOSE AND NEED FOR THE ACTION

The purpose of the Proposed Action is to install and operate a wind turbine in order to study certain impacts of wind energy, while at the same time assist Camp Perry ANGS with its move towards generating more of its energy on base through renewable resources. Specifically, the project would provide opportunities for scientific research that could result in improved design and conservation measures for wind turbines near migratory bird routes. In fiscal years 2006–2008, the U.S. House of Representatives passed a defense appropriations bill that funded the wind turbine project.

Should the project be approved and constructed, Camp Perry ANGS would work with local universities, including the University of Toledo and University of Bowling Green, to study the impacts that construction and operation of this wind turbine will have on local Lake Erie natural resources for two years after construction has been completed. Joint studies with the universities would include monitoring avian and bat mortality rates. Results of the monitoring data would be used to make recommendations on wind turbine operational modifications to reduce potential impacts to bird and bat populations at Camp Perry and perhaps elsewhere.

Additionally, the Proposed Action would assist in implementing Federal Executive Orders by generating on-base renewable energy production during times when the turbine is in operation. The energy produced would not be enough to sustain the Base, particularly when the turbine is operating at reduced speed or is non-operational as a proposed mitigation measure. However, any energy produced would help offset energy consumption at Camp Perry ANGS, assisting the Base, to a limited degree, in meeting directives established Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, and the Energy Independence and Security Act of 2007.

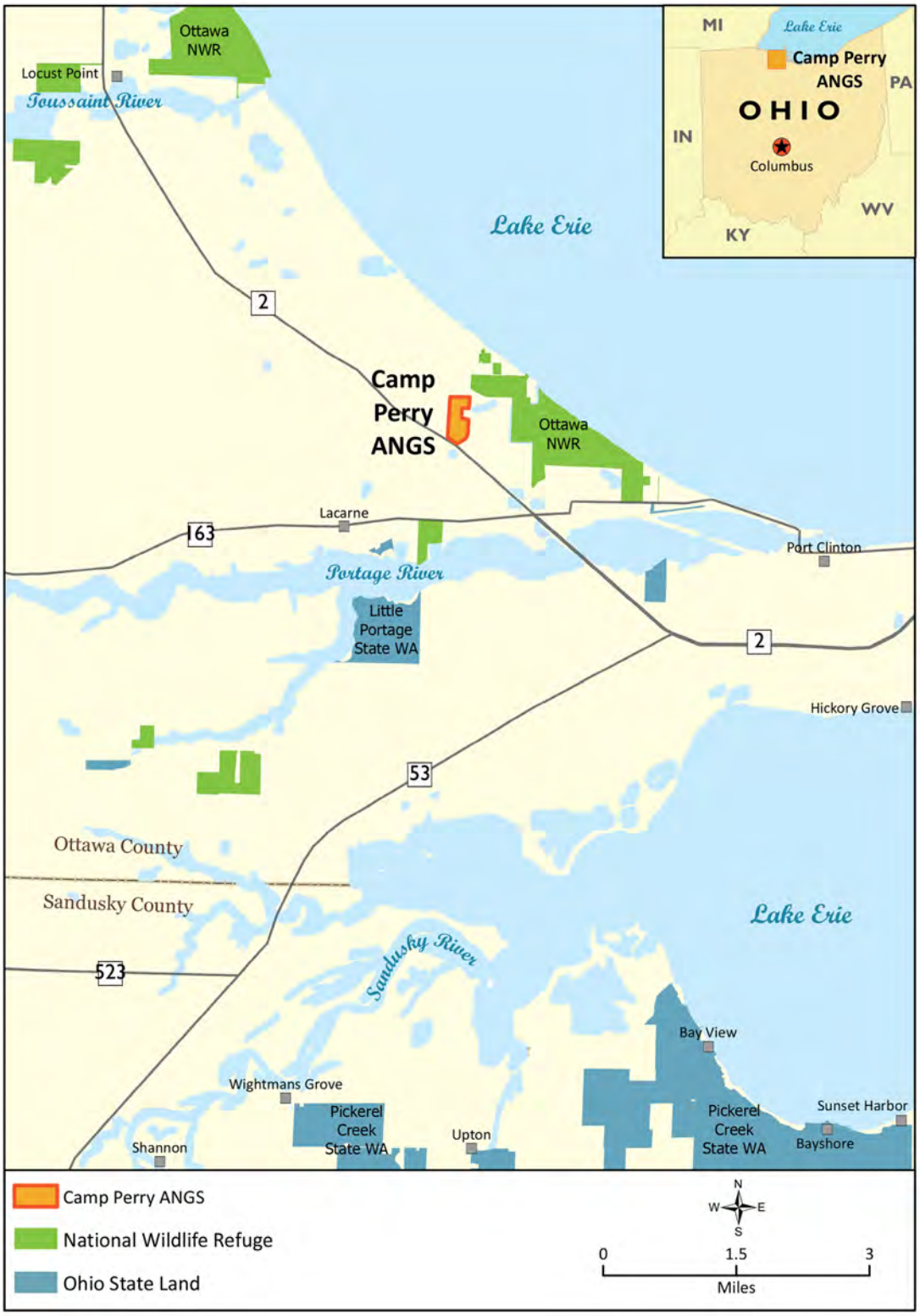
1.3 LOCATION AND DESCRIPTION OF THE 200 RHS

The Camp Perry ANGS 200 RHS is located at the Camp Perry Joint Training Center, east of Port Clinton, in northwest Ohio on the shores of Lake Erie (Figure 1-1). The 200 RHS's major wartime responsibility is to provide a highly mobile, rapidly deployable, civil engineering response force that is self-sufficient to perform heavy damage repair required for recovery of critical Air Force facilities and utility systems and aircraft launch and recovery. In addition, it accomplishes engineer support for beddown of weapon systems required to initiate and sustain operations in an austere, bare base environment, including remote hostile locations, or locations in a chemical, biological, radiological, nuclear, and high-yield explosives prone environment. The primary tasking in peacetime is to train for contingency and wartime operations. In case of emergency, the 200 RHS also provides the State of Ohio with a highly mobile, rapidly deployable civil engineering response force trained and equipped to protect life and property, preserve peace, order, and public safety.

1.4 ENVIRONMENTAL RESOURCE AREAS NOT CARRIED FORWARD FOR DETAILED ANALYSIS

The determination of issues to be analyzed versus those not carried forward for detailed analysis is part of the EA process as described in 40 CFR 1501.7(a)(3), which states that issues addressed in prior environmental review, or that are not significant, may be eliminated from discussion in the EA.

The following environmental resource areas were found to have no applicability to the Proposed Action or No Action Alternative, as there would be no potential for direct, indirect, or cumulative impacts. Therefore, these environmental resource areas are not carried forward for detailed analysis in this EA.



No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the Enterprise GIS database.

Figure 1-1. Location of 200 RHS of the OHANG

Air Quality – The Proposed Action would have a negligible impact on air quality. Wind turbine operations would generate no significant air pollutants, although minor pollutant emissions would result from heavy equipment (e.g., cranes) used during installation. The Proposed Action would produce benefits associated with a reduction in greenhouse gases (GHG) when the turbine is in operation. These benefits are discussed under the Electrical Power Supply section.

Coastal Zone Management – The Coastal Zone Management Act (CZMA) Federal Consistency provision requires that federal actions having reasonably foreseeable effects on any land or water use or natural resource of Ohio's designated Coastal Management Area must be consistent with the enforceable policies of the Ohio Coastal Management Program. The Proposed Action would have no impact on land or water use. Impacts to natural resources (i.e., bird species) are discussed under the Biological Resources section.

Geological Resources – Geological resources can be defined in terms of drainage capacity, erodibility, composition, and topography. The turbine foundation pad has already been constructed; however, there may be shallow digging/trenching operations associated with the installation of new buried power lines. These activities would be very minor in scope and would have no adverse impacts on geological resources.

Noise – Noise from heavy equipment (e.g., cranes) would occur during installation of the turbine. This noise would be temporary in nature without long-term impacts. Once operational, the turbine would also generate noise associated with the motor and the rotation of the propeller blades. The nearest off-base sensitive noise receptors would be a residential dwelling located south of State Road 2, at approximately 640 feet from the proposed turbine location. Turbine noise is a function of wind speed—the higher the wind speed, the higher the noise level generated. Operation of the proposed Vestas 600-kW turbine during periods of highest average wind speed (during winter months) would result in estimated sound levels of approximately 42 A-weighted decibels (dBA) at the residential dwelling. For comparison, this sound level is typically associated with those found in a library or a bedroom. Turbine noise would likely be further masked by traffic on nearby State Road 2. Consequently, no significant impacts to noise would be anticipated.

Socioeconomics – Although this project would publicize and promote the use of renewable energy technologies in the local area, due to its limited scope, the Proposed Action would provide no socioeconomic benefits to the local economy.

Environmental Justice – As discussed under *Noise* and *Safety* above, proposed activities would pose no environmental health or safety risks to sensitive populations, including children, minorities, or low-income communities, as identified in EO 13045, *Protection of Children from*

Environmental Health Risks and Safety Risks, and EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*.

Solid Debris and Hazardous Materials and Wastes – Routine maintenance of the wind turbine may require the use of some hazardous materials, including surface coatings and lubricating oils. Maintenance may also generate small quantities of paint- or petroleum-related wastes. The quantities of these materials/wastes would be considered de minimis when compared with those generated on a day-to-day basis at the Base. Additionally, all work involving hazardous materials and waste will be done in accordance with the Base's Hazardous Materials Management Process; consequently, no adverse impacts are anticipated.

1.5 ENVIRONMENTAL RESOURCE AREAS CARRIED FORWARD FOR DETAILED ANALYSIS

After preliminary analyses of potential environmental issues, the following resource areas will be carried forward for further analysis in this EA due to their potential for direct, indirect, or cumulative impacts:

Biological Resources – The analyses will consider potential impacts to birds and bats associated with the construction and operation of the wind turbine. These impacts may include disturbances, such as posing a barrier to flight paths, due to the interfering presence of the wind turbine, or a risk of collision with the rotor blades resulting in bird mortality, injury, and habitat loss.

Section 7 of the Endangered Species Act (ESA) of 1973 and its amendments require that a Biological Assessment (BA) be prepared for all Federal actions that may affect Federally listed or proposed endangered or threatened species or critical habitat for those species. In October 2015, the OHANG submitted a BA to the U.S. Fish and Wildlife Service (USFWS) for the construction and operation of the single 600-kW wind turbine at Camp Perry (Appendix B). Based on a review of the BA, the USFWS issued a Final Biological Opinion (BO) and Incidental Take Statement on 8 March 2016 for the proposed wind turbine project (Appendix B). Details related to the BA and BO are further discussed in Section 4.2.

Cultural Resources – The analyses will consider whether proposed construction activities, specifically, the digging/trenching operations associated with the installation of new buried power lines, could have potential impacts on buried cultural resources.

Electrical Power Supply – The analyses will consider the potential for the Proposed Action to affect overall electric utility usage. Under EO 13693, *Planning for Federal Sustainability in the Next Decade*, Federal agencies must increase the percent of clean energy used, accounted for by renewable electric energy and alternative energy.

Visual Resources – Visual resources are defined as the natural and manufactured features that constitute the aesthetic qualities of an area. The proposed wind turbine would have a maximum height of approximately 200 feet (40 meters), including the blade height, and a rotor diameter of 144 feet (44 meters). Due to its size, the wind turbine would be a prominent feature in the immediate area of the Base. The analyses will consider the potential for the Proposed Action to affect the local viewshed.

Water Resources – The analyses will consider the potential for the Proposed Action to affect water resources as the result of the digging/trenching activities.

Safety – The analyses will consider safety issues associated with turbine construction and operation. These issues are associated with construction/workplace safety, turbine blade and structural failure, and turbine icing.

1.6 ENVIRONMENTAL COORDINATION AND CONSULTATIONS

1.6.1 Interagency Coordination and Consultations

Scoping is an early and open process for developing the breadth of issues to be addressed in the EA and for identifying significant concerns related to a proposed action. Per the requirements of Intergovernmental Cooperation Act of 1968 (42 USC 4231[a]) and EO 12372, Federal, state, and local agencies with jurisdiction that could be affected by the proposed actions were notified during the development of this EA. Appendix A contains the list of agencies consulted during this analysis and copies of correspondence.

1.6.2 Government-to-Government Consultations

1.6.2.1 *Consultation with Tribal Governments*

EO 13175, *Consultation and Coordination with Indian Tribal Governments*, directs Federal agencies to coordinate and consult with Native American tribal governments whose interests might be directly and substantially affected by activities on Federally administered lands. Consistent with EO 13175, Department of Defense (DoD) Instruction 4710.02, *Interactions with Federally-Recognized Tribes*, and AFI 90-2002, *Air Force Interaction with Federally-Recognized Tribes*, Federally recognized tribes that are historically affiliated with Camp Perry geographic region have been contacted by certified mail and by phone on all proposed undertakings related to this action that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations. The Camp Perry point of contact for Native American tribes is the Base

Commander. Tribal governments that will be consulted with regarding these actions are listed in Appendix A.

1.6.2.2 *Endangered Species Act Section 7 Consultation*

Per the requirements of Section 7 of the ESA, the Migratory Bird Treaty Act (MBTA), and Section 106 of the National Historic Preservation Act and implementing regulations (36 CFR Part 800), and others as appropriate, findings of effect and request for concurrence will be transmitted to the USFWS and State Historic Preservation Officer (SHPO). For this project, the OHANG has submitted a BA to the USFWS. Based on a review of the BA, the USFWS issued a Final BO and Incidental Take Statement for the proposed wind turbine project. Correspondence regarding the findings and concurrence and resolution of any adverse effect is included in Appendix A.

1.7 PUBLIC AND AGENCY REVIEW OF EA

A Notice of Availability (NOA) of the Draft EA and FONSI was published in the newspapers of record (the Port Clinton *News Herald*) announcing the availability of the EA for review on 25 July 2016. Copies of the EA were also made available to the public at the Ida Rupp Public Library (310 Madison Street, Port Clinton, Ohio). The document was also made available for review at the following website: https://afpims.dma.mil/shared/media/document/AFD-160719-002.pdf. The NOA invited the public to review and comment on the Draft EA. The public and agency review period ended on 22 August 2016. The NOA and public and agency comments are provided in Appendix A.

1.8 DECISION TO BE MADE

The EA evaluates whether the Proposed Action would result in significant impacts on the human or natural environment. If significant impacts are identified, the OHANG would undertake mitigation to reduce impacts to below the level of significance, undertake the preparation of an EIS addressing the Proposed Action, or abandon the Proposed Action.

This EA is a planning and decision-making tool that will be used to guide the OHANG in implementing the Proposed Action in a manner consistent with Air Force and ANG standards.

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2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter presents a detailed description of the Proposed Action to install and operate a wind turbine at Camp Perry ANGS. Details of the Proposed Action form the basis for the analyses of potential environmental impacts. This chapter includes discussion of the considerations used to identify candidate alternatives, as well as the No Action Alternative.

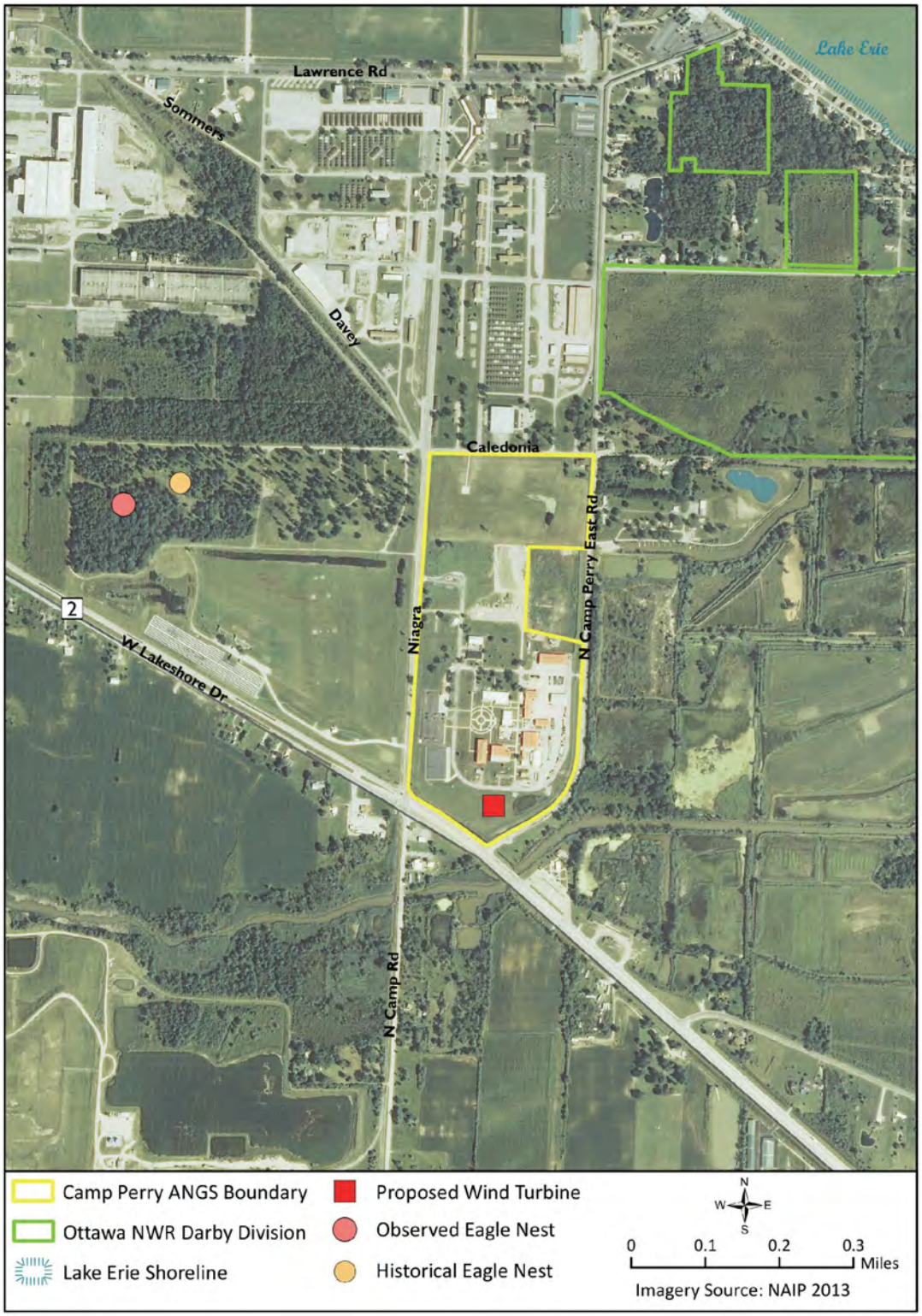
2.2 PROPOSED ACTION

The proposed wind turbine would be located entirely within the Camp Perry ANGS property boundaries and would be erected within the southern lawn of the facility (Figure 2-1). The southern lawn encompasses approximately 82,000 square feet (SF) (7,632 square meters [m^2]) of previously disturbed and routinely maintained land. Vehicles and equipment would be staged on this lawn during construction or within the nearby parking lots which cover approximately 62,500 SF (5,800 m^2) near the proposed project site.

2.2.1 Construction of Wind Turbine

The foundation for the wind turbine occupies 172 SF (16 m^2) and has already been constructed (Photograph 2-1). A single 600-kW Vestas 44 wind turbine is proposed for construction. This model has a rotor diameter of 144 feet (44 meters) and a maximum height of approximately 200 feet (40 meters), which includes the height of the blade. The turbine is similar in appearance to a wind turbine located at the nearby Lake Erie Business Park (Photograph 2-2). Note: The wind turbine at the business park is significantly taller, with a height of approximately 300 feet.

The rotor has three blades, and its swept area would cover 16,366 SF (1,520.53 m^2). The maximum height of the rotor tip on any single blade in the 12 o'clock position would be 198.4 feet (60.5 meters) above ground level (AGL). In the 6 o'clock position, the rotor tip would be as low as 85.3 feet (26 meters) AGL. The turbine would be mounted on a tubular steel tower with lighting that would comply with the Federal Aviation Administration's (FAA's) advisory circular, *Obstruction Marking and Lighting* (AC 70/7460-1K). A flashing red light-emitting diode (LED) would be placed at the top of the wind turbine tower. All electrical interconnection lines are internal to the turbine and would connect underground to an existing on-site electrical substation for Camp Perry ANGS. No aboveground electrical lines would be exposed for the turbine.



No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and are incorporated into the Enterprise GIS database.

Figure 2-1. Location of Proposed Wind Turbine at Camp Perry ANGS

Photograph 2-1. Foundation for Proposed Wind Turbine at Camp Perry ANGS

Photograph 2-2. Single 900-kW Wind Turbine at a Nearby Lake Erie Business Park

2.2.2 Operation of Wind Turbine

Camp Perry proposes to construct a wind turbine as part of a Phase IV renewable energy demonstration project. The proposed 600-kW Vestas 44 turbine can operate at a cut-in wind speed (the minimum speed at which it can operate) of 13.1 feet per second (ft/s) (4 meters per second [m/s]). The cut-out wind speed (the maximum wind speed it can operate under) for this turbine model is 65.6 ft/s (20 m/s). The proposed turbine would be able to generate electricity at a maximum capacity of 52.5 ft/s (16 m/s) based on its wind speed rated performance standards. The hours of operation would depend on wind speeds. To minimize potential bat and bird strikes, Camp Perry ANGS proposes avoidance and minimization measures that would reduce speed or stop the rotation of the rotor blades in accordance with the BO. These conservations measures are detailed in Section 4.2.

Routine maintenance and service of the proposed wind turbine would be performed in accordance with the manufacturer's guidelines. Routine maintenance would ensure the turbine is operating properly, minimizing wear and tear on the equipment and reducing downtime due to breakdowns and repairs. Unplanned maintenance would be carried out should there be an equipment malfunction.

2.2.3 Research of Conservation Measures

A primary purpose of the project would be to evaluate design and conservation measures associated with the operation of wind turbines near migratory bird routes. Joint studies with the universities would include monitoring avian and bat mortality rates and monitoring noise levels. Results of the monitoring data would be used to make recommendations on wind turbine operational modifications to reduce potential impacts to bird and bat populations at Camp Perry.

2.3 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

The alternatives selection process considered the overall layout of all components of the project within the boundaries of the Base. Specifically, the location for the wind turbine considered factors such as distance to existing electrical system infrastructure and setback distances from roads, dwellings, overhead lines, Base boundaries, etc. Based on these factors, the following two alternative siting locations were also considered but were not carried forward because they did not adequately meet the needs of the Proposed Action.

- North Outdoor Training Area Location – This 11-acre rectangular area is used for mission preparation and training and for the storage of fill dirt. This area is roughly bound by Niagra Road to the west, North Camp Perry Road East to the east, a paved driveway to the south, and a chainlink fence to the north. Installation of a wind turbine in

this area would require reallocating and reconfiguring the mission training area and relocating the main entrance to the Base, and it would provide no additional advantage over that of the Proposed Action location.

- *Vacant Field Location* – This approximate 20-acre area is a grass-covered field and small L-shaped pond that makes up the north portion of Camp Perry ANGS. This location is roughly bound by Niagra Road to the west, North Camp Perry Road East to the east, a chainlink fence to the south, and Caledonia Drive to the north. Although this area is relatively flat and unrestricted by structures and vegetation, it is the farthest location from the 200 RHS facility. The connections between the turbine, substation, and existing transmission lines will be belowground. This site would require the longest distance of infrastructure to complete the installation, and it would provide no additional advantage over that of the Proposed Action location.

No siting locations outside of Camp Perry ANGS were considered in main part because the funding provided by Congress to the DoD for the wind turbine directed that the location be in Ohio's 9th Congressional District where Camp Perry is located. Additionally, part of the purpose of the Proposed Action is to provide opportunities for scientific research that could result in new or improved design and conservation measures associated with the operation of wind turbines near migratory bird routes, which is Camp Perry's location. As a result of these factors, no other locations besides Camp Perry ANGS will be carried through in this EA for consideration.

2.4 NO ACTION ALTERNATIVE

The CEQ regulation 40 CFR 1502.14(d) specifically requires analysis of a no action alternative in all NEPA documents. Under the No Action Alternative, Camp Perry ANGS would not install the proposed wind turbine. The No Action Alternative also would not execute the Research, Development, Test, and Evaluation appropriation, which specifically outlines analysis of wind technologies in the area of the Camp Perry ANGS.

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3.0 AFFECTED ENVIRONMENT

Chapter 3 describes the environmental conditions potentially affected by the Proposed Action. This section provides information to serve as a baseline from which to identify and evaluate environmental changes likely to result from implementation of the Proposed Action. Baseline conditions represent current conditions. The description of potential environmental impacts of implementing the Proposed Action or the No Action Alternative is in Chapter 4.

In compliance with NEPA, CEQ guidelines, and 32 CFR Part 989, et seq., the description of the affected environment focuses on those resources and conditions potentially subject to impacts. These resources and conditions include biological resources, cultural resources, electrical power supply, visual resources, and water resources.

3.1 BIOLOGICAL RESOURCES

3.1.1 Definition of Resource

For purposes of this EA, biological resources include native or naturalized plants and animals, and the habitats in which they exist (e.g., wetlands, forests, grasslands). Sensitive and protected biological resources include plant and animal species that are Federally (USFWS) or state-listed (Ohio Department of Natural Resources [ODNR]) for protection within Ottawa County, Ohio. Identifying which species occur in an area affected by an action was accomplished through literature reviews and coordination with appropriate Federal and state regulatory agency representatives, resource managers, and other knowledgeable experts.

3.1.2 Existing Conditions

3.1.2.1 Regulatory Setting

Endangered Species Act

Section 7(a)(2) of the ESA of 1973, as amended (16 USC Section 1531 et seq.), requires Federal agencies to consult with the USFWS to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.

Migratory Bird Treaty Act (16 USC 703 et seq.) and EO 13186

The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. The take of all migratory birds is governed by the MBTA's

regulation that affects educational, scientific, and recreational purposes and requires harvest to be limited to levels that prevent overuse.

EO 13186 (effective 10 January 2001), outlines the responsibilities of Federal agencies to protect migratory birds, in accordance with the MBTA, the Bald and Golden Eagle Protection Acts (BGEPA), ESA, and NEPA. This order specifies the following:

- USFWS is the lead for coordinating and implementing EO 13186.
- Requires Federal agencies to incorporate migratory bird protection measures into their activities
- Requires Federal agencies to obtain permits from USFWS before any "take" occurs, even when the agency intent is not to kill or injure migratory birds

Bald and Golden Eagle Protection Act

The BGEPA provides for the protection of the bald and golden eagles (as amended in 1962) by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 USC 668(a); 50 CFR 22). "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 USC 668c; 50 CFR 22.3).

Sikes Act (16 USC 670)

The Sikes Act applies to Federal land under DoD control and requires military services to establish Integrated Natural Resources Management Plans (INRMPs) to conserve natural resources for their military installations. The INRMPs include evaluations of threatened and endangered species, other fish and wildlife resources, wetlands, migratory bird habitat, and forest lands. Camp Perry has developed an INRMP in cooperation with the USFWS and state fish and wildlife agencies.

Ohio Revised Code

The Ohio Revised Code contains legislation passed by the Ohio General Assembly. Title XV of the Code includes legislation to conserve and protect Ohio's natural resources. Chapter 1531 and Chapter 1533 contain laws for the Division of Wildlife to protect and preserve Ohio's wildlife. The chief of the Division of Wildlife has been established as the executive officer who initiates and concurs on all statutory responsibilities, which are either mandatory or directory in nature. The management of these wild animals is to be for the benefit of all the people and is based upon the premise that wildlife is a usable, renewable resource.

3.1.2.2 Vegetation Communities

The Proposed Action area is predominately landscaped, resulting in well maintained grounds with a predominance of short turf grasses, shrubs, cultivated flowers, and three trees (Table 3-1). The Proposed Action area also encompasses a portion of State Route 2, a four-lane highway owned by the Ohio Department of Transportation.

Table 3-1. Land Cover within the Proposed Action Area

Land cover	Percent Coverage	Classification Description
Developed open space	24%	Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover.
Developed low intensity	31.5%	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover.
Developed medium intensity	42.6%	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover.
Developed high intensity	1.9%	Highly developed areas where people reside or work in high numbers. Impervious surfaces account for 80% to 100% of the total cover.

Source: USFWS 2016a; NLCD 2006

The area south of Camp Perry is predominately agricultural, with the Republic Services Ottawa County Landfill approximately 0.5 mile to the south. Camp Perry borders Lake Erie to the north, and a portion of Ottawa National Wildlife Refuge (ONWR) Darby Unit 0.1 mile to the east. To the west, there is an approximate 80-acre forest block and the Lake Erie Business Park (a commercial development). Habitats within the Base's 59 acres include five natural vegetation communities as described below:

Pin Oak Forest – Approximately 38 acres of pin oak forest cover the southwestern portion of the Base. Dominant trees include pin oak (*Quercus palustris)*, green ash (*Fraxinus pennsylvanica)*, red maple (*Acer rubrum*), shellbark hickory (*Caryalaciniata),* bur oak (*Quercus macrocarpa*), silver maple (*A. saccharinum*), shagbark hickory (*Carya ovata*), and white ash (*Fraxinus americana)*. Rough-leaved dogwood (*Cornus drummondii)* and invasive multiflora rose (*Rosa multiflora*) comprise the shrub layer. Dominant native species in the herb layer include poison ivy (*Toxidodendron radicans*), dorryard violet (*Viola sororia*), Canada goldenrod (*Solidago canadensis*), forest-phlox (*Phlox divaricata*), thick-leaved wild strawberry (*Fragaria virginiana*), and small-flowered crowfoot (*Ranunculus abortivus*) (OHANG 2007).

Old Field – Approximately 12 acres of open area, referred to as "Old Field," are present within the far northwestern corner of the property and as several long narrow berms that run parallel to Lake Erie. Dominant herbaceous plants include Canada goldenrod, tall fescue, Awl-aster (*Aster pilosus*), wild carrot (*Dacus carota*), horseweed (*Conza canadensis*), Rough fleabane (*Erigeron strigosus*), Shepherd's purse (*Capsella bursapastoris)*, red clover (*Trifolium pretense*), white clover (*Trifolium repens*), cheatgrass (*Bromus tectorum*), and invasive exotic Canada thistle (*Cirsium arevense*) (BHE 2006).

Forested wetland – Four forested wetlands (3.2 acres, 0.5 acre, 1.3 acres, and 0.8 acre in size, respectively), are located in the pin oak forest woodlot. Vegetation includes pin oak, swamp white oak (*Quercus bicolor*), green ash, shellbark hickory, red maple, silver maple, and sedges (*Carex* spp.). Dogwood shrubs (*Cornus* spp.) and invasive common woodreed (*Cinna arundinacea*) also occur (OHANG 2007).

Emergent wetland – Ten emergent wetlands totaling approximately 4.6 acres are present within the Base boundaries, and range in size from 0.01 to 3.4 acres (OHANG 2007).

Beach Habitat – Approximately 7 acres of beach habitat are located along Lake Erie along the northern portion of the Base (OHANG 2007).

3.1.2.3 Wildlife

Due to Camp Perry ANGS's highly developed nature, the Base provides limited natural habitat for birds, small mammals, fish, reptiles, and amphibians. The habitat present is frequently disturbed by noise from highway traffic, training activities, and maintenance work such as mowing. Fauna Planning Level Surveys were conducted during the spring, summer, and fall in 2005 (BHE 2006). Common mammalian species documented included white-tailed deer, rabbit, raccoon, woodchuck, northern short-tailed shrew, meadow vole, white-footed mouse, squirrel, skunk, and numerous other rodent species. Reptile and amphibian species observed included various frogs (bull, chorus, green, and northern leopard), snakes (northern water and garter), turtles (midland painted and common snapping), and a mole salamander (OHANG 2007).

Camp Perry ANGS provides limited nesting habitat for the majority of Ohio's breeding bird species, however, the Base may serve as a stopover habitat for numerous avian migrant species. A total of 114 bird species were observed at Camp Perry ANGS during the 2005 point count, breeding bird, and pedestrian surveys. Of the 114 bird species observations, 62 species were found as summer residents and nested or attempted to nest on the Base (BHE 2006). Camp Perry ANGS is located adjacent to ONWR Darby Unit, which is known for its high diversity of birds, particularly during spring migration. The ONWR Complex, which also includes the Cedar Point and West Sister Island National Wildlife Refuges, lists 273 species of birds as regular visitors

and another 49 species as "accidentals" (USFWS 2000). Refer to Section 3.1.2.6 for a detailed discussion of migratory birds.

3.1.2.4 Federally Proposed, Candidate, Threatened, and Endangered Species

USFWS special status species lists by county were obtained to identify species known or believed to occur within Ottawa County, Ohio (USFWS 2015a). Table 3-2 provides the list of Federally proposed, candidate, threatened, and endangered species that may occur in Ottawa County, Ohio. This species list was generated from the USFWS Environmental Conservation Online System Information for Planning and Conservation (Consultation Code: 03E15000-2015-SLI-1291) on 9 July 2015 (USFWS 2015a: Appendix C).

Table 3-2. Federally Proposed, Candidate, Threatened, and Endangered Species that May Occur in Ottawa County, Ohio

Scientific Name	Common Name	Federal Status
Birds		
Calidris canutus rufa	Red knot	Threatened
Charadrius melodus	Piping plover	Endangered
Setophaga kirtlandii	Kirtland's warbler	Endangered
Flowering Plants		
Hymenoxys herbacea	Lakeside daisy	Threatened
Platanthera leucophaea	Eastern prairie fringed orchid	Threatened
Mammals		
Myotis septentrionalis	Northern long-eared bat	Threatened
Myotis sodalis	Indiana bat	Endangered
Reptiles		
Sistrurus catenatus	Eastern massasauga	Candidate

Source: USFWS 2015a

Of the eight Federally proposed, candidate, threatened, and endangered species listed, five have potential to occur within or near the action area. Habitat requirements and status for each of these five species are discussed in the following paragraphs. Species further excluded from the analysis are discussed in Sections 3.1.2.5 and 3.1.2.10.

Red Knot

The red knot (*Calidris canutus rufa*) was listed as threatened under the ESA in December 2014 (50 CFR Part 17) and are protected under the MBTA. Red knots migrate extraordinarily long distances from breeding grounds near the arctic tundra in North America and Russia to wintering

habitats in South America, Africa, Europe, Australia, and New Zealand (up to 15,000 kilometers each way). Once considered the most numerous shorebird in North America, the red knot's populations declined substantially in the 1800s and early 1900s due to hunting along its migratory paths. Populations have declined from about 82,000 birds in the 1980s to less than 30,000 in 2010, most likely due to degradation of breeding and wintering habitats and global climate change (Baker et al. 2013).

The red knot breeds in drier tundra areas, nesting on sparsely vegetated, elevated locations; typically on slopes with stunted vegetation or windswept ridges. Red knots feed on tundra invertebrates along coastal tidal sand flats, lakeshores, marshes, and beaches. During migration red knots use marine habitats in both North and South America, preferring to rest and forage along sandy shores at or near tidal inlets or at mouths of bays and estuaries (Baker et al. 2013).

Status of the Species in the Action Area

Red knots are an annual migrant in small numbers in Ohio. The vast majority of observations of this species in Ohio are from along the shoreline of Lake Erie. Other observations are along large waterbodies such as lakes and reservoirs. Red knots have a prolonged migration and may occur in Ohio anytime between 1 April and 31 October. Red knots have been documented in Ottawa County, along the shore of Lake Erie within 1.2 miles of the project area (USFWS 2016a) (Figure 3-1). No Critical Habitat has been designated for this species at this time (USFWS 2016a).

Piping Plover

The piping plover (*Charadrius melodus*) is a small shorebird that nests in three geographic areas in North America. The Great Lakes subpopulation was Federally listed as endangered in 1985 (50 CFR 50726-50734). This shorebird inhabits wide, open beaches, alkali flats, and sand flats. It breeds along the Atlantic Coast; the shores of Lakes Superior, Michigan, and Huron; and along rivers in the Great Plains of Nebraska to Canada. Most piping plovers winter on coastal beaches from the Carolinas to the Yucatan Peninsula, West Indies, and the Bahamas (Elliot-Smith and Haig 2004).

Piping plover nests consist of shallow depressions in the sand above high-tide lines on coastal beaches, sand flats, barrier islands, and foredunes. Nests occur on a range of substrates, including sand, a mixture of sand and pebbles, shells, cobble, and deposited dredge material. Nests are typically established in areas with little to no vegetation. Historically, piping plovers nested on large Lake Erie beaches in Ohio. Due to disturbance and destruction of nesting habitat, this species has not been recorded nesting in Ohio since 1942 and is considered a migrant species in the state (ODNR 2012a).

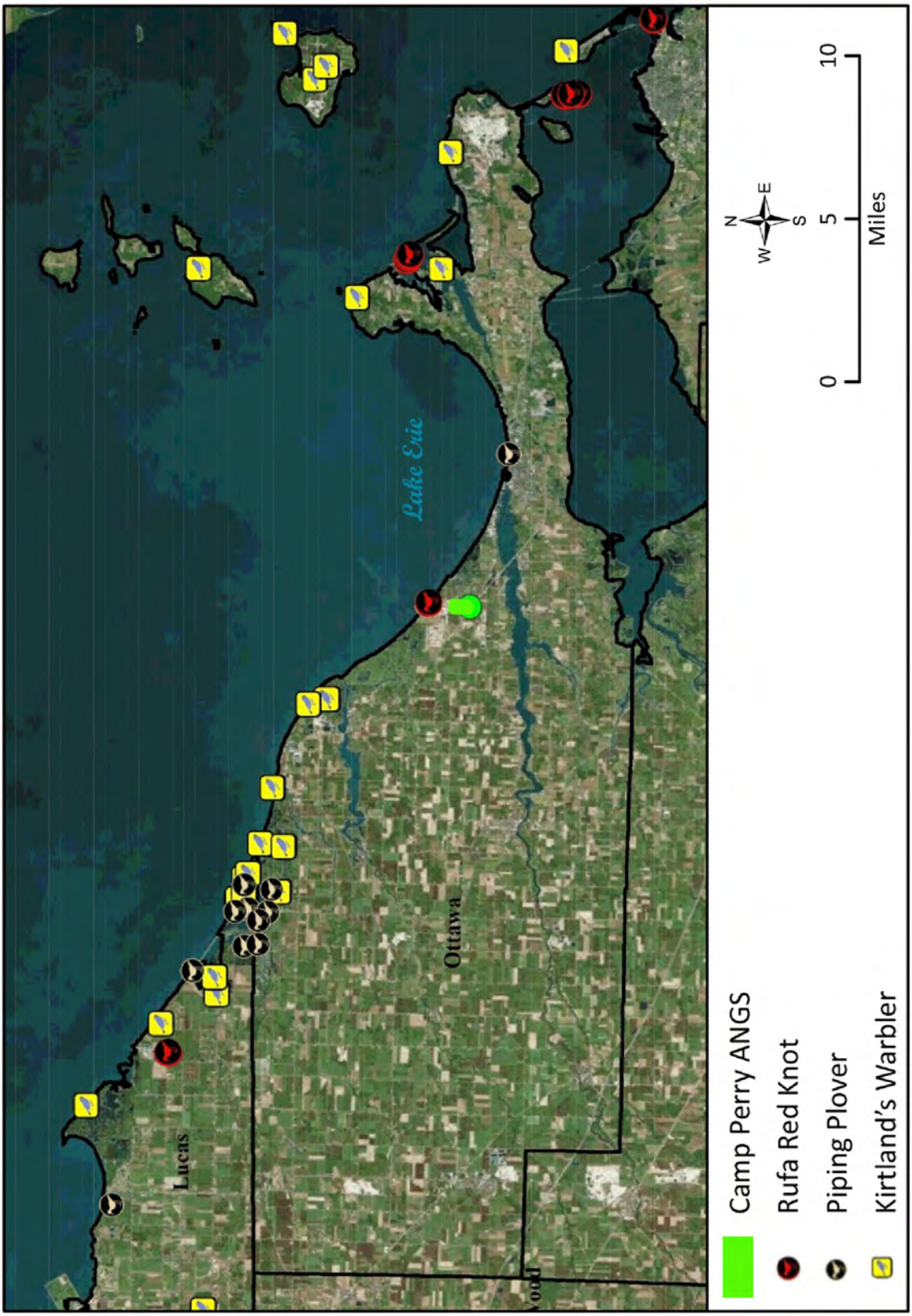


Figure 3-1. Observations of Listed Bird Species in Ottawa County, Ohio

Status of the Species in the Action Area

Piping plovers are an annual migrant in small numbers in Ohio. The vast majority of observations of this species in Ohio are from along the shoreline of Lake Erie. Other observations are along large waterbodies such as lakes and reservoirs. Piping plovers typically pass through Ohio between 1 April and 31 May, and 15 July and 31 October. Piping plovers have been documented in Ottawa County, along the shore of Lake Erie within 1.3 miles of the project area (USFWS 2016a) (Figure 3-1).

Critical Habitat was designated for the Great Lakes population in 2001 (USFWS 2001), while a different rule-making determined critical habitat for the Northern Great Plains population in 2002 (USFWS 2002). There are two sites of Critical Habitat in Ohio; these are at Mentor Headlands Beach and Sheldon Marsh (approximately 21 and 91 miles away, respectively) (USFWS 2016a).

Kirtland's Warbler

Kirtland's warbler (*Setophaga kirtlandii*) is one of the rarest songbirds in North America. This species was listed as endangered in 1967 under the Endangered Species Conservation Act (32 CFR 4001) (predecessor of ESA) This species is also listed as endangered in Ohio under the Ohio Revised Code 1531.25. In 1971, surveys documented a decline in population size from 1,000 individuals to 400 nationwide. The species depends on large tracks of dry sandy soils with young jack pines (*Pinus banksiana*) for breeding habitat, and these habitats have become fragmented by fire suppression and development. The young jack pine fragmented forests also made Kirtland's warblers more susceptible to nest parasitism by brown-headed cowbirds (*Molothrus ater*). The Kirtland's warbler has responded well to recovery efforts on its breeding grounds, and in 2012 the population had reached 4,000 individuals nationwide. Kirtland's warblers nest on the ground in jack pine forests of Michigan, Wisconsin, and Canada. The species conceals the nest with grass and other low-growing vegetation (Bocetti et al. 2014). No nesting habitat for this species occurs in Ohio (USFWS 2016a).

Status of the Species in the Action Area

Kirtland's warblers do not breed within Ohio. But, outside of Michigan, Ohio has the highest number of Kirtland's warbler observations during migration, signifying that a significant portion of the population passes through Ohio on their way to and from the Bahamas. Kirtland's warblers typically pass through Ohio between 22 April and 1 June, and 15 August and 15 October. Kirtland's warblers have been documented in Ottawa County, within 5.2 miles of the project area (USFWS 2016a). No Critical Habitat has been designated for this species at this time (Figure 3-1).

Northern Long-eared Bat

The northern long-eared bat (*Myotis septentrionalis*) was listed as Federally threatened under the ESA in April 2015 (50 CFR 17). This species is also listed as a species of concern in Ohio under Ohio Revised Code 1531.25. The northern long-eared bat is a medium-sized dark brown bat that is distinguishable from other *Myotis* species by its relatively long ears (0.7 inch long on average). In the summer, northern long-eared bats typically roost underneath bark or in cavities of live trees and snags (standing, dead or dying trees). Compared to Indiana bats, northern long-eared bats are less particular in the species of tree it selects as a roost. In the winter, northern long-eared bats typically select caves or mines as hibernacula (a location to hibernate). This species typically forages 1 to 3 meter above the ground (above understory plants), but usually under the forest canopy, making mature forests an important habitat for foraging northern long-eared bats. Northern long-eared bats are also known to forage over water, forest clearings, and along roads. Peak foraging hours are between five and eight hours after sunset (USFWS 2015d).

Status of the Species in the Action Area

Camp Perry ANGS is located at the northern edge of the northern long-eared bat's known range (Air National Guard Readiness Center [ANGRC] 2011). Suitable foraging habitat and roosting substrates for northern long-eared bat exist in the wooded area northwest of the ANGS. The site consists of mature lowland deciduous forest with pin oak (*Quercus palustris*), bur oak (*Q. macrocarpa*), red maple (*Acer rubrum*), and shagbark hickory (*Carya ovata*). Most of the understory of the wooded area is open and mowed. No known hibernacula for the northern long-eared bat occur within the Proposed Action area.

In the summer of 2011, the Environmental Division of the ANGRC conducted bat surveys at Camp Perry. Mist netting and acoustic surveys for bats were conducted according to Indiana bat protocols (USFWS 2009). Mist nets were placed in the wooded lot northwest of the Base. Nets were open for two nights in June and two in August 2011. One adult female northern long-eared bat was captured in a mist net during the August surveys, but the northern long-eared bat was not detected during the acoustic surveys (ANGRC 2011).

Indiana Bat

The Indiana bat (*Myotis sodalis*) was listed as Federally endangered under the Endangered Species Preservation Act of 1966 (23 CFR 4001) (predecessor to ESA) in March 1967 and is currently listed as endangered under the ESA. This insectivore is also listed as endangered in Ohio under Ohio Revised Code 1531.25. The Indiana bat is a medium-sized bat and closely resembles the northern long-eared bat. The Indiana bat is known to occur in Ohio, but there is no known summer or winter records of this species in Ottawa County, Ohio (ODNR 2012b;

USFWS 2007). Indiana bats forage in wooded areas and hibernate during the winter in caves and mines. In the summer this species forages in closed to semi-open forested habitats and forest edges. The species will forage in open grasslands or agricultural areas adjacent to a forest's edge but typically will not venture far from roosting locations.

Status of the Species in the Action Area

Camp Perry ANGS is located at the northern edge of the Indiana bat's known range (ANGRC 2011), although no record has been found of this species occurring in Ottawa County (ODNR 2012b; USFWS 2007). No winter hibernacula are known to occur in or near the Proposed Action area or Ottawa County, Ohio (USFWS 2009). Suitable foraging habitat and roosting substrates may exist in the wooded area northwest of the ANGS. The site consists of mature lowland deciduous forest with pin oak, bur oak, red maple, and shagbark hickory. Most of the understory of the wooded area is open and mowed. Forested wetlands occur in the southwestern portion of this wooded lot and contain a subcanopy of green ash, pin oak, and red maple with an understory of poison ivy, hawthorn, and silky dogwood.

During the 2011 bat surveys previously discussed in the *Northern Long-eared Bat* section above, no Indiana bats were captured or recorded acoustically during the surveys (ANGRC 2011).

3.1.2.5 Federally Listed Species Further Excluded from Analysis

Of the eight listed species (Table 3-2) with potential to occur, three are not likely to occur in the action area and are further excluded from this analysis. These species include two plants, the eastern prairie orchid (*Platanthera leucopaea*) and lakeside daisy (*Hemenoxys herbacea*), and one reptile, the eastern massasauga (*Sistrurus catenatus*). All three species were not observed during the 2005 Vascular Plant Surveys or Fauna Planning Level Surveys and have not been previously documented at Camp Perry ANGS, according to ODNR observation records (BHE 2006, ODNR 2004). Additionally, habitats for each species do not occur within the Proposed Action area. The proposed construction site is on a maintained (mowed) lawn. The orchid and daisy require undisturbed, unaltered terrestrial habitat. Habitat for the eastern massasauga includes wet areas such as prairies, marshes and low areas along rivers and lakes, and does not exist within the Proposed Action area (USFWS 2015c).

3.1.2.6 Migratory Birds and Bald Eagles

In addition to threatened and endangered species protected under the ESA, the Ohio ANG has additional responsibilities under the MBTA and BGEPA. Any Federal activity, intentional or unintentional, resulting in a take of eagles or migratory birds is prohibited unless the taking agency is permitted by the USFWS (50 CFR Section 10.12 and 16 USC Section 668[a]).

Migratory Birds

Lake Erie serves as a barrier to migrating raptors because the thermals they require for lift do not occur over the open water. Hence, many raptors will fly along shorelines during migration. The Black Swamp Bird Observatory along the Lake Erie shore has documented over 10,000 raptors each year migrating around and through the Camp Perry area in 2006, 2008, and 2009 (Shieldcastle 2009). The Black Swamp Bird Observatory has conducted surveys for migratory birds within the neighboring ONWR from 2008–2014, and in the spring of 2014 the observatory recorded 139 species and 21,154 individuals during 46 days of point count surveys at the Navarre Unit (Shieldcastle 2014). Northern cardinal, red-winged blackbird, common grackle, tree swallow, song sparrow, and American robin were observed on each count day. The most abundant species recorded was red-winged blackbird (3,838) followed by Canada goose (1,989), tree swallow (1,516), blue jay (1,444), and common grackle (983).

Additionally, avian radar data was collected at the Proposed Action area (from 2011 to 2013) at the Camp Perry ANGS using the MERLIN avian radar system (DeTect 2012, 2013a, 2013b, 2015a, 2015b). Specifically, bird and bat movements (targets) were tracked and documented using vertical scanning radar. While the radar data did not identify species, target altitudes, number of targets, and passage rates. A summary of the 2012 and 2013 data is presented in Table 3-3 and Table 3-4.

During the 2.5 years of data collection, target passage rates for birds and bats averaged highest to lowest during nights, dawns, days, and dusk respectively. However, rates were practically the same during the night as they were at dawn. The lower-than-average nighttime passage rates from 2011 may have been due to weather and software glitches during peak migration times making data unusable; consequently, these data were not included in the analysis (Table 3-3).

Radar data collected at the Camp Perry ANGS indicated that over the 2.5 years, peak hours of passage occurred from 9:00 PM to 12:30 AM and from 11:00 AM to 3:00 PM (Table 3-3). Average flight heights of birds and bats were highest at night; average flight heights during day, dusk, and dawn were lower (Table 3-4). All average target heights throughout a day were higher than the top rotor blade height (60.5 meters above ground level) and most targets were detected flying above the rotor blades no matter the time of day (Table 3-4). Only 3 percent of targets flying at night were detected flying at a height within the rotor swept zone, with the highest numbers observed in this zone during dawn and dusk (41 and 30 percent respectively).

Table 3-3. Average Target Passage Rates and Peak Hours of Activity from 2011–2013 Collected from Radar Data at Camp Perry Air National Guard Center, Ottawa County, Ohio

Date	Average Target Passage Rate (targets/1 km front/hr)				Peak Hours of Activity
	Night	Dawn	Day	Dusk	
15 August– 15 December 2011	176	447	432	218	10:00 AM – 3:00 PM
24 January– 31 May 2012	539	537	520	333	10:00 PM – 1:00 AM 12:00 PM – 3:00 PM
15 August– 15 December 2012	671	396	375	172	9:00 PM – MIDNIGHT 11:00 AM – 1:00 PM
1 January– 31 May 2013	270	270	192	126	9:00 PM – MIDNIGHT 11:00 AM – 4:00 PM
15 August– 15 December 2013	573	574	526	334	9:00 PM – 1:00 AM 11:00 AM – 4 :00 PM
Average	**446**	**445**	**409**	**237**	9:00 PM – 12:30 AM 11:00 AM – 3:00 PM

Sources: DeTect 2012, 2013a, 2013b, 2015a, 2015b
hr = hour; km = kilometer

Table 3-4. Mean Target Height and Percent of Targets Above Rotor Swept Zone of Avian Radar Data Collected in 2011–2013 at the Camp Perry Air National Guard Center, Ottawa County, Ohio

Date	Percent of Days with Collected Data[1]	Mean Target Heights[2] (meters)				Percent (%) of Targets Above/Within/Below Rotor Swept Zone			
		Night	Dawn	Day	Dusk	Night	Dawn	Day	Dusk
15 August– 15 December 2011	77%	332	103	134	115	91/5/4	40/58/2	66/31/3	54/39/7
24 January– 31 May 2012	85%	267	151	175	162	94/2/4	63/30/7	68/21/11	59/21/20
15 August– 15 December 2012	92%	338	132	169	151	94/4/2	50/45/5	62/30/8	61/31/8
1 January– 31 May 2013	89%	240	142	163	143	94/4/2	62/32/6	66/22/12	57/28/15
15 August– 15 December 2013	76%	334	146	194	170	96/3/1	55/42/3	71/24/5	62/32/6
Average	**84%**	**302**	**135**	**167**	**148**	**94/3/3**	**54/41/5**	**67/25/8**	**59/30/11**

Sources: DeTect 2012, 2013a, 2013b, 2015a, 2015b
Notes:
[1] Percentage indicates the portion of the season with useable radar data; some data were lost due to rain or other interference.
[2] The rotor swept zone maximum height is 60.5 meters above ground level and the lowest rotor blade height is 26 meters above ground level.

Bald Eagles

Bald eagles are Federally protected by the MBTA and the BGEPA and are listed as threatened by the state of Ohio (ODNR 2015a). The bald eagle is a large bird of prey and is an opportunistic forager that eats a variety of prey but prefers fish over other food sources. This bird will scavenge, pirate, or capture its own prey (only when no other option is available). The preferred habitats of bald eagles are shorelines and bodies of water that offer a diverse and abundant prey base with areas of shallow water away from human development and disturbance (Buehler 2000). Ottawa County has the highest nesting density of bald eagles in Ohio, and in 2012 there were 60 known bald eagle nests within 10 miles of the proposed project site, although not all nests were active (USFWS 2012a).

The bald eagle typically breeds in forested areas within 1.25 miles of large bodies of water with available food. Bald eagle nesting sites often occur in mature riparian forests near lakes, large rivers, and oceans. Bald eagles select one of the largest trees that are available with easily accessible limbs capable of holding the weight of their heavy nests. Bald eagles may build more than one nest in a breeding season but only use a single nest. This species is also known to use the same nest year after year (Buehler 2000).

Status of the Species in the Action Area

In the spring of 2015, the ODNR Division of Wildlife completed its annual bald eagle nesting survey (ODNR 2015b). This aerial survey consists of searching for eagle nests in woodlots and along rivers over five blocks that are roughly 10 square miles. Two of the blocks, which are located around Sandusky Bay (Ottawa/Sandusky Counties) on Lake Erie and Mosquito Creek Wildlife Area (Trumbull County) in northeastern Ohio, are flown every year while the other three are rotated every year. In 2015, the other three blocks were located in Mercer County, Wayne/Holmes Counties, and Defiance/Henry Counties. From the survey, biologists calculated that there were approximately 207 eagle nests within the state. This is a slight increase from the 2014 estimate of 200 nests. In the past five years, the estimate of number of nests has averaged 200 per year. The average number of young in 2015 was estimated at 288 (ODNR 2015b).

At the Camp Perry ANGS, a known bald eagle pair has resided just outside the base, within a woodlot located on the grounds of the Camp Perry Joint Regional Training Center. Since 1995, the bald eagle pair has maintained a frequently active nest in a cottonwood tree on the edge of the woodlot facing the south range (Figure 2-1). The eagle pair has been historically observed tending to the nest, perching, and foraging throughout the southern portion of the Training Center (BHE 2006). However, in 2011 the pair built a nest in a tree farther inside the Training Center boundaries, approximately 940 meters northwest of the proposed wind turbine site (OHANG 2015).

3.1.2.7 Critical Habitat

No critical habitat designated for a Federally listed species occurs within the Camp Perry ANGS (USFWS 2015b).

3.1.2.8 Other Protected Habitats

The ONWR Darby Division is located 0.1 mile to the east of Camp Perry ANGS (Figure 2-1). This wildlife refuge is part of the ONWR established in 1961 to provide habitat for waterfowl, migratory birds, and other local wildlife. No National Wildlife Refuge land or other protected landscapes occur within the wind turbine's construction footprint.

3.1.2.9 State Listed Species

According to the ODNR Division of Wildlife State-Listed Species by County list, there are 9 threatened species, 9 endangered species, 27 species of concern, and 16 species of special interest listed species for Ottawa County, Ohio (ODNR 2015a) (Appendix C).

The Camp Perry Training Site Integrated Natural Resources Management Plan (INRMP) provides a detailed description of the Base's on-site and adjacent physical and biotic environments (OHANG 2013). The INRMP identified 20 species listed by the State of Ohio as either endangered, threatened, species of concern, or species of special interest that have the potential to occur at the Camp Perry ANGS (OHANG 2013). Vascular Plant Surveys, Fauna Planning Level Surveys, and Threatened and Endangered Species Surveys were performed in the spring, summer, and fall of 2005 (BHE 2006). Twelve state listed species (including the bald eagle) were observed during the surveys, including nine birds, two plants, four mussels, and one snake. Each species is briefly described below, presented by state listing status.

The ODNR defines an endangered species as a "native species or subspecies threatened with extirpation from the state." The danger may result from one or more causes, such as habitat loss, pollution, predation, interspecific competition, or disease" (ODNR 2005c).

Species observed at Camp Perry ANGS that appear on Ohio's Endangered Species list were:

- *Bald Eagle* – Commonly observed during surveys at an active nest site in southwestern woodlot (refer to Section 4.1.2.4 for a more detailed discussion).
- *Osprey* (*Pandion haliaeetus*) – Individual birds were observed along the Lake Erie shoreline. Breeding criteria for this species was not confirmed at the Camp Perry ANGS; however, Osprey may nest along the north perimeter of the Base where potential suitable habitat is present.

- *Cattle Egret* (*Bubulcus ibis*) – One individual bird was observed. Breeding criteria for this species was not confirmed at the Base. The Cattle Egret is known to nest on West Sister Island, approximately 14 miles north-northwest of the Camp Perry ANGS.
- *Common Tern* (*Sterna hirundo*) – Single birds were observed in August 2005 near the Lake Erie shoreline. Breeding criteria for this species was not confirmed at Camp Perry ANGS. Common Terns nest in nearby marshes in Erie County, immediately east of Ottawa County.
- *Yellow-bellied Sapsucker* (*Sphyrapicus varius*) – This bird species was a relatively common fall migrant.

The ODNR defines a threatened species as "a species or subspecies whose survival in Ohio is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered" (ODNR 2005c).

Species observed that appear on Ohio's Threatened Species list were:

- *Dark-eyed Junco* (*Junco hyemalis*) – The Dark-eyed Junco was numerous and widespread during spring and fall migration. The bird may winter on the Base.

The ODNR defines a species of concern as "a species or subspecies which might become threatened in Ohio under continued or increased stress. Also, a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status. This category may contain species designated as a furbearer or game species but whose statewide population is dependent on the quality and/or quantity of habitat and is not adversely impacted by regulated harvest" (ODNR 2005c).

Species observed that appear on Ohio's Species of Concern list were:

- *Great Egret* (*Ardea alba*) was a common visitor to Base ponds throughout the survey.
- *Bobolink* (*Dolichonyx oryzivorus*) – Confirmed breeding criteria for the Bobolink, along-distance Neotropical migrant bird, were obtained in the Young Range, where males and females were seen carrying food to young in early June. All signs of Bobolink presence disappeared when the nest area was mowed.
- *Melanistic Eastern Garter Snake* (*Thamnophis sirtalis sirtalis*) – This snake is found on the southern shoreline areas of the western basin of Lake Erie. One specimen was found in the construction debris pile in the northwestern corner of the Base.

The ODNR defines a special interest species as one that "occurs periodically and is capable of breeding in Ohio. It is at the edge of a larger, contiguous range with viable population(s) within the core of its range. These species have no federal endangered or threatened status, are at low

breeding densities in the state, and have not been recently released to enhance Ohio's wildlife diversity. With the exception of efforts to conserve occupied areas, minimal management efforts will be directed for these species because it is unlikely to result in significant increases in their populations within the state" (ODNR 2005c).

Species observed that appear on Ohio's Special Interest Species list were:

- Golden-crowned Kinglets (*Regulus satrapa*) were observed in October 2005. Suitable breeding habitat for this species was not observed at the Base.

3.1.2.10 State Listed Species Further Excluded from Analysis

Of the 12 Ohio state listed species observed during the 2005 surveys, 6 species (2 plants and 4 mussels) are not likely to occur in the Proposed Action area and are further excluded from this analysis. Two plant species (Ohio state-listed as potentially threatened), seaside spurge and sea rocket, are in ODNR records as having been observed within sandy dunes and sandy beaches along the Lake Erie shoreline; outside of the Proposed Action area. Four state-listed mussel species are listed in ODNR records as having been observed prior to 1968 along the Lake Erie shoreline near the Camp Perry ANGS. These species include the Eastern pondmussel (*Ligumia nasuta*) – state endangered, fawnsfoot (*Truncilla donaciformis*) – state threatened, threehorn wartyback (*Obliquaria reflexa*) – state threatened, and deertoe (*Truncilla truncate*) – species of concern. Mussels were not included in the 2005 surveys. The ODNR indicates that these species may be extirpated from the vicinity of the Base, although not from the entire Lake Erie shoreline.

3.2 CULTURAL RESOURCES

3.2.1 Definition of Resource

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They can include archaeological resources, historic architectural resources, sacred sites and traditional cultural properties. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Historic architectural resources include standing buildings and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP); however, more recent structures, such as Cold War-era resources, may warrant protection if they are associated with significant events or have the potential to gain significance in the future and are considered extraordinary in nature. Traditional cultural properties are

associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community.

Historic properties (as defined in 36 CFR 60.4) are significant archaeological, architectural, or traditional resources listed in, or eligible for listing in, the NRHP. Historic properties are evaluated for potential adverse impacts from an action, as are significant traditional cultural resources identified by American Indian tribes or other groups. In 1999, DoD promulgated its American Indian and Alaska Native Policy, which emphasizes the importance of respecting and consulting with tribal governments on a government-to-government basis. The policy requires an assessment, through consultation, of the effect of proposed DoD actions having the potential to significantly affect protected tribal resources, tribal rights, and Indian lands before decisions are made by the services.

The region of influence for cultural resources consists of those portions of the 200 RHS that would be directly affected by ground-disturbing activities (e.g., digging/trenching for buried power line installation, areas of vehicle and equipment access and egress). For the purposes of cultural resources analysis, the region of influence is considered equivalent to the Area of Potential Effects (APE), as defined by 36 CFR 800.16(d).

3.2.2 Existing Conditions

The area surrounding Camp Perry was inhabited by prehistoric Native American groups starting approximately 10,000 B.C. with the retreat of the glaciers. A continuous presence of prehistoric groups can be found in the archaeological record until the middle 1600s (Griffin 1978). In the 1700s, historic period Native American tribes, included Wyandot, Shawnee, Delaware, Miami, and Ottawa began settling in northwest Ohio in response to British enticements and activity near Detroit. Significant European settlement in northern Ohio did not begin until after the War of 1812, when pioneers clustered along the region's rivers and ridges. The population gradually moved out of rural areas and into cities, leaving the region as mostly rural land with some larger cities, as it remains today (ANG, Environmental Division 2004a).

The Congressional Act of 1903 gave Federal funding assistance to establish Camp Perry. Ohio legislation officially established Camp Perry in 1906, and it became a permanent camp by 1909. During World War II, the State of Ohio purchased nearly 200 acres from private owners and enlarged Camp Perry. Camp Perry became an induction center for new draftees in 1941, and resulted in construction of numerous buildings during this time. In 1942, the State of Ohio transferred ownership of Camp Perry to the Federal government. From 1943 to 1946, Camp Perry was a Prisoner of War camp (ANG, Environmental Division 2004a).

In 1946, the Federal government transferred Camp Perry back to the State of Ohio, and many buildings were donated or sold and moved offsite. Creation of Rapid Engineer Deployable Heavy Operational Repair Squadron Engineering (RED HORSE) units occurred in 1965, resulted in mobile civil engineering units. The 200 RHS was activated in 1971, and was the first ANG RHS.

Numerous buildings at Camp Perry have been constructed and demolished since 1971. The ANGS currently leases a portion of the original ARNG Camp Perry site from the State of Ohio (ANG, Environmental Division 2004a). There are no eligible or potentially eligible sites within the APE.

3.3 ELECTRICAL POWER SUPPLY

3.3.1 Definition of Resource

This discusses electrical power supply at the Base, which is the only utility impacted by the Proposed Action. EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, sets numerous Federal energy requirements and goals regarding the design, construction, and operation of the projects. These include increasing alternative and renewable energy use, pursuing cost-effective, innovative strategies to minimize consumption of energy, and identifying alternatives to renovation that reduce existing asset deferred maintenance costs.

3.3.2 Existing Conditions

Ohio Edison (a First Energy Corporation company) supplies electrical power to Camp Perry ANGS. In addition, the Base operates a photovoltaic power station (i.e., solar farm), located on the southwest corner of the installation, to supplement its electrical power supply. In addition to providing lighting, electricity is used to cool facilities, and each major building contains its own central air conditioning system. Emergency generators are located in all critical facilities. Almost every facility at the Base is metered by its own electric meter.

On average, the Base consumes approximately 810,000 kilowatt hours (kWh) of electricity annually. Approximately 72 percent (585,000 kWh) of the electricity consumed is supplied by Ohio Edison, with the remainder (225,000 kWh) generated on-site by the solar farm (OHANG 2016). In general, the electrical power supply is in adequate condition, has capacity for growth, and does not present major constraints to development.

3.4 VISUAL RESOURCES

3.4.1 Definition of Resource

The assessment of visual and aesthetic value involves a characterization of existing resources in the study areas. Areas of unique beauty that are a result of the combined characteristics of the natural aspects of land and human aspects of land use are examples of visual resources. Examples of natural aspects of land include wild and scenic rivers, topography, and geologic landforms. Examples of human aspects of land use include scenic highways and historic districts.

Social considerations, including public value placed on the resource, public awareness of the area, and general community concern for visual resources in the area influence changes in visual character. The degree of public interest in a visual resource and concern over adverse changes in the quality of that resource affect social considerations and visual sensitivity of a resource.

Landforms, water surfaces, vegetation, and manufactured features are characteristic of an area if they are inherent to the structure and function of the landscape. These features form the overall impression that an observer receives of an area or its landscape character (ANG, Environmental Division 2004a).

3.4.2 Existing Conditions

Camp Perry ANGS is located 3 miles west of the City of Port Clinton, Ohio. The City of Port Clinton covers a total land area of 2.1 square miles within Ottawa County. The topography of the area is very level to slightly sloping. Agricultural and residential land uses dominate the regional visual character.

The visual environment at ANGS is characteristic of military activities. The area surrounding the Base is primarily rural in nature. The visual environment within the proposed project locations is characteristic of large, open, maintained areas interspersed with prominent vertical elements of buildings, utilities and a water tower. There are no designated scenic viewsheds within the area of Camp Perry ANGS.

3.5 WATER RESOURCES

3.5.1 Definition of Resource

Water resources analyzed in this EA include surface water and floodplains. Surface water resources include lakes, rivers, and streams and are important for a variety of reasons, including irrigation, power generation, recreation, flood control, and human health. Surface waters at Camp Perry ANGS are limited to two small ponds as well as drainage ditches for stormwater runoff. This section also addresses 100-year floodplains. This section does not address wetlands as none are present on the Base. Under the Clean Water Act (CWA), it is illegal to discharge pollutants from a point source into any surface water without a National Pollutant Discharge Elimination System (NPDES) permit. The State of Ohio has authority to implement and enforce the provisions of the CWA and has implemented the NPDES Program through the Ohio Environmental Protection Agency. The Ohio stormwater regulations for stormwater discharges associated with industrial activity are codified in Chapter 3745-39 of the Ohio Administrative Code.

In December 2007, Congress enacted the EISA; Section 438 of this act establishes stormwater runoff requirements for Federal development and redevelopment projects. In January 2010, the Deputy Under Secretary of Defense, Installation and Environment, issued a memorandum directing DoD components to implement EISA Section 438 using low-impact development (LID) techniques. As a result, the policy has been incorporated into the Unified Facilities Criteria (UFC) 3-210-10, *Low Impact Development.* UFC 3-210-10 provides the technical criteria, technical requirements, and references for the planning and design of applicable projects to comply with stormwater requirements under EISA Section 438. (EISA Section 438 requirements are independent of NPDES permit requirements.) LID is a stormwater management strategy designed to maintain site hydrology and mitigate the adverse impacts of stormwater runoff and non-point-source pollution (DoD 2010). While the criteria and design standards in UFC 3-210-10 apply to all DoD construction, EISA Section 438 requirements apply to a project where the construction footprint is greater than 5,000 SF.

Floodplains and riparian habitat are biologically unique and highly diverse ecosystems providing a rich diversity of aquatic and terrestrial species, as well as promoting stream bank stability and regulating water temperatures. Floodplains are defined by EO 11988, *Floodplain Management*, as:

- The elevation and flood hazard area that result from using a climate-informed science approach that uses the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science;

- The elevation and flood hazard area that result from using the freeboard value, reached by adding an additional 2 feet to the base flood elevation for non-critical actions and from adding an additional 3 feet to the base flood elevation for critical actions;

- The area subject to flooding by the a 0.2 percent annual chance flood; or
- The elevation and flood hazard area that results from using any other method identified in an update to the Federal Flood Risk Management Standard.

EO 11988 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

A wetlands delineation was conducted on the Camp Perry military installation's approximately 10 acres of wetlands at the Camp Perry Joint Training Center; however, there were no wetlands identified at Camp Perry ANGS (OHANG 2012).

3.5.2 Existing Conditions

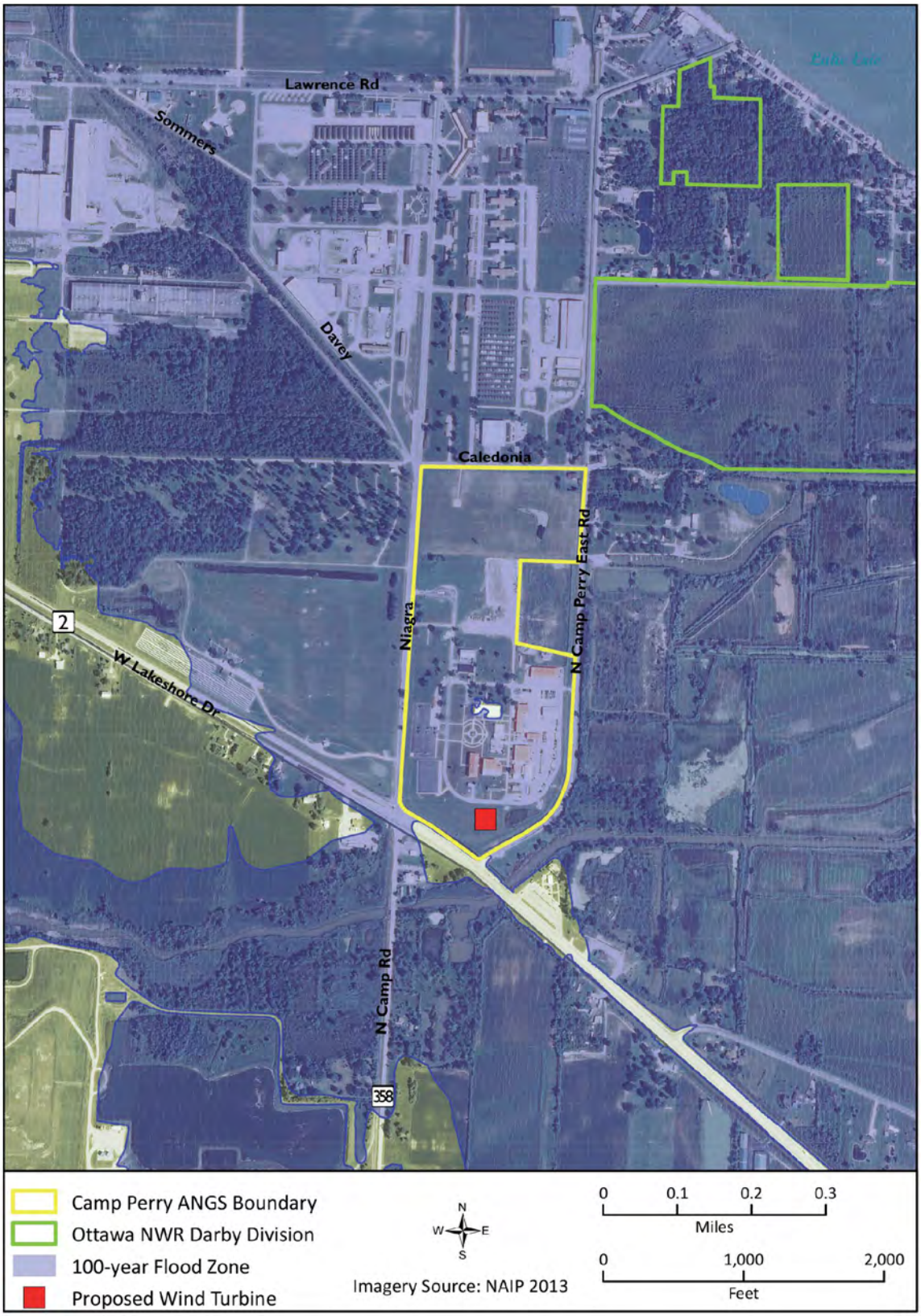
Surface and Ground Water

Camp Perry ANGS is located in the Lower Portage River basin. Three major surface water bodies are located in the vicinity; Lake Erie, the Portage River, and LaCarpe Creek. Lake Erie is the most significant of these surface water bodies, and influences the site with its fluctuating lake level. The Portage River is located approximately 1 mile south of Camp Perry ANGS and flows to the northeast to discharge along the southwestern edge of Lake Erie. LaCarpe Creek is located on the southeastern edge of the facility and discharges into Lake Erie (200 RHS 2001).

Lake Erie is the most significant surface water body located in the region. The fluctuation in lake levels greatly influences the drainage of other smaller surface water bodies (rivers and streams) and groundwater. Surface water bodies in the region characteristically flow toward Lake Erie.

Floodplains

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps indicates that the entire Base is located within the Lake Erie 100-year floodplain (Figure 3-2).



1 **Figure 3-2. 100-year Floodplain**

3.6 SAFETY

3.6.1 Definition of the Resource

This discussion of public health and safety includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of the public. The primary goal is to identify and prevent potential accidents or impacts on the general public. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. Potential health and safety hazards would be limited to areas associated with the construction or operation of the wind turbine.

A variety of Air Force regulations address and govern safety, including Air Force Manual 91-201, *Explosives Safety Standards*, and AFI 91-202, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Standards*. Under 29 CFR 1960 series, Occupational Safety and Health Administration (OSHA) standards do not apply to military-unique workplaces, operations, equipment, and systems. However, according to DoD instruction, they apply insofar as is possible, practicable, and consistent with military requirements. AFOSH standards apply unless specifically exempted by variance or determined to be an acceptable deviation.

3.6.2 Existing Conditions

Day-to-day operations and maintenance activities are performed by the 200 RHS in accordance with applicable Air Force safety regulations, published Air Force technical orders, and standards prescribed by AFOSH requirements. Contractors working at Camp Perry ANGS must prepare appropriate job site safety plans explaining how job safety will occur throughout the life of the project. Contractors must also follow applicable OSHA requirements.

Emergency services, including fire and rescue services, are provided by the local municipality.

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4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 describes potential environmental consequences of the Proposed Action. Each of the following sections includes a discussion of criteria used to evaluate whether the Proposed Action would result in significant impacts.

4.1 BIOLOGICAL RESOURCES

4.1.1 Significance Criteria

Analysis Methodology

Significance criteria for assessing impacts to biological resources are based on four major elements:

- The *importance* of the resource, in legal, commercial, recreational, ecological or scientific terms;
- The *proportion* of the resource that would be affected, relative to its abundance in the region;
- The *sensitivity* of the resource to proposed activities; and
- The *duration* of the ecological consequences.

Impacts to biological resources would be significant if important species or habitats (i.e., species or habitats considered significant by state or Federal natural resource agencies) are adversely affected over relatively large areas; a large proportion of an important species or habitat within a region is adversely affected; or if disturbances related to the Proposed Action cause significant reductions in population size or distribution of an important species. The duration of an impact also affects its significance level. For example, temporary impacts (i.e., noise associated with construction or training activities) are typically considered less significant than permanent impacts (such as a land conversion).

The analysis considers potential impacts to birds and bats associated with the construction and operation of the wind turbine. These impacts may include disturbances, such as posing a barrier to flight paths, due to the interfering presence of the wind turbine, or a risk of collision with the rotor blades resulting in bird mortality, injury, and habitat loss.

4.1.2 Proposed Action

Under the Proposed Action the wind turbine would be constructed in a small area (16 m^2) on a maintained lawn. The turbine would be mounted on a tubular steel tower without guy wires,

reducing the number of substrates with which birds and bats could collide. The lack of guy wires also reduces the number of potential perches for birds, especially for birds of prey, so fewer birds would be attracted to the turbine and the strike potential would be reduced. Lighting on the tower will adhere to FAA guidelines. A red flashing LED would be placed at the top of the wind turbine because a steady light could attract birds to the wind turbine at night. Most electrical interconnection lines within the turbine would be laid underground and would connect to an existing on-site electrical substation for Camp Perry ANGS, further reducing the number of objects associated with the wind turbine with which birds or bats could collide.

These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. These monitoring surveys would be conducted in association with local higher education institutions such as the University of Toledo and the University of Bowling Green and would involve reporting to the USFWS as directed in any Biological Opinion and/or incidental take permit issued for this project. If a take of a migratory bird, Federally listed, or state-listed species is observed, the local USFWS service office would be notified; thereafter, a decision on how to mitigate/curtail turbine operations will be reached following discussions with USFWS.

4.1.2.1 Vegetation Communities

Because the foundation for the wind turbine has already been constructed, impacts to vegetation from the Proposed Action would be limited to temporary disturbance from construction traffic. However, the area is previously disturbed and routinely maintained land. Vehicles and equipment would be staged within the southern lawn of the facility (Figure 2-1) during construction or within the nearby parking lots near the proposed project site. None of the five natural vegetation communities within the Camp Perry ANGS would be impacted during construction and operation of the wind turbine project.

4.1.2.2 Wildlife

Potential impacts to wildlife would result from a slight increase in noise levels associated with construction activities; however, noise impacts would be temporary and limited to the brief construction phase. The estimated ambient noise level at the turbine location is 50 dBA) (USFWS 2016a). The 50 dBA ambient level is equivalent to that of a typical road with heavy traffic (Ohio Department of Transportation 2006), which would be indicative of noise associated with State Route 2, approximately 70 meters from the base of the turbine. Based upon noise measurements on a similar model turbine (Vestas V47-660kw; Vestas 2003) sound levels generated by the turbine are expected to be reduced to ambient levels (50 dBA) at a distance of 100 meters from the turbine (Ohio Department of Transportation 2006). These noise levels would not be anticipated to be significant and would not be anticipated to adversely affect wildlife.

Species within Camp Perry ANGS and in the vicinity are frequently subjected to noise disturbance from highway traffic, ongoing operations such as training activities (firing) and maintenance work (such as mowing). Therefore, no significant impacts to wildlife are anticipated.

4.1.2.3 Federally Proposed, Candidate, Threatened, and Endangered Species

Red Knot

Red knots are expected to be present in the vicinity of the Base during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing with their migration. Red knots can be expected to stop over along the Lake Erie shore during 1 April through 31 May during spring migration and 15 July through 31 August during fall migration. Based on annual survey data collected by the Black Swamp Bird Observatory, red knots are expected to be a more common visitor to the area during fall migration than during spring migration.

MERLIN radar data collected at the Camp Perry ANGS in 2011-2013 (DeTect 2012, 2013a, 2013b, 2015a, 2015b) demonstrated that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Even though migrating red knots are expected to fly higher than the rotor blades, operations under the Proposed Action could potentially result in Red Knot mortality or injury as a result of collision with the rotor blades during inclement weather. Clouds can influence the red knots' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of the bird colliding with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower altitudes, again increasing the risk of collision with a wind turbine.

On 8 March 2016, the USFWS issued a *Final Biological Opinion (BO) and Incidental Take Statement for the Proposed Wind Turbine on the Ohio Air National Guard Station, Camp Perry, Ohio* (USFWS 2016a). Using post-construction monitoring data (conducted at 116 wind energy facilities) from Erickson et al. (2014), the USFWS BO calculated estimates for red knot mortality over the life of the proposed turbine by multiplying the number of birds anticipated to be killed per megawatt (MW) of energy generated per year by the 25-year life span of the project by percent shorebird composition of the all-bird mortality rate by the wattage of the turbine:

> *3.35 birds/MW/year * 25 years * 1% shorebird composition * 0.6 MW turbine = 0.50 rufa Red Knots over the 25 year period.*

The USFWS BO concluded that it is not possible to only take 0.5 bird, thus assuming that one red knot would be killed over the life of the proposed turbine. Due to the broad overwintering

range of the red knot, there are currently no range-wide population estimates for this species (USFWS 2014b). Summing the results of various overwintering surveys gives an estimate of approximately 30,000 birds. The take of one bird over a 25 year period would represent 0.003 percent of this one-year estimate. This level of take is unlikely to affect the distribution or reproductive success, or significantly impact the number of individuals within the population of this species (USFWS 2016a).

The BO requires consultation with the USFWS if a taking occurs; thereafter, a decision on how to mitigate/curtail turbine operations will be reached following discussions with USFWS.

Piping Plover

Piping plovers are expected to be present in the vicinity of the ANGS during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing on with their migration. Piping plovers can be expected to stop over along the Lake Erie shore from 1 April through 31 May during spring migration and from 15 July through 31 August during fall migration. Based on annual survey data collected by the Black Swamp Bird Observatory, this species is not expected to be a very common visitor to the region.

This species typically migrates at night. As stated earlier, MERLIN radar showed that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Even though migrating piping plovers are expected to fly higher than the rotor blades, operations under the Proposed Action could result in mortality as a result of collision with the rotor blades during inclement weather. Clouds can influence the piping plovers' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of collision with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower altitudes, increasing the risk of collision with a wind turbine.

Using post-construction monitoring data (conducted at 116 wind energy facilities) from Erickson et al. (2014), the USFWS BO calculated estimates for piping plover mortality over the life of the proposed turbine, by multiplying the number of birds anticipated to be killed per MW of energy generated per year by the 25-year life span of the project by percent shorebird composition of the all-bird mortality rate by the wattage of the turbine (USFWS 2016a).

*3.35 birds/MW/year * 25 years * 1% shorebird composition * 0.6 MW turbine = 0.50 Piping Plovers over the 25 year period.*

The USFWS BO concluded that it is not possible to only take 0.5 bird, thus assuming that one piping plover would be killed over the life of the proposed turbine. In 2009 the Great Lakes

population of piping plovers was estimated to be 126 individuals (USFWS 2003). At current population levels, the take of one bird over a 25-year period would represent 0.79 percent of the population. This level of take is unlikely to affect the distribution or reproductive success, or significantly impact the numbers of individuals within the population of this species (USFWS 2016a).

Kirtland's Warbler

Kirtland's warblers are expected to be present in the vicinity of the Camp Perry ANGS during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing with their migration. Kirtland's warblers can be expected to stop over along the Lake Erie shore from 22 April through 1 June during spring migration and from 15 August through 15 October during fall migration. Foraging habitat for this species does not occur within ANGS but it does occur within a few miles of the facility.

MERLIN radar data collected at the Camp Perry ANGS in 2011-2013 (DeTect 2012, 2013a, 2013b, 2015a, 2015b) demonstrate that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Kirtland's warblers are known to migrate at night (Table 3-3 and Table 3-4). Based on the data the risk of this species colliding with the wind turbine during calm, clear weather is extremely low. Even though migrating Kirtland's warblers are expected to fly higher than the rotor blades, operations under the Proposed Action could result in mortality as a result of collision with the rotor blades during inclement weather. Inclement weather can increase the risk of Kirtland's warblers collisions with the wind turbine. Clouds can influence the Kirtland's warblers' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of the bird colliding with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower altitudes, again increasing the risk of collision with a wind turbine. The risk of colliding with the rotor blades would increase during inclement weather; however, operators can reduce the speed or even stop the rotation of the turbine blades. Construction and operational effects on migrating Kirtland's warblers should be minimal if turbine operations cease when inclement weather during the migration season could push birds to fly at an altitude that intersects the rotor swept zone. Kirtland's warbler mortality may still result as a consequence of collisions with the wind turbine and its rotating blades, however.

Using post-construction monitoring data (conducted at 116 wind energy facilities) from Erickson et al. (2014), the USFWS BO calculated estimates for Kirtland's warbler mortality over the life of the proposed turbine, by multiplying the number of birds anticipated to be killed per MW of

energy generated per year by the 25-year life span of the project by percent Kirtland's warbler composition of the all-bird mortality rate by the wattage of the turbine (USFWS 2016a).

> *3.35 birds/MW/year * 25-years * 1.6% blackpoll composition * 0.6 MW turbine = 0.804 Kirtland's Warblers over the 25 year period.*

The USFWS BO concluded that it is not possible to only take 0.804 bird, thus assuming that one Kirtland's warbler would be killed over the life of the proposed turbine. During the 2011 census of singing male Kirtland's warbler over 1,800 males were found (USFWS 2012a). Given a 50:50 sex ratio, this would result in a population of approximately 3,600 individuals. At current population levels, the take of one bird over 25 years would represent 0.02 percent of the population. This level of take is unlikely to affect the distribution or reproductive success, or significantly impact the numbers of individuals within the population of this species (USFWS 2016a).

Northern Long-eared Bat

Northern long-eared bats have been recorded during surveys on land adjacent to the Camp Perry ANGS and potential roosting trees such as shagbark hickory are present in a wooded area northwest of the Base. The finding of a northern long-eared bat during summer mist net surveys at Camp Perry in 2011 (ANGRC 2011) indicates that northern long-eared bats may use the wooded area northwest of the project site as a roosting area. Although northern long-eared bats typically forage under the canopy of a forest and would not likely be affected by the wind turbine when foraging, they could cross over the project area when moving between summer habitat and hibernation habitat.

During migration it is expected that northern long-eared bats would fly at heights just above the local canopy level, which would fall within the rotor swept zone resulting in a higher risk of collision and an adverse effect (ANGRC 2011). As with direct collisions with wind turbines, if a bat gets close enough to the moving blades to experience the effects of barotraumas, internal hemorrhaging could occur and cause the bats to die. Northern long-eared bats are expected to be able to avoid a nonoperational wind turbine due to their echolocation abilities and would likely only be affected when the turbine is operational (USFWS 2012b). Operational wind turbines pose a risk of killing or injuring bats, and the risk appears to be a factor of the turbine characteristics, cut-in speeds, bat behavior, and environmental conditions. Mortality seems to be the highest on low-wind-speed nights, after storms, and during periods of higher barometric pressure (USFWS 2012b).

Based on the *Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects* (USFWS 2011), having only a single wind turbine constructed in a location greater than 1,000 feet from

foraging and roosting habitat should minimize the risk of taking northern long-eared bats (a species with similar habits to the Indiana bat) during the summer. Curtailing blade movement during peak northern long-eared bat activity (evening hours on warm, low-wind nights) has been shown to substantially reduce fatalities (USFWS 2012b).

During all spring and fall migrations (15 March through 31 October), the wind turbine would be in operation only during daylight hours. This mitigation, combined with the fact that the wind turbine is located more than 1,000 feet away from any foraging or roosting site, would make a take of this species unlikely. Therefore, the Proposed Action may affect, but is unlikely to adversely affect the northern long-eared bat.

The USFWS BO concluded that the minimization measures outlined are sufficient to avoid take of the species and concur with the determination that the Proposed Action is not likely to adversely affect northern long-eared bats (USFWS 2016a). Should, during the term of this action, additional information on this species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with USFWS would be reinitiated to assess whether the determinations are still valid.

Indiana Bat

Indiana bats have not been recorded at the Camp Perry ANGS or in Ottawa County, Ohio (ODNR 2012b). Since no Indiana bats were detected during the summer 2011 surveys at Camp Perry, it is unlikely that a maternity colony of Indiana bats exists on the facility. In that case, it is also unlikely that migrating Indiana bats would cross over the project area when moving from a local summer habitat to hibernacula. Although the risk of exposure to adverse effects by wind turbines can occur anywhere throughout the bat's range, the risk is higher where suitable habitat is nearby. During migration it is expected that Indiana bats would fly at heights just above the local canopy level, which would fall within the rotor swept zone, resulting is a higher risk of collision and an adverse effect. As with direct collisions with wind turbines, if a bat gets close enough to the moving blades to experience the effects of barotraumas, internal hemorrhaging could occur and cause the bats to die. Indiana bats are expected to be able to avoid a nonoperational wind turbine due to their echolocation abilities and should only be affected when the turbine is operational. Operational wind turbines pose a risk of killing or injuring bats and the risk appears to be a factor of the turbine characteristics, cut-in speeds, bat behavior, and environmental conditions. Mortality seems to be the highest on low-wind-speed nights, after storms, and during periods of higher barometric pressure (USFWS 2012b).

Based on the *Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects* (USFWS 2011), having only a single wind turbine constructed in a location greater than 1,000 feet from

foraging and roosting habitat should minimize the risk of taking Indiana bats during the summer. Curtailing blade movement during peak Indiana bat activity has been shown to substantially reduce fatalities (USFWS 2012b).

During spring and fall migrations (15 March through 31 October), the wind turbine and the ANGS will be in operation only during daylight hours (when Indiana bat activity is unlikely). This mitigation, combined with the fact that the wind turbine is located more than 1,000 feet away from any foraging or roosting site, would make a take of this species unlikely. Therefore, the Proposed Action is unlikely to adversely affect the Indiana bat.

The USFWS BO concluded that the minimization measures outlined are sufficient to avoid take of the species and concur with the determination that the Proposed Action is not likely to adversely affect Indiana bats (USFWS 2016a). Should, during the term of this action, additional information on these species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with USFWS would be reinitiated to assess whether the determinations are still valid.

4.1.2.4 Migratory Birds and Bald Eagles

Migratory Birds

Construction and operation of wind turbines can result in both direct (mortalities) and indirect (habitat destruction) impacts to migratory birds. Bird mortalities at wind turbines are well documented and have shown that the majority of avian fatalities involve nocturnal migratory songbirds. Although most nocturnal migrating birds fly at heights that exceed the upper reaches of wind turbine rotors, the greatest risks to are to birds descending and ascending at stopover locations or due to inclement weather near wind turbines (Erickson et al. 2002).

The location of the proposed wind turbine is near state and Federal wildlife refuges along Lake Erie's southern shore, which provides habitat for waterfowl, raptors, and neotropical migrants in high numbers during spring and fall migration seasons. Of these groups, raptors and songbirds are the most likely to be killed by colliding with the proposed wind turbine. Based on the MERLIN radar data collected at the Proposed Action site, most birds and bats detected at night (when most birds migrate) were flying above the rotor blade height of the proposed wind turbine. These birds are typically most vulnerable to colliding with the rotor blades when cloud cover, fog, or inclement weather creates a ceiling that pushes the birds into the rotor swept zone. Migratory birds are also most vulnerable during "fallout events" during heavy flight nights following cold fronts and when flying through strong headwinds. During fallout events birds may fly at lower altitudes and could collide with the wind turbine. Based on the radar data, the highest risk to migratory birds would occur at dusk (one hour before sunset to one hour after

sunset) and dawn (two hours before sunrise to one hour after sunrise) when birds take off and could fly through the rotor swept zone.

The MBTA prohibits takes of individual birds, and failure to comply with the MBTA can result in criminal penalties. The MBTA does not include a provision to authorize incidental take of migratory birds resulting from the implementation of a Federal action. Even if all reasonable avoidance and mitigation measures are implemented, the USFWS recognizes that some level of mortality of migratory birds will occur at wind turbines (USFWS 2010). In the case of wind turbines, the USFWS continues to provide guidance in making good-faith efforts to enable a wind energy project to comply with the MBTA. The Department of Justice has exercised discretion based on recommendations by the USFWS in enforcing provisions of the MBTA regarding wind energy projects that have made good-faith efforts to avoid the take of migratory birds. Table 4-1 lists species of migratory birds that could potentially be affected by activities in Ottawa County, Ohio.

Table 4-1. Migratory Birds Potentially Present in Ottawa County

Species	Season
Acadian flycatcher (*Empidonax virescens*)	Breeding
American bittern (*Botaurus lentiginosus*)	Breeding
Bald eagle (*Haliaeetus leucocephalus*)	Year-round
Black tern *Chlidonias niger*)	Breeding
Black-billed cuckoo (*Coccyzus erythropthalmus*)	Breeding
Black-crowned night-heron (*Nycticorax nycticorax*)	Breeding
Blue-winged warbler (*Vermivora pinus*)	Breeding
Canada warbler (*Wilsonia canadensis*)	Breeding
Cerulean warbler (*Dendroica cerulea*)	Breeding
Common tern (*Sterna hirundo*)	Breeding
Dickcissel (*Spiza americana*)	Breeding
Field sparrow (*Spizella pusilla*)	Breeding
Golden-winged warbler (*Vermivora chrysoptera*)	Breeding
Henslow's sparrow (*Ammodramus henslowii*)	Breeding
Least bittern (*Ixobrychus exilis*)	Breeding
Northern flicker (*Colaptes auratus*)	Year-round
Peregrine falcon (*Falco peregrinus*)	Breeding
Pied-billed grebe (*Podilymbus podiceps*)	Breeding
Red-headed woodpecker (*Melanerpes erythrocephalus*)	Year-round
Rusty blackbird (*Euphagus carolinus*)	Wintering
Short-eared owl (*Asio flammeus*)	Wintering
Upland sandpiper (*Bartramia longicauda*)	Breeding
Willow flycatcher (*Empidonax traillii*)	Breeding
Wood thrush (*Hylocichla mustelina*)	Breeding

Source: USFWS 2016b

Because migratory bird mortality may occur during the lifetime operation of the proposed wind turbine, Camp Perry ANGS, in coordination with the USFWS, developed the following avoidance and minimization measures to minimize collision potential:

- Proposing design considerations such as installing the turbine on a single tower without guy wires and installing power lines below ground to reduce the number of perching substrates
- Installing a red flashing LED light on the tower to reduce the attraction of birds to the turbine
- Limiting construction to one turbine to reduce the project footprint and the potential for strikes
- Regular maintenance of the surrounding lawn to help reduce the populations of prey animals that could attract raptors
- Limiting turbine operation during nighttime hours to avoid all spring and fall migrations (15 March through 31 October). The definition of *night* is one hour before sunset to one hour after dawn, as described in the attached BA (Appendix B).

Additionally, post-construction monitoring will help Camp Perry ANGS better understand how to reduce potential migratory bird injuries and mortalities by identifying when to reduce speed or even stop the turbine until the risk has passed. By curtailing the operation of the wind turbine during dawn and dusk in spring and fall migration periods, the Base would greatly reduce the potential impacts on migratory birds. Finally, by implementing all best management practices in the USFWS's *Land-Based Wind Energy Guidelines*, Camp Perry ANGS would minimize the effects of the wind turbine on migratory birds and bats. Based on the planned implementation of these design considerations, conservation measures, and best management practices, the construction and operation of this proposed wind turbine may affect, but is unlikely to adversely affect migratory birds.

Bald Eagles

Placement of the proposed wind turbine will not affect any bald eagle nesting habitat. The known pair of nesting bald eagles were most recently observed in 2015, approximately 940 meters northwest of the proposed wind turbine construction site (Figure 2-1), and Ottawa County has the highest nesting density of Bald Eagles in Ohio (USFWS 2012a). This pair is one of the four original breeding pairs that have been tracked in Ohio since 1975. Between 1975 and 1991, this pair resided at Rusha Creek in Carroll Township. From 1991 to 1994, they resided at the ONWR Darby Unit. Prior to 2001, there were three years of failure, but they have nested successfully for the past five years. The Camp Perry Joint Regional Training Center bald eagle pair are fairly tolerant of noise (for example, the nest is right next to a shooting range) and vehicle activity, but not of humans (OHANG 2007). And, since 1995, the ODNR and the OHNG have had a working relationship in regard to the management of the bald eagle nest at the Camp Perry Joint Regional Training Center. Volunteers for the ODNR monitor the nest every three to four days. The woodlot is normally closed (no training occurs in the woodlot) from

1 January to 1 July each year to protect the breeding pair. The management of this nest is not anticipated to change with implementation of the Proposed Action.

Bald eagles were removed from the list of threatened species in 2007 and are now protected by the Bald and Golden Eagle Protection Act. The recovery of bald eagles continues with annual average increases of roughly 3 to 6 percent for many eastern and Midwestern states. Numbers have increased dramatically to about 210 nesting pairs in 2012 in Ohio, up from slightly more than 50 in 1999 and only 4 nesting pairs in 1979. Thus, the "population" in Ohio is increasing at a very rapid rate, demonstrating that this species is resilient when substances like DDT are not spread over the landscape. Existing threats to bald eagles today in the Midwest and beyond include collisions with vehicles, lead poisoning from hunting ammunition, electrocution and collision with transmission lines, fur trapping, collision with trains, and gunshot wounds. For example, in adjacent Michigan about 22 bald eagles were killed per year between 2008 and 2012 after colliding with automobiles on roadways and roughly 12 per year were killed in that state by lead ammunition during the same time period. These impacts are reported from most Midwestern and some Eastern states (Kerlinger 2013b).

While the proposed wind turbine site is near a small pond containing fish that could attract a bald eagle; bald eagles have been observed to avoid collisions when near an operational turbine (Sharp et al. 2010). With respect to impacts from wind turbines, fewer than 10 bald eagles (likely 6 or 7) have been killed by all the wind turbines in North America since wind energy commenced development. Those birds were killed in Wyoming (two birds), Iowa (three), Ontario (one), potentially Minnesota (one), and Maryland (one) (USFWS 2014a). The latter fatality was at a very small wind turbine owned and operated on a National Wildlife Refuge by the USFWS. It is not known if the turbine at the Refuge was even operating at the time of the collision. The small turbine at the Refuge could have been used as a perch by raptors, unlike modern wind turbines that do not offer perching opportunities. These birds were killed during the past few years and represent all the known mortality of bald eagles at wind turbines in the history of wind power development and operation. Thus, of all the human-induced mortality, wind turbines appear to take the least toll on bald eagles (Kerlinger 2013a). While bald eagle mortality might result from wind turbine operation, it is highly unlikely with the Camp Perry wind turbine due to its structure, location and the implementation of the mitigation measures referenced above. If even five bald eagles are killed per year by wind turbines in North America, that amounts to one bald eagle fatality per 10,000 turbines. Rates this low are, by their nature, not biologically significant or predictable. No bald eagle fatalities have been documented in Ohio (USFWS 2013).

The Camp Perry turbine is a smaller and simpler single turbine in comparison to the six utility scale turbines in Wyoming, Iowa, and Ontario that killed small numbers of eagles. The Camp

Perry ANG turbine is much less than one-half the rotor diameter and height of the utility scale turbines. Collisions of bald eagles with wind turbines are rare events even at large utility scale projects. USFWS's turbine is the only location where an eagle fatality has been reported at a single turbine facility. All of the other sites where bald eagles were killed have been projects with dozens of turbines. Additionally, the Camp Perry turbine will be situated in a transit area, where bald eagles tend to transit above the turbine rotor height, and, therefore, the location will present less of a risk than a forage area (Kerlinger 2013b). The Camp Perry ANGS turbine site is not a foraging area, although bald eagles do fly over the base as they move, apparently, between nesting and foraging areas. The turbine site is between a building and a highway, a site that is not friendly to foraging or nesting eagles (and most other birds). Combining these variables, the resultant probability of a bald eagle colliding with the single Camp Perry ANGS wind turbine is quite low.

While unlikely, bald eagle mortality may result as a consequence of collisions with the wind turbine and its rotating blades. As such, Camp Perry ANGS, in accordance with USFWS's *Land-Based Wind Energy Guidelines* and *Eagle Conservation Plan Guidance* (ECPG), is preparing an Eagle Conservation Plan (ECP) to ensure that avoidance and minimization measures are implemented into project design and operation; that the project remains in compliance with Bald and Golden Eagle Protection Act requirements; and that mitigation for impacts that cannot be avoided or minimized are addressed through an appropriate program of compensatory mitigation. The ECP will establish measures and effects that are "compatible with the preservation of the bald eagle as set forth in the ECPG and enable Camp Perry ANGS to apply for a "voluntary" eagle take permit. Minimization measures already planned by the Camp Perry ANGS that will reduce adverse effects by the wind turbine on bald eagles include:

- The ANGS would maintain the southern lawn regularly and will not seed the lawn with vegetation that could attract small mammals (prey).
- The ANGS would remove and properly dispose of any carcasses found within 100 meters of the turbine in conformance with local regulations.
- The design of the turbine is a monopole without any lattice structure or guy wires, which will deter perching.
- All electrical lines will be placed underground to reduce perching substrates near the wind turbine.
- The ANGS would conduct post-construction monitoring for two years to document any take of bald eagles based on guidelines accepted by USFWS.

4.1.2.5 Critical Habitat

No critical habitat designated for a Federally listed species occurs within the Proposed Action area, therefore no affects to critical habitat from the Proposed Action would occur.

4.1.2.6 Other Protected Habitats

No impacts to the ONWR Darby Division are anticipated. Impacts from the Proposed Action would be limited to the Proposed Action area.

4.1.2.7 State Listed Species

The melanistic eastern garter snake is not expected to be impacted by the construction or operation of the wind turbine. Impacts from the Proposed Action would be limited to the Proposed Action area, within previously disturbed habitat, and outside of the snakes known habitat along the southern shoreline areas of the western basin of Lake Erie.

The remaining Ohio state listed species are birds and the effects of the Proposed Action will be similar to those for the previously discussed migratory birds and the bald eagle (Section 4.1.2.4). Ospreys, cattle egrets, common terns, yellow-bellied sapsuckers, great egrets, bobolinks, and golden-crowned kinglets are all at risk of potential collisions as bird mortality may occur during the lifetime operation of the proposed wind turbine. As previously discussed under Migratory Birds and bald eagles, mitigation and conservation measures will be implemented to minimize the effects of the proposed wind turbine on avian species. Additionally, post-construction monitoring will help Camp Perry ANGS better understand how to reduce potential bird injuries and mortalities by identifying when to reduce speed or even stop the turbine until the risk has passed.

By curtailing the nighttime operation (i.e., one hour before sunset to one hour after dawn) of the wind turbine during spring and fall migration periods, the Base would greatly reduce the potential impacts on migratory birds. Finally, by implementing all best management practices in the USFWS's Land-Based Wind Energy Guidelines, Camp Perry ANGS would minimize the effects of the wind turbine on migratory birds. Based on the planned implementation of these design considerations, conservation measures and best management practices, the construction and operation of this proposed wind turbine is unlikely to adversely affect Ohio state listed bird species.

4.1.2.8 No Action Alternative

Under the No Action Alternative, Camp Perry ANGS would not install the proposed wind turbine. There would be no changes in operations relative to the existing baseline conditions for

biological resources. Current facility operations, including training and maintenance activities would continue to occur. Therefore, no additional impacts to biological resources at the Camp Perry ANGS would occur under the No Action Alternative.

4.2 CULTURAL RESOURCES

4.2.1 Significance Criteria

Cultural resources are subject to review under both Federal and state laws and regulations. Under the NHPA of 1966 (as amended), Federal agencies must determine the significance of cultural resources under their jurisdiction by evaluating them relative to NRHP eligibility criteria. The NRHP criteria for evaluation (Advisory Council on Historic Preservation 2008) state that, "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

(a) that are associated with events that have made a significant contribution to the broad patterns of our history; or

(b) that are associated with the lives of persons significant in our past; or

(c) that embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) that have yielded, or may be likely to yield, information important in prehistory or history."

Cultural resources that have been determined to be significant are eligible for listing on the NRHP, and are called historic properties. Section 106 of the NHPA and its implementing regulations (36 CFR Part 800) require Federal agencies to take into account the effects of their undertakings (i.e., any federally initiated, licensed, or permitted projects) on historic properties. An effect may be considered adverse if it changes those qualities of a historic property that qualify it for the NRHP, or if a cultural resource has been identified as important to Native Americans, as outlined in the American Indian Religious Freedom Act, EO 13007, *Indian Sacred Sites*, and other regulations. The NHPA also requires the agency to consult with the SHPO regarding the undertaking and any potential effects to historic properties.

DoD American Indian and Alaska Native Policy (1999) provides guidance for interacting and working with federally recognized American Indian governments. DoD policy requires that installations provide timely notice to, and consult with, tribal governments prior to taking any actions that may have the potential to significantly affect protected tribal resources, tribal rights, or American Indian lands.

Analysis of potential impacts to cultural resources considers impacts that may occur by the following:

- Physically altering, damaging, or destroying all or part of a resource
- Altering characteristics of the surrounding environment that contribute to the resource's significance
- Introducing visual or audible elements that are out of character with the property or alter its setting
- Neglecting the resource to the extent that it deteriorates or is destroyed

Direct impacts can be assessed by identifying the types and locations of proposed activities and determining the exact location of cultural resources that could be affected. Indirect impacts occur later in time or farther from the proposed action. Indirect impacts to cultural resources generally result from the effects of project-induced population increases, such as the need to develop new housing areas, utility services, and other support functions to accommodate population growth. These activities and the subsequent use of the facilities can impact cultural resources.

4.2.2 Proposed Action

The ANGS completed a reconnaissance level survey in 2004 (the "Archaeological Resources Assessment") (Environmental Planning Branch ANGS/CEVP 2004). The results of the Archaeological Resources Assessment suggested that Camp Perry has a low potential for archaeological sites and did not identify any specific sites within the planned project area. There is a historic district at Camp Perry, but it does not include the ANGS facilities.

As part of a previous EA for this project (OHANG 2012), the 200 RHS consulted with the Ohio Historic Preservation Office (OHPO) (see Appendix A). The OHPO initially expressed concern in a letter written on 3 February 2011 that the proposed wind turbine would visually dominate the historic guard towers flanking the main entrance to the National Register-eligible Camp Perry Historic District, diminishing its integrity. Based on a review of the actual location of the turbine, the OHPO, in a letter dated 8 June 2012, determined that the proposed project would have no adverse effect on historic properties.

The OHPO stated that no further coordination is required unless there were changes to the project scope (OHPO 2012). No such changes have occurred.

The concrete pad for the proposed wind turbine has already been constructed; however, there might be additional, limited digging and trenching activities associated with the installation of power lines. As there are no identified subsurface cultural resources, no adverse effects to cultural resources are anticipated during implementation of the Proposed Action; however, in the event of an inadvertent discovery during ground-disturbing operations, the 200 RHS would cease work immediately, contact a professional archaeologist, and notify the OHPO.

Impacts to Native American traditional resources from the Proposed Action are not anticipated. In accordance with 36 CFR Part 800.2, the 200 RHS is seeking to include interested Native American tribes. Even though no traditional cultural properties or sacred sites have been identified at the Base, Camp Perry ANGS has already provided consultation correspondence to Native American tribes with potential interest in the proposed undertaking. These potentially interested tribes are listed in Appendix A.

4.2.3 No Action Alternative

Under the No Action Alternative, Camp Perry ANGS would not install the wind turbine. There would be no impacts to historic properties, and any potentially significant cultural resources located at Camp Perry ANGS would be managed in accordance with the Base's Integrated Cultural Resources Management Plan, applicable Federal laws, regulations, and DoD and Air Force instructions.

4.3 ELECTRICAL POWER SUPPLY

This section discusses potential impacts to electricity and evaluates the potential for the Proposed Action or No Action Alternative to result in changes to existing levels of utility usage. Effects may include disruption, degradation, or improvement of existing levels of service.

Under EO 13693, *Planning for Federal Sustainability in the Next Decade*, Federal agencies must maintain leadership in sustainability and greenhouse gas emission reductions. Specifically, Federal agencies shall ensure that at a minimum, not less than 25 percent by fiscal year 2025 of the total amount of building electric energy and thermal energy shall be clean energy, accounted for by renewable electric energy and alternative energy.

4.3.1 Significance Criteria

Significant impacts on utilities could occur under one of these two scenarios: (1) if implementation of the Proposed Action or No Action Alternative resulted in high-intensity

regional or local impacts over the long term due to an increase in average and peak utility use and demand beyond the capacity of existing utility infrastructure or (2) if requirements of the Proposed Action necessitated major system upgrades beyond those projected by the utility system in its capital improvement plan and were necessary to maintain the existing level of service.

4.3.2 Proposed Action

Currently, the Base consumes an average of approximately 810,000 kWh annually, with approximately 72 percent (585,000 kWh) supplied by the local utility, Ohio Edison.

The average annual wind velocity in the Camp Perry ANGS area is estimated to be approximately 9.5 miles per hour, increasing during the winter and decreasing during the summer (CustomWeather 2016). Based on this wind velocity, the proposed wind turbine would generate approximately 400,000 kWh of electricity annually (assuming round-the-clock operations), or almost 70 percent of the utility-provided electrical power.

This assumes full-time operation of the turbine; however, the mitigative measures discussed previously and summarized in Chapter 6 would limit the actual operating time of the turbine, as follows:

	Hours
Total annual hours:	8,760
Hours associated with curtailment of night operations during 15 March to 31 October (231 days x 12 hours/day):	2,772
Net operating hours:	**5,988**

Based on the net hours of operation, approximately 273,425 kWh of electricity would be generated annually. This means that approximately 62 percent of the electricity consumed on the Base would be generated by renewable energy sources (solar farm and wind turbine).

This would also result in an annual decrease in GHG emissions of approximately 288 tons (U.S. Department of Energy 2016). This would further facilitate the Base's ability to comply with the requirements of EO 13693. Consequently, the Proposed Action will not have a significant impact to the electrical power supply. *Note: The net operating hours reflected above may be further reduced based on operational constraints, including weekend Base manning limitations or turbine maintenance requirements*.

4.3.3 No Action Alternative

No impact to current electrical power usage would result under the No Action Alternative. Beneficial impacts would not be realized since energy efficiency measures would not be implemented, affecting the Base's ability to comply with EO 13693.

4.4 VISUAL RESOURCES

4.4.1 Significance Criteria

Determination of the significance of the impact on visual resources is based on the level of visual sensitivity in the area. Visual sensitivity is defined as the degree of public interest in a visual resource and concern over adverse changes in the quality of the resource. In general, a potential impact on a visual resource is significant if implementation of the Proposed Action would result in substantial alteration to an existing sensitive visual setting.

4.4.2 Proposed Action

Erie Township in Ottawa County is mostly rural in nature, and a portion of the ARNG property surrounds Camp Perry ANGS to the north and west. These areas include a grenade launcher, shotgun ranges, and abandoned World War II era five-man hutments. Various manufacturing facilities are also located to the west of Camp Perry in the Erie Industrial Park, and Waste Management, Inc. (a licensed landfill) is located to the south. A wind turbine is currently located at the nearby Lake Erie Business Park. The proposed turbine would have a maximum height of 200 feet (including the height of the blade) and would be similar in appearance to the turbine currently located at the business park; however, it would be significantly shorter as the existing turbine at the business park has a height of approximately 300 feet. Several tall, steel radio/communications antennas are also located in the general area. Based on the existing viewshed, the addition of the proposed wind turbine would not be expected to result in significant impacts. Any impacts to visual resources due to the use of a large crane to install the wind turbine would be temporary.

4.4.3 No Action Alternative

Under the No Action Alternative, there would be no impacts to visual resources, as the installation of the wind turbine would not occur.

4.5 WATER RESOURCES

4.5.1 Significance Criteria

Analysis of potential impacts to water resources resulting from proposed activities examines the suitability of locations for proposed operations and activities. Minimization of soil erosion/stormwater runoff and the siting of facilities in relation to potential soil limitations are considered when evaluating impacts. If a proposed action were to substantially affect or be substantially affected by any of these features, impacts would be considered significant. Generally, impacts can be avoided or minimized to a level of insignificance if proper construction techniques, erosion control measures, and structural engineering designs are incorporated into project development.

4.5.2 Proposed Action

The concrete pad for the proposed wind turbine has already been constructed; however, there might be additional digging and trenching activities associated with the installation of buried power lines. The scope of any such activity would be expected to disturb an area well less than 1 acre. Consequently, requirements associated with NPDES stormwater permitting would not apply. Requirements associated with EISA Section 438 would also not apply because it would be expected that project would disturb less than 5,000 SF.

Regardless, the Base would apply applicable best management practices for controlling runoff, erosion, and sedimentation associated with any ground-disturbing activities. These may include using silt fences or straw wattles, minimizing surficial area disturbed, stabilizing cut/fill slopes, minimizing earth-moving activities during wet weather, and covering soil stockpiles. No adverse impacts from construction activities would result from the Proposed Action.

The entire Camp Perry ANGS and surrounding area is within the 100-year floodplain of Lake Erie. Pursuant to EO 11988, *Floodplain Management* and AFI 32-7064, *Integrated Natural Resources Management*, there is no practicable alternative to this action. The Proposed Action includes all practicable measures to minimize harm to the floodplain environments; consequently, the Proposed Action will not have a significant impact on water resources.

4.5.3 No Action Alternative

Under the No Action Alternative, the Camp Perry ANGS would not implement the actions described above; consequently, no adverse or beneficial impacts to the electrical power supply would occur.

4.6 SAFETY

4.6.1 Significance Criteria

This analysis evaluates issues that have a potential to affect safety relative to the degree to which the activity increases or decreases safety risks to military personnel, the public, and property. A significant impact would occur with a new or unique safety risk (over those which are associated with typical operations) to military personnel or the public from implementation of any phase of the Proposed Action.

4.6.2 Proposed Action

Potential safety issues for the Proposed Action are discussed below as they relate to construction/workplace safety, turbine blade and structural failure, and turbine icing issues.

Construction/Workplace Safety

Modern wind turbines must meet strict international engineering standards, and documented injuries to construction crews occurred only when construction and operating instructions were not adhered to (Chatham-Kent 2008). All construction would be accomplished by technically qualified personnel and would be conducted in accordance with applicable Air Force safety requirements and standards. Contractor construction activities associated with the Proposed Action would be conducted in accordance with applicable OSHA regulations 29 CFR sections 1910 and 1926.

No unique construction practices or materials would be required to construct the proposed geothermal facility. During construction, standard industrial safety standards and best management practices would be followed, including implementing procedures to ensure that fall-protection, guards, housekeeping, and personal protective equipment are in place; establishing programs and procedures for lockout, right-to-know, confined space, hearing conservation, forklift operations, etc.; conducting employee safety orientations and performing regular safety inspections; and developing a plan of action for the correction of any identified hazards. No unusual safety risks would be expected from these activities.

Turbine Blade and Structural Failure

It is estimated that there were approximately a total 268,000 wind turbines operating around the world at the end of 2014 (Global Wind Energy Council 2016). Over the last five years (2011–2015), an average of 164 wind turbine accidents have occurred annually, or one accident per every 1,634 turbines (Caithness 2016).

From 1996 through 2015, there were a total of 118 reported fatal accidents associated with wind turbine operations, resulting in 168 fatalities (some accidents involved multiple fatalities). Most of these fatalities (96) were directly associated with wind industry and direct support workers (divers, construction, maintenance, engineers, etc.). The remaining fatalities were associated with transportation-related accidents, with most accidents involving turbine sections falling from transporters. Four members of the public were also killed in an aircraft-related crash in 2014. To date, there is no recorded evidence of injury to the public due to blade or turbine breakage and/or collapse (Caithness 2016).

The American Wind Energy Association identifies the leading causes of blade failure as vandalism, improper assembly, or exceeding design limits (Chatham-Kent 2008). Because the proposed turbine would be located on Camp Perry, it would be safe from vandalism. It would also be assembled and maintained only by technically qualified personnel. Finally, wind turbines are designed to withstand wind strengths equivalent to hurricane forces. The proposed Vestas turbine is designed for a maximum wind speed of approximately 116 miles per hour, and to shut down if wind speeds reach more than 44 miles per hour. Education of on-site personnel would be required regarding proper turbine operational procedures, including emergency shutdown.

Icing Issues

There is possibility that ice buildup on the turbine or turbine blades can drop or be "thrown," causing a potential for injury from falling ice. Modern turbines, as the one proposed, are designed to detect ice buildup on the blades and to automatically shut down the turbine in such cases. Education of construction crews and maintenance staff would also be required regarding icing potential, policies and procedures (shutdown and system reactivation). Additionally, warning signs would be posted around turbine areas where icing potential exists and established setback distances would be enforced to keep all non-authorized personnel from approaching the turbine at all times.

With implementation of the procedures described above, the Proposed Action would not result in significant impacts to public health and safety.

4.6.3 No Action Alternative

Under the No Action Alternative, Camp Perry ANGS would not install the proposed wind turbine. Established safety procedures and protocols would continue to be implemented.

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5.0 CUMULATIVE IMPACTS

Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the ROI. Cumulative impacts can result from individually minor but collectively substantial actions undertaken over a period of time by various agencies (Federal, state, and local) or individuals. In accordance with NEPA, a discussion of cumulative impacts resulting from projects that are proposed, or anticipated over the foreseeable future, is required.

This section discusses the potential for cumulative impacts caused by implementation of the Proposed Action when combined with other past, present, and reasonably foreseeable actions occurring in the Region of Influence.

The pad for the wind turbine has already been constructed and there would be only additional minor activities (i.e., installation of buried utility lines) associated with the installation of the turbine. Due to the limited scope of the project there would be no cumulative impacts associated with cultural resources, electrical power supply, visual resources, and water resources. Potential cumulative impacts associated with biological resources are discussed below.

5.1 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

In 2014, under Senate Bill 310, Governor John Kasich signed into law legislation freezing for two years a requirement that utility companies sell more electricity from renewable sources of energy. No new commercial wind energy projects were initiated between 2013 and 2015, but the Pew Charitable Trusts predicts that when the freeze is lifted in 2016 investments in wind power in Ohio will reach $125 million. Wind energy capacity in the state is expected to reach nearly 1,500 MW by 2023 (The Pew Charitable Trusts 2015). This predicted increase in the number of wind turbines in the state would likely see many constructed along the shore of Lake Erie, potentially near the action area. This increase in wind turbines would potentially result in an increase in bat and bird fatalities in Ohio due to collisions with wind turbines.

Wind turbines present two major types of potential impact to avian and bat populations, including (1) disturbance/displacement and (2) collision. Water fowl and shore birds are more likely to be affected by disturbance or displacement, although these species will be very rarely on site because of the absence of suitable habitat for them. A small number of raptors may be affected by collision, but those potential fatalities are not likely to result in biologically significant impacts. Studies show that migrating nocturnal song birds, water fowl, and shore birds typically travel at altitudes higher than the proposed turbine. Therefore, collision impacts are less likely to occur for these species.

Camp Perry ANGS acknowledges that potential bat and bird mortality at the proposed wind turbine may contribute cumulatively to mortality rates of other wind projects slated in and around the Lake Erie shore. Camp Perry ANGS is aware of an additional commercial wind turbine (above 300 feet) proposed for construction by the owner of the existing wind turbine northwest of the facility. However, the placement of a single, small demonstration wind turbine on the Camp Perry ANGS property would not result in significant cumulative impacts to local or regional avian and bat populations.

6.0 SPECIAL OPERATING PROCEDURES

This section summarizes special operating procedures and best management practices associated with this EA. *Special operating procedures* are defined as measures that would be implemented to address minor potential environmental impacts associated with implementation of the Proposed Action.

The following special procedures would be implemented as part of the Proposed Action. Other resources areas would require no unique special operating procedures.

Biological Resources

Camp Perry ANGS has implemented the following design considerations to avoid or minimize the potential impacts to local natural resources from the construction of the wind turbine (USFWS 2012b):

- The wind turbine's design does not include guy wires, which reduces the likelihood of injury or death of birds and bats due to collision and minimizes the area available for raptors to perch. Additionally, the turbine is a monopole, which reduces the potential for perching.
- The wind turbine would be built in a previously disturbed area, thereby eliminating the potential for habitat loss during construction.
- Limiting construction to one turbine will reduce the project footprint and the potential for strikes. The initial project concept included three turbines; however, this was revised as a result of coordination with the USFWS.
- All interconnection wires would be internal to the turbine. Electrical lines connecting the turbine to an existing substation on Camp Perry ANGS would be installed underground, thereby reducing or eliminating potential risks of electrocution and collision associated with overhead electrical lines.
- The design uses a FAA-approved red LED strobe light to reduce collisions by birds that are attracted to steadily burning lights.

Camp Perry ANGS will also implement the following minimization measures:

- Camp Perry ANGS would implement scalable operational controls during periods of higher bird and bat activity and when weather conditions could potentially increase bird and bat activity near the operational zone of the turbine. This includes cessation of operations to reduce biologically significant impacts, particularly during the nighttime

(i.e., one hour before sunset to one hour after dawn) and spring and fall migration periods.

- Camp Perry ANGS would maintain the southern lawn regularly to help reduce prey populations that could attract raptors.
- Camp Perry ANGS would remove and properly dispose of any animal carcasses not part of the post-construction monitoring studies found within 100 meters of the turbine in conformance with local regulations.
- Camp Perry ANGS would light buildings and structures within a half-mile of the turbine to the minimum level possible, while still complying with facility security requirements, to reduce prey (insects) attracted to the lights. The street lighting and lighting at the closest buildings have already been changed to LED high-color temperature lights to reduce attraction of insects in and around the area.

Table 6-1 summarizes the operational curtailment regimes that would be implemented for operation of the turbine.

Table 6-1. Operational Curtailment Regimes

Species	Operational Control	Dates of Curtailment	Desired Outcome
Indiana and northern long-eared bats	Full curtailment at night*	15 March – 31 October	Avoid take of these two species.
Piping Plover	Full curtailment at night	15 March – 31 October	Minimize potential impacts
Red Knot	Full curtailment at night	15 March – 31 October	Minimize potential impacts
Kirtland's Warbler	Full curtailment at night	15 March – 31 October	Minimize potential impacts

* Night is defined as one hour before sunset to one hour after dawn.

Once the turbine becomes operational, the study would involve *two years of post-construction monitoring* for bird and bat carcasses at or near the wind turbine. These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. This monitoring would follow the ODNR single-turbine protocol at a minimum (Appendix D).

These monitoring surveys would be conducted in association with local higher education institutions such as the University of Toledo and the University of Bowling Green and would involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project. If a take of a migratory bird, Federally listed, or state-listed species is observed, the local USFWS service office would be notified; thereafter, a decision on how to mitigate/curtail turbine operations would be reached following discussions with USFWS.

Bald Eagle

The Camp Perry ANGS, in accordance with USFWS's Land-Based Wind ECPG (USFWS 2013), is preparing an Eagle Conservation Plan (i.e., an ECP) to ensure that avoidance and minimization measures are implemented into project design and operation; that the project remains in compliance with BGEPA requirements; and that mitigation for impacts that cannot be avoided or minimized are addressed through an appropriate program of compensatory mitigation. The ECP will establish measures and effects that are "compatible with the preservation of the bald eagle as set forth in the ECPG and enable the Camp Perry ANGS to apply for a "voluntary" eagle take permit.

The Bald and Golden Eagle Protection Act (16 USC 668-668d) makes it illegal to import, export, take (which includes molest or disturb), sell, purchase, or barter any bald eagle or golden eagle or parts thereof. The USFWS oversees enforcement of this act. Under the Bald and Golden Eagle Protection Act (72 *Federal Register* 31132, 5 June 2007), "Take" is defined as to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest or disturb." "Disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." "Disturb" was defined in 2007 (72 FR 31132) as "to agitate or bother a bald or golden eagle to a degree that causes...injury to an eagle, reduced productivity, or nest abandonment."

With the removal in 2007 of the bald eagle from the ESA list of threatened and endangered species, the USFWS issued new regulations to authorize the limited take of bald and golden eagles under the Bald and Golden Eagle Protection Act, where the take that may be authorized is associated with otherwise lawful activities. A final Eagle Permit Rule was published on 11 September 2009 (74 *Federal Register* 46836-46879; 50 CFR 22.26 and 22.27). Under these new rules, the USFWS can issue permits authorizing individual instances of take of bald and golden eagles when the take is associated with, but not the purpose of, an otherwise lawful activity and cannot practicably be avoided. The regulations also authorize permits for "programmatic" take, which means that instances of "take" may not be isolated, but may recur. The programmatic take permits are the most germane permits for wind energy facilities. However, under these regulations, any ongoing or programmatic take must be unavoidable even after the implementation of Advanced Conservation Practices (ACPs).

The USFWS issued the ECPG to provide recommendations for the development of ECPs in support of issuance of programmatic eagle take permits for wind facilities; mitigating adverse

effects on bald and golden eagles. The ECPG is linked with USFWS Wind Energy Guidelines (WEG) (Appendix E) by incorporating 5 ECPG stages with 3 WEG tiers. The intent of the guidance is to collaboratively work with developers in all project phases: conceptual, development, and operational to ensure ACPs developed, through surveys, monitoring, and analysis, for the ECP are sufficient to meet the eagle take permit requirements in 50 CFR 22.26. The Draft Guidance was published in the *Federal Register* on 18 February 2011 (76 *Federal Register* 9529), and a revised version was published in May 2013 (78 *Federal Register* 25758, 2 May 2013). Although eagles are protected by both the MBTA and the Bald and Golden Eagle Protection Act, MBTA take authorization is not required because the Eagle Permit Rule exempts those who hold Bald and Golden Eagle Protection Act permits from the requirement to obtain an MBTA permit (50 CFR 22.11[a]).

Cultural Resources

The Proposed Action may involve the installation of buried power lines. For any discoveries of previously unknown or unrecorded archaeological resources encountered during construction, Camp Perry ANGS will cease work immediately, contact a professional archaeologist, and notify the OHPO. If Native American human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the NGB will comply with the Native American Graves Protection and Repatriation Act and other pertinent authorities in accordance with applicable Federal laws, regulations, and DoD and USAF instructions.

Water Resources

Best management practices would be employed during digging activities to minimize soil movement, stabilize runoff, and generally control sedimentation. These best management practices may include the use of silt fences and covering of soil stockpiles.

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8.0 PERSONS AND AGENCIES CONTACTED

The preparation of this EA involved coordination with personnel from the USFWS and ODNR. Please see the Agency Coordination List in Appendix A for information on specific USFWS and ODNR personnel contacted.

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Heather Gordon, Environmental Analyst (GIS)
M.S., Geography, 2007
B.A., Environmental Studies and Planning, 1996
Years of Experience: 13

Jason Koralewski, Environmental Scientist
Cultural Resources
M.A., Anthropology
B.A., Anthropology
Years of Experience: 20

Carmen J. Ward, P.E., Senior Project Manager
M.S., Environmental Engineering
B.S., Chemical Engineering
Years of Experience: 23

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APPENDIX A
INTERAGENCY AND INTERGOVERNMENTAL COORDINATION

AGENCY COORDINATION LIST

FOR PROPOSED INSTALLATION AND OPERATION OF WIND TURBINE AT 200 RHS, CAMP PERRY ANGS, PORT CLINTON, OH

Public Agencies

Keith Lott/Megan Seymour
U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230

Jennifer Norris
Ohio Department of Natural Resources
2045 Morse Road
Columbus, OH 43229-6693

Ottawa County Soil and Water Conservation District
Division of Soil and Water Conservation
Ohio Department of Natural Resources
240 West Lake Street, Unit B
Oak Harbor, Ohio 43449-1039

Mr. Ken Westlake, Environmental Management
U.S. EPA Region 5
77 West Jackson Boulevard Mail Code: E-19J
Chicago, IL 60604-3507

Mr. Shannon Nabors, District Chief Northwest District Office
Ohio Environmental Protection Agency
347 North Dunbridge Road
Bowling Green, Ohio 43402

Mr. Paul Jayko
Office of Federal Facilities Oversight, Ohio Environmental Protection Agency
347 North Dunbridge Road
Bowling Green, Ohio 43402

Amanda Schraner Terrell, Director, State Historic Preservation Office
Deputy State Historic Preservation Officer
Ohio History Connection
800 E. 17th Ave.
Columbus, OH 43211-2474

Mr. Reid Van Cleve
Ottawa County Wildlife Officer, Wildlife District Two
Division of Wildlife
Ohio Department of Natural Resources
952 Lima Avenue
Findlay, Ohio 45840

Mr. Todd Audet, P.E.
District Deputy Director, District 2
Ohio Department of Transportation
317 East Poe Road
Bowling Green, Ohio 43402-1330

Native American Tribes and Representatives

Chairperson John Warren
Pokagon Band of Potawatomi Indians, Michigan and Indiana
P.O. Box 180
Dowagiac, MI 49047

THPO Marcus Winchester
Pokagon Band of Potawatomi Indians
P.O. Box 180
Dowagiac, MI 49047

Chairman Lester Randall
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
1107 Goldfinch Road
Horton, KS 66439

THPO Nellie Cadue
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
1107 Goldfinch Road
Horton, KS 66439

Chairperson Liana Onnen
Prairie Band of Potawatomi Nation, Kansas
16281 Q Road
Mayetta, KS 66509

THPO Virginia LeClere
Prairie Band of Potawatomi Nation, Kansas
16281 Q Road
Mayetta, KS 66509

Chairperson Kenneth Meshigaud
Hannahville Indian Community, Michigan
N14911 Hannahville B1 Road
Wilson, MI 49896-9728

THPO Earl Meshigaud
Hannahville Indian Community, Michigan
N14911 Hannahville B1 Road
Wilson, MI 49896-9728

Ogema Larry Romanelli
Little River Band of Ottawa Indians, Michigan
2608 Government Center Drive
Manistee, MI 49660

Director Jonnie Sam
Little River Band of Ottawa Indians, Michigan
375 River Street
Manistee, MI 49660

Chairperson Regina Gasco-Bentley
Little Traverse Bay Bands of Odawa Indians, Michigan
7500 Odawa Circle
Harbor Springs, MI 49740

THPO Wesley Andrews
Little Traverse Bay Bands of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740

Chairperson David Sprague
Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan
1743 142nd Avenue
Dorr, MI 49323

THPO Sydney Martin
Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan
3556 26th Street
Hopkins, MI 49328

Chairperson Homer Mandoka
Nottawaseppi Huron Band of the Potawatomi, Michigan
1485 Mno--Bmadzen Way
Fulton, MI 49052

THPO Beth Moody
Nottawaseppi Huron Band of the Potawatomi
1485 Mno--Bmadzen Way
Fulton, MI 49052

Chairman John "Rocky" Barrett
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Shawnee, OK 74801

THPO Kelli Mosteller
Citizen Potawatomi
1601 S. Gordon Cooper Drive
Shawnee, OK 74801

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THPO Jason Ross
Delaware Nation, Oklahoma
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Anadarko, OK 73005

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Bartlesville, OK 74006-2838

Sect 106 Dr. Brice Obermeyer
Delaware Tribe of Indians, Oklahoma
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Roosevelt Hall, RM 212,
Emporia State University
Emporia, KS 66801

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McLoud, OK 74851

Kickapoo Tribe of Oklahoma
P.O. Box 70
McLoud, OK 74851

Chief Ethel Cook
Ottawa Tribe of Oklahoma
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Miami, OK 74354

THPO Rhonda Dixon
Ottawa Tribe of Oklahoma
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Wyandotte, OK 74370

THPO Sherri Clemons
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Wyandotte, OK 74370

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Eagle Pass, TX 78852

Kickapoo Traditional Tribe of Texas
HC 1, Box 9700
Eagle Pass, TX 78852

Chairman Harold Frank
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Crandon, WI 54520

THPO Melissa Cook
Forest County Potawatomi Community
P.O. Box 340
Crandon, WI 54520

President Wallace Miller
Stockbridge Munsee Community, Wisconsin
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Bowler, WI 54416

THPO Sherry White
Stockbridge-Munsee Community
N8476 Moh-He-Con-Nuck Rd
Bowler, WI 54416

Chairperson Alvin Pedwaydon
Grand Traverse Band of Ottawa and Chippewa Indians, Michigan
2605 NW Bayshore Drive
Suttons Bay, MI 49682

Museum Director Cindy Winslow
Grand Traverse Band of Ottawa and Chippewa Indians, Michigan
2605 NW Bayshore Drive
Suttons Bay, MI 49682

Governor Edwina Butler-Wolfe
The Absentee-Shawnee Tribe of Indians of Oklahoma
2025 S. Gordon Cooper Dr
Shawnee, OK 74801

THPO Leonard Longhorn
The Absentee-Shawnee Tribe of Indians of Oklahoma
2025 S. Gordon Cooper Dr
Shawnee, OK 74801

Chief Glenna Wallace
The Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, MO 64865

THPO Robin Dushane
The Eastern Shawnee of Oklahoma
12705 S. 705 Road
Wyandotte, OK 74370-3148

Chief Ron Sparkman
The Shawnee Tribe, Oklahoma
29 South 69a Highway
Miami, OK 74354

THPO Kim Jumper
The Shawnee Tribe, Oklahoma
29 South 69a Highway
Miami, OK 74354

DRAFT AGENCY COORDINATION LETTER

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

25 July 2016

Jennifer Norris
Ohio Department of Natural Resources
2045 Morse Road
Columbus, OH 43229-6693

Dear Ms. Norris

The National Guard Bureau (NGB) has prepared an Environmental Assessment (EA) to consider the potential consequences to the human and natural environment associated with the installation and operation of a single 600-kilowatt (kW) wind turbine at the 200th RED HORSE Squadron (200 RHS) of the Ohio Air National Guard (OHANG), Camp Perry Air National Guard Station (ANGS), Port Clinton, Ohio.

The purpose of the Proposed Action is to install and operate a wind turbine in order to study certain impacts of wind energy, while at the same time assist Camp Perry ANGS with its move towards generating more of its energy on base through renewable resources. Specifically, the project would provide opportunities for scientific research that could result in improved design and conservation measures for wind turbines near migratory bird routes. In fiscal years 2006-2008, the U.S. House of Representatives passed defense appropriations bill that funded the wind turbine project.

The environmental analysis for the Proposed Action is being conducted by the NGB in accordance with the Council on Environmental Quality guidelines pursuant to the National Environmental Policy Act of 1969. In accordance with Executive Order 12372, *Intergovernmental Review of Federal Programs*, we request your participation by reviewing the attached draft EA and draft Finding of No Significant Impacts (FONSI), and solicit your comments concerning the proposal and any potential environmental consequences of the action. Please provide any comments you may have within 30 days of receipt of this letter. Also, please indicate in writing if you wish to receive the final EA and/or signed FONSI.

If you have any questions concerning the proposal, please contact me at 240-612-8855. Please forward your written comments to NGB, Asset Management Division, Attn: Kevin Marek, NGB/A4AM, 3501 Fetchet Avenue, Andrews AFB, MD 20762, or fax to (301) 836-7427, or email to Kevin.P.Marek.civ@mail.mil. Thank you for your assistance.

Sincerely

Kevin Marek
Environmental Specialist
Air National Guard, National Guard Bureau,
(NGB/A7AM)
Asset Management Division, Plans and
Requirements Branch

Attachment:
Draft Environmental Assessment for the Installation and Operation of Wind Turbine at 200 RHS, Camp Perry ANGS, Port Clinton, OH

OHPO CONSULTATION

OHIO HISTORY

June 8, 2012

Roger W. Nienberg, 1Lt., Environmental Manager
200th RHS Air National Guard
1200 N. Camp Perry E. Road
Port Clinton, OH 43452

Dear Mr. Nienberg:

RE: 200th RHS Camp Perry Wind Turbine R&D Project (Phase IV RDTE Project EUBC090000)

This is in response to your correspondence dated February 6, 2012 (received May 3, 2012), regarding the above project. My comments are made pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

The 200th RED HORSE Squadron- Air National Guard proposes to use congressionally appropriated funding to construct a 138' tall wind turbine (170' to blade tip) at the Camp Perry Air National Guard Station in Ottawa County, Ohio. You have requested the Ohio Historic Preservation Office's (OHPO) comments regarding its effects on historic properties.

OHPO project reviewer Dave Snyder expressed concern in a letter written on February 3, 2011, that the proposed wind turbine would visually dominate the historic guard towers flanking the main entrance to the National Register-eligible Camp Perry Historic District, diminishing its integrity. Based on the simulated photographs presented in your most recent submission, it appears that the proposed location, 650' to the east of the east guard tower, would remove the turbine from the primary view shed as one approaches the main entrance, minimizing its visual impact on the historic gateway towers. Therefore, the proposed undertaking will have no adverse effect on historic properties.

No further coordination is required unless there are changes to the project scope. In such a situation, this office should be contacted as per 36 CFR Section 800.13. If you have any questions, please contact me by phone at (614) 298-2000 or by email at jbertram@ohiohistory.org. Thank you.

Sincerely,

JBertram

Jamie Bertram, Project Reviews Manager
Resource Protection and Review

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office
1982 Velma Avenue, Columbus, Ohio 43211-2497 ph: 614.298.2000 fx: 614.298.2037
www.ohiohistory.org

2010-OTT-11976
Serno 1044152

USFWS LIST OF THREATENED OR ENDANGERED SPECIES IN PROJECT AREA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Columbus Ohio Field Office
4625 MORSE ROAD, SUITE 104
COLUMBUS, OH 43230
PHONE: (614)416-8993 FAX: (614)469-8994

Consultation Code: 03E15000-2015-SLI-1291 July 09, 2015
Event Code: 03E15000-2015-E-00457
Project Name: Camp Perry

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having

similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit http://www.fws.gov/migratorybirds/AboutUS.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project

2

planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Official Species List

Provided by:

Columbus Ohio Field Office
4625 MORSE ROAD, SUITE 104
COLUMBUS, OH 43230
(614) 416-8993

Consultation Code: 03E15000-2015-SLI-1291
Event Code: 03E15000-2015-E-00457

Project Type: POWER GENERATION

Project Name: Camp Perry
Project Description: A Biological Assessment of a proposed wind turbine on the facility

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

http://ecos.fws.gov/ipac, 07/09/2015 09:56 AM
1

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-83.01801681518555 41.52972027618687, -83.01569938659668 41.53097321462512, -83.01552772521973 41.53161573774448, -83.01544189453125 41.533703893808074, -83.01715850830078 41.533800268614435, -83.0170726776123 41.53569561062476, -83.01544189453125 41.53569561062476, -83.01544189453125 41.537494527938335, -83.01994800567627 41.53746240485365, -83.02024841308594 41.53094108830163, -83.01801681518555 41.52972027618687)))

Project Counties: Ottawa, OH

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Endangered Species Act Species List

There are a total of 8 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Kirtland's Warbler *(Setophaga kirtlandii)* Population: Entire	Endangered		
Piping Plover *(Charadrius melodus)* Population: Great Lakes watershed	Endangered	Final designated	
Red Knot *(Calidris canutus rufa)*	Threatened		
Flowering Plants			
Eastern Prairie Fringed orchid *(Platanthera leucophaea)*	Threatened		
Lakeside daisy *(Hymenoxys herbacea)*	Threatened		
Mammals			
Indiana bat *(Myotis sodalis)* Population: Entire	Endangered		
Northern long-eared Bat *(Myotis septentrionalis)*	Threatened		
Reptiles			
eastern Massasauga *(Sistrurus*	Candidate		

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

catenatus)			

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Critical habitats that lie within your project area

There are no critical habitats within your project area.

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APPENDIX B
BIOLOGICAL ASSESSMENT AND FINAL BIOLOGICAL OPINION

BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT FOR PROPOSED WIND TURBINE ON THE OHIO AIR NATIONAL GUARD STATION, CAMP PERRY, OHIO

Prepared for:

200th Red Horse Squadron
Ohio Air National Guard -
Camp Perry
1200 North Camp Perry
East Road
Port Clinton, Ohio 43452

Prepared by:

VERNADERO GROUP
INCORPORATED

4422 E. Indian School Road
Suite 101
Phoenix, Arizona 85018

September 2015

FORMAT PAGE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

FORMAT PAGE

LIST OF ACRONYMS AND ABBREVIATIONS

agl	Above Ground Level
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ANGS	Air National Guard Station
BA	Biological Assessment
BGEPA	Bald and Golden Eagle Protection Act
BO	Biological Opinion
CFR	Code of Federal Regulations
EA	Environmental Assessment
ESA	Endangered Species Act
FAA	Federal Aviation Administration
hr	Hour
INRMP	Integrated Natural Resources Management Plan
km	Kilometers
kW	Kilowatt
LED	Light-Emitting Diode
m	Meters
m^2	Square Meters
MBTA	Migratory Bird Treaty Act
m/s	Meters per Second
NWR	National Wildlife Refuge
ODNR	Ohio Department of Natural Resources
s	Seconds
U.S.	United States
U.S.C.	United States Code

1	USFWS	United States Fish and Wildlife Service
2	WNS	White Nose Syndrome
3		

1.0 INTRODUCTION

Section 7 of the Endangered Species Act (ESA) of 1973 and its amendments require that a Biological Assessment (BA) be prepared for all federal actions that may affect federally listed or proposed endangered or threatened species or critical habitat for those species. The proposed federal action considered for this BA is the construction and operation of a single 600-kilowatt (kW) wind turbine at Camp Perry Air National Guard Station (ANGS), Port Clinton, Ohio. The Ohio Air National Guard (ANG) at Camp Perry proposes to construct a wind turbine as part of a Phase IV Renewable Energy Demonstration project.

The proposed wind turbine at Camp Perry would provide opportunities for scientific research that could result in new or improved design and conservation measures associated with the operation of wind turbines near migratory bird routes. In 2007, the House of Representatives passed a defense appropriations bill that funded the wind turbine project at Camp Perry ANGS as a joint learning and research undertaking with local academia to study the impacts of wind energy on military facilities near lakeshore zones. Should the project be approved and constructed, Camp Perry ANGS will work with local universities such as the University of Toledo and University of Bowling Green to study the impacts that construction and operation of this wind turbine will have on local natural resources for two years after construction has been completed. Joint studies with the universities would include monitoring avian and bat mortality rates and monitoring noise levels. Results of the monitoring data would be used to make recommendations on wind turbine operational modifications to reduce potential impacts to bird and bat populations at Camp Perry and for wind turbines proposed at other military installations. These studies are included among the proposed conservation measures discussed in Section 2.5 of this BA.

Although the primary purpose of the proposed wind turbine is for research and demonstration purposes, the project would result in some minor secondary benefits to Camp Perry ANGS in the form of renewable energy production during times when the turbine is in operation. The energy produced would not be enough to sustain the Installation, particularly when the turbine is operating at reduced speed or is nonoperational as a proposed mitigation measure. However, any energy produced would help offset energy consumption at Camp Perry ANGS, assisting the installation, to a limited degree, in meeting directives established under Executive Order 13693, *Planning for Federal Sustainability in the Next Decade,* and the Energy Independence and Security Act of 2007. Although the turbine offsets electrical consumption, this is not the stated purpose of the project.

Camp Perry ANGS is also preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act under a separate contract. The EA will incorporate the findings of this BA and the results of subsequent Section 7 consultation with the United States Fish and Wildlife Service (USFWS). The EA will provide a comprehensive environmental analysis of the construction and operation of the wind turbine, whereas the BA focuses on potential impacts from the proposed project to federally protected species and their habitats.

FORMAT PAGE

2.0 PROJECT DESCRIPTION

2.1 Location

Camp Perry ANGS is north of State Route 2 in the Erie Township portion of Ottawa County, Ohio (Figure 2-1). The ANGS is approximately 5 kilometers west of Port Clinton, near the mouth of the Portage River, 1.6 km southwest of Lake Erie and approximately 6.5 km northwest of Sandusky Bay. The ANGS consists of 21 permanent facilities on 23.9 hectares adjacent to the southern boundary of the Ohio ANG Camp Perry Joint Training Center.

The proposed wind turbine would be located entirely within the Camp Perry ANGS property boundaries and would be erected within the southern lawn of the facility (Figure 2-2). The southern lawn encompasses 7,632 square meters (m^2) of previously disturbed and routinely maintained land. Vehicles and equipment would be staged on this lawn during construction or within the nearby parking lots which cover approximately 5,800 m^2 near the proposed project site.

2.2 Construction of Wind Turbine

The foundation for the wind turbine occupies 16 m^2 and has already been constructed. (See Figure 2-3). A single 600 kW Vestas 44 wind turbine is proposed for construction. This model has a rotor diameter of 44 meters (m) and a tower height of 40 m (see a photo of this make and model wind turbine in Figure 2.4). The rotor has three blades, and its swept area would cover 1,520.53 m^2. The maximum height of the rotor tip on any single blade in the 12 o'clock position would be 60.5 m above ground level (agl). In the 6 o'clock position the rotor tip would be as low as 26 m agl. The turbine would be mounted on a tubular steel tower with lighting that will comply with the Federal Aviation Administration's (FAA's) *Obstruction Marking and Lighting (AC 70/7460-1K).* A flashing red light-emitting diode (LED) would be placed at the top of the wind turbine tower. All electrical interconnection lines are internal to the turbine would connect underground to an existing on-site electrical substation for Camp Perry ANGS. No electrical aboveground lines will be exposed for the turbine.

The project initially began moving forward after a previous EA and Finding of No Significant Impact were prepared. Construction of the foundation was completed, but construction was halted after a letter of intent to sue was received from a local bird interest group. Since that time, the Ohio ANG has been working proactively with USFWS to modify the design of the project to reduce the potential for impacts to federally listed species. The ANG is committed to ensuring that the project design and operation incorporate appropriate mitigation measures and affirms its intent to continue to be a responsive partner with USFWS.

2.3 Operation of Wind Turbine

Camp Perry proposes to construct a wind turbine as part of a Phase IV Renewable Energy Demonstration Project. Because the wind turbine will be operated as a Renewable Energy Demonstration Project, goals for renewable energy power generation are not necessary for this turbine. The proposed 600 kW Vestas 44 turbine can operate at a cut-in wind speed (the

minimum speed in which it can operate) of 4 m per second (m/s). The cut-out wind speed (the maximum wind speed it can operate under) for this turbine model is 20 m/s. The proposed turbine would be able to generate electricity at a maximum capacity of 16 m/s based on its wind speed rated performance standards (Bundesverband WindEnergie 2015). The hours of operation would depend on wind speeds. To minimize potential bat and bird strikes, Camp Perry ANGS proposes avoidance and minimization measures that would reduce speed or stop the rotation of the rotor blades. Proposed conservation measures are discussed in Section 2.5.

2.4 Maintenance of Wind Turbine

Routine maintenance and service of the proposed wind turbine would be performed in accordance with the manufacturer's guidelines. Routine maintenance will ensure the turbine is operating properly, minimizing wear and tear on the equipment and reducing downtime due to breakdowns and repairs. Unplanned maintenance would be carried out should there be an equipment malfunction.

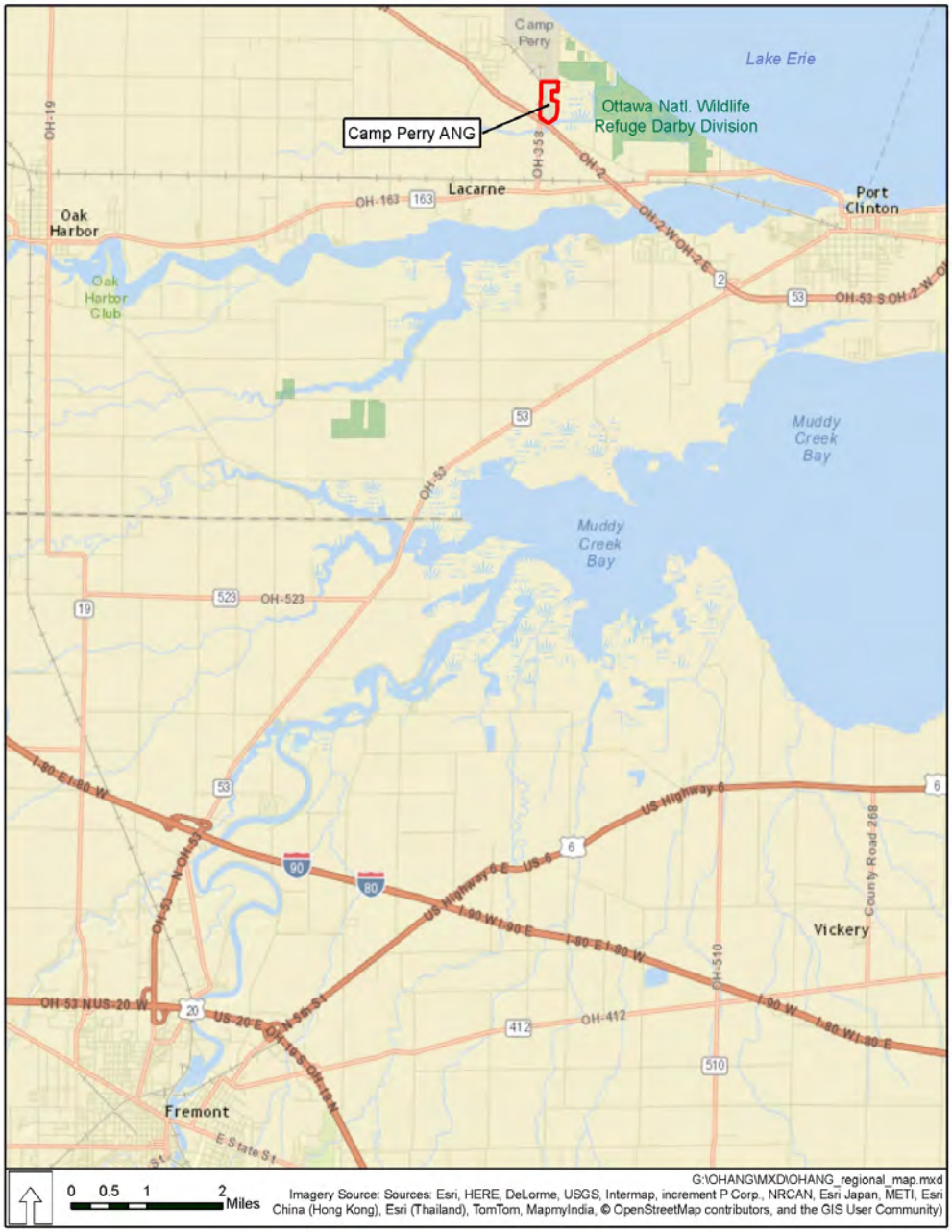

Figure 2-1. Regional Location of the Camp Perry ANGS, Ottawa County, Ohio

Figure 2-2. Site Map and Points of Interest for the Camp Perry ANGS

Figure 2.3. Photograph of Foundation of Proposed Wind Turbine at Camp Perry ANGS

Figure 2.4. Photograph of a Single 600 kW Vestas 44 Wind Turbine at a Lake Erie Business Park

2.5 Conservation Measures

The ANGS has implemented the following design considerations to avoid or minimize the potential impacts to local natural resources from the construction of the wind turbine (USFWS 2012a):

- The wind turbine's design does not include guy wires, which reduces the likelihood of injury or death of birds and bats due to collision. The absence of guy wires will also minimize the area available for raptors to perch, thereby reducing the chances of collision with one of the rotor blades. Additionally, the turbine is a monopole, which reduces the potential for perching.
- The wind turbine would be built in a previously disturbed area, thereby eliminating the potential for habitat destruction and greatly reducing possible impacts to natural resources during construction.
- Limiting construction to one turbine to reduce the project footprint and the potential for strikes. The initial project concept included three turbines; however, this was revised as a result of coordination with the USFWS.
- All interconnection wires would be internal to the turbine. Electrical lines connecting the turbine an existing substation on Camp Perry would be installed underground, thereby reducing or eliminating the potential risks associated with overhead electrical lines. Raptors and other birds would therefore not collide with overhead electrical lines or be electrocuted by using them as perches. No electrical lines or poles would be near the wind turbine to serve as attractive perches for raptors, so the number of raptors in the area would not increase, which could have increased the possibility of collisions with the wind turbine.
- The design uses a FAA-approved red LED strobe light to reduce collisions by birds that are attracted to steadily burning lights.

The ANGS has also completed the following pre-construction planning efforts and committed to these additional mitigation strategies and conservation measures:

- ANGS has conducted 2.5 years of avian and bat surveys using a MERLIN avian radar system to collect data on local bird and bat movements.
- ANGS has forged relationships with local universities to study the impacts that construction and operation of this wind turbine would have on local natural resources for the two years after construction has been completed. This two-year joint study with the universities would include monitoring avian and bat mortality rates and turbine noise levels, and would measure the effectiveness of mitigation measures implemented to reduce these fatalities. The study would analyze the impacts on birds and bats while in operating the turbine to determine optimal operational speeds, and to determine under what specific circumstances the wind turbine should be slowed or completely stopped.

  For example, the study could use bird and bat strike data to develop specific thresholds for operation during inclement weather or during peak migratory periods. Based on the results of the 2.5 years of avian and bat surveys using a MERLIN avian radar system

(discussed in Section 4.2.1), the highest number of bird and bat occurrences were at night. As such, the joint university study could compare impact levels at varying operational speeds and those from shutting down the wind turbine operations overnight (dusk to dawn) during peak bird migration periods to find the highest reduction in bird/bat strikes and optimal operating speeds. The results of the joint university research project would be used to develop best management practice recommendations for operation of this turbine and for other proposed turbines across the U.S.

- The ANGS would adjust operation during spring and fall migration periods and during inclement weather. This includes adjusting the cut-in speed at 6.9 m/s as suggested by the USFWS (2014b) and ceasing operations at nighttime during spring and fall bat migrations.
- The ANGS would maintain the southern lawn regularly to help reduce prey populations that could attract raptors.
- The ANGS would remove and properly dispose of any carcasses found within 100 m of the turbine in conformance with local regulations.
- The ANGS would conduct post-construction monitoring for two years to document any take of special status species, migratory birds, or eagles based on guidelines accepted by the USFWS.
- The ANGS would light buildings and structures within a half-mile of the turbine to the minimum level possible, while still complying with facility security requirements, to reduce prey (insects) attracted to the lights.

1

2 FORMAT PAGE

3.0 ACTION AREA

The proposed wind turbine would be constructed on a maintained lawn at the southern side of the ANGS (Figure 2-2). The ANGS is situated within the Huron/Erie Lake Plains ecoregion, which is characterized as nearly flat plains punctuated with sand dunes and beach ridges (Brockman 1998). This ecoregion historically contained swamps and forests, but most of those have been drained and cleared for agriculture and development. A 0.2-hectare lies just east of the proposed stationing area for the wind turbine, and a small forested area is located northwest of the ANGS. The forested area covers approximately 14.2 hectares of the Camp Perry Joint Training Center.

The Ottawa National Wildlife Refuge (NWR) Darby Unit is located 0.16 km east of the action area. The Ottawa NWR was established in 1961 under the authority of the Migratory Bird Conservation Act (16 United States Code [U.S.C.] 715d) to provide habitat for waterfowl and other migratory birds, threatened and endangered species, and other resident wildlife. The Ottawa NWR provides foraging and resting habitat for migratory birds crossing Lake Erie in the spring and fall, including 70 percent of the Mississippi Flyway's population of American black ducks (*Anas rubripes*), a species protected by the Migratory Bird Treaty Act (MBTA). These wetlands are found along a major bird migration route that essentially funnels birds through a small area along the shoreline of Lake Erie. The wetlands within the NWR provide important stopover locations for migrating waterfowl, neotropical songbirds, raptors, shorebirds and wading birds (USFWS 2000).

Several wind turbines have been constructed within the vicinity of the ANGS. The closest one is 2.1 kilometers (km) northwest of proposed wind turbine site at the ANGS (Figure 2-2). Three other turbines are located about 40 km west of the ANGS in Oregon City, Ohio. These turbines were constructed in 2012. One is located at Clay High School about 2.5 km south of Lake Erie, and two others are at Eisenhower Intermediate School 3 km from the lakeshore. Both wind turbines are surrounded mostly by agricultural fields.

FORMAT PAGE

4.0 SPECIES AND PROTECTED RESOURCES POTENTIALLY IN ACTION AREA

4.1 Federally Proposed, Candidate, Threatened, and Endangered Species

The Camp Perry ANGS prepared this BA to evaluate the potential impacts to species that are under the jurisdiction of the USFWS and may occur within the proposed action area. Table 4-1 provides a list of federally proposed, candidate, threatened, and endangered species that may occur in Ottawa County, Ohio. This species list was generated from the USFWS Environmental Conservation Online System Information for Planning and Conservation (Consultation Code: 03E15000-2015-SLI-1291) on 9 July 2015 (USFWS 2015a: Appendix A).

Of the eight federally listed species (Table 4-1) that may be present in the general area, three are not likely to occur in the action area. These three species are the eastern prairie orchid (*Platanthera leucopaea*), lakeside daisy (*Hemenoxys herbacea*), and eastern massasauga (*Sistrurus catenatus*). These three terrestrial plant species would only be affected if construction of the wind turbine occurs in habitat they could potentially occupy. Since the proposed construction site is on a maintained (mowed) lawn and these plants require undisturbed, unaltered terrestrial habitat, these three species are not expected to occur in the action area. Furthermore, habitat for these species does not occur in the construction footprint. Since impacts from this action are not likely to affect these three species, they are not further addressed in this BA.

Table 4-1. Federally Proposed, Candidate, Threatened, and Endangered Species that May Occur in Ottawa County, Ohio

Scientific Name	Common Name	Federal Status
Birds		
Calidris canutus rufa	Red Knot	Threatened
Charadrius melodus	Piping Plover	Endangered
Setophaga kirtlandii	Kirtland's Warbler	Endangered
Flowering Plants		
Hymenoxys herbacea	Lakeside Daisy	Threatened
Platanthera leucophaea	Eastern Prairie Fringed Orchid	Threatened
Mammals		
Myotis septentrionalis	Northern Long-Eared Bat	Threatened
Myotis sodalist	Indiana Bat	Endangered
Reptiles		
Sistrurus catenatus	Eastern Massasauga	Candidate

Source: USFWS 2015a

Table 4-2 presents the federally listed species that may occur on and/or near the action area.

Table 4-2. Potential Federally Listed Species in the Action Area

Scientific Name	Common Name	Status
Birds		
Calidris canutus rufa	Red Knot	Threatened
Charadrius melodus	Piping Plover	Endangered
Setophaga kirtlandii	Kirtland's Warbler	Endangered
Mammals		
Myotis septentrionalis	Northern Long-Eared Bat	Threatened
Myotis sodalis	Indiana Bat	Endangered

4.1.1 Red Knot

Description and Distribution

The red knot (*Calidris canutus rufa*) was listed as threatened under the ESA in December 2014 (50 Code of Federal Regulations [CFR] Part 17) and are protected under the MBTA. Red knots migrate extraordinarily long distances from breeding grounds near the arctic tundra in North America and Russia to wintering habitats in South America, Africa, Europe, Australia, and New Zealand (up to 15,000 km trip each way). Once considered the most numerous shorebird in North America, the red knot's populations declined substantially in the 1800s and early 1900s due to hunting along its migratory paths. Populations have declined from about 82,000 birds in the 1980s to less than 30,000 in 2010, most likely due to degradation of breeding and wintering habitats and global climate change (Baker et al. 2013).

The red knot is a medium sized, bulky marine shorebird with short legs. Head and breast breeding plumage is red and changes to grey outside the breeding season. This species breeds in drier tundra areas, nesting on sparsely vegetated, elevated locations; typically on slopes with stunted vegetation or windswept ridges. Red knots feed on tundra invertebrates along coastal tidal sand flats, lakeshores, marshes, and beaches. During migration red knots use marine habitats in both North and South America, preferring to rest and forage along sandy shores at or near tidal inlets or at mouths of bays and estuaries (Baker et al. 2013).

Nesting

Red knots nest in the high arctic and would only pass through the Camp Perry area during migration. No nesting activity is expected in or around the proposed action area.

Status of the Species in the Action Area

In Ohio, red knots are more common during fall migration than spring migration according to the Ohio Department of Natural Resources (ODNR 2012a). Red knots in the Atlantic Flyway fly

along the western shore of Lake Erie, stopping at marshes on the coast of the lake. Data searches on eBird, a real-time, online checklist program for documenting presence, absence, and abundance of birds, provided recent species recordings. There are recorded sightings of red knots at East Harbor Park (16 km east of the ANGS) and Celotex Marsh (11 km southeast of the ANGS) in 2014. The species was recorded at the Ottawa NWR Main Unit (19 km northwest of the ANGS) in 2011. The Black Swamp Bird Observatory recorded 1 red knot during spring migration and 46 during fall migration during surveys along the Lake Erie Marsh system in 2013 (Shieldcastle 2013a). With records of this species occurring throughout the Lake Erie's southern shore, it is likely that red knots could fly over the ANGS during migration or between foraging locations during migration. These occurrences would be more likely during fall migration compared to spring migration.

4.1.2 Piping Plover

Description and Distribution

The piping plover (*Charadrius melodus*) is a small shorebird that nests in three geographic areas in North America. The Great Lakes subpopulation was federally listed as endangered in 1985 (50 CFR 50726-50734). This shorebird inhabits wide, open beaches, alkali flats, and sand flats. It breeds along the Atlantic Coast; the shores of Lakes Superior, Michigan, and Huron; and along rivers in the Great Plains of Nebraska to Canada. Most piping plovers winter on coastal beaches from the Carolinas to the Yucatan Peninsula, West Indies, and the Bahamas (Elliot-Smith and Haig 2004).

Nesting

Piping plover nests consist of shallow depressions in the sand above high-tide lines on coastal beaches, sand flats, barrier islands, and foredunes. Nests occur on a range of substrates including sand, a mixture of sand and pebbles, shells, cobble, and deposited dredge material. Nests are typically established in areas with little to no vegetation. Historically, piping plovers nested on large Lake Erie beaches in Ohio. Due to disturbance and destruction of nesting habitat, this species has not been recorded nesting in Ohio since 1942 and is considered a migrant species in the state (ODNR 2012b).

Status of the Species in the Action Area

A single male piping plover was recorded on the Camp Perry Beach in April 2013 and another individual was recorded along that same beach in August 2013. Individual piping plovers were also recorded at the Ottawa NWR and Cedar Point NWR in 2013 (eBird 2015). The Black Swamp Bird Observatory recorded nine piping plovers during spring migration and two during fall migration during surveys along the Lake Erie Marsh system in 2013 (Shieldcastle 2013a). Although this species is an infrequent visitor to the southern Lake Erie shore, it could be a potential visitor to the ANGS as it flies over the ANGS area during migration or between foraging locations used during migration.

4.1.3 Kirtland's Warbler

Description and Distribution

Kirtland's warbler (*Setophaga kirtlandii*) is one of the rarest songbirds in North America. This species was listed as endangered in 1967 under the Endangered Species Conservation Act (32 CFR 4001). This species is also listed as endangered in the Ohio under Ohio Revised Code 1531.25. In 1971, surveys documented a decline in population size from 1,000 individuals to 400 nationwide. The species depends on large tracks of dry sandy soils with young jack pines (*Pinus banksiana*) for breeding habitat, and these habitats have become fragmented by fire suppression and development. These fragmented forests also made Kirtland's warblers more susceptible to nest parasitism by brown-headed cowbirds (*Molothrus ater*). The Kirtland's warbler has responded well to recovery efforts on its breeding grounds, and in 2012 the population had reached 4,000 individuals nationwide. Until 1995 Kirtland's warblers were only known to nest in the lower Michigan Peninsula, but now the species is known to nest in the Upper Peninsula, Wisconsin, and Canada. This neotropical migrant winters in low broad-leaved scrub habitat in the Bahamas and uses similar habitat during migration (Bocetti et al. 2014).

Nesting

Kirtland's warblers nest on the ground in jack pine forests of Michigan, Wisconsin, and Canada. The species conceals the nest with grass and other low-growing vegetation (Bocetti et al. 2014). No nesting habitat for this species occurs in Ohio or in the action area.

Status of the Species in the Action Area

Kirtland's warbler is considered an infrequent visitor/migrant to Lake Erie's southern shore and Camp Perry ANGS. The Kirtland warbler's preferred migratory habitat, broad-leaved scrub, does not occur on the ANGS. This species has been recorded during spring migration near the ANGS along the southern shore of Lake Erie. In 2000, an individual was captured at a banding station at Navarre Marsh, 8 km northwest of the action area. Maggee Marsh and the core Ottawa NWR, 18 km northwest of the action area, have recorded observations in 2009, 2010, and 2013; and Cedar Point NWR had an observation in 2014 (eBird 2015). Although the Kirtland's warbler is considered an infrequent visitor to the southern Lake Erie shore, it could be an infrequent visitor the ANGS as it flies over the ANGS during migration or between foraging locations used during migration.

4.1.4 Northern Long-eared Bat

Description and Distribution

The northern long-eared bat (*Myotis septentrionalis*) was listed as federally threatened under the ESA in April 2015 (50 CFR 17). This species is also listed as a species of concern in Ohio under Ohio Revised Code 1531.25. This federally threatened species is known to occur in 37 states, including Ohio. The northern long-eared bat is a medium-sized dark brown bat that is distinguishable from other *Myotis* species by its relatively long ears (1.7 millimeters long on average).

In the summer, northern long-eared bats typically roost underneath bark or in cavities of live trees and snags. Compared to Indiana bats, northern long-eared bats are less particular in the species of tree it selects as a roost. In the winter northern long-eared bats typically select caves or mines as hibernacula (a location to hibernate). This species typically forages 1 to 3 m above the ground (above understory plants), but usually under the forest canopy, making mature forests an important habitat for foraging northern long-eared bats. Northern long-eared bats are also known to forage over water, forest clearings, and along roads. Peak foraging hours are five and eight hours after sunset. Northern long-eared bats have been recorded foraging up to 1,719 m from their roost (USFWS 2015b).

Once considered one of the more frequently encountered bat species in the Midwest, populations have been recently reduced at an alarming rate due to the effects of white nose syndrome (WNS). Over 1,100 hibernacula have been identified as being used by this species, including 7 hibernacula in Ohio. In Ohio, this species was regularly collected statewide as incidental catches during surveys for the Indiana bat (*Myotis sodalist*). Two hibernacula in Ohio contained approximately 90 percent of the state's wintering bat population prior to WNS being detected in the state during the winter of 2010-2011. Those two hibernacula saw populations drop from on average 282 northern long-eared bats in pre-WNS years to 17 in the 2013-2014 winter (USFWS 2015b). Initial results from statewide summer acoustic surveys conducted by the ODNR from 2011 to 2014 indicate a 56 percent reduction in detections of *Myotis* in the state during this three-year period. Capture rates at Indiana bat monitoring sites also dropped by 58 percent in post-WNS years compared to pre-WNS years. No known hibernacula for the northern long-eared bat occur within the action area.

Status of the Species in the Action Area

In the summer of 2011 the A7AM, Environmental Planning and Requirements Branch of the Air National Guard Readiness Center (ANGRC) conducted bat surveys at the Camp Perry ANGS due to the existence of suitable habitat at the facility that was at the northern edge of the Indiana bat's known range (ANGRC 2011: Appendix B). Mist netting and acoustic surveys for bats that focused on Indiana bats were conducted in the summer of 2011. Surveys were conducted according to Indiana bat protocols. Mist nets were placed in the wooded lot northwest of the ANGS, the same area where the bald eagle (*Haliaeetus leucocephalus*) nest is located in Figure 2-2. Nets were open for two nights in June and two in August 2011. One adult female northern long-eared bat was captured in a mist net during the August surveys, but the northern long-eared bat was not detected during the acoustical surveys (ANGRC 2011).

Foraging habitat and roosting substrates exist in the wooded area northwest of the ANGS. The site consists of mature lowland deciduous forest with pin oak (*Quercus palustris*), bur oak (*Q. macrocarpa*), red maple (*Acer rubrum*), and shagbark hickory (*Carya ovata*). Most of the understory of the wooded area is open and mowed. Forested wetlands occurs in the southwestern portion of this wooded lot and contains a subcanopy of green ash, pin oak, and red maple with an understory of poison ivy (*Toxicodendron radicans*), hawthorn (*Crataegus* sp.) and silky dogwood (*Cornus amomum*).

4.1.5 Indiana Bat

Description and Distribution

The Indiana bat (*Myotis sodalis*) was listed as federally endangered under the Endangered Species Preservation Act of 1966 (23 CFR 4001) in March 1967 and is currently listed as endangered under the ESA. This insectivore is also listed as endangered in Ohio under Ohio Revised Code 1531.25. The Indiana bat is a medium-sized bat and closely resembles the northern long-eared bat. The Indiana bat is known to occur in Ohio, but there is no known summer or winter records of this species in Ottawa County, Ohio (ODNR 2012c; USFWS 2007).

Indiana bats forage in wooded areas and hibernate during the winter in caves and mines. In the summer this species forages in closed to semiopen forested habitats and forest edges. The species will forage in open grasslands or agricultural areas adjacent to a forest's edge but typically will not venture far from roosting locations.

Winter populations of the Indiana bat occur within limestone caves in karst regions of the eastern U.S. Abandoned mines have also been recorded as being used by Indiana bats as winter hibernacula. Most Indiana bats hibernate in hibernacula in Illinois, Kentucky, Missouri, New York, Ohio, Tennessee, and West Virginia. In 2009, the USFWS estimated that 387,000 Indiana bats occurred nationwide (USFWS 2015c) with 2 percent (7,740) of the Indiana bat rangewide population occurring in the Ohio winter hibernacula (Stantec Consulting Services Inc. 2013).

In the summer, female Indiana bats typically roost under exfoliating bark or in narrow cracks of trees. Most roost trees used by Indiana bats are either dead or dying, but living trees that have naturally peeling bark such as hickories and oaks are occasionally used as roosts. Roosts typically do not occur in open fields but are trees are usually found within 16 m of a forest's edge. Adult males use a wider range of summer roosts compared to females. Males can use caves or trees as roost and often select smaller trees than females (Stantec Consulting Services Inc. 2013).

Status of the Species in the Action Area

No winter hibernacula are known to occur in or near the action area or Ottawa County, Ohio (USFWS 2009). No record has been found of this species occurring in Ottawa County (ODNR 2012; USFWS 2007). In the summer of 2011 the A7AM, Environmental Planning and Requirements Branch of the ANGRC conducted bat surveys at the Camp Perry ANGS due to the existence of suitable habitat in small tracts of forest and wetlands on the property and because the facility was in the northern edge of the Indiana bat's known range (ANGRC 2011). Mist nets and acoustic surveys that focused on Indiana bats were conducted in the summer of 2011. Surveys were conducted according to Indiana bat protocols. No Indiana bats were captured or recorded acoustically during the surveys (ANGRC 2011).

Foraging habitat and roosting substrates exist in the wooded area northwest of the ANGS. The site consists of mature lowland deciduous forest with pin oak, bur oak, red maple, and shagbark

hickory. Most of the understory of the wooded area is open and mowed. Forested wetlands occur in the southwestern portion of this wooded lot and contain a subcanopy of green ash, pin oak, and red maple with an understory of poison ivy, hawthorn, and silky dogwood.

4.2 Migratory Birds and Bald Eagles

In addition to threatened and endangered species protected under the ESA, the Ohio ANG has additional responsibilities under the MBTA and Bald and Golden Eagle Protection Act (BGEPA). Any federal activity, intentional or unintentional, resulting in a take of eagles or migratory birds is prohibited unless the taking agency is permitted by the USFWS (50 CFR Section 10.12 and 16 U.S.C. Section 668[a]).

4.2.1 Migratory Birds

Migrating birds are often concentrated near water, especially near the Great Lakes where the wind energy production potential is quite high (Ewert et al. 2011). Lake Erie serves as a barrier to migrating raptors because the thermals they require for lift do not occur over the open water. Hence, many raptors will fly along shorelines during migration. The Black Swamp Bird Observatory along the Lake Erie shore has documented over 10,000 raptors each year migrating around and through the Camp Perry area in 2006, 2008, and 2009 (Shieldcastle 2009). The Black Swamp Bird Observatory has also conducted surveys for migratory birds within the Ottawa NWR from 2008-2013, and in the spring of 2013 the observatory recorded 25,261 individual birds during 43 days of point-count surveys at the Navarre Unit (Shieldcastle 2013b).

Construction and operation of wind turbines can result in both direct (mortalities) and indirect (habitat destruction) impacts to migratory birds. Bird mortalities at wind turbines are well documented and have shown that the majority of avian fatalities involve nocturnal migratory songbirds (Erickson et al. 2002). Although most nocturnal migrating landbirds fly at heights that exceed the upper reaches of wind turbine rotors, the greatest risks to are to birds descending or ascending at stopover locations or due to inclement weather near wind turbines.

<u>Avian and Bat Radar Data</u>

In 2011-2013 the ANGS operated a MERLIN avian radar system to collect data at the proposed action area to monitor bird and bat activity at the site. Radar data on bird and bat movements (targets) were collected using vertical scanning radar. Radar data do not identify species but are used to determine target altitudes, number of targets, and passage rates. A summary of the 2011-2013 data is presented in Tables 4-3 and 4-4.

During the 2.5 years of data collection, target (birds and bats) passage rates averaged highest to lowest during nights, dawns, days, and dusk respectively, but rates were practically the same during the night as they were at dawn. The lower-than-average nighttime passage rates from 2011 may have been due to weather and software glitches during peak migration times making data incomplete; however, the data is presented in an effort to be transparent. The data for 2012-2013 is accurate and complete.

Radar data collected at Camp Perry ANGS indicated that over the 2.5 years, peak hours of passage occurred from 2100 to 0030 hours and from 1100 to 500 hours (Table 4-3). Average flight heights of birds and bats were highest at night, then day, dusk, and dawn (Table 4-4). All average target heights throughout the day were higher than the top rotor blade height (60.5 m agl) and most targets were detected flying above the rotor blades no matter the time of day (Table 4-4). Only 3 percent of targets were detected flying at a height within the rotor swept zone, with the highest numbers observed in this zone during dawn and dusk (41 and 30 percent respectively).

Table 4-3. Average Target Passage Rates and Peak Hours of Activity from 2011-2013 Collected from Radar Data at Camp Perry Air National Guard Center, Ottawa County, Ohio

Date	Average Target Passage Rate (targets/1 km front/hr)				Peak Hours of Activity
	Night	Dawn	Day	Dusk	
15 August-15 December 2011	176	447	432	218	1000-1500 hrs
24 January-31 May 2012	539	537	520	333	2200-0100 hrs 1200-1500 hrs
15 August-15 December 2012	671	396	375	172	2100-0000 hrs 1100-1300 hrs
1 January-31 May 2013	270	270	192	126	2100-0000 hrs 1100-1600 hrs
15 August-15 December 2013	573	574	526	334	2100-0100 hrs 1100-1600 hrs
Average	**446**	**445**	**409**	**237**	**2100-0030 hrs** **1100-1500 hrs**

Sources: DeTect 2012, 2013a, 2013b, 2015a, 2015b
km – kilometer; **hr** – hour

Table 4-4. Mean Target Height and Percent of Targets Above Rotor Swept Zone of Avian Radar Data Collected in 2011-2013 at the Camp Perry Air National Guard Center, Ottawa County, Ohio

Date	Percent of Days with Collected Data[1]	Mean Target Heights[2] (m)				Percent (%) of Targets Above/Within/Below Rotor Swept Zone			
		Night	Dawn	Day	Dusk	Night	Dawn	Day	Dusk
15 August-15 December 2011	77%	332	103	134	115	91/5/4	40/58/2	66/31/3	54/39/7
24 January-31 May 2012	85%	267	151	175	162	94/2/4	63/30/7	68/21/11	59/21/20
15 August-15 December 2012	92%	338	132	169	151	94/4/2	50/45/5	62/30/8	61/31/8

Date	Percent of Days with Collected Data[1]	Mean Target Heights[2] (m)				Percent (%) of Targets Above/Within/Below Rotor Swept Zone			
		Night	Dawn	Day	Dusk	Night	Dawn	Day	Dusk
1 January-31 May 2013	89%	240	142	163	143	94/4/2	62/32/6	66/22/12	57/28/15
15 August-15 December 2013	76%	334	146	194	170	96/3/1	55/42/3	71/24/5	62/32/6
Average	**84%**	**302**	**135**	**167**	**148**	**94/3/3**	**54/41/5**	**67/25/8**	**59/30/11**

Sources: DeTect 2012, 2013a, 2013b, 2015a, 2015b
m – meters
[1] Percentage indicates the portion of the season with useable radar data; some data were lost due to rain or other interference.
[2] The rotor swept zone maximum height is 60.5 meters above ground level and the lowest rotor blade height is 26 meters above ground level.

4.2.2 Bald Eagles

Description and Distribution

Bald eagles are federally protected by the MBTA and the BGEPA and are listed as threatened by the state of Ohio (ODNR 2015). The bald eagle is a large bird of prey and is an opportunistic forager that eats a variety of prey but prefers fish over other food sources. This bird will scavenge, pirate, or capture its own prey (only when no other option is available). The preferred habitats of bald eagles are bodies of water with a diverse and abundant prey base with areas of shallow water away from human development and disturbance (Buehler 2000). In the winter this bird typically occurs in the Chesapeake Bay, along major Midwestern rivers, Intermountain West rivers, the Klamath Basin, Oregon-California rivers, and Pacific Northwest rivers. Birds may concentrate in large numbers where open water occurs and prey is available. Records of breeding bald eagles occur in all U.S. states except for Rhode Island, Vermont, and Hawaii. The species breeds throughout Canada and a small breeding population is found in Baja California and northern Mexico.

Nesting

The bald eagle typically breeds in forested areas within 2 km of large bodies of water with available food. Bald eagle nesting sites often occur in mature riparian forests near lakes, large rivers, and oceans. Bald eagles select one of the largest trees that is available with easily accessible limbs capable of holding the weight of their heavy nests. Bald eagles may build more than one nest a breeding season but only select a single nest to use. This species is also known to use the same nest year after year (Buehler 2000).

Status of the Species in the Action Area

A pair of nesting bald eagles was observed approximately 940 m northwest of the proposed wind turbine construction site (Figure 2-2). Ottawa County has the highest nesting density of

bald eagles in Ohio, and in 2012 there were 60 known bald eagle nests within 16 km of the proposed project site (USFWS 2012b).

4.3 Critical Habitat

No critical habitat designated for a federally listed species occurs within this action area.

4.4 Other Protected Habitats

The Ottawa NWR Darby Division is adjacent to the east of Camp Perry ANGS (Figure 2-1). This wildlife refuge is part of the Ottawa NWR established in 1961 to provide habitat for waterfowl, migratory birds, and other local wildlife. No NWR land or other protected landscapes occur within the wind turbine's construction footprint.

4.5 State Listed Species

The Ohio ANG Integrated Natural Resources Management Plan (INRMP) covers all Ohio National Guard locations and lists species that have been recorded at Camp Perry Army National Guard Center. The INRMP identifies 20 species listed by the state of Ohio as endangered, threatened, species of concern, or species of special interest that have the potential to occur on the ANGS (Ohio ANG 2013). Those 20 species are listed in Table 4-5. Two reptiles and one amphibian species are included on the INRMP list. These species are not expected to be impacted by the construction or operation of the wind turbine since it is being constructed within previously disturbed habitat and these are terrestrial species that will not come into contact with rotor blades.

The remaining species are birds and bats, and the effects of the proposed action will be similar to those for the previously discussed migratory birds and two federally listed bat species. The USFWS has jurisdiction over federally listed species only and does not have the authority to make a ruling on the effect of the proposed action on state listed species. It is recommended that the species listed in Table 4-5 be addressed in the EA for the proposed action to afford the ODNR the opportunity to provide input on the effects of the turbine on state listed species. Although conservation measures discussed in Section 2.5 are targeted to minimize or avoid impacts to federally listed species, the same conservation measures are likely to equally benefit state listed species.

Table 4-5. Threatened, Endangered, Species of Concern, and Species of Interest of Ohio with the Potential to Occur on the Camp Perry Air National Guard Station

Scientific Name	Common Name	State Status
Amphibians		
Ambystoma latarale	Blue-Spotted salamander	Endangered
Birds		
Anas crecca	Green-Winged Teal	Species of Special Interest
Ardea alba	Great Egret	Species of Concern
Bubulcus ibis	Cattle Egret	Endangered
Charadrius melodus	Piping Plover	Endangered[1]
Dolichonyx oryzivorus	Bobolink	Species of Concern
Junco hyemalis	Dark-Eyed Junco	Species of Special Interest
Regulus satrapa	Golden-Crowned Kinglet	Species of Special Interest
Sphyrapicus varius	Yellow-Bellied Sapsucker	Species of Concern
Sterna hirundo	Common Tern	Endangered
Mammals		
Eptesicus fuscus	Big Brown Bat	Species of Concern
Lasionycteris noctivagans	Silver-Haired Bat	Species of Concern
Lasiurus borealis	Red Bat	Species of Concern
Lasiurus cinereus	Hoary Bat	Species of Concern
Myotis lucifugus	Little Brown Bat	Species of Concern
Myotis septentrionalis	Northern Long-Eared Bat	Species of Concern[1]
Myotis sodalist	Indiana Bat	Endangered[1]
Nycticeius humeralis	Evening Bat	Species of Special Interest
Reptiles		
Nerodia sipedon insularum	Lake Erie Watersnake	Threatened
Thamnophis sirtalis sirtalis	Eastern Gartersnake	Species of Concern

[1] Also a federally listed species

FORMAT PAGE

5.0 EFFECT OF THE PROPOSED ACTION

Potential impacts to birds and bats associated with the construction and operation of the proposed action could include disturbances, such as (1) barriers to flight paths due to the interfering presence of the wind turbine and (2) the risk of collision with the rotor blades. Construction impacts can also include bird mortality, injury, and habitat loss. Turbines can also have indirect effects as birds adjust previous migratory routes to avoid them. While adjustments to operation of wind turbines during relatively low wind speeds are known to reduce bat mortality (USFWS 2011), the same adjustments are not known to reduce bird mortalities. This may be due to the differences in bird and bat flight/migration behavior. The direct destruction of bird and bat habitat will not occur since the Camp Perry ANGS turbine would be constructed in a small footprint on already disturbed lawn.

Avian collisions and mortality at wind turbines are well-documented occurrences. As of 2012, it has been estimated that 573,000 bird fatalities occur per year at the 51,630 MW of installed wind energy sites across the U.S. (Smallwood 2013). Studies have provided annual mortality estimates at 0.44 to 11.83 birds per turbine per year, with a mean rate of 4.26 birds per turbine per year (USFWS 2014a). Although most of these estimates come from data at large wind farms and not from single turbines such as the proposed project at the Camp Perry ANGS, this rate can be used as a benchmark to determine when mortality rates at a wind turbine are too high and operation of the turbine should be discontinued.

Avian collisions at wind turbines can happen throughout the year, but most have been documented during migration (National Research Council of the National Academies 2007). Although only one turbine has been proposed for this project, it would be located in a highly dense avian migration route; mortalities are therefore expected. However, the mortality rate is likely to be no higher than the per-turbine national average since local radar data have shown that 97 percent of nighttime targets (birds and bats) flew at heights that would not collide with the rotor blades of the proposed turbine (Table 4-4) and migrants tend to fly at night.

Since the primary purpose of the proposed wind turbine is not to generate electricity, but rather to collect data that will help gain a more thorough understanding of the effectiveness of mitigation strategies through design and operational adjustments, the following impacts are anticipated to be reduced over time by adjusting operational speed of the wind turbine.

5.1 Red Knots

5.1.1 Direct and Indirect Effects

Little is known about how the red knot responds to wind turbine operation, but the species migrates at night and rests during the day. Red knots are expected to be present in the vicinity of the ANGS during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing with their migration. Red knots can be expected to stop over along the Lake Erie shore during 1 April through 31 May during spring migration and 15 July through 31 August during fall migration. Based on annual survey data collected by the Black

Swamp Bird Observatory, red knots are expected to be a more common visitor to the area during fall migration than during spring migration.

Radar data collected at the Camp Perry ANGS in 2011-2013 demonstrate that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Even though migrating red knots are expected to fly higher than the rotor blades, operations under the proposed action could result in red knot mortality or injury as a result of collision with the rotor blades during inclement weather. Clouds can influence the red knots' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of the bird colliding with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower altitudes, again increasing the risk of collision with a wind turbine. Finally, inclement weather can disorient migrating red knots and force them to land closer to the wind turbine than their intended stopover sites. The risk of red knots colliding with the turbines would not only increase when they are forced to land nearby during inclement weather, but also when they take off again after the bad weather has subsided.

Lighting on the wind turbine can be a factor in bird collisions with wind turbines during inclement weather. Certain types of lighting may attract migrating birds, increasing their chance of colliding with the turbine or causing the birds to circle the turbine until exhausted, falling to the ground where they are at risk of dying due to exposure, predation, or collision with the turbines when ascending again.

5.1.2 Actions to Reduce Adverse Effects

The size, type, and additional infrastructure to be constructed for this proposed action were designed to minimize bird and bat collisions. Under the proposed action the wind turbine will be constructed in a small area (16 m^2) on a maintained lawn, which is not considered to be foraging or stopover habitat for the red knot. The turbine would be mounted on a tubular steel tower without guy wires, reducing the number of substrates with which red knots could collide. The lack of guy wires also reduces the number of potential perches for birds, so fewer birds would be attracted to the turbine and the strike potential would be reduced. Lighting on the tower will adhere to FAA guidelines. A red flashing LED light would be placed at the top of the wind turbine since a steady light could attract birds to the wind turbine at night. All electrical interconnection lines within the turbine will be laid underground and will connect to an existing on-site electrical substation for Camp Perry ANGS, further reducing the number of objects associated with the wind turbine with which red knots could collide.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. The results of this study will help operators at the ANGS determine when or if the turbine would operate throughout the day or season. The project has stipulated to shutting down the wind turbine at night in order to dramatically reduce the possibility of bird strikes. The study would also determine the effectiveness of stopping the turbine at night or

stopping or reducing cut-in speeds at during inclement weather and at night during the red knot's migration season (1 April through 31 May and 15 July through 31 August).

If the project is approved, the study would involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine. These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of a red knot is observed, the local USFWS service office would be notified within 24 hours. These monitoring surveys would be conducted in association with local higher education institutions such as the University of Toledo and University of Bowling Green and would involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project.

5.1.3 Conclusions and Determination

Red knots would likely occur within the vicinity of the project area only during spring and fall migration. This species typically migrates at night and radar data (Table 4-4) from the ANGS indicate that most birds fly higher than the rotor heights at night. Based on these data the risk of this species colliding with the wind turbine during calm, clear weather is extremely low. The risk of colliding with the rotor blades would increase during inclement weather; however, operators can reduce the speed or even stop the rotation of the turbine blades. Construction and operational effects on migrating red knots should be minimal if turbine operations cease when inclement weather and at night during the migration season could push red knots to fly at an altitude that intersects the rotor swept zone. Red knot mortality may still result as a consequence of collisions with the wind turbine and its rotating blades; however, any potential for mortality will be greatly reduced over time as ANGS in combination with a two-year university study begins to identify the precise thresholds for either slowing or shutting down the wind turbines when risk of injury or death is greatest. Because the loss of a single red knot is considered an adverse impact, the ANGS concludes that the proposed action **may affect, and is likely to adversely affect** the red knot. *Based on this finding the ANGS requests initiation of Section 7 formal consultation with the USFWS.*

5.2 Piping Plover

5.2.1 Direct and Indirect Effects

Little is known about how piping plovers respond to wind turbine operation, but the species migrates at night and rests during the day. Piping plovers are expected to be present in the vicinity of the ANGS during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing on with their migration. Piping plovers can be expected to stop over along the Lake Erie shore from 1 April through 31 May during spring migration and from 15 July through 31 August during fall migration. Based on annual survey data collected by the Black Swamp Bird Observatory, this species is not expected to be a very common visitor to the region. Radar data collected at the Camp Perry ANGS in 2011-2013 showed that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Even though migrating piping plovers are expected to fly higher than the rotor blades, operations under the proposed action could result in mortality as a result of collision with the

rotor blades during inclement weather. Clouds can influence the piping plovers' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of collision with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower altitudes, increasing the risk of collision with a wind turbine. Finally, inclement weather can disorient migrating birds and force them to land closer to the wind turbine then their intended stopover sites. The risk of piping plovers colliding with the turbines would not only increase when they are forced to land nearby during inclement weather, but also when they take off again after the bad weather has subsided.

Lighting on the wind turbine can be a factor in bird collisions with wind turbines during inclement weather. Certain types of lighting may attract migrating birds, increasing their chance to collide with the turbine or causing the birds to circle the turbine until exhausted, falling to the ground where they are at risk of dying due to exposure, predation, or collision with the turbines when ascending again.

5.2.2 Actions to Reduce Adverse Effects

Under the proposed action the wind turbine would be constructed in a small area (16 m^2) on a maintained lawn, which is not considered foraging or stopover habitat for the piping plover. The turbine would be mounted on a tubular steel tower without guy wires, reducing the number of substrates with which birds and bats could collide. The lack of guy wires also reduces the number of potential perches for birds, especially for birds of prey, so fewer birds would be attracted to the turbine and the strike potential would be reduced. Lighting on the tower will adhere to FAA guidelines. A red flashing LED light would be placed at the top of the wind turbine to reduce the possibility of the light since a steady light could attract birds to the wind turbine at night. All electrical interconnection lines within the turbine will be laid underground and will connect to an existing on-site electrical substation for Camp Perry ANGS, further reducing the number of objects associated with the wind turbine with which piping plovers could collide.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. The results of this study will help operators at the ANGS determine when or if the turbine would operate throughout the day or season. . The study would also determine the effectiveness of stopping the turbine at night or stopping or reducing cut-in speeds at during inclement weather and at night during the piping plover's migration season (1 April through 31 May and 15 July through 31 August).

If the project is approved, the study would involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine. These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of a piping plover is observed, the local USFWS service office would be notified within 24 hours. These monitoring surveys would be conducted in association with local higher education institutions such as the University of Toledo and the

University of Bowling Green and would involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project.

5.2.3 Conclusions and Determination

Piping plovers would likely occur within the vicinity of the project area only during spring and fall migration. This species typically migrates at night (when the turbine will be shut off), and radar data (Table 4-4) from the ANGS indicate that most birds fly higher than the rotor heights at night. Based on these data the risk of this species colliding with the wind turbine during calm, clear weather is extremely low. The risk of colliding with the rotor blades would increase during inclement weather; however, operators can reduce the speed or even stop the rotation of the turbine blades. Construction and operational effects on migrating piping plovers should be minimal if turbine operations cease when inclement weather during the migration season could push the piping plover to fly at an altitude that intersects the rotor swept zone. Piping plover mortality may still result as a consequence of collisions with the wind turbine and its rotating blades; however, any potential for mortality will be greatly reduced over time as ANGS in combination with a two-year university study begins to identify the precise thresholds for either slowing or shutting down the wind turbines when risk of injury or death is greatest. Because the loss of a single individual piping plover is considered an adverse impact, the ANGS concludes that the proposed action **may affect, and is likely to adversely affect**, the piping plover. *Based on this finding the ANGS requests initiation of Section 7 formal consultation with the USFWS.*

5.3 Kirtland's Warbler

5.3.1 Direct and Indirect Effects

Kirtland's warblers are expected to be present in the vicinity of the ANGS during migration, either flying over the facility or foraging along the Lake Erie shores to refuel before continuing with their migration. Migration by this species occurs in a broad front across Ohio, and approximately half of all observations in the state occur within 5 km of the Lake Erie shore (USFWS 2012b). Kirtland's warblers typically forage in shrub/scrub or forested habitat for a few days to refuel and then continue on to their breeding grounds. Foraging habitat for this species does not occur within ANGS but it does occur within a few kms of the facility. Kirtland's warblers can be expected to stop over along the Lake Erie shore from 22 April through 1 June during spring migration and from 15 August through 15 October during fall migration. Radar data collected at the Camp Perry ANGS in 2011-2013 demonstrate that the majority (97 percent) of the birds detected at night were flying above or below the rotor blade heights. Kirtland's warblers are known to migrate at night.

Even though migrating Kirtland's warblers are expected to fly higher than the rotor blades, operations under the proposed action could result in mortality as a result of collision with the rotor blades during inclement weather. Inclement weather can increase the risk of red knot collisions with the wind turbine. Clouds can influence the Kirtland's warblers' altitude when migrating by forcing the birds to lower altitudes, thereby increasing the probability of the bird colliding with the wind turbine. This could also be the case if the cloud ceiling is at or near the height of the rotor blades. Fog and rain can impair visibility and cause birds to fly at lower

altitudes, again increasing the risk of collision with a wind turbine. Finally, inclement weather can disorient migrating birds and force them to land closer to the wind turbine then their intended stopover sites. The risk of Kirtland's warblers colliding with the turbines would not only increase when they are forced to land nearby during inclement weather, but also when they take off again after the bad weather has subsided.

Lighting on the wind turbine can be a factor in bird collisions with wind turbines during inclement weather. Certain types of lighting may attract migrating birds, increasing their chance of colliding with the turbine or causing the birds to circle the turbine until exhausted, falling to the ground where they are at risk of dying due to exposure, predation, or collision with the turbines when ascending again.

5.3.2 Actions to Reduce Adverse Effects

Under the proposed action the wind turbine will be constructed in a small area (16 m^2) on a maintained lawn, which is not considered foraging or stopover habitat for Kirtland's warbler. The turbine will be mounted on a tubular steel tower without guy wires, reducing the number of substrates with which birds and bats could collide. The lack of guy wires would also reduce the number of potential perches birds, especially for birds of prey, so fewer birds would be attracted to the turbine and the strike potential would be reduced. Lighting on the tower will adhere to FAA guidelines. A red flashing LED light would be placed at the top of the wind turbine since a steady light could attract birds to the wind turbine at night. All electrical interconnection lines within the turbine will be laid underground and will connect to an existing on-site electrical substation for Camp Perry ANGS, reducing the number of objects associated with the wind turbine with which Kirtland's warblers could collide.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. The results of this study will help operators at the ANGS determine when or if the turbine would operate throughout the day or season. . The study would also determine the effectiveness of stopping the turbine at night or stopping or reducing cut-in speeds at during inclement weather and at night during the Kirtland's warbler's migration season (22 April through 1 June and 15 August through 15 October).

If the project is approved, the study would involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine. These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of a Kirtland's warbler is observed, the local USFWS service office will be notified within 24 hours. These monitoring surveys will be conducted in association with local higher education institutions such as the University of Toledo and the University of Bowling Green and will involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project.

5.3.3 Conclusions and Determination

Kirtland's warblers would likely occur within the vicinity of the project area only during spring and fall migration. This species typically migrate at night and radar data (Table 4-4) from the ANGS indicate that most birds fly higher than the rotor heights at night. Based on these data the risk of this species colliding with the wind turbine during calm, clear weather is extremely low. The risk of colliding with the rotor blades would increase during inclement weather; however, operators can reduce the speed or even stop the rotation of the turbine blades. Construction and operational effects on migrating Kirtland's warblers should be minimal if turbine operations cease when inclement weather during the migration season could push birds to fly at an altitude that intersects the rotor swept zone. Kirtland's warbler mortality may still result as a consequence of collisions with the wind turbine and its rotating blades; however, any potential for mortality will be greatly reduced over time as ANGS in combination with a two-year university study begins to identify the precise thresholds for either slowing or shutting down the wind turbines when risk of injury or death is greatest. Because the loss of a single individual Kirtland's warbler is considered an adverse impact, the ANGS concludes that the proposed action **may affect, and is likely to adversely affect**, the Kirtland's warbler. *Based on this finding the ANGS requests initiation of Section 7 formal consultation with the USFWS.*

5.4 Northern Long-Eared Bat

5.4.1 Direct and Indirect Effects

Northern long-eared bats have been recorded during surveys on land adjacent to the ANGS, and potential roosting trees such as shagbark hickory are present in a wooded area northwest of the ANGS. The finding of a northern long-eared bat during summer mist net surveys at Camp Perry in 2011 indicates that northern long-eared bats may use the wooded area northwest of the project site as a roosting area. Although northern long-eared bats typically forage under the canopy of a forest and would not likely be affected by the wind turbine when foraging, they could cross over the project area when moving between summer habitat and hibernation habitat. During migration it is expected that northern long-eared bats would fly at heights just above the local canopy level, which would fall within the rotor swept zone resulting is a higher risk of collision and an adverse affect. As with direct collisions with wind turbines, if a bat gets close enough to the moving blades to experience the effects of barotraumas, internal hemorrhaging could occur and cause the bats to die. Northern long-eared bats are expected to be able to avoid a nonoperational wind turbine due to their echolocation abilities and would likely only be affected when the turbine is operational.

Operational wind turbines pose a risk of killing or injuring bats, and the risk appears to be a factor of the turbine characteristics, cut-in speeds, bat behavior, and environmental conditions. Mortality seems to be the highest on low-wind-speed nights, after storms, and during periods of higher barometric pressure (USFWS 2012b).

5.4.2 Actions to Reduce Adverse Affects

Based on the *Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects* (USFWS 2011), having only a single wind turbine constructed in a location greater than 300 m from foraging and roosting habitat and not in any known direct migration path, should minimize the risk of taking northern long-eared bats (a species with similar habits to the Indiana bat) during the summer. Curtailing blade movement during peak northern long-eared bat activity (evening hours on warm, low-wind nights) has been shown to substantially reduce fatalities (USFWS 2012b). Curtailing blade movements can be done by increasing the cut-in speed, feathering the blades, or a combination of both. Recent studies have shown that changing the turbine cut-in speed to 5.5 m/s resulted in at least a 50 percent drop in bat mortalities (Arnett et al. 2009). Wind speeds below 4 m/s have been shown to be positively related to bat fatalities while wind speeds greater than 6 m/s have had the reverse outcome. During spring migration (16 March through 14 May) and fall migration (16 August through 15 November), the wind turbine and the ANGS will be in operation only when northern long-eared bat activity is unlikely (during appropriate wind speeds and not at night). In addition the ANGS will reduce the likelihood of turbine impact by setting the cut-in speed at 6.9 m/s as suggested in the USFWS's *Northern Long-Eared Bat Interim Conference and Planning Guidance* (USFWS 2014b).

Additionally, to reduce the amount of insects (prey) drawn to nearby and auxiliary structures, facilities located within a half-mile of the turbines will be lighted to the minimum level possible, while still complying with facility security requirements. This may include using lights with motion or heat sensors and switches to keep lights turned off when not required; installing hoods on lights to direct light downward and minimize horizontal and skyward illumination; minimizing the use of high intensity lighting, steady-burning or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights; and requiring all lighting internal to the nacelle and tower to be extinguished when unoccupied.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. The results of this study will help operators at the ANGS determine when or if the turbine would operate throughout the day or season. If the project is approved, the study would involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine. These monitoring surveys will be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of the northern long-eared bat is observed, the local USFWS service office will be notified within 24 hours. These monitoring surveys will be conducted in association with local higher education institutions such as the University of Toledo and the University of Bowling Green and would involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project.

5.4.3 Conclusions and Determination

Since the wind turbine is more than 300m away from any foraging or roosting site, is not in any known direct migration path, will be shut down at night and cut-in speeds for the turbine will be

set to level when bats are not expected to be active, the ANGS concludes that take of this species unlikely under this proposed project. Given the above, the ANGS concludes that proposed action **may affect, but is unlikely to adversely affect**, the northern long-eared bat. *Based on this finding the ANGS asks for concurrence from the USFWS on this conclusion.*

5.5 Indiana Bat

5.5.1 Direct and Indirect Effects

Indiana bats have not been recorded at the Camp Perry ANGS or in Ottawa County, Ohio (ODNR 2012b). Indiana bats use similar habitats to those of northern long-eared bats, but they are more selective about the trees they use for maternity colonies. Since no Indiana bats were detected during the summer 2011 mist net surveys at Camp Perry, it is unlikely that a maternity colony of Indiana bats exists on the facility. In that case, it is also unlikely that migrating Indiana bats would cross over the project area when moving from a local summer habitat to hibernacula. Although the risk of exposure to adverse effects by wind turbines can occur anywhere throughout the bat's range, the risk is higher where suitable habitat is nearby.

During migration it is expected that Indiana bats would fly at heights just above the local canopy level, which would fall within the rotor swept zone, resulting is a higher risk of collision and an adverse affect. As with direct collisions with wind turbines, if a bat gets close enough to the moving blades to experience the effects of barotraumas, internal hemorrhaging could occur and cause the bats to die. Indiana bats are expected to be able to avoid a nonoperational wind turbine due to their echolocation abilities and should only be affected when the turbine is operational.

Operational wind turbines pose a risk of killing or injuring bats and the risk appears to be a factor of the turbine characteristics, cut-in speeds, bat behavior, and environmental conditions. Mortality seems to be the highest on low-wind-speed nights, after storms, and during periods of higher barometric pressure (USFWS 2012b).

5.5.2 Actions to Reduce Adverse Affects

Based on the *Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects* (USFWS 2011), having only a single wind turbine constructed in a location greater than 300 m from foraging and roosting habitat and not in any known direct migration path, should minimize the risk of taking Indiana bats during the summer. Curtailing blade movement during peak Indiana bat activity (evening hours on warm, low-wind nights) has been shown to substantially reduce fatalities (USFWS 2012b). Curtailing blade movements can be done by increasing the cut-in speed, feathering the blades, a combination of both or by shutting off the turbine entirely. Wind speeds below 4 m/s have been shown to be positively related to bat fatalities while wind speeds greater than 6 m/s have the reverse outcome. During spring migration (15 March through 15 May) and fall migration (15 August through 15 October), the wind turbine will be in operation only when Indiana bat activity is unlikely (not during the night), and by setting the cut-in speed at 6.9 m/s which matches guidelines by the USFWS for the northern long-eared bat, a similar species.

Additionally, to reduce the amount of insects (prey) drawn to nearby and auxiliary structures, facilities located within a half-mile of the turbines will be lighted to the minimum level possible, while still complying with facility security requirements. This may include using lights with motion or heat sensors and switches to keep lights turned off when not required; installing hoods on lights to direct light downward and minimize horizontal and skyward illumination; minimizing the use of high intensity lighting, steady-burning or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights; and requiring all lighting internal to the nacelle and tower to be extinguished when unoccupied.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. The results of this study will help operators at the ANGS determine when or if the turbine would operate throughout the day or season. If the project is approved, the study will involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine. These monitoring surveys will be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of an Indiana bat is observed, the local USFWS service office will be notified within 24 hours. These monitoring surveys will be conducted in association with local higher education institutions such as the University of Toledo the University of Bowling Green and would involve reporting to the USFWS as directed in any BO and/or incidental take permit issued for this project.

5.5.3 Conclusions and Determination

Since the wind turbine is more than 300m from any foraging or roosting site, is not in any known direct migration path, the turbine will be off at night and cut in speeds for the turbine will be set to level when Indiana bats are not expected to be active, the ANGS concludes that take of this species is unlikely under this proposed project. Given the above, the ANGS concludes that proposed action **may affect, but is unlikely to adversely affect**, the Indiana bat. *Based on this finding the ANGS asks for concurrence from the USFWS on this conclusion.*

5.6 Bald Eagle

5.6.1 Direct and Indirect Effects

Bald eagles have been observed to avoid collisions when near an operational turbine (Sharp et al. 2010). Through July 2014, six bald eagle fatalities have been confirmed at wind turbine projects in the contiguous U.S., with an additional potential fatality at a wind turbine in Minnesota (USFWS 2014a). Fatalities of bald eagles at wind turbines remain rare regardless of continued operation near this species.

Although placement of the Camp Perry ANGS wind turbine will not affect any bald eagle habitat, it is near a pond that contains fish that could attract a bald eagle near the wind turbine. A pair of nesting bald eagles were observed in 2015 approximately 940 m northwest of the proposed wind turbine construction site (Figure 2-2), and Ottawa and Ottawa County have the highest nesting density of bald eagles in Ohio (USFWS 2012b). Therefore it is likely that an incidental

take of a bald eagle colliding with the wind turbine could occur over the lifetime operation of the wind turbine.

5.6.2 Actions to Reduce Adverse Affects

Incidental take permits can be issued by the USFWS to authorize the take of bald eagles under the authority of the BGEPA when take is associated with lawful activities, cannot be practicably avoided, and is compatible with the goal of having a stable or increasing eagle breeding population. A permit can be issued if certain conditions are met. Minimization measures already planned by the ANGS that will reduce adverse affects by the wind turbine on bald eagles include:

- The ANGS would maintain the southern lawn regularly and will not seed the lawn with vegetation that could attract small mammals (prey).
- The ANGS would remove and properly dispose of any carcasses found within 100 m of the turbine in conformance with local regulations.
- The design of the turbine is a monopole without any lattice structure or guy wires, which will deter perching.
- All electrical lines will be placed underground to reduce perching substrates near the wind turbine.
- The ANGS would conduct post-construction monitoring for two years to document any take of bald eagles based on guidelines accepted by the USFWS.

5.6.3 Conclusions and Determination

Bald eagle mortality may result as a consequence of collisions with the wind turbine and its rotating blades. Because the loss of a single individual bald eagle is considered an adverse impact, the ANGS concludes that the proposed action **may affect, and is likely to adversely affect**, the bald eagle. *Based on this finding, the ANGS requests initiation of Section 7 formal consultation with the USFWS to begin the process of applying for an incidental take permit for bald eagles.*

5.7 Migratory Birds

The MBTA implemented treaties with Canada, Russia, Japan, and Mexico that prohibit the take, possession, transportation, and importation of native migratory birds, their eggs, or parts (i.e., feathers). The MBTA prohibits takes of individual birds, and failure to comply with the MBTA can result in criminal penalties. The MBTA does not include a provision to authorize incidental take of migratory birds resulting from the implementation of a federal action. Even if all reasonable avoidance and mitigation measures are implemented, the USFWS recognizes that some level of mortality of migratory birds will occur at wind turbines (USFWS 2010). In the case of wind turbines, the USFWS continues to provide guidance in making good-faith efforts to enable a wind energy project to comply with the MBTA. The Department of Justice has exercised discretion based on recommendations by the USFWS in enforcing provisions of the MBTA regarding wind energy projects that have made good-faith efforts to avoid the take of migratory birds.

5.7.1 Direct and Indirect Impacts

The size of the construction footprint and the location of the Camp Perry ANGS wind turbine on a maintained lawn are not expected to have an adverse effect on migratory bird habitat. The location of the wind turbine is near state and federal wildlife refuges along Lake Erie's southern shore, which provides habitat for waterfowl, raptors, and neotropical migrants in high numbers during spring and fall migration seasons. Of these groups, raptors and songbirds are the most likely to be killed by colliding with the proposed wind turbine.

Based on radar data collected at the proposed action site, most birds and bats detected at night (when most birds migrate) were flying above the rotor blade height of the proposed wind turbine. These birds are typically most vulnerable to colliding with the rotor blades when cloud cover, fog, or inclement weather creates a ceiling that pushes the birds into the rotor swept zone.

Migratory birds are also most vulnerable during "fallout events" during heavy flight nights following cold fronts and when flying through strong headwinds. During fallout events birds may fly at lower altitudes and could collide with the wind turbine. Based on the radar data, the highest risk to migratory birds would occur at dusk (one hour before sunset to one hour after sunset) and dawn (two hours before sunrise to one hour after sunrise) when birds take off and could fly through the rotor swept zone.

5.7.2 Actions to Reduce Adverse Affects

The ANGS installed and operated a bird radar system from 2011-2013 to study average migration heights of birds and bats throughout the year at the proposed wind turbine construction site. The data collected was used to make affects determinations throughout this BA. Other actions to minimize adverse affects on migratory birds are described below.

The turbine would be mounted on a tubular steel tower without guy wires, which would reduce the substrates with which migratory birds could collide and reduce potential perches that birds, especially birds of prey, could use. Lighting of the tower would adhere to FAA guidelines. A red flashing LED light would be placed at the top of the wind turbine to reduce the chance of a steady light attracting birds to the wind turbine at night. All electrical interconnection lines within the turbine will be laid underground and will connect to an existing on-site electrical substation for Camp Perry ANGS, reducing the number of objects associated with the wind turbine with which birds could collide.

This proposed project was funded in part to conduct research to study the effectiveness and ability of the Department of Defense to use energy-generating wind turbines at facilities near large bodies of water. If the project is approved, the research study would involve two years of post-construction monitoring for bird and bat carcasses at or near the wind turbine would be conducted. These bird and bat monitoring surveys would be conducted concurrently to ensure that significant fatalities of birds and bats do not occur during their migratory periods. If a take of a bird or bat is observed, the local USFWS service office will be notified within 24 hours. These monitoring surveys will be conducted in association with local higher education institutions such

as the University of Toledo and the University of Bowling Green and would entail reporting to the USFWS as directed in any BO issued for this project.

5.7.3 Conclusions and Determination

Migratory bird mortality will likely occur during the lifetime operation of the proposed wind turbine. Mitigation and conservation measures include the following:

- Proposed design considerations such as installing the turbine on a single tower without guy wires and installing power lines below ground would reduce the number of perching substrates.
- Installing a red flashing LED light on the tower would reduce the attraction of birds to the turbine.
- Limiting construction to one turbine would reduce the project footprint and the potential for strikes.
- Regular maintenance of the surrounding lawn would help reduce the populations of prey animals that could attract raptors.
- Limiting turbine operation to daylight hours (dawn to dusk).
- Limiting turbine operation to avoid spring migration (15 March through 30 May) and fall migration (15 August through 31 October) and during inclement weather.

Post-construction monitoring will help ANGS better understand how to reduce potential migratory bird injuries and mortalities by identifying when to reduce speed or even stop the turbine until the risk has passed. By curtailing the operation of the wind turbine during dawn and dusk in spring and fall migration periods, ANGS would greatly reduce the potential impacts on migratory birds. Any potential for mortality will be greatly reduced over time as ANGS in combination with a two-year university study begins to identify the precise thresholds for either slowing or shutting down the wind turbines when risk of injury or death is greatest. Finally, by implementing best management practices in the USFWS's *Land-Based Wind Energy Guidelines*, ANGS would minimize the effects of the wind turbine on migratory birds and bats.

Based on the planned implementation of these design considerations, conservation measures and best management practices, the ANGS concludes the construction and operation of this proposed wind turbine **may affect, but is unlikely to adversely affect,** migratory birds.

FORMAT PAGE

6.0 CUMMULATIVE EFFECTS

The ANGS acknowledges that bat and bird mortality at the proposed wind turbine would contribute cumulatively to mortality rates of other wind projects slated in and around the Lake Erie shore. The ANGS is aware of an additional wind turbine to be constructed by the owner of the existing wind turbine northwest of the facility (Figure 2-2). That turbine is to be constructed near the location of the existing turbine. Any potential for mortality from new wind turbines will be greatly reduced over time as ANGS in combination with a two-year university study begins to identify the precise thresholds for either slowing or shutting down the wind turbines when risk of injury or death is greatest. This information can be used for each facility to implement purposeful and meaningful mitigation to reduce bird and bat injuries and mortalities.

In 2014, under Senate Bill 310, Governor John Kasich signed into law legislation freezing for two years a requirement that utility companies sell more electricity from renewable sources of energy. No new commercial wind energy projects were initiated between 2013 and 2015, but the Pew Charitable Trusts predicts that when the freeze is lifted in 2016 investments in wind power in Ohio will reach $125 million. Wind energy capacity in the state is expected to reach nearly 1,500 megawatts by 2023 (The Pew Charitable Trusts 2015). This predicted increase in the number of wind turbines in the state would likely see many constructed along the shore of Lake Erie, potentially near the action area. This increase in wind turbines would result in an increase in bat and bird fatalities in Ohio due to collisions with wind turbines.

FORMAT PAGE

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Appendix A. Federally Listed Species with the Potential to Occur in the Proposed Action Area, USFWS Official List

FORMAT PAGE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Columbus Ohio Field Office
4625 MORSE ROAD, SUITE 104
COLUMBUS, OH 43230
PHONE: (614)416-8993 FAX: (614)469-8994

Consultation Code: 03E15000-2015-SLI-1291 July 09, 2015
Event Code: 03E15000-2015-E-00457
Project Name: Camp Perry

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having

similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit http://www.fws.gov/migratorybirds/AboutUS.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project

planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Official Species List

Provided by:

Columbus Ohio Field Office
4625 MORSE ROAD, SUITE 104
COLUMBUS, OH 43230
(614) 416-8993

Consultation Code: 03E15000-2015-SLI-1291
Event Code: 03E15000-2015-E-00457

Project Type: POWER GENERATION

Project Name: Camp Perry
Project Description: A Biological Assessment of a proposed wind turbine on the facility

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-83.01801681518555 41.52972027618687, -83.01569938659668 41.53097321462512, -83.01552772521973 41.53161573774448, -83.01544189453125 41.533703893808074, -83.01715850830078 41.533800268614435, -83.0170726776123 41.53569561062476, -83.01544189453125 41.53569561062476, -83.01544189453125 41.537494527938335, -83.01994800567627 41.53746240485365, -83.02024841308594 41.53094108830163, -83.01801681518555 41.52972027618687)))

Project Counties: Ottawa, OH

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Endangered Species Act Species List

There are a total of 8 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	**Status**	**Has Critical Habitat**	**Condition(s)**
Kirtland's Warbler *(Setophaga kirtlandii)* Population: Entire	Endangered		
Piping Plover *(Charadrius melodus)* Population: Great Lakes watershed	Endangered	Final designated	
Red Knot *(Calidris canutus rufa)*	Threatened		
Flowering Plants			
Eastern Prairie Fringed orchid *(Platanthera leucophaea)*	Threatened		
Lakeside daisy *(Hymenoxys herbacea)*	Threatened		
Mammals			
Indiana bat *(Myotis sodalis)* Population: Entire	Endangered		
Northern long-eared Bat *(Myotis septentrionalis)*	Threatened		
Reptiles			
eastern Massasauga *(Sistrurus*	Candidate		

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

catenatus)			

United States Department of Interior
Fish and Wildlife Service

Project name: Camp Perry

Critical habitats that lie within your project area

There are no critical habitats within your project area.

BIOLOGICAL OPINION

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
Ecological Services Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / Fax (614) 416-8994

March 8, 2016

Colonel Andy Stephan
200th Red Horse Squadron Commander
1200 N. Camp Perry E. Road
Port Clinton, Ohio
43452-9577

Dear Colonel Stephan, TAILS# 03E15000-2016-F-0180

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion for the Proposed Wind Turbine on the Ohio Air National Guard Station, Camp Perry, in Ottawa County, Ohio and its effects on the federally listed rufa red knot (*Calidris canutus rufa*), piping plover (*Charadrius melodus*), and Kirtland's warbler (*Setophaga kirtlandii*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). We received your request for formal consultation on October 20, 2015.

We submitted a draft Biological Opinion to you for review on January 13, 2016 and received your agency's comments on January 27, 2016. Upon considering the comments we have made the appropriate modifications and clarifications in the final document.

This concludes formal consultation on the Camp Perry Proposed Wind Turbine. If you have any questions regarding this consultation, please contact Keith Lott, of my staff, at (614) 416-8993, ext.31 or Keith_Lott@fws.gov.

Sincerely,

Dan Everson
Field Supervisor

Biological Opinion and Incidental Take Statement
for the Proposed Wind Turbine
on the Ohio Air National Guard Station, Camp Perry, Ohio

March 8, 2016

Prepared by:

U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Rd., Suite 104
Columbus, OH 43230

Table of Contents

INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service's) biological opinion based on our review of the proposed wind turbine installation at the Ohio Air National Guard (ANG) Station, Camp Perry, Ohio, and its effects on the rufa red knot (*Calidris canutus rufa*), piping plover (*Charadrius melodus*), and Kirtland's warbler (*Setophaga kirtlandii*) per section 7 of the Endangered Species Act of 1973, as amended (Act, 16 U.S.C. 1531 *et seq*.). Your October 20, 2015 request for formal consultation was received on October 23, 2015.

This biological opinion is based on information provided in the December 2015 Biological Assessment (Vernadero Group 2015), telephone conversations, and other sources of information. A complete administrative record of this consultation is on file at the Service's Columbus, Ohio Ecological Services Field Office.

Consultation History
ANG determined that the wind turbine project is likely to adversely affect the rufa red knot, piping plover, and Kirtland's warbler and submitted a request for initiation of formal consultation to the Service on October 20, 2015. In a November 12, 2015 response letter, the Service agreed that the initiation package was complete in accordance with 50 CFR §402.14, and that the timeframe for formal consultation had begun effective October 20, 2015.

Table 1. Consultation History

Date	Event
Oct. 24, 2007	ANG consultants Curry & Kerlinger send letter to Service requesting input on proposal to install wind turbines at Camp Perry.
Dec. 4, 2007	Service letter to consultants Curry & Kerlinger regarding early coordination on proposed wind turbine at ANG. Comments addressed the following topics: proximity to Ottawa National Wildlife Refuge; bald eagle; endangered species; and migratory birds.
Dec. 2009	Onsite meeting between Service and ANG.
Feb. 23, 2010	Conference call between Service and ANG
April 8, 2010	Service letter to ANG regarding pre-construction monitoring for bald eagle.
May 17, 2010	Service receives Draft Environmental Assessment (EA) for the proposed wind turbine at Camp Perry.
June 16, 2010	Service letter to ANG providing comments on the Draft EA for the proposed wind turbine. Comments addressed the following topics: impacts to migratory birds; impacts to federally-listed endangered and threatened species; impacts to bald eagles; and compliance with National Environmental Policy Act (NEPA).
July 31, 2012	Meeting between Service, ANG, U.S. Representative Kaptur, Consultants, Univ. of Toledo, and Bowling Green State Univ. Discussion addressed: status of EA; bald eagles and migratory birds; bat surveys that were conducted; radar data collected; and post-construction monitoring.
Aug. 28, 2012	Service receives Final EA for the proposed wind turbine at Camp Perry.

Sept. 5, 2012	Meeting between Service and ANG to discuss: final EA; measures to minimize impact to endangered species, bald eagles, and migratory birds; and monitoring and adaptive management.
Sept. 25, 2012	Service letter to ANG providing comments on the Final EA for the proposed wind turbine. Comments addressed the following topics: Endangered species impacts; bald eagle impacts; and migratory bird impacts.
Aug. 23, 2013	Service receives email from ANG with Finding of No Significant Impact (FONSI) and Addendum to the Final EA.
Sept. 10, 2013	Service letter to ANG regarding FONSI and Addendum to the Final EA. Comments addressed Service's concern that take of bald eagles is likely, and that take of Kirtland's warbler and piping plover may occur unless minimization measures are implemented. Additional comments on migratory birds, monitoring, and un-listed bat species are also provided.
Sept. 13, 2013	Service email to ANG regarding piping plover observations at Camp Perry.
Jan. 8, 2014	Service receives Notice of Intent to Sue from Meyer Glitzenstein & Crystal, relative to the Camp Perry wind energy project.
June 11, 2014	Meeting between Service and ANG and Ohio Department of Natural Resources (ODNR). Discussed ANG's intent to develop a new EA; siting alternatives; Bald and Golden Eagle Protection Act; Migratory Bird Treaty Act; Endangered Species Act; and engaging stakeholders.
March 2, 2015	ANG letter to Service, inviting Service to be a cooperating agency under NEPA in development of a new EA for the project.
April 7, 2015	Service letter to ANG, declining invitation to be a cooperating agency under NEPA, but committing to work closely on issues of concern to the Service.
Oct. 20, 2015	ANG letter to Service requesting formal consultation under Section 7 of ESA, accompanied by Biological Assessment (BA).
Oct. 30, 2015	Conference call between Service and ANG to address questions on BA.
Nov. 12, 2015	Service letter to ANG, indicating that initiation package was complete, and that the timeframe for formal consultation had begun effective October 20, 2015. Letter also provided suggested revisions to content of BA.
Dec. 2, 2015	ANG email to Service transmitting revised final BA.
Jan. 13, 2015	Service email to ANG with the Draft BO.
Jan. 27, 2015	Comments on Draft BO received from ANG.

The Service has assessed the avoidance and minimization measures included in the BA (Vernadero Group 2015) to address the potential for take of the Northern long-eared bat (*Myotis septentrionalis*), a federally threatened species, and the Indiana bat (*Myotis sodalis*), a federally endangered species. No critical habitat for either species will be impacted by this project. We have concluded that the minimization measures, primarily feathering the turbine until a cut-in wind speed of 6.9 m/s is reached at night, from March 15-October 31, are sufficient to avoid take of these species. Thus, ANG has determined that the project is not likely to adversely affect these species, and the Service concurs with this determination. Should, during the term of this action, additional information on these species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with

the Service should be reinitiated to assess whether the determinations are still valid. These species will not be addressed further in this biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The federal action evaluated in this biological opinion (BO) is the construction, operation, and maintenance of a single 600 kilowatt (kW) Vestas 44 wind turbine at the Camp Perry ANG site, north of State Route 2, Erie Township, Ottawa County, Ohio (Figure 1).

The Service is issuing this BO pursuant to section 7 of the ESA. Direct and indirect effects of the federal action (construction and operation of the wind turbine) and the interrelated or interdependent activities are analyzed to ensure they are not likely to jeopardize the continued existence of federally listed or proposed endangered or threatened species. Indirect effects of the federal action include, "…effects that are caused by or result from the action, are later in time but are reasonably certain to occur…" Interdependent actions have no independent utility apart from the proposed action, and interrelated actions are part of a larger action and depend on the larger action for their justification (50 CFR §402.02).

Camp Perry ANG is north of State Route 2 in the Erie Township portion of Ottawa County, Ohio. The ANG is approximately 5 kilometers west of Port Clinton, near the mouth of the Portage River, 1.6 km southwest of Lake Erie and approximately 6.5 km northwest of Sandusky Bay.

The following project description is taken primarily from the BA (Vernadero Group 2015):

The proposed wind turbine would be located entirely within the Camp Perry ANG property boundary and would be erected within the southern lawn of the facility (Figure 1). The southern lawn encompasses 7,632 square meters (m^2) of previously disturbed and routinely maintained land. Vehicles and equipment would be staged on this lawn during construction or within the nearby parking lots which cover approximately 5,800 m^2 near the proposed project site.

The foundation for the wind turbine occupies 16 m^2 and has already been constructed. A single 600 kW Vestas 44 wind turbine is proposed for construction. This model has a rotor diameter of 44 meters (m) and a tower height of 40 m. The rotor has three blades, and its swept area would cover 1,520.53 m^2. The maximum height of the rotor tip on any single blade in the 12 o'clock position would be 60.5 m above ground level (agl). In the 6 o'clock position the rotor tip would be as low as 26 m agl. The turbine would be mounted on a tubular steel tower with lighting that will comply with the Federal Aviation Administration's (FAA's) *Obstruction Marking and Lighting (AC 70/7460-1K).* A flashing red light emitting diode (LED) would be placed at the top of the wind turbine tower. All electrical interconnection lines are internal to the turbine and

would connect underground to an existing onsite electrical substation for Camp Perry ANG. No electrical aboveground lines will be exposed for the turbine. The ANG expects the turbine to be operational for 25 years.

Camp Perry proposes to construct the wind turbine as part of a Phase IV Renewable Energy Demonstration Project. Because the wind turbine will be operated as a Renewable Energy Demonstration Project, goals for power generation are not necessary for this turbine. The proposed 600 kW Vestas 44 turbine can operate at a cut-in wind speed (the minimum speed in which it can operate) of 4 m per second (m/s). The cut-out wind speed (the maximum wind speed it can operate under) for this turbine model is 20 m/s. The proposed turbine would be able to generate electricity at a maximum capacity of 16 m/s based on its wind speed rated performance standards (Bundesverband WindEnergie 2015). To minimize potential bat and bird strikes, Camp Perry ANG proposes avoidance and minimization measures that would stop the rotation of the rotor blades during certain periods of time, depending on factors including wind speed, season, and time of day/night.

Routine maintenance and service of the proposed wind turbine would be performed in accordance with the manufacturer's guidelines. Routine maintenance will ensure the turbine is operating properly, minimizing wear and tear on the equipment and reducing downtime due to breakdowns and repairs. Unplanned maintenance would be carried out should there be an equipment malfunction.

Conservation Measures

The ANG has implemented the following design considerations to avoid or minimize the potential impacts to local natural resources from the construction of the wind turbine (USFWS 2012b):

- The wind turbine's design does not include guy wires, which reduces the likelihood of injury or death of birds and bats due to collision and minimizes the area available for raptors to perch. Additionally, the turbine is a monopole, which reduces the potential for perching.
- The wind turbine would be built in a previously disturbed area, thereby eliminating the potential for habitat loss during construction.
- Limiting construction to one turbine will reduce the project footprint and the potential for strikes. The initial project concept included three turbines; however, this was revised as a result of coordination with the USFWS.
- All interconnection wires would be internal to the turbine. Electrical lines connecting the turbine to an existing substation on Camp Perry would be installed underground, thereby reducing or eliminating potential risks of electrocution and collision associated with overhead electrical lines.

- The design uses a FAA-approved red LED strobe light to reduce collisions by birds that are attracted to steadily burning lights.

ANG has also completed the following pre-construction monitoring measures:

- ANG has conducted 2.5 years of avian and bat surveys using a MERLIN avian radar system to collect data on local bird and bat movements.
- ANG conducted a bat mist net survey in a nearby woodlot to document bat species diversity and identify potential risks to federally listed bats.

ANG has committed to implement the following minimization measures:

- The ANG would implement scalable operational controls during periods of higher bird and bat activity and when weather conditions could potentially increase bird and bat activity near the operational zone of the turbine. This includes adjusting the cut-in speed at 6.9 m/s as suggested by the USFWS (2014b) and establishing protocols for cessation of operations to reduce biologically significant impacts, particularly during the nighttime and spring and fall migration periods (Table 2).
- The ANG would maintain the southern lawn regularly to help reduce prey populations that could attract raptors.
- ANG will remove and properly dispose of any animal carcasses not part of the post-construction monitoring studies found within 100 m of the turbine in conformance with local regulations.
- The ANG would light buildings and structures within a half-mile of the turbine to the minimum level possible, while still complying with facility security requirements, to reduce prey (insects) attracted to the lights. The street lighting and lighting at the closest buildings have already been changed to LED high-color temperature lights to reduce attraction of insects in and around the area.

Table 2. Operational curtailment regimes.

Species	**Operational control**	**Dates of curtailment**	**Desired outcome**
Indiana and northern long-eared bats	Curtail turbines at night when wind speed are less than 6.9 m/s.	15 March – 31 October	Avoid take of these two species.
Piping plover	Full curtailment at night.	1 April – 31 May, and 15 July – 31 October	Minimize potential impacts
Red knot	Full curtailment at night.	1 April – 31 October	Minimize potential impacts
Kirtland's warbler	Full curtailment at night.	22 April – 1 June, and 15 August – 15 October	Minimize potential impacts

The ANG would conduct post-construction monitoring for at least two years to document any take of special status species, migratory birds, or eagles. This monitoring would follow the Ohio Department of Natural Resources single-turbine protocol at a minimum.

Action Area

In 50 CFR §402.02 "Action Area" is defined as, "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The Action Area is not limited to the footprint of the action and should consider the effects to the environment resulting from the action. Within a set Action Area, all activities that can cause measurable or detectable changes in land, air, and water or to other measurable factors that may elicit a response in the species or critical habitat are considered. The Action Area is not defined by the range of the species that would be impacted; rather it is defined by the impacts to the environment that would elicit a response in the species (USFWS and NMFS 1998). Therefore, the Action Area includes the on the ground footprint of the turbine and the geographic extent of the area that could be affected by the construction, operation, and maintenance of the turbine either directly, indirectly, or through interrelated or interdependent actions.

Since the base of the turbine has already been installed, significant amounts of additional ground disturbance are not expected. Of the project activities, noise from turbine construction and operation is expected to result in the most far reaching changes to the natural environment. The estimated ambient noise level at the turbine location on Camp Perry ANG is 50 decibels (dBA). The 50 dBA ambient level is based on that of a typical road with heavy traffic (Ohio Department of Transportation 2006), which would be indicative of noise associated with State Route 2, approximately 70 m from the base of the turbine. Based upon noise measurements on a similar model turbine (Vestas V47-660kw; Vestas 2003) sound levels generated by the turbine are expected to be reduced to ambient levels (50 dBA) at a distance of 100 m from the turbine (Ohio Department of Transportation 2006).

The construction, maintenance, and operation of the turbine will result in direct effects and indirect effects throughout the project area and the surrounding area up to 100 m from the base of the turbine. Therefore, the Action Area for this consultation extends from the base of the turbine, to a distance of 100 m along the ground, and 60.5 m vertically (the maximum height of the turbine with the blade oriented at the 12 o'clock position). The Action Area encompasses approximately 7.72 acres (Figure 1).

Figure 1. Action Area

The Action Area is comprised primarily of mowed grass and paved surfaces. There is a portion of a retention pond within the Action Area, and three trees (Table 3). Most of the Action Area is owned and managed by Camp Perry ANG. The Action Area also encompasses a portion of State Route 2, a four-lane highway owned by the Ohio Department of Transportation. Thus all of the Action Area is owned by federal or state government agencies.

Table 3.

Land cover	Percent coverage
Developed open space	24%
Developed low intensity	31.5%

Developed medium intensity	42.6%
Developed high intensity	1.9%

The area surrounding the Action Area is comprised of a mix of natural and developed lands. The entire Camp Perry Air National Guard Station is 59 acres in size, and is mostly comprised of buildings, roads, and maintained grass. The area south of Camp Perry is predominately agricultural, with the Republic Services Ottawa County Landfill approximately 0.5 miles to the south (Figure 2). Camp Perry abuts Lake Erie to the north, and a portion of Ottawa National Wildlife Refuge to the east. To the west there is an approximate 80 acre forest block and the Lake Erie Business Park (a commercial development).

Figure 2. Proposed turbine location and surrounding area.

STATUS OF THE SPECIES

The proposed turbine locations lies within the range of the federally listed Indiana bat [E], Kirtland's warbler [E], piping plover [E], northern long-eared bat [T], eastern prairie fringed orchid [T] (*Platanthera leucophaea*), Lakeside daisy [T] (*Hymenoxys herbacea*), rufa red knot [T] (*Calidris canutus rufa*), eastern massasauga [PT] (*Sistrurus catenatus*), Lake Erie watersnake [SC] (*Nerodia sipedon insularum*), and bald eagle [SC] (*Haliaeetus leucocephalus*)[1]. The Action Area lacks suitable habitat for these species, but there is the potential that listed birds or bats may be struck by this turbine as they fly through the airspace surrounding the turbine. Camp Perry ANG has agreed to implement measures to avoid take of listed species of bats (Indiana bat and northern long-eared bat), therefore they will not be considered further in this BO. The bald eagle is no longer listed, though still protected under the Bald and Gold Eagle Protection Act. The U.S. Fish & Wildlife Service has a separate process to address impacts to bald eagle, therefore that species will not be addressed in this BO. This BO will address federally listed birds that have the potential to collide with the turbine when flying through the airspace surrounding the turbine.

Rufa Red Knot

Species Description: The rufa red knot is a medium-sized shorebird about 9 to 11 inches (in) (23 to 28 centimeters (cm)) in length. Additional information on this species' biology or threats can be found with the 2014 Rufa Red Knot Final Rule (79 FR 73706).

Life History and Biology: The red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States (Southeast), the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America (79 FR 73706). During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed (USFWS 2014a). Shorebird migration typically occurs at night, and during the day the birds stopover to rest, though they will make short distance flights during the day, from one patch of habitat to another. Migration stopover habitat is typically comprised of beaches and mudflats.

Threats: Threats to the red knot from habitat destruction and modification are occurring throughout the entire range of the subspecies. These threats include climate change, shoreline stabilization, and coastal development, exacerbated regionally or locally by lesser habitat-related threats such as beach cleaning, invasive vegetation, agriculture, and aquaculture (USFWS 2014a).

Rangewide Status: Within the Final Rule it was determined that an overall, sustained decline of red knot numbers occurred at Tierra del Fuego and Delaware Bay in the 2000s, and that the red knot populations may have stabilized at a relatively low level in the last few years. And while sufficient data did not exist throughout the wintering and stopover range, declines at these two sites likely have driven an overall population decline.

[1] E: Endangered, T: Threatened, PT: Proposed threatened, SC: Species of Concern

Status in Ohio: Red knots are an annual migrant in small numbers in Ohio. The vast majority of observations of this species in Ohio are from along the shoreline of Lake Erie. Other observations are along large waterbodies such as lakes and reservoirs. Red knots have a prolonged migration and may occur in Ohio anytime between 1 April – 31 October. Red knots have been documented in Ottawa County, along the shore of Lake Erie within 1.2 miles of the project area (Figure 3).

Critical Habitat: No Critical Habitat has been designated for this species at this time.
Conservation Needs: The species' conservation needs define what is needed in terms of reproduction, numbers, and distribution to ensure the species is no longer in danger of extinction. The conservation needs should be defined in the species' recovery outline or plan. Relative to the migration period, conservation of important stopover habitat and ensuring food availability is key to success during migratory periods (USFWS 2014a).

Piping Plover

Species Description: Piping plovers are a small, stocky shorebird that has a sand-colored upper body, a white underside, and orange legs. During the breeding season, adults have a black forehead, a black breast band, and an orange bill. Additional information on this species' biology or threats can be found with the 2009 Piping Plover 5-Year Review (USFWS 2009).

Life History and Biology: Piping plovers are migratory birds. The Great Lakes population is known to nest primarily in Michigan, Wisconsin, and Ontario, Canada. These birds typically over-winter along the southeastern U.S. Atlantic Coast. Piping plovers use wide, flat, open, sandy beaches with very little grass or other vegetation during both nesting and winter seasons. During migration piping plovers are often documented stopping over along the shores of inland lakes and reservoirs.

Threats: Primary threats to this species include the loss and/or modification of habitat in their breeding and wintering grounds. This includes shoreline development, disturbance (beach nourishment, stabilization projects, or beach cleaning), sand mining, etc.

Rangewide Status: The Great Lakes piping plover population, which has been traditionally represented as the number of breeding pairs, has increased since the completion of the recovery plan in 2003 (Stucker et al. 2003; Stucker and Cuthbert 2004; Westbrock et al. 2005; Cuthbert and Roche 2006, 2007). The Great Lakes piping plover recovery plan documents the 2002 population at 51 breeding pairs (USFWS 2003). The most recent census conducted in 2008 found 63 breeding pairs, an increase of approximately 23% (USFWS 2009). In addition, the number of non-nesting individuals has increased annually since 2003.

Status in Ohio: Piping plovers are an annual migrant in small numbers in Ohio. The vast majority of observations of this species in Ohio are from along the shoreline of Lake Erie. Other observations are along large waterbodies such as lakes and reservoirs. Piping plovers typically pass through Ohio in 1 April – 31 May, and 15 July – 31 October. Piping plovers have been documented in Ottawa County, along the shore of Lake Erie within 1.3 miles of the project area (Figure 3).

Critical Habitat: Critical Habitat was designated for the Great Lakes population in 2001 (USFWS 2001), while a different rule-making determined critical habitat for the Northern Great Plains population in 2002 (USFWS 2002). There are two sites of Critical Habitat in Ohio; these are at Mentor Headlands Beach and Sheldon Marsh (approximately 21 and 91 miles away respectively).

Conservation Needs: Maintaining and improving breeding grounds, while preserving stopover habitat (USFWS 2009).

Kirtland's Warbler

Species Description: The Kirtland's warbler is a relatively large, long-tailed and heavy-billed wood warbler, measuring approximately 14 cm in length and 12-15 g in weight (Mayfield 1960; Walkinshaw 1983; Dunn and Garrett 1997). The plumage is generally bluish-gray on the upperparts and heavily streaked with black on the back. The throat, breast and belly are lemon-yellow in color and streaked in black on the sides and flanks, becoming white on the undertail coverts.

Life History and Biology: The Kirtland's warbler nests only in young jack pine forests growing on a special type of sandy soil. The warblers prefer to nest in forests that are about 80 acres (roughly 60 football fields) or larger with numerous small, grassy openings. Kirtland's warblers prefer to nest in groups. They build their nests only on the ground among grass or other plants like blueberry bushes. The jack pine trees in its nesting area must be just the right height (about 5 to 16 feet tall) and the trees must be spaced to let sunlight through to the ground. Kirtland's warblers nest in Michigan, Wisconsin, and Ontario. In the fall they migrate to the Bahamas, and will return in the spring (April-May). Stopover habitat for Kirtland's warblers is typically comprised of deciduous scrub/shrub vegetation.

Threats: The ultimate limiting factor on the nesting population is the special habitat requirement of young jack pine forests. Historically, wildfires were the most important factor in the establishment of natural jack pine forests and Kirtland's warbler nesting habitat. However, modern wildfire suppression has greatly altered the natural disturbance regime that generated Kirtland's warbler breeding habitat for thousands of years (Byelich et al. 1985; Cleland et al. 2004). Other factors have adversely affected the Kirtland's warbler, such as nest parasitism by brown-headed cowbirds. Cowbird control has been conducted since 1972.

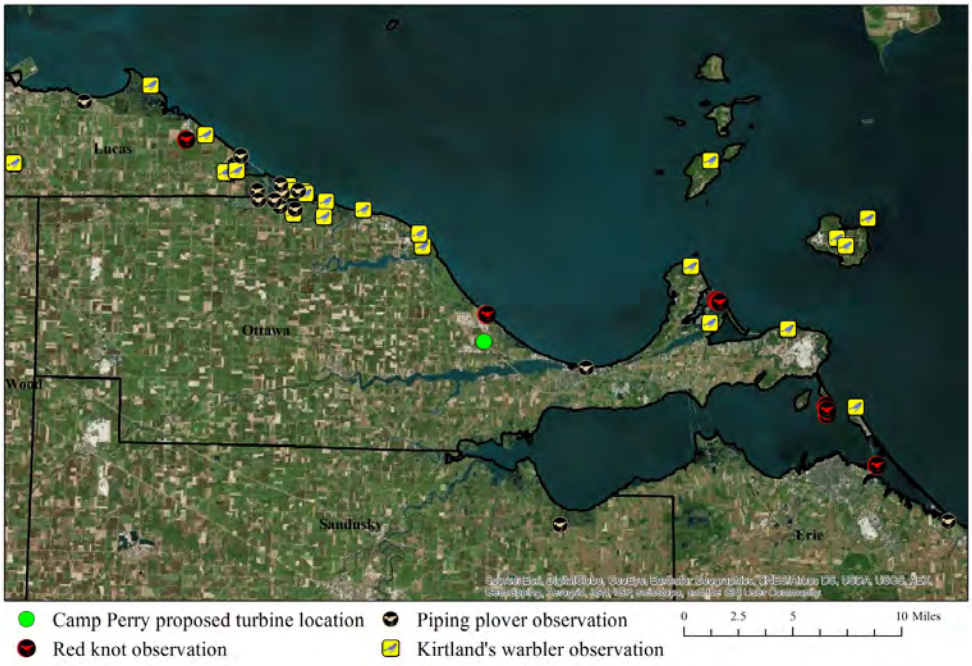
Rangewide Status: Following listing under the Endangered Species Act, the Kirtland's warbler population level remained relatively stable at approximately 200 singing males but experienced record lows of only 167 singing males in 1974 and again in 1987. Shortly after 1987, the population began a dramatic increase, reaching a record high of 1,828 singing males in 2011.

Status in Ohio: Kirtland's warblers do not breed within Ohio. But, outside of Michigan, Ohio has the highest number of Kirtland's warbler observations during migration, signifying that a significant portion of the population passes through Ohio on their way to and from the Bahamas. Kirtland's warblers typically pass through Ohio in 22 April – 1 June, and 15 August – 15 October. Kirtland's warblers have been documented in Ottawa County, within 5.2 miles of the project area (Figure 3).

Critical Habitat: No Critical Habitat has been designated for this species at this time.

Conservation Needs: Artificial regeneration of suitable habitat has been critical to Kirtland's warbler dramatic rebound in population size. In addition to forest management, brown-headed cowbird control has been identified as a continuing conservation need.

Figure 3. Observations of listed species of bird in Ottawa County, Ohio.



ENVIRONMENTAL BASELINE

The Environmental Baseline analyzes the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and the ecosystem within the Action Area. In order to assess the potential for take of listed birds to occur within the Action Area, the Service must formulate reasonable assumptions. These assumptions must be made in order to analyze the potential effects of the action. It is important to note that the Service has been mandated by Congress to provide the benefit-of-the-doubt to federally listed species (H.R.Conf. Report No. 697, 96th Cong., 2d Session, 1979). That is to say, the Service must err on the conservative side (the side of the species) when making reasoned assumptions.

Status of the Species in the Action Area

None of the three listed bird species (Kirtland's warbler, rufa red knot, and piping plover) breed or winter within the Action Area, thus the risk this project poses is limited to the migration period. While each of the species has been found within Ottawa County, and several within a few miles of the site during migration, none have been observed with the Action Area (Figure 3).

Factors affecting the Species' Environment in the Action Area

The Action Area is primarily comprised of maintained lawn, asphalt (parking lots and roads), a small sediment retention pond, and several buildings (Table 3). Based upon aerial photographs there are approximately three trees within the Action Area. The vegetation and habitat types within the Action Area do not represent suitable habitat for these species. However, the airspace within the action area may provide suitable migration habitat. As rufa red knot, piping plover, and Kirtland's warbler are all known to occur within a few miles of the Action Area during migration, it is reasonable to assume that they may also fly through the airspace in the Action Area during migration. If they were to fly through the airspace of the Action Area during migration they may be struck by the turbine.

EFFECTS OF THE ACTION

Direct Effects

Birds are known to occasionally collide with tall stationary structures such as buildings, power lines, and communication towers. It is estimated that between 100 million and 1 billion birds are killed annually in the U.S. from striking man-made structures (Klem 1990; Manville 2000). Wind turbines pose an added threat to birds which may collide with the stationary base, or may be struck by the spinning blades (Erickson et al. 2014). Erickson et al. 2003 estimated that between 20,000 and 37,000 birds are struck by turbines each year. Rates of avian collision mortality at existing wind facilities in the east and upper Midwest of the United States have been documented to range from zero to approximately 10 bird fatalities per turbine per year (Erickson et al. 2001). Although avian collision mortality can occur at any time of year, patterns in avian

collision mortality at tall towers, buildings, wind turbines, and other structures suggest that the majority of fatalities occur during the spring and fall migration period (NRC 2007). Limited data from existing wind facilities suggest that migrant species represent roughly half the fatalities, while resident species represent the other half (NRC 2007).

While most bird mortality estimates are generated from commercial-scale wind energy facilities, bird mortality has also been documented at non-utility-scale turbines. The Ohio Department of Natural Resources has been working with the public to monitor three small turbines for bird and bat mortality. Over the last 4 years a total of 18 birds have been found as a result of these searches (USFWS unpublished data).

Using data from 116 post-construction monitoring studies conducted at wind energy facilities, Erickson et al. (2014) estimated the small bird mortality rate at wind turbines to be 2.10 to 3.35 birds/megawatt (MW) annually. The shoreline of Lake Erie, specifically Ottawa County (the County where this project is proposed), is known to be an important stopover location for large numbers of birds during spring and fall migration; while many of the locations used for the Erickson et al. study area may be "low bird-use" areas (agricultural areas). Thus the higher estimate of 3.35 birds/MW was used while estimating take for these species. While some facilities have documented higher than average bird mortality levels reported by Erickson et al. (2014), the ANG is proposing to use strict cut-in speed and curtailment methods at night during spring and fall migration for birds, and at night during summer for bats in order to keep mortality rates low. Thus, we believe it is reasonable to assume that higher than average bird mortality is not likely to occur at the ANG wind turbine. The model turbine proposed for this location is a 600 kilowatt (0.6 MW) turbine. The expected operational life-span of a turbine is approximately 25 years, thus we assume this turbine will operate for 25 years.

Rufa red knot

Erickson et al. (2014) estimated that shorebirds comprised approximately 1% of the birds found at the 116 projects included within the study. Thus, we assume that 1% of all birds killed at the ANG wind turbine over the 25 year life of the project will be shorebirds. Since there were no species-specific estimates of mortality for shorebirds, in order to estimate a "worst-case" scenario we assume that all shorebirds found at this project could be rufa red knots. To estimate rufa red knot mortality over the life of the ANG turbine, we multiply the number of birds anticipated to be killed per MW of energy generated per year by the 25 year life span of the project by percent shorebird composition of the all-bird mortality rate by the wattage of the ANG turbine:

3.35 birds/MW/year * 25 years * 1% shorebird composition * 0.6 MW turbine = 0.50 rufa red knots over the 25 year period.

It is not possible to only take 0.5 birds, thus we assume that one rufa red knot will be killed over the life of the ANG turbine.

Due to the broad overwintering range of the red knot there are currently no range-wide population estimates for this species (USFWS 2014b). Summing the results of various overwintering surveys gives an estimate of approximately 30,000 birds. The take of one bird over a 25 year period would represent 0.003% of this one-year estimate. This level of take is unlikely to effect the distribution or reproductive success, or significantly impact the number of individuals within the population of this species.

Piping plover

Erickson et al. (2014) estimated that shorebirds comprised approximately 1% of the birds found at the 116 projects included within the study. Thus, we assume that 1% of all birds killed at the ANG wind turbine over the 25 year life of the project will be shorebirds. Since there were no species specific estimates of mortality for shorebirds, in order to estimate a "worst-case" scenario we assume that all shorebirds found at this project could be piping plovers. To estimate piping plover mortality over the life of the ANG turbine, we multiply the number of birds anticipated to be killed per MW of energy generated per year by the 25 year life span of the project by percent shorebird composition of the all-bird mortality rate by the wattage of the ANG turbine:

3.35 birds/MW/year * 25 years * 1% shorebird composition * 0.6 MW turbine = 0.50 piping plovers over the 25 year period

It is not possible to only take 0.5 birds, thus we assume that one piping plover will be killed over the life of the ANG turbine.

In 2009 the Great Lakes population of piping plovers was estimated to be 126 individuals (USFWS 2003). At current population levels the take of one bird over a 25 year period would represent 0.79% of the population. This level of take is unlikely to effect the distribution or reproductive success, or significantly impact the numbers of individuals within the population of this species.

Kirtland's warbler

Wood warblers comprise 10.8% of bird mortalities at wind turbines (Erickson et al. 2014). While a Kirtland's warbler has never been documented during post-construction mortality studies at wind energy facilities, blackpoll warblers (*Setophaga striata*), which are also nocturnally migrating wood warblers of similar size, have been found at wind turbine facilities. Blackpoll warblers comprised 1.6% of the birds found during the post-construction monitoring studies pooled by Erickson et al. (2014). The International Union for Conservation of Nature (IUCN) Red List of Threatened Species lists the blackpoll warbler as a species of "Least Concern," and that the species population is "extremely large" (IUCN 2012, accessed 1/11/2016). Therefore it is more likely that a blackpoll warbler would strike the turbine than a Kirtland's warbler, however in order to estimate a "worst-case" scenario we assume that the number of blackpoll warblers that may be taken is equivalent to the number of Kirtland's warblers that may be taken.

To estimate Kirtland's warbler mortality over the life of the ANG turbine, we multiply the number of birds anticipated to be killed per MW of energy generated per year by the 25 year life span of the project by percent blackpoll warbler composition of the all-bird mortality rate by the wattage of the ANG turbine:

3.35 birds/MW/year * 25-years * 1.6% blackpoll composition * 0.6 MW turbine = 0.804 Kirtland's warblers over the 25 year period

It is not possible to only take 0.804 birds, thus we assume that one Kirtland's warbler will be killed over the life of the ANG turbine.

During the 2011 census of singing male Kirtland's warbler over 1,800 males were found (USFWS 2012a). Given a 50:50 sex ratio, this would result in a population of approximately 3,600 individuals. At current population levels the take of one bird over 25 years would represent 0.02% of the population. This level of take is unlikely to effect the distribution or reproductive success, or significantly impact the numbers of individuals within the population of this species.

Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur. Because the primary effect is caused by operation of the turbine, effects are largely direct. Further, because no suitable habitat occurs within the Action Area, no indirect effects are anticipated from habitat loss.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act.

Because most of the Action Area is federally owned by ANG, future activities on this portion of the Action Area would be subject to a separate consultation under section 7 of the Act, and thus are not considered in cumulative effects.

A portion of the Action Area is comprised of State Route 2 and adjacent right-of-way, owned by the Ohio Department of Transportation (ODOT). ODOT receives substantial funding from the Federal Highway Administration, a federal agency, to operate, maintain, repair, and reconstruct roads, and thus, all ODOT projects are considered federal actions and are subject to separate consultation under section 7 of the Act. ODOT actions therefore, are not considered in cumulative effects.

Due to the small size of the Action Area, and that the Action Area is all federally-owned, it is unlikely that any additional non-Federal projects would occur within this area that would contribute to cumulative effects.

Summary of Effects

Based upon mortality rates observed at other turbines we anticipate that a maximum of one individual rufa red knot, piping plover, and Kirtland's warbler may be subject to lethal take during the 25 year lifespan of this project. Because there will be no impacts to suitable habitat, no indirect impacts are expected. Take of one of each individual species is unlikely to impact the reproduction, numbers, or distribution of any of the species over 25 years.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the rufa red knot, piping plover, or Kirtland's warbler. No critical habitat exists for these species within the Action Area; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Take Anticipated

The Service believes that over the 25 year expected lifespan of this turbine potentially one of each of the species covered in this Biological Opinion (rufa red knot, piping plover, and Kirtland's warbler) may be taken. If the take of one of these species is documented the ANG

should reinitiate consultation with this office prior to continuing operation of the turbine in order to avoid exceeding the level of take analyzed in this Biological Opinion.

Effect of the Take
Due to the extremely low level of take expected from this project, impacts to the distribution, reproductive success, or significant impacts to the overall population for the three species covered in this Biological Opinion are not anticipated. This project is not likely to cause jeopardy to the Kirtland's warbler, piping plover, or the rufa red knot.

Reasonable and Prudent Measures
The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the impacts of incidental take of listed birds during the construction and operation of the ANG Camp Perry Wind Project:

1. Conduct post-construction monitoring at the turbine for at least two years commencing as soon as the turbine is operational.
2. Provide the Service with results of post-construction monitoring studies annually.
3. Reduce lighting around the turbine to the maximum extent practicable.
4. Should the turbine be inoperable for more than one year, the turbine should be removed.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the ESA, ANG must comply with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are non-discretionary.

1. At a minimum post-construction monitoring effort should follow that of Ohio Department of Natural Resources Division of Wildlife *Small-Turbine Fatality Search Protocols* (attached). Any proposed variation from this protocol should be approved by the U.S. Fish and Wildlife Service Ohio Ecological Services Field Office.
2. Reports on the results of post-construction monitoring annually, including incidental finds. Reports are due annually one year after the start of monitoring.

Conservation Recommendations
Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid the adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

The Service has identified the following actions that, if undertaken by ANG, would further the conservation of the listed birds.

1. Restoration of scrub/shrub habitat along the shoreline of Lake Erie to provide important stopover habitat for migrating song birds including Kirtland's warbler.
2. Beach restoration or enhancement to improve stopover habitat for red knot, piping plover, and other shorebirds.

Reinitiation Notice
This concludes formal consultation for ANG's actions outlined in your request received October 23, 2015. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (if any of the species covered in this Biological Opinion are found incidentally or during post-construction studies); (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, such as a proposed change in the operational minimization measures based on research results; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

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APPENDIX C
OHIO STATE LISTED THREATENED, ENDANGERED, SPECIES OF CONCERN, AND SPECIES OF INTEREST

Ohio State Listed Threatened, Endangered, Species of Concern, and Species of Interest with the Potential to Occur on the Camp Perry Air National Guard Station

Scientific Name	Common Name	State Status
Amphibians		
Ambystoma latarale	Blue-Spotted Salamander	Endangered
Birds		
Anas crecca	Green-Winged Teal	Species of Special Interest
Ardea alba	Great Egret	Species of Concern
Bubulcus ibis	Cattle Egret	Endangered
Charadrius melodus	Piping Plover	Endangered
Dolichonyx oryzivorus	Bobolink	Species of Concern
Junco hyemalis	Dark-Eyed Junco	Species of Special Interest
Regulus satrapa	Golden-Crowned Kinglet	Species of Special Interest
Sphyrapicus varius	Yellow-Bellied Sapsucker	Species of Concern
Sterna hirundo	Common Tern	Endangered
Mammals		
Eptesicus fuscus	Big Brown Bat	Species of Concern
Lasionycteris noctivagans	Silver-Haired Bat	Species of Concern
Lasiurus borealis	Red Bat	Species of Concern
Lasiurus cinereus	Hoary Bat	Species of Concern
Myotis lucifugus	Little Brown Bat	Species of Concern
Myotis septentrionalis	Northern Long-Eared Bat	Species of Concern[1]
Myotis sodalis	Indiana Bat	Endangered[1]
Nycticeius humeralis	Evening Bat	Species of Special Interest
Reptiles		
Nerodia sipedon insularum	Lake Erie Watersnake	Threatened
Thamnophis sirtalis sirtalis	Eastern Gartersnake	Species of Concern

Source: ODNR 2012

[1] Also a federally listed species

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OTTAWA COUNTY

State Status	Federal Status	County	Category	Species	CommonName	Sensitive Species	Most Recent Record	FWS
Endangered	Endangered	Ottawa	Bird	Charadius melodus	Piping Plover	No		*
Endangered	Endangered	Ottawa	Bird	Dendroica kirtlandii	Kirtland's Warbler	No		*
Endangered		Ottawa	Fish	Opsopoeodus emiliae	Pugnose Minnow	No	2011	
Endangered	Endangered	Ottawa	Invert. - fw bivalve	Epioblasma torulosa rangiana	Northern Riffleshell	No	1976	
Endangered	Endangered	Ottawa	Invert. - fw bivalve	Epioblasma triquetra	Snuffbox	No	1977	
Endangered		Ottawa	Invert. - fw bivalve	Ligumia nasuta	Eastern Pondmussel	No	2013	
Endangered	Endangered	Ottawa	Invert. - fw bivalve	Villosa fabalis	Rayed Bean	No	1977	
Endangered	**Endangered**	**Ottawa**	**Mammal**	**Myotis sodalis**	**Indiana Myotis**	**Yes**		*
Endangered	**Candidate**	**Ottawa**	**Reptile - Snake**	**Sistrurus catenatus catenatus**	**Eastern Massasauga**	**Yes**		*
Threatened		Ottawa	Fish	Percina copelandi	Channel Darter	No	1996	
Threatened		Ottawa	Insect - caddisfly	Hydroptila albicornis		No	1939	
Threatened		Ottawa	Invert. - fw bivalve	Ligumia recta	Black Sandshell	No	2008	
Threatened		Ottawa	Invert. - fw bivalve	Obliquaria reflexa	Threehorn Wartyback	No	2013	
Threatened		Ottawa	Invert. - fw bivalve	Truncilla donaciformis	Fawnsfoot	No	2012	
Threatened		Ottawa	Invert. - fw bivalve	Uniomerus tetralasmus	Pondhorn	No	2008	
Threatened	Species of Concern	Ottawa	Reptile - Snake	Nerodia sipedon insularum	Lake Erie Watersnake	No		*
Threatened		Ottawa	Reptile - Turtle	Clemmys guttata	Spotted Turtle	Yes	1962	
Threatened		**Ottawa**	**Reptile - Turtle**	**Emydoidea blandingii**	**Blanding's Turtle**	**Yes**	**2007**	
Species of Concern		Ottawa	Amphibian - Frog / Toad	Acris crepitans crepitans	Eastern Cricket Frog	No	1970	
Species of Concern		Ottawa	Bird	Accipiter striatus	Sharp-shinned Hawk	No	2013	
Species of Concern		Ottawa	Bird	Ammodramus henslowii	Henslow's Sparrow	No	2013	
Species of Concern		Ottawa	Bird	Cistothorus palustris	Marsh Wren	No	2013	
Species of Concern		Ottawa	Bird	Dendroica cerulea	Cerulean Warbler	No	2013	
Species of Concern		Ottawa	Bird	Porzana carolina	Sora Rail	No	2006	
Species of Concern		Ottawa	Bird	Protonotaria citrea	Prothonotary Warbler	No	2013	
Species of Concern		Ottawa	Bird	Sphyrapicus varius	Yellow-bellied Sapsucker	No	2013	
Species of Concern		Ottawa	Fish	Esox masquinongy	Muskellunge	No	2008	
Species of Concern		Ottawa	Fish	Moxostoma carinatum	River Redhorse	No	2010	
Species of Concern		Ottawa	Invert. - decapod	Orconectes (Crokerinus) propinquus	Great Lakes Crayfish	No	2007	
Species of Concern		Ottawa	Invert. - fw bivalve	Cyclonaias tuberculata	Purple Wartyback	No	1994	
Species of Concern		Ottawa	Invert. - fw bivalve	Lampsilis fasciola	Wavy-rayed Lampmussel	No	1961	
Species of Concern		Ottawa	Invert. - fw bivalve	Pleurobema sintoxia	Round Pigtoe	No	2013	
Species of Concern		Ottawa	Invert. - fw bivalve	Ptychobranchus fasciolaris	Kidneyshell	No	1996	

Species of Concern		Ottawa	Invert. - fw bivalve	Simpsonaias ambigua	Salamander Mussel	No	1990
Species of Concern		Ottawa	Invert. - fw bivalve	Truncilla truncata	Deertoe	No	2013
Species of Concern		Ottawa	Mammal	Eptesicus fuscus	Big Brown Bat	No	2013
Species of Concern		Ottawa	Mammal	Lasionycteris noctivagans	Silver-haired Bat	No	1982
Species of Concern		Ottawa	Mammal	Lasiurus borealis	Red Bat	No	2013
Species of Concern		Ottawa	Mammal	Lasiurus cinereus	Hoary Bat	No	2013
Species of Concern		Ottawa	Mammal	Myotis lucifugus	Little Brown Bat	No	1978
Species of Concern	Threatened	Ottawa	Mammal	Myotis septentrionalis	Northern Long-eared Bat	No	2013
Species of Concern		Ottawa	Mammal	Peromyscus maniculatus	Deer Mouse	No	2005
Species of Concern		Ottawa	Mammal	Taxidea taxus	Badger	No	2006
Species of Concern		Ottawa	Reptile - Snake	Pantherophis vulpinus	Eastern Foxsnake	No	1962
Species of Concern		Ottawa	Reptile - Snake	Regina septemvittata	Queensnake	No	1967
Special Interest		Ottawa	Bird	Anas rubripes	American Black Duck	No	2009
Special Interest		Ottawa	Bird	Carduelis pinus	Pine Siskin	No	2013
Special Interest		Ottawa	Bird	Carpodacus purpureus	Purple Finch	No	2013
Special Interest		Ottawa	Bird	Catharus guttatus	Hermit Thrush	No	2013
Special Interest		Ottawa	Bird	Certhia americana	Brown Creeper	No	2013
Special Interest		Ottawa	Bird	Dendroica caerulescens	Black-throated Blue Warbler	No	2013
Special Interest		Ottawa	Bird	Dendroica fusca	Blackburnian Warbler	No	2013
Special Interest		Ottawa	Bird	Dendroica magnolia	Magnolia Warbler	No	2013
Special Interest		Ottawa	Bird	Empidonax minimus	Least Flycatcher	No	2013
Special Interest		Ottawa	Bird	Gallinago delicata	Wilson's Snipe	No	2013
Special Interest		Ottawa	Bird	Junco hyemalis	Dark-eyed Junco	No	2013
Special Interest		Ottawa	Bird	Oporornis philadelphia	Mourning Warbler	No	2013
Special Interest		Ottawa	Bird	Regulus satrapa	Golden-crowned Kinglet	No	2013
Special Interest		Ottawa	Bird	Seiurus noveboracensis	Northern Waterthrush	No	2007
Special Interest		Ottawa	Bird	Sitta canadensis	Red-breasted Nuthatch	No	2013
Special Interest		Ottawa	Bird	Wilsonia canadensis	Canada Warbler	No	2013
Extirpated		Ottawa	Bird	Vermivora chrysoptera	Golden-winged Warbler	No	2013

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APPENDIX D
AMENDMENT TO THE ON-SHORE BIRD AND BAT PRE- AND POST- CONSTRUCTION MONITORING PROTOCOL FOR COMMERCIAL WIND ENERGY FACILITIES IN OHIO

Amendment to the On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio
Revision: June 2012

In 2009, the Ohio Department of Natural Resources (ODNR), Division of Wildlife developed the *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (dated May 4, 2009). Standardized procedures within this document have and will continue to allow the Division of Wildlife to make comparisons among proposed on-shore wind energy facilities throughout the state. Since the development of the 2009 protocol, the wind industry has expanded throughout the Midwest and the country. Accordingly, there have been several wind facilities that have conducted post-construction evaluations examining the potential impacts wind energy facilities have on wildlife. Several different methodologies have been utilized and suggested in post-construction monitoring of wind energy facilities; some have been more efficient and more statistically accurate than others. Given the importance of being adaptive to the new science provided by the existing monitoring, and evaluations of protocols, as well as a need for a more efficient methodology, the ODNR Division of Wildlife has recently reviewed the Mortality Search section of the *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (dated May 4, 2009) and amended this section of the protocol.

The objectives of the post-construction monitoring in Ohio are to determine if wind energy facility operations are causing an unacceptable level of impact on wildlife, as well as evaluate potential rare events. Results from monitoring will enable ODNR Division of Wildlife to make recommendations on additional minimization or mitigation measures that, if needed, can be employed. Additionally, the ODNR Division of Wildlife will assess the predictive value of pre-construction monitoring by comparing those results with post-construction mortality, and ultimately provide Ohio-specific data to define typical or expected versus unacceptable levels of mortality to wildlife from wind energy facilities within Ohio.

The amended protocol provides the developers with two options (Options A and B) for standardized post-construction mortality search protocols. Option A includes daily searches and search distances that are twice the blade length, as specifically detailed in the *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* dated May 4, 2009. Option B methodology includes a smaller sample of turbines searched using the Option A protocol, and a double-sampling protocol that consists of searches on cleared plots that are sampled every 3 days and a roads and pads search that is sampled weekly (outlined in Table 1). ODNR Division of Wildlife will review site-specific data for each wind facility, when determining if the facility is eligible for both (Options A and B) post-construction monitoring protocols. Facilities requiring an HCP, have significant wildlife concerns, or areas with boundaries that encompass greater than 50% red areas (i.e., extensive

1

monitoring) from ODNR pre-construction monitoring maps, will likely be ineligible for Option B.

One of the two standardized protocols must be followed for a minimum of the first two years of post-construction monitoring, no other variation will be considered until there is sufficient data to evaluate the protocols. For both options, post-construction monitoring should commence immediately (within 2 weeks) following date of first operation, if operation is initiated during 1 April to 15 November. In this circumstance, the first year of post-construction monitoring may be extended over 2 calendar years (e.g., start monitoring 1 July 2011 continue to 15 November 2011, resume monitoring 1 April 2012 to 30 June 2012). If the facility begins operation during 16 November to 31 March, monitoring will begin on 1 April and continue to 15 November.

If a facility is eligible for Option B and meet all of the below listed criteria, then all search plots can change to a 3-day interval during June and July, and again from 15 October to 15 November.

Criteria for amended Option B (all must apply):

- Scavenger rate, based on a minimum of 20 samples during April and May (and again in August and September), must have an average that is greater than or equal to 5 days.
- The mean number of birds killed per turbine sampled must be less than or equal to 50% above the mean regional average (2.5; +50% = 3.75), pro-rated for 2 months of the year (critical value = 0.62), during April and May (and again in August and September).
- The mean number of bats killed per turbine sampled must be less than or equal to 50% above the mean regional average (9.6; +50% = 14.4), pro-rated for 2 months of the year (critical value = 2.40), during April & May (and again in August and September).
- If the facility as a whole, based on sampling a subset of turbines, meets all 3 criteria listed above, then any turbines with daily search requirements can be switched to searching on a 3-day interval during June and July (or from mid-October thru mid-November). The only exception would be that any individual turbine that had >5 birds/bats in total found on any sampling day on 3 or more occasions during April and May (or again in August and September) would still need to be sampled daily.

Depending on the results of the first year, ODNR Division of Wildlife will determine if post-construction monitoring will continue into the second year or be reduced (i.e., focused on time periods when higher numbers of fatalities were detected). A similar assessment and determination will be provided after the second year, if a continuation is deemed necessary.

2

The number of turbines searched will depend on the number of turbines at the facility, as well as the protocol option chosen (Table 1). Turbines to be searched will be randomly selected, but may include specific turbines in areas of concern if so noted by the ODNR Division of Wildlife or U.S. Fish & Wildlife Service based on pre-construction monitoring results. Turbines randomly selected should be assessed and approved by ODNR Division of Wildlife prior to initiation of post-construction monitoring. Recommendations for monitoring during additional years following may differ, as noted above, both in terms of time period, specific turbines and number of turbines searched to address potential wildlife impacts.

The results of the mortality searches should be submitted to ODNR Division of Wildlife and U.S. Fish and Wildlife Service for review. All original data forms and electronic data detailing all raw data from post-construction monitoring will be provided to ODNR Division of Wildlife. ODNR will provide a standardized blank electronic database that should be used for all Ohio post-construction projects.

Sample size and search protocols

Table 1. A comparison of the amended ODNR Division of Wildlife mortality search protocol options for the *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio.*

Protocol	Search time interval	Search distance from turbine (m)[c]	Sample size (# turbines searched)	Plots cleared [a]
Option A.				
2009 ODNR [a]	daily (7d/wk)	twice blade length	Facilities with ≤10 total turbines: all searched, 11-40 turbines: 1/2 searched, minimum of 10 turbines searched, or >40 turbines: 1/4 searched, minimum of 20. And all meteorological towers.	No
Option B.				
2009 ODNR [a]	daily (7d/wk)	twice blade length	10% of the total turbines, or minimum of 5 and any meteorological tower with guy wires.	No
3-day, plots cleared [a]	every 3 days (3 day interval)	1.2 times the blade length or a minimum of 60 m	= the total number of turbines in Option A minus the number of turbines in the box immediately above (3-	Yes

Roads and pads [b]	weekly	within 100 m of turbine	day search) – remaining turbines in boundary that are not searched with another method	Yes

[a] Option A (ODNR 2009 protocol) does not require clearing of searched plots, however in agricultural areas it is suggested that developers encourage landowners to plant areas within 60 meters of the turbine in either soybean or wheat crops to increase the probability of detecting carcasses. For Option B, the turbines in the 3-day search-interval sample should have the entire search plot cleared. Cleared will be defined as *vegetation maintained at a height of 4 inches or less, with less than 2% of interspersed vegetation no higher than 12 inches.* If mowing is used to clear and maintain plots, mowing should only occur within 12 hours of the last mortality search.

[b] The roads and pads searches are part of a double-sampling technique and must be used in conjunction with the cleared plot searches. Including the roads and pads weekly method allows sampling to occur at all the turbines, which could capture the variability for the entire facility. The double-sampling technique will use the data collected from cleared plots used as a correction factor for the data for the roads and pads searches. In the analyses, the double-sampling technique will be used to calculate a facility-wide mortality estimate.

[c] At each turbine search plot, north-south oriented transects should be established every 5 meters. The length of these transects, and perpendicular distance that transects should extend from the turbine base should be equal to 1.2 or 2 times the blade length of the turbine being searched (depending on the methods). Transects should not venture into hazardous areas, such as steep slopes or high water.

All searches should begin at first light; this reduces the number of carcasses removed by diurnal scavengers and increases the likelihood of recovering live individuals. The appropriate number of surveyors should be hired to completely search the allotted turbines by 1:00 p.m. The initial start and stop time should be recorded for each survey. Searchers should walk slowly, scanning ~ 2.5 meters on either side of the transect. When a bird or bat is encountered, the distance when the observer first detected it should be recorded. The searcher should then assess whether the individual is alive or dead. If the individual is alive, efforts should be made to release or take the animal to a licensed rehabilitator[1]. If successful rehabilitation is not likely, then the individual should be humanely euthanized through cervical dislocation[2]. For each individual (regardless of dead or alive), the site should be flagged, and returned to after the turbine search has been completed. Once relocated, a photograph should be taken of the carcass before it is moved. The carcass should be collected in individual re-sealable plastic bags, and the carcass identification number written in pencil on a piece of write-in-the-rain paper enclosed with the carcass. All information on the "Fatality Reporting Form" should be

[1] Contact the Ohio Division of Wildlife District office nearest to the site for area wildlife rehabilitators.
[2] If the species in question is a state or federally protected species the appropriate agency must be contacted before the individual is euthanized.

recorded. Mortalities encountered outside the bounds of an official search should be collected, and the above information recorded, but "Incidental" should be written into the notes area. These will not be used in the calculation of site mortality rates, but may (depending on species) be used in searcher efficiency or carcass removal trials. Bats within the *Myotis* family are difficult to differentiate, and should not be used for scavenging rate or searcher efficiency trials. These carcasses should be frozen and given to the ODNR Division of Wildlife at a prearranged date. If a state or federal threatened or endangered species is located, the ODNR Division of Wildlife and U.S. Fish & Wildlife Service must be contacted within 48 hours. At that time arrangements will be made for turning over the carcass to the appropriate agency. If a larger than expected mortality event occurs, ODNR Division of Wildlife and the U.S. Fish & Wildlife Service must be notified within 24 hours. For our purposes a significant mortality event will be defined as >5 birds/bats at an individual turbine, and/or >20 birds and/or bats across the entire facility.

Vegetation mapping
Vegetation mapping should be done for each of the searched turbines 3 times a year (spring, summer, and fall), regardless of search protocol. Mapping will consist of recording the GPS location, vegetation height and percent cover (1-meter transect) every 10 meters for each transect. Additional points should be taken at abrupt transition zones such as the edge of a road. An estimate of searchable area should be also provided for each searched turbine.

Searcher efficiency trials
Search efficiency trials consist of placing test carcasses at locations chosen at random to assess an individual's ability to detect turbine mortalities. Carcasses should be placed on search plots unbeknownst to the searchers and by someone who is not actively involved in the mortality searches. Individual trials should be conducted randomly at least 200 times each year (a trial consists of the placement of an individual carcass). For those facilities that are using Option B mortality searches, the number of random trials for each protocol (daily, 3-day cleared plots, and roads and pads) should be reviewed by ODNR Division of Wildlife as part of the facilities post-monitoring study plan. Carcasses may be used for multiple trials throughout the season. Each carcass should be placed at a turbine, with distance (within the searched area) and direction selected at random. Each carcass should be discreetly marked to identify it as a trial individual. Carcasses must be similar to those expected to be encountered during the search and should vary in both species composition and stage of decomposition. After a searcher has finished his or her survey, the individual conducting the efficiency trial should attempt to recover any missed carcasses to ascertain whether they were scavenged prior to the beginning of the search.

Scavenging rate trials
In an effort to assess how quickly carcasses are removed from the site by scavengers, a minimum of 50 carcasses per year should be placed at random distances and directions. Although the number of scavenging rates will be the same for both options (A and B), for those facilities that are using Option B mortality searches, the proportion for each protocol (daily, 3-day cleared plots, and roads and pads) should be reviewed by ODNR

Division of Wildlife as part of the facilities post-monitoring study plan. Several carcasses should be placed each month, since rates are likely to change throughout the year. Each carcass should be discreetly marked to identify it as a trial individual. These carcasses should be checked daily for the first week, then every 2 days until the carcass is removed or completely decomposed. Preferably, carcasses used for scavenging rate estimation will be those collected from the site, and not surrogate species such as pigeons, starlings, or house sparrows since these have been found to be scavenged less frequently. Characteristics that should be recorded for each placed carcass include: the GPS location, vegetation height, percent cover, distance/direction from turbine, and species.

Wildlife monitoring
The amended searcher protocol does not impact the need for wildlife monitoring to include acoustic monitoring and breeding bird surveys. These survey methods should follow the *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (dated May 4, 2009).

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6

APPENDIX E
USFWS LAND-BASED ENERGY WIND ENERGY GUIDELINES

U.S. Fish & Wildlife Service

U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines

Cover Photo:

Wind Turbine. Photo by Stefanie Stavrakas, USFWS

U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines

OMB Control No, 1018-0148
Expiration Date: 12/31/2014

U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines

March 23, 2012

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The U.S. Fish and Wildlife Service (Service) would like to recognize and thank the Wind Turbine Guidelines Advisory Committee for its dedication and preparation of its Recommendations. The Recommendations have served as the basis from which the Service's team worked to develop the Service's Land-Based Wind Energy Guidelines. The Service also recognizes the tireless efforts of the Headquarters, Regional and Field Office staff that helped to review and update these Guidelines.

Paperwork Reduction Act Statement: The Land-Based Wind Energy Guidelines contain reporting and recordkeeping requirements that require Office of Management and Budget approval in accordance with the Paperwork Reduction Act of 1995. Your response is voluntary. We collect this information in order to provide technical assistance related to addressing wildlife conservation concerns at all stages of land-based wind energy development. For each response, we estimate the time necessary to provide the information as follows:

Tier 1 – 83 hours
Tier 2 – 375 hours
Tier 3 – 2,880 hours
Tier 4 – 2,550 hours
Tier 5 – 2,400 hours

The above estimates include time for reviewing instructions, gathering and maintaining data, and preparing and transmitting reports. Send comments regarding these estimates or any other aspect of the requirements to the Service Information Collection Clearance Officer, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, MS 2042-PDM, Arlington, VA 22203.

We may not conduct and you are not required to respond to a collection of information unless it displays a currently valid OMB control number.

Table of Contents

List of Figures and Tables

Executive Summary

As the Nation shifts to renewable energy production to supplant the need for carbon-based fuel, wind energy will be an important source of power. As wind energy production increases, both developers and wildlife agencies have recognized the need for a system to evaluate and address the potential negative impacts of wind energy projects on species of concern. These voluntary Guidelines provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development. They also promote effective communication among wind energy developers and federal, state, and local conservation agencies and tribes. When used in concert with appropriate regulatory tools, the Guidelines form the best practical approach for conserving species of concern. The Guidelines have been developed by the Interior Department's U.S. Fish and Wildlife Service (Service) working with the Wind Turbine Guidelines Advisory Committee. They replace interim voluntary guidance published by the Service in 2003.

The Guidelines discuss various risks to "species of concern" from wind energy projects, including collisions with wind turbines and associated infrastructure; loss and degradation of habitat from turbines and infrastructure; fragmentation of large habitat blocks into smaller segments that may not support sensitive species; displacement and behavioral changes; and indirect effects such as increased predator populations or introduction of invasive plants. The Guidelines assist developers in identifying species of concern that may potentially be affected by their proposed project, including migratory birds; bats; bald and golden eagles and other birds of prey; prairie and sage grouse; and listed, proposed, or candidate endangered and threatened species. Wind energy development in some areas may be precluded by federal law; other areas may be inappropriate for development because they have been recognized as having high wildlife value based on their ecological rarity and intactness.

The Guidelines use a "tiered approach" for assessing potential adverse effects to species of concern and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail; quantifying the possible risks of proposed wind energy projects to species of concern and their habitats; and evaluating those risks to make siting, construction, and operation decisions. During the pre-construction tiers (Tiers 1, 2, and 3), developers are working to identify, avoid and minimize risks to species of concern. During post-construction tiers (Tiers 4 and 5), developers are assessing whether actions taken in earlier tiers to avoid and minimize impacts are successfully achieving the goals and, when necessary, taking additional steps to compensate for impacts. Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers. Each tier offers a set of questions to help the developer evaluate the potential risk associated with developing a project at the given location.

Briefly, the tiers address:

- Tier 1 – Preliminary site evaluation (landscape-scale screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife and habitat and predict project impacts
- Tier 4 – Post-construction studies to estimate impacts[1]
- Tier 5 – Other post-construction studies and research

The tiered approach provides the opportunity for evaluation and decision-making at each stage, enabling a developer to abandon or proceed with project development, or to collect additional information if required. This approach does not require that every tier, or every element within each tier, be implemented for every project. The Service anticipates that many distributed or community facilities will not need to follow the Guidelines beyond Tiers 1 and 2. Instead, the tiered approach allows efficient use of developer and wildlife agency resources with increasing levels of effort.

If sufficient data are available at a particular tier, the following outcomes are possible:

1. The project proceeds to the next tier in the development process without additional data collection.
2. The project proceeds to the next tier in the development process with additional data collection.
3. An action or combination of actions, such as project

[1] The Service anticipates these studies will include fatality monitoring as well as studies to evaluate habitat impacts.

modification, mitigation, or specific post-construction monitoring, is indicated.

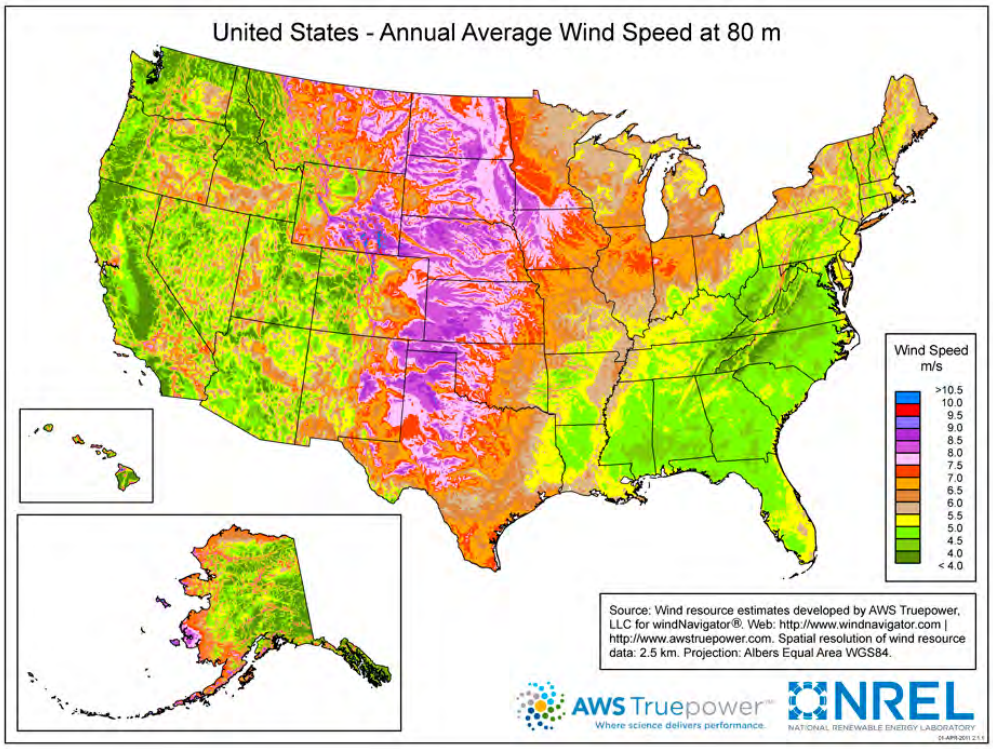
4. The project site is abandoned because the risk is considered unacceptable.

If data are deemed insufficient at a tier, more intensive study is conducted in the subsequent tier until sufficient data are available to make a decision to modify the project, proceed with the project, or abandon the project.

The most important thing a developer can do is to consult with the Service as early as possible in the development of a wind energy project. Early consultation offers the greatest opportunity for avoiding areas where development is precluded or where wildlife impacts are likely to be high and difficult or costly to remedy or mitigate at a later stage. By consulting early, project developers can also incorporate appropriate wildlife conservation measures and monitoring into their decisions about project siting, design, and operation.

Adherence to the Guidelines is voluntary and does not relieve any individual, company, or agency of the responsibility to comply with laws and regulations. However, if a violation occurs the Service will consider a developer's documented efforts to communicate with the Service and adhere to the Guidelines. The Guidelines include a Communications Protocol which provides guidance to both developers and Service personnel regarding appropriate communication and documentation.

The Guidelines also provide Best Management Practices for site development, construction, retrofitting, repowering, and decommissioning. For additional reference, a glossary of terms and list of literature cited are included in the appendices.



Wind Resource Map. Credit: NREL

Chapter 1 - General Overview

The mission of the U.S. Fish and Wildlife Service (Service) is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. As part of this, the Service implements statutes including the Endangered Species Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act. These statutes prohibit taking of federally listed species, migratory birds, and eagles unless otherwise authorized.

Recent studies have documented that wind energy facilities can kill birds and bats. Mortality rates in fatalities per nameplate MW per year vary among facilities and regions. Studies have indicated that relatively low raptor (e.g., hawks, eagles) fatality rates exist at most modern wind energy developments with the exception of some facilities in California and Wyoming. Turbine-related bat deaths have been reported at each wind facility to date. Generally, studies in the West have reported lower rates of bat fatalities than facilities in the East. There is still much uncertainty regarding geographic distribution and causes of bat fatalities (NWCC 2010).

These Guidelines are intended to:

(1) Promote compliance with relevant wildlife laws and regulations;

(2) Encourage scientifically rigorous survey, monitoring, assessment, and research designs proportionate to the risk to species of concern;

(3) Produce potentially comparable data across the Nation;

(4) Mitigate, including avoid, minimize, and compensate for potential adverse effects on species of concern and their habitats; and,

(5) Improve the ability to predict and resolve effects locally, regionally, and nationally.

As the United States moves to expand wind energy production, it also must maintain and protect the Nation's wildlife and their habitats, which wind energy production can negatively affect. As with all responsible energy development, wind energy projects should adhere to high standards for environmental protection. With proper diligence paid to siting, operations, and management of projects, it is possible to mitigate for adverse effects to wildlife, and their habitats. This is best accomplished when the wind energy project developer communicates as early as possible with the Service and other stakeholders. Such early communication allows for the greatest range of development and mitigation options. The following website contains contact information for the Service Regional and Field offices as well as State wildlife agencies: http://www.fws.gov/offices/statelinks.html.

In response to increasing wind energy development in the United States, the Service released a set of voluntary, interim guidelines for reducing adverse effects to fish and wildlife resources from wind energy projects for public comment in July 2003. After the Service reviewed the public comments, the Secretary of the Interior (Secretary) established a Federal Advisory Committee[2] to provide recommendations to revise the guidelines related to land-based wind energy facilities. In March 2007, the U.S. Department of the Interior established the Wind Turbine Guidelines Advisory Committee (the Committee). The Committee submitted its final Recommended Guidelines (Recommendations) to the Secretary on March 4, 2010. The Service used the Recommendations to develop its Land-Based Wind Energy Guidelines.

The Service encourages project proponents to use the process described in these voluntary Land-based Wind Energy Guidelines (Guidelines) to address risks to species of concern. The Service intends that these Guidelines, when used in concert with the appropriate regulatory tools, will form the best practical approach for conservation of species of concern.

Statutory Authorities

These Guidelines are not intended nor shall they be construed to limit or preclude the Service from exercising its authority under any law, statute, or regulation, or from conducting enforcement action against any individual, company, or agency. They are not meant to relieve any individual, company, or agency of its obligations to comply with any applicable federal, state,

[2] Committee membership, from 2008 to 2011, has included: Taber Allison, Massachusetts Audubon; Dick Anderson, California Energy Commission; Ed Arnett, Bat Conservation International; Michael Azeka, AES Wind Generation; Thomas Bancroft, National Audubon; Kathy Boydston, Texas Parks and Wildlife Department; René Braud, EDP Renewables; Scott Darling, Vermont Fish and Wildlife Department; Michael Daulton, National Audubon; Aimee Delach, Defenders of Wildlife; Karen Douglas, California Energy Commission; Sam Enfield, MAP Royalty; Greg Hueckel, Washington Department of Fish and Wildlife; Jeri Lawrence, Blackfeet Nation; Steve Lindenberg, U.S. Department of Energy; Andy Linehan, Iberdrola Renewables; Rob Manes, The Nature Conservancy, Kansas; Winifred Perkins, NextEra Energy Resources; Steven Quarles, Crowell & Moring; Rich Rayhill, Ridgeline Energy; Robert Robel, Kansas State University; Keith Sexson, Association of Fish and Wildlife Agencies; Mark Sinclair, Clean Energy States Alliance; David Stout, U.S. Fish and Wildlife Service; Patrick Traylor, Hogan Lovells.

tribal, or local laws, statutes, or regulations. The Guidelines do not prevent the Service from referring violations of law for enforcement when a company has not followed the Guidelines.

Ultimately it is the responsibility of those involved with the planning, design, construction, operation, maintenance, and decommissioning of wind projects to conduct relevant wildlife and habitat evaluation and determine, which, if any, species may be affected. The results of these analyses will inform all efforts to achieve compliance with the appropriate jurisdictional statutes. Project proponents are responsible for complying with applicable state and local laws.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a Service permit or regulatory authorization, are a violation of the MBTA.

The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird …. [The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." 16 U.S.C. 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 CFR 10.12.

The MBTA provides criminal penalties for persons who commit any of the acts prohibited by the statute in section 703 on any of the species protected by the statute. See 16 U.S.C. 707. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. The MBTA does not protect introduced species such as the house (English) sparrow, European starling, rock dove (pigeon), Eurasian collared-dove, and non-migratory upland game birds. The Service maintains a list of introduced species not protected by the Act. See 70 Fed. Reg. 12,710 (Mar. 15, 2005).

Bald and Golden Eagle Protection Act

Under authority of the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668–668d, bald eagles and golden eagles are afforded additional legal protection. BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. 16 U.S.C. 668. BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," 16 U.S.C. 668c, and includes criminal and civil penalties for violating the statute. See 16 U.S.C. 668. The Service further defined the term "disturb" as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. 50 CFR 22.3. BGEPA authorizes the Service to permit the take of eagles for certain purposes and under certain circumstances, including scientific or exhibition purposes, religious purposes of Indian tribes, and the protection of wildlife, agricultural, or other interests, so long as that take is compatible with the preservation of eagles. 16 U.S.C. 668a.

In 2009, the Service promulgated a final rule on two new permit regulations that, for the first time, specifically authorize the incidental take of eagles and eagle nests in certain situations under BGEPA. See 50 CFR 22.26 & 22.27. The permits authorize limited, non-purposeful (incidental) take of bald and golden eagles; authorizing individuals, companies, government agencies (including tribal governments), and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities such as operating utilities and airports.

Bald Eagle, Credit: USFWS

Removal of active eagle nests would usually be allowed only when it is necessary to protect human safety or the eagles. Removal of inactive nests can be authorized when necessary to ensure public health and safety, when a nest is built on a human-engineered structure rendering it inoperable, and when removal is necessary to protect an interest in a particular locality, but only if the take or mitigation for the take will provide a clear and substantial benefit to eagles.

To facilitate issuance of permits under these new regulations, the Service has drafted Eagle Conservation Plan (ECP) Guidance. The ECP Guidance is compatible with these Land-Based Wind Energy Guidelines. The Guidelines guide developers through the process of project development and operation. If eagles are identified as a potential risk at a project site, developers are strongly encouraged to refer to the ECP Guidance. The ECP Guidance describes specific actions that are recommended to comply with the regulatory requirements in BGEPA for an eagle take permit, as described in 50 CFR 22.26 and 22.27. The ECP Guidance provides a national framework for assessing and mitigating risk specific to eagles through development of ECPs and issuance of programmatic incidental takes of eagles at wind turbine facilities. The Service will make its final ECP Guidance available to the public through its website.

Endangered Species Act

The Endangered Species Act (16 U.S.C. 1531–1544; ESA) was enacted by Congress in 1973 in recognition that many of our Nation's native plants and animals were in danger of becoming extinct. The ESA directs the Service to identify and protect these endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. To this end, federal agencies are directed to utilize their authorities to conserve listed species, and ensure that their actions

Indiana bat. Credit: USFWS

are not likely to jeopardize the continued existence of these species or destroy or adversely modify their critical habitat. Federal agencies are encouraged to do the same with respect to "candidate" species that may be listed in the near future. The law is administered by the Service and the Commerce Department's National Marine Fisheries Service (NMFS). For information regarding species protected under the ESA, see: http://www.fws.gov/endangered/.

The Service has primary responsibility for terrestrial and freshwater species, while NMFS generally has responsibility for marine species. These two agencies work with other agencies to plan or modify federal projects so that they will have minimal impact on listed species and their habitats. Protection of species is also achieved through partnerships with the states, through federal financial assistance and a system of incentives available to encourage state participation. The Service also works with private landowners, providing financial and technical assistance for management actions on their lands to benefit both listed and non-listed species.

Section 9 of the ESA makes it unlawful for a person to "take" a listed species. Take is defined as "... to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." 16 U.S.C. 1532(19). The terms harass and harm are further defined in our regulations. See 50 CFR 17.3. However, the Service may authorize "incidental take" (take that occurs as a result of an otherwise legal activity) in two ways.

Take of federally listed species incidental to a lawful activity may be authorized through formal consultation under section 7(a)(2) of the ESA, whenever a federal agency, federal funding, or a federal permit is involved. Otherwise, a person may seek an incidental take permit under section 10(a)(1)(B) of the ESA upon completion of a satisfactory habitat conservation plan (HCP) for listed species. Developers not receiving federal funding or authorization should contact the Service to obtain an incidental take permit if a wind

Utility-Scale Wind turbine with an anemometer tower in the background. Credit: University of Minnesota College of Science and Engineering

energy project is likely to result in take of listed threatened or endangered wildlife species. For more information regarding formal consultation and the requirements of obtaining HCPs, please see the Endangered Species Consultation Handbook at http://www.fws.gov/endangered/esa-library/index.html#consultations and the Service's HCP website, http://www.fws.gov/endangered/what-we-do/hcp-overview.html.

Implementation of the Guidelines

Because these Guidelines are voluntary, the Service encourages developers to use them as soon as possible after publication. To receive the considerations discussed on page 6 regarding enforcement priorities, a wind energy project would fall into one of three general categories relative to timing and implementation:

- For projects initiated after publication, the developer has applied the Guidelines, including the tiered approach, through site selection, design, construction, operation and post-operation phases of the project, and has communicated and shared information with the Service and considered its advice.
- For projects initiated prior to publication, the developer should consider where they are in the planning process relative to the appropriate tier and inform the Service of what actions they will take to apply the Guidelines.
- For projects operating at the time of publication, the developer should confer with the Service regarding the appropriate period of fatality monitoring consistent with Tier 4, communicate and share information with the Service on monitoring results, and consider Tier 5 studies and mitigation options where appropriate.

Projects that are already under development or are in operation are not expected to start over or return to the beginning of a specific tier. Instead, these projects should implement those portions of the Guidelines relevant to the current phases of the project per the bullets above.

The Service is aware that it will take time for Service staff and other personnel, including wind energy developers and their biologists, to develop expertise in the implementation of these Guidelines. Service staff and many staff associated with the wind energy industry have been involved with developing these Guidelines. Therefore, they have a working knowledge of the Guidelines. To further refine their training, the Service will make every effort to offer an in-depth course within 6 months of the final Guidelines being published.

The Communications Protocol on page 5 provides guidance to Service staff and developers in the exchange of information and recommendations at each tier in the process. Although the advice of the Service is not binding, a developer should review such advice, and either accept or reject it. If they reject it, they should contemporaneously document with reasoned justification why they did so. Although the Guidelines leave decisions up to the developer, the Service retains authority to evaluate whether developer efforts to mitigate impacts are sufficient, to determine significance, and to refer for prosecution any unlawful take that it believes to be reasonably related to lack of incorporation of Service recommendations or insufficient adherence with the Guidelines.

Table 1. Suggested Communications Protocol
This table provides examples of potential communication opportunities between a wind energy project developer and the Service. Not all projects will follow all steps indicated below.

TIER	*Project Developer/Operator Role*	*Service Role*
Tier 1: Preliminary site evaluation	• Landscape level assessment of habitat for species of concern • Request data sources for existing information and literature	• Provide lists of data sources and references, if requested
Tier 2: Site characterization	• Assess potential presence of species of concern, including species of habitat fragmentation concern, likely to be on site • Assess potential presence of plant communities present on site that may provide habitat for species of concern • Assess potential presence of critical congregation areas for species of concern • One or more reconnaissance level site visit by biologist • Communicate results of site visits and other assessments with the Service • Provide general information about the size and location of the project to the Service	• Provide species lists, for species of concern, including species of habitat fragmentation concern, for general area, if available • Provide information regarding plant communities of concern, if available • Respond to information provided about findings of biologist from site visit • Identify initial concerns about site(s) based on available information • Inform lead federal agencies of communications with wind project developers
Tier 3: Field studies and impact prediction	• Discuss extent and design of field studies to conduct with the Service • Conduct biological studies • Communicate results of all studies to Service field office in a timely manner • Evaluate risk to species of concern from project construction and operation • Identify ways to mitigate potential direct and indirect impacts of building and operating the project	• Respond to requests to discuss field studies • Advise project proponent about studies to conduct and methods for conducting them • Communicate with project proponent(s) about results of field studies and risk assessments • Communicate with project proponents(s) ways to mitigate potential impacts of building and operating the project • Inform lead federal agencies of communications with wind project developers
Tier 4: Post construction studies to estimate impacts	• Discuss extent and design of post-construction studies to conduct with the Service • Conduct post-construction studies to assess fatalities and habitat-related impacts • Communicate results of all studies to Service field office in a timely manner • If necessary, discuss potential mitigation strategies with Service • Maintain appropriate records of data collected from studies	• Advise project operator on study design, including duration of studies to collect adequate information • Communicate with project operator about results of studies • Advise project operator of potential mitigation strategies, when appropriate
Tier 5: Other post-construction studies and research	• Communicate with the Service about the need for and design of other studies and research to conduct with the Service, when appropriate, particularly when impacts exceed predicted levels • Communicate with the Service about ways to evaluate cumulative impacts on species of concern, particularly species of habitat fragmentation concern • Conduct appropriate studies as needed • Communicate results of studies with the Service • Identify potential mitigation strategies to reduce impacts and discuss them with the Service	• Advise project proponents as to need for Tier 5 studies to address specific topics, including cumulative impacts, based on information collected in Tiers 3 and 4 • Advise project proponents of methods and metrics to use in Tier 5 studies • Communicate with project operator and consultants about results of Tier 5 studies • Advise project operator of potential mitigation strategies, when appropriate, based on Tier 5 studies

Consideration of the Guidelines in MBTA and BGEPA Enforcement

The Service urges voluntary adherence to the Guidelines and communication with the Service when planning and operating a facility. While it is not possible to absolve individuals or companies from MBTA or BGEPA liability, the Office of Law Enforcement focuses its resources on investigating and prosecuting those who take migratory birds without identifying and implementing reasonable and effective measures to avoid the take. The Service will regard a developer's or operator's adherence to these Guidelines, including communication with the Service, as appropriate means of identifying and implementing reasonable and effective measures to avoid the take of species protected under the MBTA and BGEPA.[3] The Chief of Law Enforcement or more senior official of the Service will make any decision whether to refer for prosecution any alleged take of such species, and will take such adherence and communication fully into account when exercising discretion with respect to such potential referral. Each developer or operator will be responsible for maintaining internal records sufficient to demonstrate adherence to the Guidelines and response to communications from the Service. Examples of these records could include: studies performed in the implementation of the tiered approach; an internal or external review or audit process; a bird and bat conservation strategy; or a wildlife management plan.

If a developer and operator are not the same entity, the Service expects the operator to maintain sufficient records to demonstrate adherence to the Guidelines.

Scope and Project Scale of the Guidelines

The Guidelines are designed for "utility-scale" land-based wind energy projects to reduce potential impacts to species of concern, regardless of whether they are proposed for private or public lands. A developer of a distributed or community scale wind project may find it useful to consider the general principles of the tiered approach to assess and reduce potential impacts to species of concern, including answering Tier 1 questions using publicly available information. In the vast majority of situations, appropriately sited small wind projects are not likely to pose significant risks to species of concern. Answering Tier 1 questions will assist a developer of distributed or community wind projects, as well as landowners, in assessing the need to further communicate with the Service, and precluding, in many cases, the need for full detailed pre-construction assessments or monitoring surveys typically called for in Tiers 2 and 3. If landowners or community/distributed wind developers encounter problems locating information about specific sites they can contact the Service and/or state wildlife agencies to determine potential risks to species of concern for their particular project.

Communication with Christy Johnson-Hughes. Credit: Rachel London, USFWS

The tiered approach is designed to lead to the appropriate amount of evaluation in proportion to the anticipated level of risk that a project may pose to species of concern and their habitats. Study plans and the duration and intensity of study efforts should be tailored specifically to the unique characteristics of each site and the corresponding potential for significant adverse impacts on species of concern and their habitats as determined through the tiered approach. This is why the tiered approach begins with an examination of the potential location of the project, not the size of the project. In all cases, study plans and selection of appropriate study methods and techniques may be tailored to the relative scale, location, and potential for significant adverse impacts of the proposed site.

The Service considers a "project" to include all phases of wind energy development, including, but not limited to, prospecting, site assessment, construction, operation, and decommissioning, as well as all associated infrastructure and interconnecting electrical lines. A "project site" is the land and airspace where development occurs

[3] With regard to eagles, this paragraph will only apply when a project is not likely to result in take. If Tiers 1, 2, and/or 3 identify a potential to take eagles, developers should consider developing an ECP and, if necessary, apply for a take permit

or is proposed to occur, including the turbine pads, roads, power distribution and transmission lines on or immediately adjacent to the site; buildings and related infrastructure, ditches, grades, culverts; and any changes or modifications made to the original site before development occurs. Project evaluations should consider all potential effects to species of concern, which includes species 1) protected by the MBTA, BGEPA, or ESA (including candidate species), designated by law, regulation or other formal process for protection and/or management by the relevant agency or other authority, or that have been shown to be significantly adversely affected by wind energy development; and 2) determined to be possibly affected by the project.

These Guidelines are not designed to address power transmission beyond the point of interconnection to the transmission system.

Service Review Period

The Service is committed to providing timely responses. Service Field Offices should typically respond to requests by a wind energy developer for information and consultation on proposed site locations (Tiers 1 and 2), pre- and post-construction study designs (Tiers 3 and 4), and proposed mitigation (Tier 3) within 60 calendar days. The request should be in writing to the Field Office and copied to the Regional Office with information about the proposed project, location(s) under consideration, and point of contact. The request should contain a description of the information needed from the Service. The Service will provide a response, even if it is to notify a developer of additional review time, within the 60 calendar day review period. If the Service does not respond within 60 calendar days of receipt of the document, then the developer can proceed through Tier 3 without waiting for Service input. If the Service provides comments at a later time, the developer should incorporate the comments if feasible. It is particularly important that if data from Tier 1-3 studies predict that the project is likely to produce significant adverse impacts on species of concern, the developer inform the Service of the actions it intends to implement to mitigate those impacts. If the Service cannot respond within 60 calendar days, this does not relieve developers from their MBTA, BGEPA, and ESA responsibilities.

The tiered approach allows a developer in certain limited circumstances to move directly from Tier 2 to construction (e.g., adequate survey data for the site exists). The developer should notify the Service of this decision and give the Service 60 calendar days to comment on the proposed project prior to initiating construction activities.

Introduction to the Decision Framework Using a Tiered Approach

The tiered approach provides a decision framework for collecting information in increasing detail to evaluate risk and make siting and operational decisions. It provides the opportunity for evaluation and decision-making at each tier, enabling a developer to proceed with or abandon project development, or to collect additional information if necessary. This approach does not require that every tier, or every element within each tier, be implemented for every project. Instead, it allows efficient use of developer and wildlife agency resources with increasing levels of effort until sufficient information and the desired precision is acquired for the risk assessment.

Figure 1 ("General Framework of Tiered Approach") illustrates the tiered approach, which consists of up to five iterative stages, or tiers:

- Tier 1 – Preliminary site evaluation (landscape-scale screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife and habitat and predict project impacts
- Tier 4 – Post-construction studies to estimate impacts[4]
- Tier 5 – Other post-construction studies and research

At each tier, potential issues associated with developing or operating a project are identified and questions formulated to guide the decision process. Chapters Two through Six outline the questions to be posed at each tier, and describe recommended methods and metrics for gathering the data needed to answer those questions.

The first three tiers correspond to the pre-construction evaluation phase of wind energy development. At each of the three tiers, the Guidelines provide questions that developers should answer, followed by recommended methods and metrics to use in answering the questions. Some questions are repeated at each tier, with successive tiers requiring a greater investment in data collection to answer certain questions. For example, while Tier 2 investigations may discover some existing information on federal or state-listed species and their use of the proposed development site, it may be necessary to collect empirical data in Tier 3 studies to determine the presence of federal or state-listed species.

Developers decide whether to proceed to the next tier. Timely communication and sharing of information will allow opportunities for the Service to provide, and developers to consider, technical advice. A developer should base the decision on the information obtained from adequately answering the questions in this tier, whether the methods used were appropriate for the site selected, and the resulting

[4] The Service anticipates these studies will include fatality monitoring as well as studies to evaluate habitat impacts.

U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines

Wind turbines in California. Credit: Rachel London, USFWS

assessment of risk posed to species of concern and their habitats.

If sufficient data are available at a particular tier, the following outcomes are possible:

1. The project proceeds to the next tier in the development process without additional data collection.

2. The project proceeds to the next tier in the development process with additional data collection.

3. An action or combination of actions, such as project modification, mitigation, or specific post-construction monitoring, is indicated.

4. The project site is abandoned because the risk is considered unacceptable.

If data are deemed insufficient at a tier, more intensive study is conducted in the subsequent tier until sufficient data are available to make a decision to modify the project, proceed with the project, or abandon the project.

The tiered approach used in these Guidelines embodies adaptive management by collecting increasingly detailed information that is used to make decisions about project design, construction, and operation as the developer progresses through the tiers. Adaptive management is an iterative learning process producing improved understanding and improved management over time (Williams et al 2007). DOI has determined that its resource agencies, and the natural resources they oversee, could benefit from adaptive management. Use of adaptive management in DOI is guided by the DOI Policy on Adaptive Management. DOI has adopted the National Research Council's 2004 definition of adaptive management, which states:

"Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders."

This definition gives special emphasis to uncertainty about management effects, iterative learning to reduce uncertainty, and improved management as a result of learning. The DOI Adaptive Management Technical Guide is located on the web at: www.doi.gov/initiatives/AdaptiveManagement/index.html.

Figure 1. General Framework of Tiered Approach

TIER 1

A. Species of concern known to be present?
   1. No ……………………………………………………………proceed to Tier 2
   2. Unknown - Insufficient or inconclusive data …………proceed to Tier 2
   3. Yes…………………………………………abandon site or proceed to Tier 2

TIER 2

A. Probability of significant adverse impacts?
   1. Unknown - Insufficient or inconclusive data …………proceed to Tier 3
   2. Low…………..proceed to obtain state and local permit (if required), design, and construction following BMPs
   3. Moderate ………………………………………proceed to Tier 3 and mitigate
   4. High, and:
      a. can be adequately mitigated...modify project and proceed to Tier 3
      b. cannot be adequately mitigated…………………………..abandon project

TIER 3

A. Probability of significant adverse impacts?
   1. Low ……………………………………………………………proceed to Tier 4
   2. Moderate to high, and:
      a. certainty regarding mitigation ……………………………. proceed to Tier 4
      b. uncertainty regarding mitigation ………………………..proceed to Tier 4
   3. High, and:
      a. can be adequately mitigated……………………………..proceed to Tier 4
      b. cannot be adequately mitigated ………….modify or abandon project

TIER 4a (See Table 2, pg 39)

A. Tier 3 studies indicate low probability of significant adverse impacts
   1. Documented fatalities are equal to or lower than predicted…………………no further studies or mitigation needed
   2. Documented fatalities are higher than predicted, but not significant, and:
      a. comparable data are available that support findings of not significant…………………………………………..no further studies needed
      b. comparable data not available to support findings of not significant…………….additional year(s) of monitoring recommended
   3. Documented fatalities are higher than predicted and are significant………………………………………….communicate with Service

B. Tier 3 studies indicate moderate probability of significant adverse impacts
   1. Documented fatalities are lower than or no different predicted, and:
      a. are not significant and no ESA or BGEPA species are affected ……………………..no further monitoring or mitigation needed
      b. are significant *OR* ESA or BGEPA species are affected ……………………………………………communicate with Service
   2. Documented fatalities are greater than predicted and are likely to be significant *OR* ESA or BGEPA species are affected…………………………………………….communicate with Service

C. Tier 3 studies indicate high probability of significant adverse impacts
   1. Documented fatalities are less than predicted and are not significant, and no ESA or BGEPA species are affected……………………..no further monitoring or mitigation needed
   2. Documented fatalities are less than predicted but are still significant, and no ESA or BGEPA species are affected…………………further monitoring or mitigation needed
   3. Fatalities are equal to or greater than predicted and are significant OR ESA or BGEPA species are affected…………………communicate with Service regarding additional mitigation

TIER 4b (See Table 3, pg. 42)

A. Species of habitat fragmentation concern potentially present?
   1. No…………………………………………………………no further studies needed
   2. Yes, and:
      a. Tier 3 studies do not confirm presence…no further studies needed
      b. Tier 3 studies confirm presence, but no significant adverse impacts predicted, and:
         i. Tier 4b studies confirm Tier 3 predictions…………………no further studies or mitigation needed
         ii. Tier 4b studies indicate potentially significant adverse impacts ………………Tier 5 studies and mitigation may be needed
      c. Tier 3 studies confirm presence, and significant adverse impacts predicted and mitigation plan is developed and implemented, and:
         i. Tier 4b studies determine mitigation is effective ………………….no further studies or mitigation needed
         ii. Tier 4b studies determine mitigation not effective………..further mitigation and, where appropriate, Tier 5 studies needed

Considering Risk in the Tiered Approach

In the context of these Guidelines, risk refers to the likelihood that adverse impacts will occur to individuals or populations of species of concern as a result of wind energy development and operation. Estimates of fatality risk can be used in a relative sense, allowing comparisons among projects, alternative development designs, and in the evaluation of potential risk to populations. Because there are relatively few methods available for direct estimation of risk, a weight-of-evidence approach is often used (Anderson et al. 1999). Until such time that reliable risk predictive models are developed regarding avian and bat fatality and wind energy projects, estimates of risk would typically be qualitative, but should be based upon quantitative site information.

For the purposes of these Guidelines, risk can also be defined in the context of populations, but that calculation is more complicated as it could involve estimating the reduction in population viability as indicated by demographic metrics such as growth rate, size of the population, or survivorship, either for local populations, metapopulations, or entire species. For most populations, risk cannot easily be reduced to a strict metric, especially in the absence of population viability models for most species. Consequently, estimating the quantitative risk to populations is usually beyond the scope of project studies due to the difficulties in evaluating these metrics, and therefore risk assessment will be qualitative.

Risk to habitat is a component of the evaluation of population risk. In this context, the estimated loss of habitat is evaluated in terms of the potential for population level effects (e.g., reduced survival or reproduction).

The assessment of risk should synthesize sufficient data collected at a project to estimate exposure and predict impact for individuals and their habitats for the species of concern, with what is known about the population status of these species, and in communication with the relevant wildlife agency and industry wildlife experts. Predicted risk of these impacts could provide useful information for determining appropriate mitigation measures if determined to be necessary. In practice in the tiered approach, risk assessments conducted in Tiers 1 and 2 require less information to reach a risk-based decision than those conducted at higher tiers.

Cumulative Impacts of Project Development

Cumulative impacts are the comprehensive effect on the environment that results from the incremental impact of a project when added to other past, present, and reasonably foreseeable future actions. Developers are encouraged to work closely with federal and state agencies early in the project planning process to access any existing information on the cumulative impacts of individual projects on species and habitats at risk, and to incorporate it into project development and any necessary wildlife studies. To achieve that goal, it is important that agencies and organizations take the following actions to improve cumulative impacts analysis:

- review the range of development-related significant adverse impacts;
- determine which species of concern or their habitats within the landscape are most at risk of significant adverse impacts from wind development in conjunction with other reasonably foreseeable significant adverse impacts; and
- make that data available for regional or landscape level analysis.

The magnitude and extent of the impact on a resource depend on whether the cumulative impacts exceed the capacity for resource sustainability and productivity.

For projects that require a federal permit, funding, or other federal nexus, the lead federal agency is required to include a cumulative impacts analysis in their National Environmental Policy Act (NEPA) review. The federal action agency coordinates with the developer to obtain the necessary information for the NEPA review and cumulative impacts analysis. To avoid project delays, federal and state agencies are encouraged to use existing wildlife data for the cumulative impacts analysis until improved data are available.

Where there is no federal nexus, individual developers are not expected to conduct their own cumulative impacts analysis. However, a cumulative impacts analysis would help developers and other stakeholders better understand the significance of potential impacts on species of concern and their habitats.

Other Federal Agencies

Other federal agencies, such as the Bureau of Land Management, National Park Service, U.S. Department of Agriculture Forest Service and Rural Utility Service, Federal Energy Regulatory Commission and Department of Energy are often interested in and involved with wind project developments. These agencies have a variety of expertise and authorities they implement. Wind project developers on public lands will have to comply with applicable regulations and policies of those agencies. State and local agencies and Tribes also have additional interests and knowledge. The Service recommends that, where appropriate, wind project developers contact these agencies early in the tiered process and work closely with them throughout project planning and development to assure that projects address issues of concern to those agencies. The definition of "species of concern" in these Guidelines includes species which are trust resources of States and of federal agencies (See Glossary). In those instances where a project may significantly affect State trust

resources, wind energy developers should work closely with appropriate State agencies.

Relationship to Other Guidelines

These Guidelines replace the Service's 2003 interim voluntary guidelines. The Service intends that these Guidelines, when used in concert with the appropriate regulatory tools, will form the best practical approach for conservation of species of concern. For instance, when developers find that a project may affect an endangered or threatened species, they should comply with Section 7 or 10 of the ESA to obtain incidental take authorization. Other federal, state, tribal and local governments may use these Guidelines to complement their efforts to address wind energy development/wildlife interactions. They are not intended to supplant existing regional or local guidance, or landscape-scale tools for conservation planning, but were developed to provide a means of improving consistency with the goals of the wildlife statutes that the Service is responsible for implementing. The Service will continue to work with states, tribes, and other local stakeholders on map-based tools, decision-support systems, and other products to help guide future development and conservation. Additionally, project proponents should utilize any relevant guidance of the appropriate jurisdictional entity, which will depend on the species and resources potentially affected by proposed development.

Pronghorn Antelope. Credit: Steve Hillebrand, USFWS

Chapter 2: Tier 1 – Preliminary Site Evaluation

For developers taking a first look at a broad geographic area, a preliminary evaluation of the general ecological context of a potential site or sites can serve as useful preparation for working with the federal, state, tribal, and/or local agencies. The Service is available to assist wind energy project developers to identify potential wildlife and habitat issues and should be contacted as early as possible in the company's planning process. With this internal screening process, the developer can begin to identify broad geographic areas of high sensitivity due to the presence of: 1) large blocks of intact native landscapes; 2) intact ecological communities; 3) fragmentation-sensitive species' habitats; or 4) other important landscape-scale wildlife values.

Tier 1 may be used in any of the following three ways:

1. To identify regions where wind energy development poses significant risks to species of concern or their habitats, including the fragmentation of large-scale habitats and threats to regional populations of federal- or state-listed species.

2. To "screen" a landscape or set of multiple potential sites to avoid those with the highest habitat values.

3. To begin to determine if a single identified potential site poses serious risk to species of concern or their habitats.

Tier 1 can offer early guidance about the sensitivity of the site within a larger landscape context; it can help direct development away from sites that will be associated with additional study need, greater mitigation requirements, and uncertainty; or it can identify those sensitive resources that will need to be studied further to determine if the site can be developed without significant adverse impacts to the species of concern or local population(s). This may facilitate discussions with the federal, state, tribal, and/or local agencies in a region being considered for development. In some cases, Tier 1 studies could reveal serious concerns indicating that a site should not be developed.

Developers of distributed or community scale wind projects are typically considering limited geographic areas to install turbines. Therefore, they would not likely consider broad geographic areas. Nevertheless, they should consider the presence of habitats or species of concern before siting projects.

Development in some areas may be precluded by federal law. This designation is separate from a determination through the tiered approach that an area is not appropriate for development due to feasibility, ecological reasons, or other issues. Developers are encouraged to visit Service and other publicly available databases or other available information during Tier 1 or Tier 2 to see if a potential wind energy area is precluded from development by federal law. Some areas may be protected from development through state or local laws or ordinances, and the appropriate agency should be contacted accordingly. Service field offices are available to answer questions where they are knowledgeable, guide developers to databases, and refer developers to other agency contacts.

Some areas may be inappropriate for large scale development because they have been recognized according to scientifically credible information as having high wildlife value, based solely on their ecological rarity and intactness (e.g., Audubon Important Bird Areas, The Nature Conservancy portfolio sites, state wildlife action plan priority habitats). It is important to identify such areas through the tiered approach, as reflected in Tier 1, Question 2 below. Many of North America's native landscapes are greatly diminished, with some existing at less than 10 percent of their pre-settlement occurrence.

Attwater's prairie chicken. Credit: Gary Halvorsen, USFWS

Herbaceous scrub-shrub steppe in the Pacific Northwest and old growth forest in the Northeast represent such diminished native resources. Important remnants of these landscapes are identified and documented in various databases held by private conservation organizations, state wildlife agencies, and, in some cases, by the Service. Developers should collaborate with such entities specifically about such areas in the vicinity of a prospective project site.

Tier 1 Questions

Questions at each tier help determine potential environmental risks at the landscape scale for Tier 1 and project scale for Tiers 2 and 3. Suggested questions to be considered for Tier 1 include:

1. **Are there species of concern present on the potential site(s), or is habitat (including designated critical habitat) present for these species?**

2. **Does the landscape contain areas where development is precluded by law or areas designated as sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: federally-designated critical habitat; high-priority conservation areas for non-government organizations (NGOs); or other local, state, regional, federal, tribal, or international categorizations.**

3. **Are there known critical areas of wildlife congregation, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?**

4. **Are there large areas of intact habitat with the potential for fragmentation, with respect to species of habitat fragmentation concern needing large contiguous blocks of habitat?**

Tier 1 Methods and Metrics

Developers who choose to conduct Tier 1 investigations would generally be able to utilize existing public or other readily available landscape-level maps and databases from sources such as federal, state, or tribal wildlife or natural heritage programs, the academic community, conservation organizations, or the developers' or consultants' own information. The Service recommends that developers conduct a review of the publicly available data. The analysis of available sites in the region of interest will be based on a blend of the information available in published and unpublished reports, wildlife range distribution maps, and other such sources. The developer should check with the Service Field Office for data specific to wind energy development and wildlife at the landscape scale in Tier 1.

Tier 1 Decision Points

The objective of the Tier 1 process is to help the developer identify a site or sites to consider further for wind energy development. Possible outcomes of this internal screening process include the following:

1. One or more sites are found within the area of investigation where the answer to each of the above Tier 1 questions is "no," indicating a low probability of significant adverse impact to wildlife. The developer proceeds to Tier 2 investigations and characterization of the site or sites, answering the Tier 2 questions with site-specific data to confirm the validity of the preliminary indications of low potential for significant adverse impact.

2. If a developer answers "yes" to one or more of the Tier 1 questions, they should proceed to Tier 2 to further assess the probability of significant adverse impacts to wildlife. A developer may consider abandoning the area or identifying possible means by which the project can be modified to avoid or minimize potential significant adverse impacts.

3. The data available in the sources described above are insufficient to answer one or more of the Tier 1 questions. The developer proceeds to Tier 2, with a specific emphasis on collecting the data necessary to answer the Tier 2 questions, which are inclusive of those asked at Tier 1.

Chapter 3: Tier 2 – Site Characterization

At this stage, the developer has narrowed consideration down to specific sites, and additional data may be necessary to systematically and comprehensively characterize a potential site in terms of the risk wind energy development would pose to species of concern and their habitats. In the case where a site or sites have been selected without the Tier 1 preliminary evaluation of the general ecological context, Tier 2 becomes the first stage in the site selection process. The developer will address the questions asked in Tier 1; if addressing the Tier 1 questions here, the developer will evaluate the site within a landscape context. However, a distinguishing feature of Tier 2 studies is that they focus on site-specific information and should include at least one visit by a knowledgeable biologist to the prospective site(s). Because Tier 2 studies are preliminary, normally one reconnaissance level site visit will be adequate as a "ground-truth" of available information. Notwithstanding, if key issues are identified that relate to varying conditions and/or seasons, Tier 2 studies should include enough site visits during the appropriate times of the year to adequately assess these issues for the prospective site(s).

If the results of the site assessment indicate that one or more species of concern are present, a developer should consider applicable regulatory or other agency processes for addressing them. For instance, if migratory birds and bats are likely to experience significant adverse impacts by a wind project at the proposed site, a developer should identify and document possible actions that will avoid or compensate for those impacts. Such actions might include, but not be limited to, altering locations of turbines or turbine arrays, operational changes, or compensatory mitigation. As soon as a developer anticipates that a wind energy project is likely to result in a take of bald or golden eagles, a developer should prepare an ECP and, if necessary, apply for a programmatic take permit. As soon as a developer realizes endangered or threatened species are present and likely to be affected by a wind project located there, a federal agency should consult with the Service under Section 7(a)(2) of the ESA if the project has a federal nexus or the developer should apply for a section 10(a)(1)(B) incidental take permit if there is not a federal nexus, and incidental take of listed wildlife is anticipated. State, tribal, and local jurisdictions may have additional permitting requirements.

Developers of distributed or community scale wind projects are typically considering limited geographic areas to install turbines. Therefore, they would likely be familiar with conditions at the site where they are considering installing a turbine. Nevertheless, they should do preliminary site evaluations to determine the presence of habitats or species of concern before siting projects.

Tier 2 Questions

Questions suggested for Tier 2 can be answered using credible, publicly available information that includes published studies, technical reports, databases, and information from agencies, local conservation organizations, and/or local experts. Developers or consultants working on their behalf should contact the federal, state, tribal, and local agencies that have jurisdiction or management authority and responsibility over the potential project.

1. **Are known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?**

2. **Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: federally-designated critical habitat;**

Open landscape with wind turbines. Credit: NREL

high-priority conservation areas for NGOs; or other local, state, regional, federal, tribal, or international categorizations.

3. **Are there plant communities of concern present or likely to be present at the site(s)?**

4. **Are there known critical areas of congregation of species of concern, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?**

5. **Using best available scientific information has the developer or relevant federal, state, tribal, and/or local agency identified the potential presence of a population of a species of habitat fragmentation concern?**

6. **Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?**

7. **Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above, and considering the design of the proposed project?**

Tier 2 Methods and Metrics

Obtaining answers to Tier 2 questions will involve a more thorough review of the existing site-specific information than in Tier 1. Tier 2 site characterizations studies will generally contain three elements:

1. A review of existing information, including existing published or available literature and databases and maps of topography, land use and land cover, potential wetlands, wildlife, habitat, and sensitive plant distribution. If agencies have documented potential habitat for species of habitat fragmentation concern, this information can help with the analysis.

2. Contact with agencies and organizations that have relevant scientific information to further help identify if there are bird, bat or other wildlife issues. The Service recommends that the developer make contact with federal, state, tribal, and local agencies that have jurisdiction or management authority over the project or information about the potentially affected resources. In addition, because key NGOs and relevant local groups are often valuable sources of relevant local environmental information, the Service recommends that developers contact key NGOs, even if confidentiality concerns preclude the developer from identifying specific project location information at this stage. These contacts also provide an opportunity to identify other potential issues and data not already identified by the developer.

3. One or more reconnaissance level site visits by a wildlife biologist to evaluate current vegetation/habitat coverage and land management/use. Current habitat and land use practices will be noted to help in determining the baseline against which potential impacts from the project would be evaluated. The vegetation/habitat will be used for identifying potential bird and bat resources occurring at the site and the potential presence of, or suitable habitat for, species of concern. Vegetation types or habitats will be noted and evaluated against available information such as land use/land cover mapping. Any sensitive resources located during the site visit will be noted and mapped or digital location data recorded for future reference. Any individuals or signs of species of concern observed during the site visit will be noted. If land access agreements are not in place, access to the site will be limited to public roads.

Specific resources that can help answer each Tier 2 question include:

1. **Are known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?**

   Information review and agency contact: locations of state and federally listed, proposed and candidate species and species of concern are frequently documented in state and federal wildlife databases. Examples include published literature such as: Natural Heritage Databases, State Wildlife Action Plans, NGOs publications, and developer and consultant information, or can be obtained by contacting these entities.

   Site Visit: To the extent practicable, the site visit(s) should evaluate the suitability of habitat at the site for species identified and the likelihood of the project to adversely affect the species of concern that may be present.

2. **Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?** Examples of designated areas include, but are not limited to: federally-designated critical habitat; high-priority conservation areas for NGOs; or other local, state, regional, federal, tribal, or international categorizations.

   Information review and agency contact such as: maps of political and administrative boundaries; National Wetland Inventory data files; USGS National Land Cover data maps; state, federal and tribal agency data on areas that have been designated to preclude development, including wind energy development; State Wildlife Action Plans; State Land and Water Resource Plans; Natural Heritage databases; scientifically credible information provided by NGO and local

Tall grass prairie. Credit: Amy Thornburg, USFWS

resources; and the additional resources listed in Appendix C: Sources of Information Pertaining to Methods to Assess Impacts to Wildlife of this document, or through contact of agencies and NGOs, to determine the presence of high priority habitats for species of concern or conservation areas.

Site Visit: To the extent practicable, the site visit(s) should characterize and evaluate the uniqueness of the site vegetation relative to surrounding areas.

3. **Are plant communities of concern present or likely to be present at the site(s)?**

Information review and agency contact such as: Natural Heritage Data of state rankings (S1, S2, S3) or globally (G1, G2, G3) ranked rare plant communities.

Site Visit: To the extent practicable, the site visit should evaluate the topography, physiographic features and uniqueness of the site vegetation in relation to the surrounding region. If plant communities of concern are present, developers should also assess in Tier 3 whether the proposed project poses risk of significant adverse impacts and opportunities for mitigation.

4. **Are there known critical areas of wildlife congregation, including, but not limited to, maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?**

Information review and agency contact such as: existing databases, State Wildlife Action Plan, Natural Heritage Data, and NGO and agency information regarding the presence of Important Bird Areas, migration corridors or stopovers, leks, bat hibernacula or maternity roosts, or game winter ranges at the site and in the surrounding area.

Site Visit: To the extent practicable, the site visit should, during appropriate times to adequately assess these issues for prospective site(s), evaluate the topography, physiographic features and uniqueness of the site in relation to the surrounding region to assess the potential for the project area to concentrate resident or migratory birds and bats.

5. **Using best available scientific information, has the relevant federal, state, tribal, and/or local agency determined the potential presence of a population of a species of habitat fragmentation concern?**

If not, the developer need not assess impacts of the proposed project on habitat fragmentation.

Habitat fragmentation is defined as the separation of a block of habitat for a species into segments, such that the genetic or demographic viability of the populations surviving in the remaining habitat segments is reduced; and risk, in this case, is defined as the probability that this fragmentation will occur as a result of the project. Site clearing, access roads, transmission lines and turbine tower arrays remove habitat and displace some species

of wildlife, and may fragment continuous habitat areas into smaller, isolated tracts. Habitat fragmentation is of particular concern when species require large expanses of habitat for activities such as breeding and foraging.

Consequences of isolating local populations of some species include decreased reproductive success, reduced genetic diversity, and increased susceptibility to chance events (e.g. disease and natural disasters), which may lead to extirpation or local extinctions. In addition to displacement, development of wind energy infrastructure may result in additional loss of habitat for some species due to "edge effects" resulting from the break-up of continuous stands of similar vegetation resulting in an interface (edge) between two or more types of vegetation. The extent of edge effects will vary by species and may result in adverse impacts from such effects as a greater susceptibility to colonization by invasive species, increased risk of predation, and competing species favoring landscapes with a mosaic of vegetation.

Site Visit: If the answer to Tier 2 Question 5 is yes, developers should use the general framework for evaluating habitat fragmentation at a project site in Tier 2 outlined below. Developers and the Service may use this method to analyze the impacts of habitat fragmentation at wind development project sites on species of habitat fragmentation concern. Service field offices may be able to provide the available information on habitat types, quality and intactness. Developers may use this information in combination with site-specific information on the potential habitats to be impacted by a potential development and how they will be impacted.

<u>General Framework for Evaluating Habitat Fragmentation at a Project Site (Tier 2)</u>

A. The developer should define the study area. The study area should not only include the project site for the proposed project, but be based on the distribution of habitat for the local population of the species of habitat fragmentation concern.

B. The developer should analyze the current habitat quality and spatial configuration of the study area for the species of habitat fragmentation concern.

   i. Use recent aerial and remote imagery to determine distinct habitat patches, or boundaries, within the study area, and the extent of existing habitat fragmenting features (e.g., highways).

   ii. Assess the level of fragmentation of the existing habitat for the species of habitat fragmentation concern and categorize into three classes:

   - High quality: little or no apparent fragmentation of intact habitat
   - Medium quality: intact habitat exhibiting some recent disturbance activity
   - Low quality: Extensive fragmentation of habitat (e.g., row-cropped agricultural lands, active surface mining areas)

C. The developer should determine potential changes in quality and spatial configuration of the habitat in the study area if development were to proceed as proposed using existing site information.

D. The developer should provide the collective information from steps A-C for all potential developments to the Service for use in assessing whether the habitat impacts, including habitat fragmentation, are likely to affect population viability of the potentially affected species of habitat fragmentation concern.

6. **Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?**

   Information review and agency contact: existing published information and databases from NGOs and federal and state resource agencies regarding the potential presence of:

   - Raptors: species potentially present by season
   - Prairie grouse and sage grouse: species potentially present by season and location of known leks
   - Other birds: species potentially present by season that may be at risk of collision or adverse impacts to habitat, including loss, displacement and fragmentation
   - Bats: species likely to be impacted by wind energy facilities and likely to occur on or migrate through the site

   Site Visit: To the extent practicable, the site visit(s) should identify landscape features or habitats that could be important to raptors, prairie grouse, and other birds that may be at risk of adverse impacts, and bats, including nesting and brood-rearing habitats, areas of high prey density, movement corridors and features such as ridges that may concentrate raptors. Raptors, prairie grouse, and other presence or sign of species of concern seen during the site visit should be noted, with species identification if possible.

7. **Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above, and considering the design of the proposed project?**

The developer has assembled answers to the questions above and should make an initial evaluation of the probability of significant adverse impacts to species of concern and their habitats. The developer should make this evaluation based on assessments of the potential presence of species of concern and their habitats, potential presence of critical congregation areas for species of concern, and any site visits. The developer is encouraged to communicate the results of these assessments with the Service.

Tier 2 Decision Points

Possible outcomes of Tier 2 include the following:

1. The most likely outcome of Tier 2 is that the answer to one or more Tier 2 questions is inconclusive to address wildlife risk, either due to insufficient data to answer the question or because of uncertainty about what the answers indicate. The developer proceeds to Tier 3, formulating questions, methods, and assessment of potential mitigation measures based on issues raised in Tier 2 results.

2. Sufficient information is available to answer all Tier 2 questions, and the answer to each Tier 2 question indicates a low probability of significant adverse impact to wildlife (for example, infill or expansion of an existing facility where impacts have been low and Tier 2 results indicate that conditions are similar, therefore wildlife risk is low). The developer may then decide to proceed to obtain state and local permit (if required), design, and construction following best management practices (see Chapter 7: Best Management Practices).

3. Sufficient information is available to answer all Tier 2 questions, and the answer to each Tier 2 question indicates a moderate probability of significant adverse impacts to species of concern or their habitats. The developer should proceed to Tier 3 and identify measures to mitigate potential significant adverse impacts to species of concern.

4. The answers to one or more Tier 2 questions indicate a high probability of significant adverse impacts to species of concern or their habitats that:

   a) Cannot be adequately mitigated. The proposed site should be abandoned.

   b) Can be adequately mitigated. The developer should proceed to Tier 3 and identify measures to mitigate potential significant adverse impacts to species of concern or their habitats.

Greater sage grouse, Credit: Stephen Ting, USFWS

Chapter 4: Tier 3 – Field Studies to Document Site Wildlife and Habitat and Predict Project Impacts

Tier 3 is the first tier in which a developer would conduct quantitative and scientifically rigorous studies to assess the potential risk of the proposed project. Specifically, these studies provide pre-construction information to:

- Further evaluate a site for determining whether the wind energy project should be developed or abandoned
- Design and operate a site to avoid or minimize significant adverse impacts if a decision is made to develop
- Design compensatory mitigation measures if significant adverse habitat impacts cannot acceptably be avoided or minimized
- Determine duration and level of effort of post-construction monitoring. If warranted, provide the pre-construction component of post-construction studies necessary to estimate and evaluate impacts

At the beginning of Tier 3, a developer should communicate with the Service on the pre-construction studies. At the end of Tier 3, developers should communicate with the Service regarding the results of the Tier 3 studies and consider the Service's comments and recommendations prior to completing the Tier 3 decision process. The Service will provide written comments to a developer that identify concerns and recommendations to resolve the concerns based on study results and project development plans.

Not all Tier 3 studies will continue into Tiers 4 or 5. For example, surveys conducted in Tier 3 for species of concern may indicate one or more species are not present at the proposed project site, or siting decisions could be made in Tier 3 that remove identified concerns, thus removing the need for continued efforts in later tiers. Additional detail on the design issues for post-construction studies that begin in Tier 3 is provided in the discussion of methods and metrics in Tier 3.

Turkey vulture and wind turbine. Credit: Rachel London, USFWS

Tier 3 Questions

Tier 3 begins as the other tiers, with problem formulation: what additional studies are necessary to enable a decision as to whether the proposed project can proceed to construction or operation or should be abandoned? This step includes an evaluation of data gaps identified by Tier 2 studies as well as the gathering of data necessary to:

- Design a project to avoid or minimize predicted risk
- Evaluate predictions of impact and risk through post-construction comparisons of estimated impacts
- Identify compensatory mitigation measures, if appropriate, to offset significant adverse impacts that cannot be avoided or minimized

The problem formulation stage for Tier 3 also will include an assessment of which species identified in Tier 1 and/or Tier 2 will be studied further in the site risk assessment. This determination is based on analysis of existing data from Tier 1 and existing site-specific data and Project Site (see Glossary in Appendix A) visit(s) in Tier 2, and on the likelihood of presence and the degree of adverse impact to species or their habitat. If the habitat is suitable for a species needing further study and the site occurs within the historical range of the species, or is near the existing range of the species but presence has not been documented, additional field studies may be appropriate. Additional analyses should not be necessary if a species is unlikely to be present or is present but adverse impact is unlikely or of minor significance.

Tier 3 studies address many of the questions identified for Tiers 1 and 2, but Tier 3 studies differ because they attempt to quantify

the distribution, relative abundance, behavior, and site use of species of concern. Tier 3 data also attempt to estimate the extent that these factors expose these species to risk from the proposed wind energy facility. Therefore, in answering Tier 3 questions 1-3, developers should collect data sufficient to analyze and answer Tier 3 questions 4-6. High risk sites may warrant additional years of pre-construction studies. The duration and intensity of studies needed should be determined through communication with the Service.

If Tier 3 studies identify species of concern or important habitats, e.g., wetlands, which have specific regulatory processes and requirements, developers should work with appropriate state, tribal, or federal agencies to obtain required authorizations or permits.

Tier 3 studies should be designed to answer the following questions:

1. **Do field studies indicate that species of concern are present on or likely to use the proposed site?**

2. **Do field studies indicate the potential for significant adverse impacts on affected population of species of habitat fragmentation concern?**

3. **What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed wind energy project?**

4. **What are the potential risks of adverse impacts of the proposed wind energy project to individuals and local populations of species of concern and their habitats? (In the case of rare or endangered species, what are the possible impacts to such species and their habitats?)**

5. **How can developers mitigate identified significant adverse impacts?**

6. **Are there studies that should be initiated at this stage that would be continued in post-construction?**

The Service encourages the use of common methods and metrics in Tier 3 assessments for measuring wildlife activity and habitat features. Common methods and metrics provide great benefit over the long-term, allowing for comparisons among projects and for greater certainty regarding what will be asked of the developer for a specific project. Deviation from commonly used methods should be carefully considered, scientifically justifiable and discussed with federal, tribal, or state natural resource agencies, or other credible experts, as appropriate. It may be useful to consult other scientifically credible information sources.

Tier 3 studies will be designed to accommodate local and regional characteristics. The specific protocols by which common methods and metrics are implemented in Tier 3 studies depend on the question being addressed, the species or ecological communities being studied and the characteristics of the study sites. Federally-listed threatened and endangered species, eagles, and some other species of concern and their habitats, may have specific protocols required by local, state or federal agencies. The need for special surveys and mapping that address these species and situations should be discussed with the appropriate stakeholders.

In some instances, a single method will not adequately assess potential collision risk or habitat impact. For example, when there is concern about moderate or high risk to nocturnally active species, such as migrating passerines and local and migrating bats, a combination of remote sensing tools such as radar, and acoustic monitoring for bats and indirect inference from diurnal bird surveys during the migration period may be necessary. Answering questions about habitat use by songbirds may be accomplished by relatively small-scale observational studies, while answering the same question related to wide-ranging species such as prairie grouse and sage grouse may require more time-consuming surveys, perhaps including telemetry.

Because of the points raised above and the need for flexibility in application, the Guidelines do not make specific recommendations on protocol elements for Tier 3 studies. The peer-reviewed scientific literature (such as the articles cited throughout this section) contains numerous recently published reviews of methods for assessing bird and bat activity, and tools for assessing habitat and landscape level risk. Details on specific methods and protocols for recommended studies are or will be widely available and should be consulted by industry and agency professionals.

Many methods for assessing risk are components of active research involving collaborative efforts of public-private research partnerships with federal, state and tribal agencies, wind energy developers and NGOs interested in wind energy-wildlife interactions (e.g., Bats and Wind Energy Cooperative and the Grassland Shrub Steppe Species Cooperative). It is important to recognize the need to integrate the results of research that improves existing methods or describes new methodological developments, while acknowledging the value of utilizing common methods that are currently available.

The methods and metrics that may be appropriate for gathering data to answer Tier 3 questions are compiled and outlined in the Technical Resources section, page 26. These are not meant to be all inclusive and other methods and metrics are available, such as the NWCC Methods & Metrics document (Strickland et al. 2011) and others listed in Appendix C:

Avian Radar

Sources of Information Pertaining to Methods to Assess Impacts to Wildlife.

Each question should be considered in turn, followed by a discussion of the methods and their applicability.

1. **Do field studies indicate that species of concern are present on or likely to use the proposed site?**

In many situations, this question can be answered based on information accumulated in Tier 2. Specific presence/absence studies may not be necessary, and protocol development should focus on answering the remaining Tier 3 questions. Nevertheless, it may be necessary to conduct field studies to determine the presence, or likelihood of presence, when little information is available for a particular site. The level of effort normally contemplated for Tier 3 studies should detect common species and species that are relatively rare, but which visit a site regularly (e.g., every year). In the event a species of concern is very rare and only occasionally visits a site, a determination of "likely to occur" would be inferred from the habitat at the site and historical records of occurrence on or near the site.

State, federal and tribal agencies often require specific protocols be followed when species of concern are potentially present on a site. The methods and protocols for determining presence of species of concern at a site are normally established for each species and required by federal, state and tribal resource agencies. Surveys should sample the wind turbine sites and applicable disturbance area during seasons when species are most likely present. Normally, the methods and protocols by which they are applied also will include an estimate of relative abundance. Most presence/absence surveys should be done following a probabilistic sampling protocol to allow statistical extrapolation to the area and time of interest.

Determining the presence of diurnally or nocturnally active mammals, reptiles, amphibians, and other species of concern will typically be accomplished by following agency-required protocols. Most listed species have required protocols for detection (e.g., the black-footed ferret). State, tribal and federal agencies should be contacted regarding survey protocols for those species of concern. See Corn and Bury 1990, Olson et al. 1997, Bailey et al. 2004, Graeter et al. 2008 for examples of reptile and amphibian protocols, survey and analytical methods. See Tier 3 Study Design Considerations on page 24 for further details.

2. **Do field studies indicate the potential for significant adverse impacts on affected populations of species of habitat fragmentation concern?**

If Tier 2 studies indicate the presence of species of habitat fragmentation concern, but existing information did not allow for a complete analysis of potential impacts and decision-making, then additional studies and analyses should take place in Tier 3.

As in Tier 2, the particulars of the analysis will depend on the species of habitat fragmentation concern and how habitat block size and fragmentation are defined for the life cycles of that species, the likelihood that the project will adversely affect a local population of the species and the significance of these impacts to the viability of that population.

To assess habitat fragmentation in the project vicinity, developers should evaluate landscape characteristics of the proposed site prior to construction and determine the degree to which habitat for species of habitat fragmentation concern will be significantly altered by the presence of a wind energy facility.

A general framework for evaluating habitat fragmentation at a project site, following that described in Tier 2, is outlined on page 27. This framework should be used in those circumstances when the developer, or a relevant federal, state, tribal and/or other local agency determines the potential presence of a population of a species of habitat fragmentation concern that may be adversely affected by the project. Otherwise, the developer need not assess the impacts of the proposed project on habitat fragmentation. This method for analysis of habitat fragmentation at project sites must be adapted to the local population of the species of habitat fragmentation concern potentially affected by the proposed development.

3. **What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed wind energy project?**

For those species of concern that are considered at risk of collisions or habitat impacts, the questions to be answered in Tier 3 include: where are they likely to occur (i.e., where is their habitat) within a project site or vicinity, when might they occur, and in what abundance. The spatial distribution of species at risk of collision can influence how a site is developed. This distribution should include the airspace for flying species with respect to the rotor-

swept zone. The abundance of a species and the spatial distribution of its habitat can be used to determine the relative risk of impact to species using the sites, and the absolute risk when compared to existing projects where similar information exists. Species abundance and habitat distribution can also be used in modeling risk factors.

Surveys for spatial distribution and relative abundance require coverage of the wind turbine sites and applicable site disturbance area, or a sample of the area using observational methods for the species of concern during the seasons of interest. As with presence/absence (see Tier 3, question 1, above) the methods used to determine distribution, abundance, and behavior may vary with the species and its ecology. Spatial distribution is determined by applying presence/absence or using surveys in a probabilistic manner over the entire area of interest. Suggested survey protocols for birds, bats, and other wildlife are found in the Technical Resources section on page 26.

Whooping crane. Credit: Ryan Hagerty, USFWS

4. **What are the potential risks of adverse impacts of the proposed wind energy project to individuals and local populations of species of concern and their habitats? (In the case of rare or endangered species, what are the possible impacts to such species and their habitats?)**

Methods used for estimating risk will vary with the species of concern. For example, estimating potential bird fatalities in Tier 3 may be accomplished by comparing exposure estimates (described earlier in estimates of bird use) at the proposed site with exposure estimates and fatalities at existing projects with similar characteristics (e.g., similar technology, landscape, and weather conditions). If models are used, they may provide an additional tool for estimating fatalities, and have been used in Australia (Organ and Meredith 2004), Europe (Chamberlin et al. 2006), and the United States (Madders and Whitfield 2006). As with other prediction tools, model predictions should be evaluated and compared with post-construction fatality data to validate the models. Models should be used as a subcomponent of a risk assessment based on the best available empirical data. A statistical model based on the relationship of pre-construction estimates of raptor abundance and post-construction raptor fatalities is described in Strickland et al. (2011) and promises to be a useful tool for risk assessment.

Collision risk to individual birds and bats at a particular wind energy facility may be the result of complex interactions among species distribution, relative abundance, behavior, weather conditions (e.g., wind, temperature) and site characteristics. Collision risk for an individual may be low regardless of abundance if its behavior does not place it within the rotor-swept zone. If individuals frequently occupy the rotor-swept zone but effectively avoid collisions, they are also at low risk of collision with a turbine (e.g., ravens). Alternatively, if the behavior of individuals frequently places them in the rotor-swept zone, and they do not actively avoid turbine blade strikes, they are at higher risk of collisions with turbines regardless of abundance. For a given species (e.g., red-tailed hawk), increased abundance increases the likelihood that individuals will be killed by turbine strikes, although the risk to individuals will remain about the same. The risk to a population increases as the proportion of individuals in the population at risk to collision increases.

At some projects, bat fatalities are higher than bird fatalities, but the exposure risk of bats at these facilities is not fully understood (National Research Council (NRC) 2007). Horn et al. (2008) and Cryan (2008) hypothesize that bats are attracted to turbines, which, if true, would further complicate estimation

of exposure. Further research is required to determine if bats are attracted to turbines and if so, to evaluate 1) the influence on Tier 2 methods and predictions, and 2) if this increased individual risk translates into higher population-level impacts for bats.

The estimation of indirect impact risk requires an understanding of animal behavior in response to a project and its infrastructure, and a pre-construction estimate of presence/absence of species whose behavior would cause them to avoid areas in proximity to turbines, roads and other components of the project. The amount of habitat that is lost to indirect impacts will be a function of the sensitivity of individuals to the project and to the activity levels associated with the project's operations. The population-level significance of this indirect impact will depend on the amount of habitat available to the affected population. If the indirect impacts include habitat fragmentation, then the risk to the demographic and genetic viability of the isolated animals is increased. Quantifying cause and effect may be very difficult, however.

5. How can developers mitigate identified significant adverse impacts?

Results of Tier 3 studies should provide a basis for identifying measures to mitigate significant adverse impacts predicted for species of concern. Information on wildlife use of the proposed area is most useful when designing a project to avoid or minimize significant adverse impacts. In cases of uncertainty with regard to impacts to species of concern, additional studies may be necessary to quantify significant adverse impacts and determine the need for mitigation of those impacts.

Chapter 7, Best Management Practices, and Chapter 8, Mitigation, outline measures that can be taken to mitigate impacts throughout all phases of a project.

The following discussion of prairie grouse and sage grouse as species of concern illustrates the uncertainty mentioned above by describing the present state of scientific knowledge relative to these species, which should be considered when designing mitigation measures. The extent of the impact of wind energy development on prairie grouse and sage grouse lekking activity (e.g., social structure, mating success, persistence) and the associated impacts on productivity (e.g., nesting, nest success, chick survival) is poorly understood (Arnett et al. 2007, NRC 2007, Manville 2004). However, recent published research documents that anthropogenic features (e.g., tall structures, buildings, roads, transmission lines) can adversely impact vital rates (e.g., nesting, nest success, lekking behavior) of lesser prairie-chickens (Pruett et al. 2009, Pitman et al. 2005, Hagen et al. 2009, Hagen et al. 2011) and greater prairie-chickens over long distances. Pitman et al. (2005) found that transmission lines reduced nesting of lesser prairie chicken by 90 percent out to a distance of 0.25 miles, improved roads at a distance of 0.25 miles, a house at 0.3 miles, and a power plant at >0.6 miles. Reduced nesting activity of lesser prairie chickens may extend farther, but Pitman et al. (2005) did not analyze their data for lower impacts (less than 90 percent reduction in nesting) of those anthropogenic features on lesser prairie chicken nesting activities at greater distances. Hagen et al. (2011) suggested that development within 1 to 1 ½ miles of active leks of prairie grouse may have significant adverse impacts on the affected grouse population. It is not unreasonable to infer that impacts from wind energy facilities may be similar to those from these other anthropogenic structures. Kansas State University, as part of the National Wind Coordinating Collaborative's Grassland and Shrub Steppe Species Subgroup, is undertaking a multi-year telemetry study to evaluate the effects of a proposed wind-energy facility on displacement and demographic parameters (e.g., survival, nest success, brood success, fecundity) of greater prairie-chickens in Kansas.[5]

The distances over which anthropogenic activities impact sage grouse are greater than for prairie grouse. Based primarily on data documenting reduced fecundity (a combination of nesting, clutch size, nest success, juvenile survival, and other factors) in sage grouse populations near roads, transmissions lines, and areas of oil and gas development/production (Holloran 2005, Connelly et al. 2000), development within three to five miles (or more) of active sage grouse leks may have significant adverse impacts on the affected grouse population. Lyon and Anderson (2003) found that in habitats fragmented by natural gas development, only 26 percent of hens captured on disturbed leks nested within 1.8 miles of the lek of capture, whereas 91 percent of hens from undisturbed areas nested within the same area. Holloran (2005) found that active drilling within 3.1 miles of sage grouse lek reduced the number of breeding males by displacing adult males and reducing recruitment of juvenile males. The magnitudes and proximal causes (e.g., noise, height of structures, movement, human activity, etc.) of those impacts on vital rates in grouse populations are areas of much needed research (Becker et al. 2009). Data accumulated through such research may improve our understanding of the buffer distances necessary to avoid or minimize significant adverse impacts to prairie grouse and sage grouse populations.

When significant adverse impacts cannot be fully avoided or adequately minimized, some form of compensatory mitigation may be

[5] www.nationalwind.org

appropriate to address the loss of habitat value. For example, it may be possible to mitigate habitat loss or degradation for a species of concern by enhancing or restoring nearby habitat value comparable to that potentially influenced by the project.

6. Are there studies that should be initiated at this stage that would be continued in post-construction?

During Tier 3 problem formulation, it is necessary to identify the studies needed to address the Tier 3 questions. Consideration of how the resulting data may be used in conjunction with post-construction Tier 4 and 5 studies is also recommended. The design of post-construction impact or mitigation assessment studies will depend on the specific impact questions being addressed. Tier 3 predictions will be evaluated using data from Tier 4 studies designed to estimate fatalities for species of concern and impacts to their habitat, including species of habitat fragmentation concern. Tier 3 studies may demonstrate the need for mitigation of significant adverse impacts. Where Tier 3 studies indicate the potential for significant adverse direct and indirect impacts to habitat, Tier 4 studies will provide data that evaluate predictions of those impacts, and Tier 5 studies, if necessary, will provide data to evaluate the effect of those impacts on populations and the effectiveness of mitigation measures. Evaluations of the impacts of a project on demographic parameters of local populations, habitat use, or some other parameter(s) are considered Tier 5 studies, and typically will require data on these parameters prior to as well as after construction of the project.

Tier 3 Study Design Considerations

Specific study designs will vary from site to site and should be adjusted to the circumstances of individual projects. Study designs will depend on the types of questions, the specific project, and practical considerations. The most common considerations include the area being studied, the species of concern and potential risk to those species, potentially confounding variables, time available to conduct studies, project budget, and the magnitude of the anticipated impacts. Studies will be necessary in part to assess a) which species of concern are present within the project area; b) how these species are using the area (behavior); and c) what risks are posed to them by the proposed wind energy project.

Rows of wind turbines. Credit: Joshua Winchell, USFWS

Assessing Presence

A developer should assess whether species of concern are likely to be present in the project area during the life of the project. Assessing species use from databases and site characteristics is a potential first step. However, it can be difficult to assess potential use by certain species from site characteristics alone. Various species in different locations may require developers to use specific survey protocols or make certain assumptions regarding presence. Project developers should seek local wildlife expertise, such as Service Field Office staff, in using the proper procedures and making assumptions.

Some species will present particular challenges when trying to determine potential presence. For instance, species that a) are rare or cryptic; b) migrate, conduct other daily movements, or use areas for short periods; c) are small or nocturnal; or d) have become extirpated in parts of their historical range can be difficult to observe. One of these challenges is migration, broadly defined as the act of moving from one spatial unit to another (Baker 1978), or as a periodic movement of animals from one location to another. Migration is species-specific, and for birds and bats occurs throughout the year.

Assessing Site Use/Behavior

Developers should monitor potential sites to determine the types of migratory species present, what type of spatial and temporal use these species make of the site (e.g., chronology of migration or other use), and the ecological function the site may provide in terms of the migration cycle of these species. Wind developers should determine not only what species may migrate through a proposed development site and when, but also whether a site may function as a staging area or stopover habitat for wildlife on their migration pathway.

For some species, movements between foraging and breeding habitat, or between sheltering and feeding habitats, occur on a daily basis. Consideration of daily movements (morning and evening; coming and going) is a critical factor when considering project development.

Duration/Intensity of Studies

Where pre-construction assessments are warranted to help assess risk to wildlife, the studies should be of sufficient duration and intensity to ensure adequate data are collected to accurately characterize wildlife presence and use of the area. In ecological systems, resource quality and quantity can fluctuate rapidly. These fluctuations occur naturally, but human actions can significantly affect (i.e., increase or decrease) natural oscillations. Pre-construction monitoring and assessment of proposed wind energy sites are "snapshots in time," showing occurrence or no occurrence of a species or habitat at the specific time surveyed. Often due to prohibitive costs, assessments and surveys are conducted for very low percentages (e.g., less than 5 percent) of the available sample time in a given year, however, these data are used to support risk analyses over the projected life of a project (e.g., 30 years of operations).

To establish a trend in site use and conditions that incorporates annual and seasonal variation in meteorological conditions, biological factors, and other variables, pre-construction studies may need to occur over multiple years. However, the level of risk and the question of data requirements will be based on site sensitivity, affected species, and the availability of data from other sources. Accordingly, decisions regarding studies should consider information gathered during the previous tiers, variability within and between seasons, and years where variability is likely to substantially affect answers to the Tier 3 questions. These studies should also be designed to collect data during relevant breeding, feeding, sheltering, staging, or migration periods for each species being studied. Additionally, consideration for the frequency and intensity of pre-construction monitoring should be site-specific and determined through consultation with an expert authority based on their knowledge of the specific species, level of risk and other variables present at each individual site.

Assessing Risk to Species of Concern

Once likely presence and factors such as abundance, frequency of use, habitat use patterns, and behavior have been determined or assumed, the developer should consider and/or determine the consequences to the "populations" and species.

Below is a brief discussion of several types of risk factors that can be considered. This does not include all potential risk factors for all species, but addresses the most common ones.

Collision

Collision likelihood for individual birds and bats at a particular wind energy facility may be the result of complex interactions among species distribution, "relative abundance," behavior, visibility, weather conditions, and site characteristics. Collision likelihood for an individual may be low regardless of abundance if its behavior does not place it within the "rotor-swept zone." Individuals that frequently occupy the rotor-swept zone but effectively avoid collisions are also at low likelihood of collision with a turbine.

Alternatively, if the behavior of individuals frequently places them in the rotor-swept zone, and they do not actively avoid turbine blade strikes, they are at higher likelihood of collisions with turbines regardless of abundance. Some species, even at lower abundance, may have a higher collision rate than similar species due to subtle differences in their ecology and behavior.

At many projects, the numbers of bat fatalities are higher than the numbers of bird fatalities, but the exposure risk of bats at these facilities is not fully understood. Researchers (Horn et al. 2008 and Cryan 2008) hypothesize that some bats may be attracted to turbines, which, if true, would further complicate estimation of exposure. Further research is required to determine whether bats are attracted to turbines and if so, whether this increased individual risk translates into higher population-scale effects.

Habitat Loss and Degradation

Wind project development results in direct habitat loss and habitat modification, especially at sites previously undeveloped. Many of North America's native landscapes are greatly diminished or degraded from multiple causes unrelated to wind energy. Important remnants of these landscapes are identified and documented in various databases held by private conservation organizations, state wildlife agencies, and, in some cases, by the Service. Species that depend on these landscapes are susceptible to further loss of habitat, which will affect their ability to reproduce and survive. While habitat lost due to footprints of turbines, roads, and other infrastructure is obvious, less obvious is the potential reduction of habitat quality.

Habitat Fragmentation

Habitat fragmentation separates blocks of habitat for some species into segments, such that the individuals in the remaining habitat segments may suffer from effects such as decreased survival, reproduction, distribution, or use of the area. Site clearing, access roads, transmission lines, and arrays of turbine towers may displace some species or fragment continuous habitat areas into smaller, isolated tracts. Habitat fragmentation is of particular concern when species require large expanses of habitat for activities such as breeding, foraging, and sheltering.

Habitat fragmentation can result in increases in "edge" resulting in direct effects of barriers

and displacement as well as indirect effects of nest parasitism and predation. Sensitivity to fragmentation effects varies among species. Habitat fragmentation and site modification are important issues that should be assessed at the landscape scale early in the siting process. Identify areas of high sensitivity due to the presence of blocks of native habitats, paying particular attention to known or suspected "species sensitive to habitat fragmentation."

Displacement and Behavioral Changes

Estimating displacement risk requires an understanding of animal behavior in response to a project and its infrastructure and activities, and a pre-construction estimate of presence/absence of species whose behavior would cause them to avoid or seek areas in proximity to turbines, roads, and other components of the project. Displacement is a function of the sensitivity of individuals to the project and activity levels associated with operations.

Indirect Effects

Wind development can also have indirect effects to wildlife and habitats. Indirect effects include reduced nesting and breeding densities and the social ramifications of those reductions; loss or modification of foraging habitat; loss of population vigor and overall population density; increased isolation between habitat patches, loss of habitat refugia; attraction to modified habitats; effects on behavior, physiological disturbance, and habitat unsuitability. Indirect effects can result from introduction of invasive plants; increased predator populations or facilitated predation; alterations in the natural fire regime; or other effects, and can manifest themselves later in time than the causing action.

When collection of both pre- and post-construction data in the areas of interest and reference areas is possible, then the Before-After-Control-Impact (BACI) is the most statistically robust design. The BACI design is most like the classic manipulative experiment.[6] In the absence of a suitable reference area, the design is reduced to a Before-After (BA) analysis of effect where the differences between pre- and post-construction parameters of interest are assumed to be the result of the project, independent of other potential factors affecting the assessment area. With respect to BA studies, the key question is whether the observations taken immediately after the incident can reasonably be expected within the expected range for the system (Manly 2009). Reliable quantification of impact usually will include additional study components to limit variation and the confounding effects of natural factors that may change with time.

Virginia big-eared bat. Credit: USFWS

The developer's timeline for the development of a wind energy facility often does not allow for the collection of sufficient pre-construction data and/or identification of suitable reference areas to complete a BACI or BA study. Furthermore, alterations in land use or disturbance over the course of a multi-year BACI or BA study may complicate the analysis of study results. Additional discussion of these issues can be found in Tier 5 Study Design Considerations.

Tier 3 Technical Resources

The following methods and metrics are provided as suggested sources for developers to use in answering the Tier 3 questions.

Tier 3, Question 1

Acoustic monitoring can be a practical method for determining the presence of threatened, endangered or otherwise rare species of bats throughout a proposed project (Kunz et al. 2007). There are two general types of acoustic detectors used for collection of information on bat activity and species identification: the full-spectrum, time-expansion and the zero-crossing techniques for ultrasound bat detection (see Kunz et al. 2007 for detailed discussion). Full-spectrum time expansion detectors provide nearly complete species discrimination, while zero-crossing detectors provide reliable and cost-effective estimates of total bat use at a site and some species discrimination. Myotis species can be especially difficult to discriminate with zero-crossing detectors (Kunz et al. 2007). Kunz et al. (2007) describe the strengths and weaknesses of each technique for ultrasonic bat detection, and either type of detector may be useful in most situations except where species identification is especially important and zero-crossing methods are inadequate to provide the necessary data. Bat acoustics technology is evolving rapidly and study objectives are an important consideration when selecting detectors. When rare or endangered species of bats are suspected, sampling should occur during different seasons and at

[6] In this context, such designs are not true experiments in that the treatments (project development and control) are not randomly assigned to an experimental unit, and there is often no true replication. Such constraints are not fatal flaws, but do limit statistical inferences of the results.

multiple sampling stations to account for temporal and spatial variability.

Mist-netting for bats is required in some situations by state agencies, Tribes, and the Service to determine the presence of threatened, endangered or otherwise rare species. Mist-netting is best used in combination with acoustic monitoring to inventory the species of bats present at a site, especially to detect the presence of threatened or endangered species. Efforts should concentrate on potential commuting, foraging, drinking, and roosting sites (Kuenzi and Morrison 1998, O'Farrell et al. 1999). Mist-netting and other activities that involve capturing and handling threatened or endangered species of bats will require permits from state and/or federal agencies.

Tier 3, Question 2

The following protocol should be used to answer Tier 3, Question 2. This protocol for analysis of habitat fragmentation at project sites should be adapted to the species of habitat fragmentation concern as identified in response to Question 5 in Tier 2 and to the landscape in which development is contemplated. The developer should:

1. Define the study area. The study area for the site should include the "footprint" for the proposed facility plus an appropriate surrounding area. The extent of the study area should be based on the area where there is potential for significant adverse habitat impacts, including indirect impacts, within the distribution of habitat for the species of habitat fragmentation concern.

2. Determine the potential for occupancy of the study area based on the guidance provided for the species of habitat fragmentation concern described above in Question 1.

3. Analyze current habitat quality and spatial configuration of the study area for the species of habitat fragmentation concern.

   a. Use recent aerial or remote imagery to determine distinct habitat patches or boundaries within the study area, and the extent of existing habitat fragmenting features.

      i. Assess the level of fragmentation of the existing habitat for the species of habitat fragmentation concern and categorize into three classes:

         - High quality: little or no apparent fragmentation of intact habitat
         - Medium quality: intact habitat exhibiting some recent disturbance activity
         - Low quality: extensive fragmentation of habitat (e.g., row-cropped agricultural lands, active surface mining areas)

      ii. Determine edge and interior habitat metrics of the study area:

         - Identify habitat, non-habitat landscape features and existing fragmenting features relative to the species of habitat fragmentation concern, to estimate existing edge
         - Calculate area and acres of edge
         - Calculate area of intact patches of habitat and compare to needs of species of habitat fragmentation concern

   b. Determine potential changes in quality and spatial configuration of the habitat in the study area if development proceeds as proposed using existing site information and the best available spatial data regarding placement of wind turbines and ancillary infrastructure:

      i. Identify, delineate and classify all additional features added by the development that potentially fragment habitat for the species of habitat fragmentation concern (e.g., roads, transmission lines, maintenance structures, etc.)

      ii. Assess the expected future size and quality of habitat patches for the species of habitat fragmentation concern and the additional fragmenting features, and categorize into three classes as described above

      iii. Determine expected future acreages of edge and interior habitats

      iv. Calculate the area of the remaining patches of intact habitat

   c. Compare pre-construction and expected post-construction fragmentation metrics:

      i. Determine the area of intact habitat lost (to the displacement footprint or by alteration due to the edge effect)

      ii. Identify habitat patches that are expected to be moved to a lower habitat quality classification as a result of the development

4. Assess the likelihood of a significant reduction in the demographic and genetic viability of the local population of the species of habitat fragmentation concern using the habitat fragmentation information collected under item 3 above and any currently available demographic and genetic data. Based on this assessment, the developer makes the finding whether or not there is significant reduction. The developer should share the finding with the relevant agencies. If the developer finds the likelihood of a significant reduction, the developer should

consider items a, b or c below:

a. Consider alternative locations and development configurations to minimize fragmentation of habitat in communication with species experts, for all species of habitat fragmentation concern in the area of interest.

b. Identify high quality habitat parcels that may be protected as part of a plan to limit future loss of habitat for the impacted population of the species of habitat fragmentation concern in the area.

c. Identify areas of medium or low quality habitat within the range of the impacted population that may be restored or improved to compensate for losses of habitat that result from the project (e.g., management of unpaved roads and ORV trails).

Tier 3, Question 3

The following protocols are suggested for use in answering Tier 3, Question 3.

Bird distribution, abundance, behavior and site use

Diurnal Avian Activity Surveys

The commonly used data collection methods for estimating the spatial distribution and relative abundance of diurnal birds includes counts of birds seen or heard at specific survey points (point count), along transects (transect surveys), and observational studies. Both methods result in estimates of bird use, which are assumed to be indices of abundance in the area surveyed. Absolute abundance is difficult to determine for most species and is not necessary to evaluate species risk. Depending on the characteristics of the area of interest and the bird species potentially affected by the project, additional pre-construction study methods may be necessary. Point counts or line transects should collect vertical as well as horizontal data to identify levels of activity within the rotor-swept zone.

Avian point counts should follow the general methodology described by Reynolds et al. (1980) for point counts within a fixed area, or the line transect survey similar to Schaffer and Johnson (2008), where all birds seen within a fixed distance of a line are counted. These methods are most useful for pre- and post-construction studies to quantify avian use of the project site by habitat, determine the presence of species of concern, and to provide a baseline for assessing displacement effects and habitat loss. Point counts for large birds (e.g., raptors) follow the same point count method described by Reynolds et al. (1980), Ralph et al. (1993) and Ralph et al. 1995).

Point count plots, transects, and observational studies should allow for statistical extrapolation of data and be distributed throughout the area of interest using a probability sampling approach (e.g., systematic sample with a random start). For most projects, the area of interest is the area where wind turbines and permanent meteorological (met) towers are proposed or expected to be sited. Alternatively, the centers of the larger plots can be located at vantage points throughout the potential area being considered with the objective of covering most of the area of interest. Flight height should also be collected to focus estimates of use on activity occurring in the rotor-swept zone.

Sampling duration and frequency will be determined on a project-by-project basis and by the questions being addressed. The most important consideration for sampling frequency when estimating abundance is the amount of variation

Hoary bat. Credit: Paul Cryan, USGS

expected among survey dates and locations and the species of concern.

The use of comparable methods and metrics should allow data comparison from plot to plot within the area of interest and from site to site where similar data exist. The data should be collected so that avian activity can be estimated within the rotor-swept zone. Relating use to site characteristics requires that samples of use also measure site characteristics thought to influence use (i.e., covariates such as vegetation and topography) in relation to the location of use. The statistical relationship of use to these covariates can be used to predict occurrence in unsurveyed areas during the survey period and for the same areas in the future.

Surveys should be conducted at different intervals during the year to account for variation in expected bird activity with lower frequency during winter months if avian activity is low. Sampling frequency should also consider the episodic nature of activity during fall and spring migration. Standardized protocols for estimating avian abundance are well-established and should be consulted (e.g., Dettmers et al. 1999). If a more precise estimate of density is required for a particular species (e.g., when the goal is to determine densities of a special-status breeding bird species), the researcher will need more sophisticated sampling procedures, including estimates of detection probability.

Raptor Nest Searches

An estimate of raptor use of the project site is obtained through appropriate surveys, but if potential impacts to breeding raptors are a concern on a project, raptor nest searches are also recommended. These surveys provide information to predict risk to the local breeding population of raptors, for micro-siting decisions, and for developing an appropriate-sized non-disturbance buffer around nests. Surveys also provide baseline data for estimating impacts and determining mitigation

Red-tailed hawk. Credit: Dave Menke, USFWS

requirements. A good source of information for raptor surveys and monitoring is Bird and Bildstein (2007).

Searches for raptor nests or raptor breeding territories on projects with potential for impacts to raptors should be conducted in suitable habitat during the breeding season. While there is no consensus on the recommended buffer zones around nest sites to avoid disturbance of most species (Sutter and Jones 1981), a nest search within at least one mile of the wind turbines and transmission lines, and other infrastructure should be conducted. However, larger nest search areas are needed for eagles, as explained in the Service's ECP Guidance, when bald or golden eagles are likely to be present.

Methods for these surveys are fairly common and will vary with the species, terrain, and vegetation within the survey area. The Service recommends that protocols be discussed with biologists from the lead agency, Service, state wildlife agency, and Tribes where they have jurisdiction. It may be useful to consult other scientifically credible information sources. At minimum, the protocols should contain the list of target raptor species for nest surveys and the appropriate search protocol for each site, including timing and number of surveys needed, search area, and search techniques.

Prairie Grouse and Sage Grouse Population Assessments

Sage grouse and prairie grouse merit special attention in this context for three reasons:

1. The scale and biotic nature of their habitat requirements uniquely position them as reliable indicators of impacts on, and needs of, a suite of species that depend on sage and grassland habitats, which are among the nation's most diminished ecological communities (Vodehnal and Haufler 2007).

2. Their ranges and habitats are highly congruent with the nation's richest inland wind resources.

3. They are species for which some known impacts of anthropogenic features (e.g., tall structures, buildings, roads, transmission lines, wind energy facilities, etc.) have been documented.

Populations of prairie grouse and sage grouse generally are assessed by either lek counts (a count of the maximum number of males attending a lek) or lek surveys (classification of known leks as active or inactive) during the breeding season (e.g., Connelly et al. 2000). Methods for lek counts vary slightly by species but in general require repeated visits to known sites and a systematic search of all suitable habitat for leks, followed by repeated visits to active leks to estimate the number of grouse using them.

Recent research indicates that viable prairie grouse and sage grouse populations are dependent on suitable nesting and brood-rearing habitat (Connelly et al. 2000, Hagen et al. 2009). These habitats generally are associated with leks. Leks are the approximate centers of nesting and brood-rearing habitats (Connelly et al. 2000, but see Connelly et al. 1988 and Becker et al. 2009). High quality nesting and

brood rearing habitats surrounding leks are critical to sustaining viable prairie grouse and sage grouse populations (Giesen and Connelly 1993, Hagen et al. 2004, Connelly et al. 2000). A population assessment study area should include nesting and brood rearing habitats that may extend several miles from leks. For example, greater and lesser prairie-chickens generally nest in suitable habitats within one to two miles of active leks (Hagen et al. 2004), whereas the average distances from nests to active leks of non-migratory sage grouse range from 0.7 to four miles (Connelly et al. 2000), and potentially much more for migratory populations (Connelly et al. 1988).

While surveying leks during the spring breeding season is the most common and convenient tool for monitoring population trends of prairie grouse and sage grouse, documenting available nesting and brood rearing habitat within and adjacent to the potentially affected area is recommended. Suitable nesting and brood rearing habitats can be mapped based on habitat requirements of individual species. The distribution and abundance of nesting and brood rearing habitats can be used to help in the assessment of adverse impacts of the proposed project to prairie grouse and sage grouse.

Mist-Netting for Birds

Mist-netting is not recommended as a method for assessing risk of wind development for birds. Mist-netting cannot generally be used to develop indices of relative bird abundance, nor does it provide an estimate of collision risk as mist-netting is not feasible at the heights of the rotor-swept zone and captures below that zone may not adequately reflect risk. Operating mist-nets requires considerable experience, as well as state and federal permits.

Occasionally mist-netting can help confirm the presence of rare species at documented fallout or migrant stopover sites near a proposed project. If mist-netting is to be used, the Service recommends that procedures for operating nets and collecting data be followed in accordance with Ralph et al. (1993).

Nocturnal and Crepuscular Bird Survey Methods

Additional studies using different methods should be conducted if characteristics of the project site and surrounding areas potentially pose a high risk of collision to night migrating songbirds and other nocturnal or crepuscular species. For most of their flight, songbirds and other nocturnal migrants are above the reach of wind turbines, but they pass through the altitudinal range of wind turbines during ascents and descents and may also fly closer to the ground during inclement weather (Able, 1970; Richardson, 2000). Factors affecting flight path, behavior, and "fall-out" locations of nocturnal migrants are reviewed elsewhere (e.g., Williams et al., 2001; Gauthreaux and Belser, 2003; Richardson, 2000; Mabee et al., 2006).

In general, pre-construction nocturnal studies are not recommended unless the site has features that might strongly concentrate nocturnal birds, such as along coastlines that are known to be migratory songbird corridors. Biologists knowledgeable about nocturnal bird migration and familiar with patterns of migratory stopovers in the region should assess the potential risks to nocturnal migrants at a proposed project site. No single method can adequately assess the spatial and temporal variation in nocturnal bird populations or the potential collision risk. Following nocturnal study methods in Kunz et al. (2007) is recommended to determine relative abundance, flight direction and flight altitude for assessing risk to migrating birds, if warranted. If areas of interest are within the range of nocturnal species of concern (e.g., marbled murrelet, northern spotted owl, Hawaiian petrel, Newell's shearwater), surveyors should use species-specific protocols recommended by state wildlife agencies, Tribes or Service to assess the species' potential presence in the area of interest.

In contrast to the diurnal avian survey techniques previously described, considerable variation and uncertainty exist on the optimal protocols for using acoustic monitoring devices, radar, and other techniques to evaluate species composition, relative abundance, flight height, and trajectory of nocturnal migrating birds. While an active area of research, the use of radar for determining passage rates, flight heights and flight directions of nocturnal migrating animals has yet to be shown as a good indicator of collision risk. Pre- and post-construction studies comparing radar monitoring results to estimates of bird and bat fatalities will be necessary to evaluate radar as a tool for predicting collision risk. Additional studies are also needed before making recommendations on the number of nights per season or the number of hours per night that are appropriate for radar studies of nocturnal bird migration (Mabee et al., 2006).

<u>Bat survey methods</u>

The Service recommends that all techniques discussed below be conducted by biologists trained in bat identification, equipment use, and the analysis and interpretation of data resulting from the design and conduct of the studies. Activities that involve capturing and handling bats may require permits from state and/or federal agencies.

Acoustic Monitoring

Acoustic monitoring provides information about bat presence and activity, as well as seasonal changes in species occurrence and use, but does not measure the number of individual bats or population density. The goal of acoustic monitoring is to provide a prediction of the potential risk of bat fatalities resulting from the construction and operation of a project. Our current state of knowledge about bat-wind turbine interactions, however, does not allow a quantitative link between pre-construction acoustic assessments of bat activity and operations fatalities. Discussions with experts, state wildlife trustee agencies, Tribes, and

Tri-colored bat. Credit: USFWS

Service will be needed to determine whether acoustic monitoring is warranted at a proposed project site.

The predominance of bat fatalities detected to date are migratory species and acoustic monitoring should adequately cover periods of migration and periods of known high activity for other (i.e., non-migratory) species. Monitoring for a full year is recommended in areas where there is year round bat activity. Data on environmental variables such as temperature and wind speed should be collected concurrently with acoustic monitoring so these weather data can be used in the analysis of bat activity levels.

The number and distribution of sampling stations necessary to adequately estimate bat activity have not been well established but will depend, at least in part, on the size of the project area, variability within the project area, and a Tier 2 assessment of potential bat occurrence.

The number of detectors needed to achieve the desired level of precision will vary depending on the within-site variation (e.g., Arnett et al. 2006, Weller 2007, See also, Bat Conservation International website for up-to-date survey methodologies). One frequently used method is to place acoustic detectors on existing met towers, approximately every two kilometers across the site where turbines are expected to be sited. Acoustic detectors should be placed at high positions (as high as practicable, based on tower height) on each met tower included in the sample to record bat activity at or near the rotor swept zone, the area of presumed greatest risk for bats. Developers should evaluate whether it would be cost effective to install detectors when met towers are first established on a site. Doing so might reduce the cost of installation later and might alleviate time delays to conduct such studies.

If sampling at met towers does not adequately cover the study area or provide sufficient replication, additional sampling stations can be established at low positions (~1.5-2 meters) at a sample of existing met towers and one or more mobile units (i.e., units that are moved to different locations throughout the study period) to increase coverage of the proposed project area. When practical and based on information from Tier 2, it may be appropriate to conduct some acoustic monitoring of features identified as potentially high bat use areas within the study area (e.g., bat roosts and caves) to determine use of such features.

There is growing interest in determining whether "low" position samples (~1.5-2 meters) can provide equal or greater correlation with bat fatalities than "high" position samples (described above) because this would substantially lower cost of this work. Developers could then install a greater number of detectors at lower cost resulting in improved estimates of bat activity and, potentially, improved qualitative estimates of risk to bats. This is a research question that is not expected to be addressed at a project.

Other bat survey techniques

Occasionally, other techniques may be needed to answer Tier 3 questions and complement the information from acoustic surveys. Kunz et al. (2007), NAS (2007), Kunz and Parsons (2009) provide comprehensive descriptions of bat survey techniques, including those identified below that are relevant for Tier 3 studies at wind energy facilities.

Roost Searches and Exit Counts

Pre-construction survey efforts may be recommended to determine whether known or likely bat roosts in mines, caves, bridges, buildings, or other potential roost sites occur within the project vicinity, and to confirm whether known or likely bat roosts are present and occupied by bats. If active roosts are detected, it may be appropriate to address questions about colony size and species composition of roosts. Exit counts and roost searches are two approaches to answering these questions, and Rainey (1995), Kunz and Parsons (2009), and Sherwin et al. (2009) are resources that describe options and approaches for these techniques. Roost searches should be performed cautiously because roosting bats are sensitive to human disturbance (Kunz et al. 1996). Known maternity and hibernation roosts should not be entered or otherwise disturbed unless authorized by state and/or federal wildlife agencies. Internal searches of abandoned mines or caves can be dangerous and should only be conducted by trained researchers. For mine survey protocol and

guidelines for protection of bat roosts, see the appendices in Pierson et al. (1999). Exit surveys at known roosts generally should be limited to non-invasive observation using low-light binoculars and infrared video cameras.

Multiple surveys should be conducted to determine the presence or absence of bats in caves and mines, and the number of surveys needed will vary by species of bats, sex (maternity or bachelor colony) of bats, seasonality of use, and type of roost structure (e.g., caves or mines). For example, Sherwin et al. (2003) demonstrated that a minimum of three surveys are needed to determine the absence of large hibernating colonies of Townsend's big-eared bats in mines (90 percent probability), while a minimum of nine surveys (during a single warm season) are necessary before a mine could be eliminated as a bachelor roost for this species (90 percent probability). An average of three surveys was needed before surveyed caves could be eliminated as bachelor roosts (90 percent probability). The Service recommends that decisions on level of effort follow discussion with relevant agencies and bat experts.

Activity Patterns

If active roosts are detected, it may be necessary to answer questions about behavior, movement patterns, and patterns of roost use for bat species of concern, or to further investigate habitat features that might attract bats and pose fatality risk. For some bat species, typically threatened, endangered, or state-listed species, radio telemetry or radar may be recommended to assess both the direction of movement as bats leave roosts, and the bats' use of the area being considered for development. Kunz et al. (2007) describe the use of telemetry, radar and other tools to evaluate use of roosts, activity patterns, and flight direction from roosts.

Mist-Netting for Bats

While mist-netting for bats is required in some situations by state agencies, Tribes, and the Service to determine the presence of threatened, endangered or other bat species of concern, mist-netting is not generally recommended for determining levels of activity or assessing risk of wind energy development to bats for the following reasons: 1) not all proposed or operational wind energy facilities offer conditions conducive to capturing bats, and often the number of suitable sampling points is minimal or not closely associated with the project location; 2) capture efforts often occur at water sources offsite or at nearby roosts and the results may not reflect species presence or use on the site where turbines are to be erected; and 3) mist-netting isn't feasible at the height of the rotor-swept zone, and captures below that zone may not adequately reflect risk of fatality. If mist-netting is employed, it is best used in combination with acoustic monitoring to inventory the species of bats present at a site.

White-Nose Syndrome

White-nose syndrome is a disease affecting hibernating bats. Named for the white fungus that appears on the muzzle and other body parts of hibernating bats, WNS is associated with extensive mortality of bats in eastern North America. All contractors and consultants hired by developers should employ the most current version of survey and handling protocols to avoid transmitting white-nose syndrome between bats.

Mule deer. Credit: Tupper Ansel Blake, USFWS

Other wildlife

While the above guidance emphasizes the evaluation of potential impacts to birds and bats, Tier 1 and 2 evaluations may identify other species of concern. Developers are encouraged to assess adverse impacts potentially caused by development for those species most likely to be negatively affected by such development. Impacts to other species are primarily derived from potential habitat loss or displacement. The general guidance on the study design and methods for estimation of the distribution, relative abundance, and habitat use for birds is applicable to the study of other wildlife. References regarding monitoring for other wildlife are available in Appendix C:

Sources of Information Pertaining to Methods to Assess Impacts to Wildlife. Nevertheless, most methods and metrics will be species-specific and developers are advised to work with the state, tribal, or federal agencies, or other credible experts, as appropriate, during problem formulation for Tier 3.

Tier 3 Decision Points

Developers and the Service should communicate prior to completing the Tier 3 decision process. A developer should inform the Service of the results of its studies and plans. The Service will provide written comments to a developer on study and project development plans that identify concerns and recommendations to resolve the concerns. The developer and, when applicable, the permitting authority will make a decision regarding whether and how to develop the project. The decision point at the end of Tier 3 involves three potential outcomes:

1. Development of the site has a low probability of significant adverse impact based on existing and new information.

   There is little uncertainty regarding when and how development should proceed, and adequate information exists to satisfy any required permitting. The decision process proceeds to permitting, when required, and/or development, and Tier 4.

2. Development of the site has a moderate to high probability of significant adverse impacts without proper measures being taken to mitigate those impacts. This outcome may be subdivided into two possible scenarios:

   a. There is certainty regarding how to develop the site to adequately mitigate significant adverse impacts. The developer bases their decision to develop the site adopting proper mitigation measures and appropriate post-construction fatality and habitat studies (Tier 4).

Little brown bat with white nose syndrome. Credit: Marvin Moriarty, USFWS

   b. There is uncertainty regarding how to develop the site to adequately mitigate significant adverse impacts, or a permitting process requires additional information on potential significant adverse wildlife impacts before permitting future phases of the project. The developer bases their decision to develop the site adopting proper mitigation measures and appropriate post-construction fatality and habitat studies (Tier 4).

3. Development of the site has a high probability of significant impact that:

   a. Cannot be adequately mitigated.

   Site development should be delayed until plans can be developed that satisfactorily mitigate for the significant adverse impacts. Alternatively, the site should be abandoned in favor of known sites with less potential for environmental impact, or the developer begins an evaluation of other sites or landscapes for more acceptable sites to develop.

   b. Can be adequately mitigated.

   Developer should implement mitigation measures and proceed to Tier 4.

Chapter 5: Tier 4 – Post-construction Studies to Estimate Impacts

The outcome of studies in Tiers 1, 2, and 3 will determine the duration and level of effort of post-construction studies.

Tier 4 post-construction studies are designed to assess whether predictions of fatality risk and direct and indirect impacts to habitat of species of concern were correct. Fatality studies involve searching for bird and bat carcasses beneath turbines to estimate the number and species composition of fatalities (Tier 4a). Habitat studies involve application of GIS and use data collected in Tier 3 and Tier 4b and/or published information. Post-construction studies on direct and indirect impacts to habitat of species of concern, including species of habitat fragmentation concern need only be conducted if Tier 3 studies indicate the potential for significant adverse impacts.

Tier 4a – Fatality Studies

At this time, community- and utility-scale projects should conduct at least one year of fatality monitoring. The intensity of the studies should be related to risks of significant adverse impacts identified in pre-construction assessments. As data collected with consistent methods and metrics increases (see discussion below), it is possible that some future projects will not warrant fatality monitoring, but such a situation is rare with the present state of knowledge.

Fatality monitoring should occur over all seasons of occupancy for the species being monitored, based on information produced in previous tiers. The number of seasons and total length of the monitoring may be determined separately for bats and birds, depending on the pre-construction risk assessment, results of Tier 3 studies and Tier 4 monitoring from comparable sites (see Glossary in Appendix A) and the results of first year fatality monitoring. Guidance on the relationship between these variables and monitoring for fatalities is provided in Table 2.

A male Eastern red bat perches among green foliage. Credit: ©MerlinD.Tuttle,BatConservationInternational,www.batcon.org

It may be appropriate to conduct monitoring using different durations and intervals depending on the species of concern. For example, if raptors occupy an area year-round, it may be appropriate to monitor for raptors throughout the year (12 months). It may be warranted to monitor for bats when they are active (spring, summer and fall or

approximately eight months). It may be appropriate to increase the search frequency during the months bats are active and decrease the frequency during periods of inactivity. All fatality monitoring should include estimates of carcass removal and carcass detection bias likely to influence those rates.

Tier 4a Questions

Post-construction fatality monitoring should be designed to answer the following questions as appropriate for the individual project:

1. **What are the bird and bat fatality rates for the project?**
2. **What are the fatality rates of species of concern?**
3. **How do the estimated fatality rates compare to the predicted fatality rates?**
4. **Do bird and bat fatalities vary within the project site in relation to site characteristics?**
5. **How do the fatality rates compare to the fatality rates from existing projects in similar landscapes with similar species composition and use?**
6. **What is the composition of fatalities in relation to migrating and resident birds and bats at the site?**
7. **Do fatality data suggest the need for measures to reduce impacts?**

Tier 4a studies should be of sufficient statistical validity to address Tier 4a questions and enable determination of whether Tier 3 fatality predictions were correct. Fatality monitoring results also should allow comparisons with other sites, and provide a basis for determining if operational changes or other mitigation measures at the site are appropriate. The Service encourages project operators to discuss Tier 4 studies with local, state, federal, and tribal wildlife agencies. The number of years of monitoring is based on outcomes of Tier 3 and Tier 4 studies and analysis of comparable Tier 4 data from other projects as indicated in Table 2. The Service may recommend multiple years of monitoring for projects located near a listed species or bald or golden eagle, or other situations, as appropriate.

Tier 4a Protocol Design Considerations

The basic method of measuring fatality rates is the carcass search. Search protocols should be standardized to the greatest extent possible, especially for common objectives and species of concern, and they should include methods for adequately accounting for sampling biases (searcher efficiency and scavenger removal). However, some situations warrant exceptions to standardized protocol. The responsibility of demonstrating that an exception is appropriate and applicable should be on the project operator to justify increasing or decreasing the duration or intensity of operations monitoring.

Some general guidance is given below with regard to the following fatality monitoring protocol design issues:

- Duration and frequency of monitoring
- Number of turbines to monitor
- Delineation of carcass search plots, transects, and habitat mapping
- General search protocol
- Field bias and error assessment
- Estimators of fatality

More detailed descriptions and methods of fatality search protocols can be found in the California (California Energy Commission 2007) and Pennsylvania (Pennsylvania Game Commission 2007) state guidelines and in Kunz et al. (2007), Smallwood (2007), and Strickland et al. (2011).

Duration and frequency of monitoring

Frequency of carcass searches (search interval) may vary for birds and bats, and will vary depending on the questions to be answered, the species of concern, and their seasonal abundance at the project site. The carcass searching protocol should be adequate to answer applicable Tier 4 questions at an appropriate level of precision to make general conclusions about the project, and is not intended to provide highly precise measurements of fatalities. Except during low use times (e.g. winter months in northern states), the Service recommends that protocols be designed such that carcass searches occur at some turbines within the project area most days each week of the study.

The search interval is the interval between carcass searches at individual turbines, and this interval may be lengthened or shortened depending on the carcass removal rates. If the primary focus is on fatalities of large raptors, where carcass removal is typically low, then a longer interval between searches (e.g., 14-28 days) is sufficient. However, if the focus is on fatalities of bats and small birds and carcass removal is high, then a shorter search interval will be necessary.

There are situations in which studies of higher intensity (e.g., daily searches at individual turbines within the sample) may be appropriate. These would be considered only in Tier 5 studies or in research programs because the greater complexity and level of effort goes beyond that recommended for typical Tier 4 post construction monitoring. Tier 5 and research studies could include evaluation of specific measures that have been implemented to mitigate potential significant adverse impacts to species of concern identified during pre-construction studies.

Number of turbines to monitor

If available, data on variability among turbines from existing

Wind turbine. Credit: NREL

projects in similar conditions within the same region are recommended as a basis for determining needed sample size (see Morrison et al., 2008). If data are not available, the Service recommends that an operator select a sufficient number of turbines via a systematic sample with a random start point. Sampling plans can be varied (e.g., rotating panels [McDonald 2003, Fuller 1999, Breidt and Fuller 1999, and Urquhart et al. 1998]) to increase efficiency as long as a probability sampling approach is used. If the project contains fewer than 10 turbines, the Service recommends that all turbines in the area of interest be searched unless otherwise agreed to by the permitting or wildlife resource agencies. When selecting turbines, the Service recommends that a systematic sample with a random start be used when selecting search plots to ensure interspersion among turbines. Stratification among different habitat types also is recommended to account for differences in fatality rates among different habitats (e.g., grass versus cropland or forest); a sufficient number of turbines should be sampled in each strata.

Delineation of carcass search plots, transects, and habitat mapping

Evidence suggests that greater than 80 percent of bat fatalities fall within half the maximum distance of turbine height to ground (Erickson 2003 a, b), and a minimum plot width of 120 meters from the turbine should be established at sample turbines. Plots will need to be larger for birds, with a width twice the turbine height to ground. Decisions regarding search plot size should be made in discussions with the Service, state wildlife agency, permitting agency and Tribes. It may be useful to consult other scientifically credible information sources.

The Service recommends that each search plot should be divided into oblong subplots or belt transects and that each subplot be searched. The objective is to find as many carcasses as possible so the width of the belt will vary depending on the ground cover and its influence on carcass visibility. In most situations, a search width of 6 meters should be adequate, but this may vary from 3-10 meters depending on ground cover.

Searchable area within the theoretical maximum plot size varies, and heavily vegetated areas (e.g., eastern mountains) often do not allow surveys to consistently extend to the maximum plot width. In other cases it may be preferable to search a portion of the maximum plot instead of the entire plot. For example, in some landscapes it may be impractical to search the entire plot because of the time required to do an effective search, even if it is accessible (e.g., croplands), and data from a probability sample of subplots within the maximum plot size can provide a reasonable estimate of fatalities. It is important to accurately delineate and map the area searched for each turbine to adjust fatality estimates based on the actual area searched. It may be advisable to establish habitat visibility classes in each plot to account for differential detectability, and to develop visibility classes for different landscapes (e.g., rocks, vegetation) within each search plot. For example, the Pennsylvania Game Commission (2007) identified four classes based on the percentage of bare ground.

The use of visibility classes requires that detection and removal biases be estimated for each class. Fatality estimates should be made for each class and summed for the total area sampled. Global positioning systems (GPS) are useful for accurately mapping the actual total area searched and area searched in each habitat visibility class, which can be used to adjust fatality estimates. The width of the belt or subplot searched may vary depending on the habitat and species of concern; the key is to determine actual searched area and area searched in each visibility class regardless of transect width. An adjustment may also be needed to take into account the density of fatalities as a function of the width of the search plot.

General search protocol

Personnel trained in proper search techniques should look for bird and bat carcasses along transects or subplots within each plot and record and collect all carcasses located in the searchable areas. The Service will work with developers and operators to provide necessary permits for carcass possession. A complete search of the area should be accomplished and subplot size (e.g., transect width) should be adjusted to compensate for detectability differences in the search area. Subplots should be smaller when vegetation makes it difficult to detect carcasses; subplots can be wider in open terrain. Subplot width also can vary depending on the size of the species being looked for. For example, small species such as bats may require smaller subplots than larger species such as raptors.

Data to be recorded include date, start time, end time, observer, which turbine area was searched (including GPS coordinates) and weather data for each search. When a dead bat or bird is found, the searcher should place a flag near the carcass and continue the search. After searching the entire plot, the searcher returns to each carcass and records information

on a fatality data sheet, including date, species, sex and age (when possible), observer name, turbine number, distance from turbine, azimuth from turbine (including GPS coordinates), habitat surrounding carcass, condition of carcass (entire, partial, scavenged), and estimated time of death (e.g., <1 day, 2 days). The recorded data will ultimately be housed in the FWS Office of Law Enforcement Bird Mortality Reporting System. A digital photograph of the carcass should be taken. Rubber gloves should be used to handle all carcasses to eliminate possible transmission of rabies or other diseases and to reduce possible human scent bias for carcasses later used in scavenger removal trials. Carcasses should be placed in a plastic bag and labeled. Unless otherwise conditioned by the carcass possession permit, fresh carcasses (those determined to have been killed the night immediately before a search) should be redistributed at random points on the same day for scavenging trials.

Field bias and error assessment

During searches conducted at wind turbines, actual fatalities are likely incompletely observed. Therefore carcass counts must be adjusted by some factor that accounts for imperfect detectability (Huso 2011). Important sources of bias and error include: 1) fatalities that occur on a highly periodic basis; 2) carcass removal by scavengers; 3) differences in searcher efficiency; 4) failure to account for the influence of site (e.g. vegetation) conditions in relation to carcass removal and searcher efficiency; and 5) fatalities or injured birds and bats that may land or move outside search plots.

Some fatalities may occur on a highly periodic basis creating a potential sampling error (number 1 above). The Service recommends that sampling be scheduled so that some turbines are searched most days and episodic events are more likely detected, regardless of the search interval. To address bias sources 2-4 above, it is strongly recommended that all fatality studies conduct carcass removal and searcher efficiency trials using accepted methods (Anderson 1999, Kunz et al. 2007, Arnett et al. 2007, NRC 2007, Strickland et al. 2011). Bias trials should be conducted throughout the entire study period and searchers should be unaware of which turbines are to be used or the number of carcasses placed beneath those turbines during trials. Carcasses or injured individuals may land or move outside the search plots (number 5 above). With respect to Tier 4a fatality estimates, this potential sampling error is considered to be small and can be assumed insignificant (Strickland et al. 2011).

Prior to a study's inception, a list of random turbine numbers and random azimuths and distances (in meters) from turbines should be generated for placement of each bat or bird used in bias trials. Data recorded for each trial carcass prior to placement should include date of placement, species, turbine number, distance and direction from turbine, and visibility class surrounding the carcass. Trial carcasses should be distributed as equally as possible among the different visibility classes throughout the study period and study area. Studies should attempt to avoid "over-seeding" any one turbine with carcasses by placing no more than one or two carcasses at any one time at a given turbine. Before placement, each carcass must be uniquely marked in a manner that does not cause additional attraction, and its location should be recorded. There is no agreed upon sample size for bias trials, though some state guidelines recommend from 50 - 200 carcasses (e.g., PGC 2007).

Estimators of fatality

If there were a direct relationship between the number of carcasses observed and the number killed, there would be no need to develop a complex estimator that adjusts observed counts for detectability, and observed counts could be used as a simple index of fatality (Huso 2011). But the relationship is not direct and raw carcass counts recorded using different search intervals and under different carcass removal rates and searcher efficiency rates are not directly comparable. It is strongly recommended that only the most contemporary equations for estimating fatality be used, as some original versions are now known to be extremely biased under many commonly encountered field conditions (Erickson et al. 2000b, Erickson et al. 2004, Johnson et al. 2003, Kerns and Kerlinger 2004, Fiedler et al. 2007, Kronner et al. 2007, Smallwood 2007, Huso 2011, Strickland et al. 2011).

Tier 4a Study Objectives

In addition to the monitoring protocol design considerations described above, the metrics used to estimate fatality rates must be selected with the Tier 4a questions and objectives in mind. Metrics considerations for each of the Tier 4a questions are discussed briefly below. Not all questions will be relevant for each project, and which questions apply would depend on Tier 3 outcomes.

1. What are the bird and bat fatality rates for the project?

The primary objective of fatality searches is to determine the overall estimated fatality rates for birds and bats for the project. These rates serve as the fundamental basis for all comparisons of fatalities, and if studies are designed appropriately they allow researchers to relate fatalities to site characteristics and environmental variables, and to evaluate mitigation measures. Several metrics are available for expressing fatality rates. Early studies reported fatality rates per turbine. However, this metric is somewhat misleading as turbine sizes and their risks to birds vary significantly (NRC 2007). Fatalities are frequently reported per nameplate capacity (i.e. MW), a metric that is easily calculated and better for comparing fatality rates among different sized turbines. Even with turbines of the same name plate capacity, the size of the rotor swept area may vary among manufacturers, and turbines at various sites may operate for

different lengths of time and during different times of the day and seasons. With these considerations in mind, the Service recommends that fatality rates be expressed on a per-turbine and per-nameplate MW basis until a better metric becomes available.

2. What are the fatality rates of species of concern?

This analysis simply involves calculating fatalities per turbine of all species of concern at a site when sample sizes are sufficient to do so. These fatalities should be expressed on a per nameplate MW basis if comparing species fatality rates among projects.

3. How do the estimated fatality rates compare to the predicted fatality rates?

There are several ways that predictions can be evaluated with actual fatality data. During the planning stages in Tier 2, predicted fatalities may be based on existing data at similar facilities in similar landscapes used by similar species. In this case, the assumption is that use is similar, and therefore that fatalities may be similar at the proposed facility. Alternatively, metrics derived from pre-construction assessments for an individual species or group of species – usually an index of activity or abundance at a proposed project – could be used in conjunction with use and fatality estimates from existing projects to develop a model for predicting fatalities at the proposed project site. Finally, physical models can be used to predict the probability of a bird of a particular size striking a turbine, and this probability, in conjunction with estimates of use and avoidance behavior, can be used to predict fatalities.

The most current equations for estimating fatality should be used to evaluate fatality predictions. Several statistical methods can be found in the revised Strickland et al. 2011 and used to evaluate fatality predictions. Metrics derived from Tier 3 pre-construction assessments may be correlated with fatality rates, and (using the project as the experimental unit), in Tier 5 studies it should be possible to determine if different preconstruction metrics can in fact accurately predict fatalities and, thus, risk.

4. Do bird and bat fatalities vary within the project site in relation to site characteristics?

Data from pre-construction studies can demonstrate patterns of activity that may depend upon the site characteristics. Turbines placed near escarpments or cliffs may intrude upon airspace used by raptors soaring on thermals. Pre-construction and post construction studies and assessments can be used to avoid siting individual, specific turbines within an area used by species of concern. Turbine-specific fatality rates may be related to site characteristics such as proximity to water, forest edge, staging and roosting sites, known stop-over sites, or other key resources, and this relationship may be estimated using regression analysis. This information is particularly useful for evaluating micro-siting options when planning a future facility or, on a broader scale, in determining the location of the entire project.

5. How do the fatality rates compare to the fatality rates from existing facilities in similar landscapes with similar species composition and use?

Comparing fatality rates among facilities with similar characteristics can be useful to determine patterns and broader landscape relationships. Developers should communicate with the Service to ensure that such comparisons are appropriate to avoid false conclusions. Fatality rates should be expressed on a per nameplate MW or some other standardized metric basis for comparison with other projects,

Big brown bat. Credit: USFWS

and may be correlated with site characteristics – such as proximity to wetlands, riparian corridors, mountain-foothill interface, wind patterns, or other broader landscape features – using regression analysis. Comparing fatality rates from one project to fatality rates of other projects provides insight into whether a project has relatively high, moderate or low fatalities.

6. What is the composition of fatalities in relation to migrating and resident birds and bats at the site?

The simplest way to address this question is to separate fatalities per turbine of known resident species (e.g., big brown bat, prairie horned lark) and those known to migrate long distances (e.g. hoary bat, red-eyed vireo). These data are useful in determining patterns of species composition of fatalities and possible mitigation measures directed at residents, migrants, or perhaps both, and can be used in assessing potential population effects.

[7] In situations where a project operator was not the developer, the Service expects that obligations of the developer for adhering to the Guidelines transfer with the project.

Table 2. Decision Framework for Tier 4a Fatality Monitoring of Species of Concern.[8]

Probability of Significant Adverse Impacts in Tier 3	*Recommended Fatality Monitoring Duration and Effort*	*Possible Outcomes of Monitoring Results*
Tier 3 Studies indicate LOW probability of significant adverse impacts	Duration: At least one year of fatality monitoring to estimate fatalities of birds and bats. Field assessments should be sufficient to confirm that risk to birds and/or bats is indeed "low."	1. Documented fatalities are approximately equal to or lower than predicted risk. No further fatality monitoring or mitigation is needed. 2. Fatalities are greater than predicted, but are not likely to be significant (i.e., unlikely to affect the long-term status of the population). If comparable fatality data at similar sites also supports that impacts are not likely to be high enough to affect population status, no further monitoring or mitigation is needed. If no comparable fatality data are available or such data indicates high risk, one additional year of fatality monitoring is recommended. If two years of fatality monitoring indicate levels of impacts that are not significant, no further fatality monitoring or mitigation is recommended. 3. Fatalities are greater than predicted and are likely to be significant OR federally endangered or threatened species or BGEPA species are affected. Communication with the Service is recommended. Further efforts to address impacts to BGEPA or ESA species may be warranted, unless otherwise addressed in an ESA or BGEPA take permit.
Tier 3 studies indicate MODERATE probability of significant adverse impacts	Duration: Two or more years of fatality monitoring may be necessary. Field assessments should be sufficient to confirm that risk to birds and/or bats is indeed "moderate." Closely compare estimated effects to species to those determined from the risk assessment protocol(s).	1. Documented fatalities after the first two years are lower or not different than predicted and are not significant and no federally endangered species or BGEPA species are affected - no further fatality monitoring or mitigation is needed. 2. Fatalities are greater than predicted and are likely to be significant OR federally endangered or threatened species or BGEPA species are affected, communication with the Service is recommended. Further efforts to address impacts to BGEPA or ESA species may be warranted, unless otherwise addressed in an ESA or BGEPA take permit.
Tier 3 studies indicate HIGH probability of significant adverse impacts	Duration: Two or more years of fatality monitoring may be necessary to document fatality patterns. If fatality is high, developers should shift emphasis to exploring opportunities for mitigation rather than continuing to monitor fatalities. If fatalities are variable, additional years are likely warranted.	1. Documented fatalities during each year of fatality monitoring are less than predicted and are not likely to be significant, and no federally endangered or threatened species or BGEPA species are affected – no further fatality monitoring or mitigation is needed. 2. Fatalities are equal to or greater than predicted and are likely to be significant - further efforts to reduce impacts are necessary; communication with the Service are recommended. Further efforts, such as Tier 5 studies, to address impacts to BGEPA or ESA species may be warranted, unless otherwise addressed in an ESA or BGEPA take permit.

[8] Ensure that survey protocols, and searcher efficiency and scavenger removal bias correction factors are the most reliable, robust, and up to date (after Huso 2009).

7. Do fatality data suggest the need for measures to reduce impacts?

The Service recommends that the wind project operator[7] and the relevant agencies discuss the results from Tier 4 studies to determine whether these impacts are significant. If fatalities are considered significant, the wind project operator and the relevant agencies should develop a plan to mitigate the impacts.

Tier 4b – Assessing direct and indirect impacts of habitat loss, degradation, and fragmentation

The objective of Tier 4b studies is to evaluate Tier 3 predictions of direct and indirect impacts to habitat and the potential for significant adverse impacts on species of concern as a result of these impacts. Tier 4b studies should be conducted if Tier 3 studies indicate the presence of species of habitat fragmentation concern, or if Tier 3 studies indicate significant direct and indirect adverse impacts to species of concern (see discussion below). Tier 4b studies should also inform project operators and the Service as to whether additional mitigation is necessary.

Tier 4b studies should evaluate the following questions:

1. **How do post-construction habitat quality and spatial configuration of the study area compare to predictions for species of concern identified in Tier 3 studies?**

2. **Were any behavioral modifications or indirect impacts noted in regard to species of concern?**

3. **If significant adverse impacts were predicted for species of concern, and the project was altered to mitigate for adverse impacts, were those efforts successful?**

4. **If significant adverse impacts were predicted for species of concern, and the project was altered to mitigate for adverse impacts, were those efforts successful?**

The answers to these questions will be based on information estimating habitat loss, degradation, and fragmentation information collected in Tier 3, currently available demographic and genetic data, and studies initiated in Tier 3. As in the case of Tier 4a, the answers to these questions will determine the need to conduct Tier 5 studies. For example, in the case that significant adverse impacts to species of concern were predicted, but mitigation was not successful, then additional mitigation and Tier 5 studies may be necessary. See Table 3 for further guidance.

1. **How do post-construction habitat quality and spatial configuration of the study area compare to predictions for species of concern identified in Tier 3 studies?**

GIS and demographic data collected in Tier 3 and/or published information can be used to determine predictions of impacts to species of concern from habitat loss, degradation, and fragmentation. The developer can provide development assumptions based on Tier 3 information that can be compared to post-construction information. Additional post-construction studies on impacts to species of concern due to direct and indirect impacts to habitat should only be conducted if Tier 3 studies indicate the potential for significant adverse impacts.

2. **Were any behavioral modifications or indirect impacts noted in regard to affected species?**

Evaluation of this question is based on the analysis of observed use of the area by species of concern prior to construction in comparison with observed use during operation. Observations and demographic data collected during Tier 3, and assessment of published information about the potential for displacement and demographic responses to habit impacts could be the basis for this analysis. If this analysis suggests that direct and/or indirect loss of habitat for a species of concern leads to behavioral modifications or displacement that are significant, further studies of these impacts in Tier 5 may be appropriate.

3. **If significant adverse impacts were not predicted in Tier 3 because of loss, degradation, or fragmentation of habitat, but Tier 4b studies indicate such impacts have the potential to occur, can these impacts be mitigated?**

When Tier 4b studies indicate significant impacts may be occurring, the developer may need to conduct an assessment of these impacts and what opportunities exist for additional mitigation.

4. **If significant adverse impacts were predicted for species of concern, and the project was altered to mitigate for adverse impacts, were those efforts successful?**

When Tier 4b studies indicate significant impacts may be occurring, the developer may need to conduct an assessment of these impacts and what opportunities exist for additional mitigation. Evaluation of the effectiveness of mitigation is a Tier 4 study and should follow design considerations discussed in Tier 5 and from guidance in the scientific literature (e.g. Strickland et al. 2011).

When Tier 3 studies identified potential moderate or high risks to species of concern that caused a developer to incorporate mitigation measures into the project, Tier 4b studies should evaluate the effectiveness of those mitigation measures. Determining such effectiveness is important for the project being evaluated to ascertain whether additional mitigation measures are appropriate as well as informing future decisions about how to improve mitigation at wind

energy facilities being developed.

Tier 4b Protocol Design Considerations

Impacts to a species of concern resulting from the direct and indirect loss of habitat are important and must be considered when a wind project is being considered for development. Some species of concern are likely to occur at every proposed wind energy facility. This occurrence may range from a breeding population, to seasonal occupancy, such as a brief occurrence while migrating through the area. Consequently the level of concern regarding impacts due to direct and indirect loss of habitat will vary depending on the species and the impacts that occur.

If a breeding population of a species of habitat fragmentation concern occurs in the project area and Tier 3 studies indicate that fragmentation of their habitat is possible, these predictions should be evaluated following the guidance indicated in Table 3 using the protocols described in Tier 3. If the analysis of post-construction GIS data on direct and indirect habitat loss suggests that fragmentation is likely, then additional displacement studies and mitigation may be necessary. These studies would typically begin immediately and would be considered Tier 5 studies using design considerations illustrated by examples in Tier 5 below and from guidance in the scientific literature (e.g. Strickland et al. 2011).

Significant direct or indirect loss of habitat for a species of concern may occur without habitat fragmentation if project impacts result in the reduction of a habitat resource that potentially is limiting to the affected population. Impacts of this type include loss of use of breeding habitat or loss of a significant portion of the habitat of a federally or state protected species. This would be evaluated by determining the amount of the resource that is lost and determining if this loss would potentially result in significant impacts to the affected population. Evaluation of potential significant impacts would occur in Tier 5 studies that measure the demographic response of the affected population.

Black-capped Vireo. Credit: Greg W. Lasley

The intention of the Guidelines is to focus industry and agency resources on the direct and indirect loss of habitat and limiting resources that potentially reduce the viability of a species of concern. Not all direct and indirect loss of a species' habitat will affect limiting resources for that species, and when habitat losses are minor or non-existent no further study is necessary.

Tier 4b Decision Points

The developer should use the results of the Tier 4b studies to evaluate whether further studies and/or mitigation are needed. The developer should communicate the results of these studies, and decisions about further studies and mitigation, with the Service. Table 3 provides a framework for evaluating the need for further studies and mitigation. Level of effort for studies should be sufficient to answer all questions of interest. Refer to the relevant methods sections for Tier 2 Question 5 and Tier 3 Question 2 in the text for specific guidance on study protocols.

Table 3. Decision Framework to Guide Studies for Minimizing Impacts to Habitat and Species of Habitat Fragmentation (HF) Concern.

Outcomes of Tier 2	*Outcomes of Tier 3*	*Outcomes of Tier 4b*	*Suggested Study/Mitigation*
• No species of HF concern potentially present	• No further studies needed	• n/a	• n/a
• Species of HF concern potentially present	• No species of HF concern confirmed to be present	• No further studies needed	• n/a
	• Species of HF concern demonstrated to be present, but no significant adverse impacts predicted	• Tier 4b studies confirm Tier 3 predictions	• No further studies or mitigation needed
		• Tier 4b studies indicate potentially significant adverse impacts	• Tier 5 studies and mitigation may be needed
• Species of HF concern potentially present	• Species of HF concern demonstrated to be present; significant adverse impacts predicted	• Tier 4b studies determine mitigation plan is effective; no significant adverse impacts demonstrated	• No further studies or mitigation needed
	• Mitigation plan developed and implemented	• Tier 4b studies determine mitigation plan is NOT effective; potentially significant adverse impacts	• Further mitigation and, where appropriate, Tier 5 studies

Chapter 6: Tier 5 – Other Post-construction Studies

Tier 5 studies will not be necessary for most wind energy projects. Tier 5 studies can be complex and time consuming. The Service anticipates that the tiered approach will steer projects away from sites where Tier 5 studies would be necessary.

When Tier 5 studies are conducted, they should be site-specific and intended to: 1) analyze factors associated with impacts in those cases in which Tier 4 analyses indicate they are potentially significant; 2) identify why mitigation measures implemented for a project were not adequate; and 3) assess demographic effects on local populations of species of concern when demographic information is important, including species of habitat fragmentation concern.

Tier 5 Questions

Tier 5 studies are intended to answer questions that fall in three major categories; answering yes to any of these questions might indicate a Tier 5 study is needed:

1. **To the extent that the observed fatalities exceed anticipated fatalities, are those fatalities potentially having a significant adverse impact on local populations? Are observed direct and indirect impacts to habitat having a significant adverse impact on local populations?**

For example, in the Tier 3 risk assessment, predictions of collision fatalities and habitat impacts (direct and indirect) are developed. Post-construction studies in Tier 4 evaluate the accuracy of those predictions by estimating impacts. If post-construction studies demonstrate potentially significant adverse impacts, Tier 5 studies may also be warranted and should be designed to understand observed versus predicted impacts.

2. **Were mitigation measures implemented (other than fee in lieu) not effective? This includes habitat mitigation measures as well as measures undertaken to reduce collision fatalities.**

Tier 4a and b studies can assess the effectiveness of measures taken to reduce direct and indirect impacts as part of the project and to identify such alternative or additional measures as are necessary. If alternative or additional measures were unsuccessful, the reasons why would be evaluated using Tier 5 studies.

3. **Are the estimated impacts of the proposed project likely to lead to population declines in the species of concern (other than federally-listed species)?**

Impacts of a project will have population level effects if the project causes a population decline in the species of concern. For non-listed species, this assessment will apply only to the local population.

Wind turbines and habitat. Credit: NREL

Tier 5 studies may need to be conducted when:

- Realized fatality levels for individual species of concern reach a level at which they are considered significant adverse impacts by the relevant agencies.

  For example, if Tier 4a fatality studies document that a particular turbine or set of turbines exhibits bird or bat collision fatality higher than predicted, Tier 5 studies may be useful in evaluating alternative mitigation measures at that turbine/turbine string.

- There is the potential for significant fatality impacts or significant adverse impacts to habitat for species of concern, there is a need to assess the impacts more closely, and there is uncertainty over how these impacts will be mitigated.

- Fatality and/or significant adverse habitat impacts suggest the potential for a reduction in the viability of an affected population, in which case studies on the potential for population impacts may be warranted.

- A developer evaluates the effectiveness of a risk reduction measure before deciding to continue the measure permanently or whether to use the measure when implementing future phases of a project.

  In the event additional turbines are proposed as an expansion of an existing project, results from Tier 4 and Tier 5 studies and the decision-making framework contained in the tiered approach can be used to determine whether the project should be expanded and whether additional information should be collected. It may also be necessary to evaluate whether additional measures are warranted to reduce significant adverse impacts to species.

Tier 5 Study Design Considerations

As discussed in Chapter 4 Tier 3, Tier 5 studies will be highly variable and unique to the circumstances of the individual project, and therefore these Guidelines do not provide specific guidance on all potential approaches, but make some general statements about study design. Specific Tier 5 study designs will depend on the types of questions, the specific project, and practical considerations. The most common practical considerations include the area being studied, the time period of interest, the species of concern, potentially confounding variables, time available to conduct studies, project budget, and the magnitude of the anticipated impacts. When possible it is usually desirable to collect data before construction to address Tier 5 questions. Design considerations for these studies are including in Tier 3.

One study design is based on an experimental approach to evaluating mitigation measures, where the project proponent will generally select several alternative management approaches to design, implement, and test. The alternatives are generally incorporated into sound experimental designs. Monitoring and evaluation of each alternative helps the developer to decide which alternative is more effective in meeting objectives, and informs adjustments to the next round of management decisions. The need for this type of study design can be best determined by communication between the project operator, the Service field office, and the state wildlife agency, on a project-by-project basis. This study design requires developers and operators to identify strategies to adjust management and/or mitigation measures if monitoring indicates that anticipated impacts are being exceeded. Such strategies should include a timeline for periodic reviews and adjustments as well as a mechanism to consider and implement additional mitigation measures as necessary after the project is developed.

When pre-construction data are unavailable and/or a suitable reference area is lacking, the reference Control Impact Design (Morrison et al. 2008) is the recommended design. The lack of a suitable reference area also can be addressed using the Impact Gradient Design, when habitat and species use are homogenous in the assessment area prior to development. When applied both pre- and post-construction, the Impact Gradient Design is a suitable replacement for the classic BACI (Morrison et al. 2008).

In the study of habitat impacts, the resource selection function (RSF) study design (see Anderson et al 1999; Morrison et al. 2008; Manly et al. 2002) is a statistically robust design, either with or without pre-construction and reference data. Habitat selection is modeled as a function of characteristics measured on resource units and the use of those units by the animals of interest. The RSF allows the estimation of the probability of use as a function of the distance to various environmental features, including wind energy facilities, and thus provides a direct quantification of the magnitude of the displacement effect. RSF could be improved with pre-construction and reference area data. Nevertheless, it is a relatively powerful approach to documenting displacement or the effect of mitigation measures designed to reduce displacement even without those additional data.

Tier 5 Examples

As described earlier, Tier 5 studies will not be conducted at most projects, and the specific Tier 5 questions and methods for addressing these questions will depend on the individual project and the concerns raised during pre-construction studies and during operational phases. Rather than provide specific guidance on all potential approaches, these Guidelines offer the following case studies as examples of studies that have attempted to answer Tier 5 questions.

<u>Habitat impacts - displacement and demographic impact studies</u>

Rows of wind turbines. Credit: Joshua Winchell, USFWS

Studies to assess impacts may include quantifying species' habitat loss (e.g., acres of lost grassland habitat for grassland songbirds) and habitat modification. For example, an increase in edge may result in greater nest parasitism and nest predation. Assessing indirect impacts may include two important components: 1) indirect effects on wildlife resulting from displacement, due to disturbance, habitat fragmentation, loss, and alteration; and 2) demographic effects that may occur at the local, regional or population-wide levels due to reduced nesting and breeding densities, increased isolation between habitat patches, and effects on behavior (e.g., stress, interruption, and modification). These factors can individually or cumulatively affect wildlife, although some species may be able to habituate to some or perhaps all habitat changes. Indirect impacts may be difficult to quantify but their effects may be significant (e.g., Stewart et al. 2007, Pearce-Higgins et al. 2008, Bright et al. 2008, Drewitt and Langston 2006, Robel et al. 2004, Pruett et al. 2009).

Example: in southwestern Pennsylvania, development of a project is proceeding at a site located within the range of a state-listed terrestrial species. Surveys were performed at habitat locations appropriate for use by the animal, including at control sites. Post-construction studies are planned at all locations to demonstrate any displacement effects resulting from the construction and operation of the project.

The Service recognizes that indirect impact studies may not be appropriate for most individual projects. Consideration should be given to developing collaborative research efforts with industry, government agencies, and NGOs to conduct studies to address indirect impacts.

Indirect impacts are considered potentially significant adverse threats to species such as prairie grouse (prairie chickens, sharp-tailed grouse), and sage grouse, and demographic studies may be necessary to determine the extent of these impacts and the need for mitigation.

Displacement studies may use any of the study designs describe earlier. The most scientifically robust study designs to estimate displacement effects are BACI, RSF, and impact gradient. RSF and impact gradient designs may not require specialized data gathering during Tier 3.

Telemetry studies that measure impacts of the project development on displacement, nesting, nest success, and survival of prairie grouse and sage grouse in different environments (e.g., tall grass, mixed grass, sandsage, sagebrush) will require spatial and temporal replication, undisturbed reference sites, and large sample sizes covering large areas. Examples of study designs and analyses used in the studies of other forms of energy development are presented in Holloran et al. (2005), Pitman et al. (2005), Robel et al. (2004), and Hagen et al. (2011). Anderson et al. (1999) provides a thorough discussion of the design, implementation, and analysis of these kinds of field studies and should be consulted when designing the BACI study.

Studies are being initiated to evaluate effects of wind energy development on greater sage grouse in Wyoming. In addition to measuring demographic patterns, these studies will use the RSF study design (see Sawyer et al. 2006) to estimate the probability of sage grouse use as a function of the distance to environmental features, including an existing and a proposed project.

In certain situations, such as for a proposed project site that is relatively small and in a more or less homogeneous landscape, an impact gradient design may be an appropriate means to assess avoidance of the wind energy facility by resident populations (Strickland et al., 2002). For example, Leddy et al. 1999 used the impact gradient design to evaluate grassland bird density as a function of the distance from wind turbines. Data were collected at various distances from turbines along transects.

This approach provides information on whether there is an effect, and may allow quantification of the gradient of the effect and the distance at which the displacement

effect no longer exists – the assumption being that the data collected at distances beyond the influence of turbines are the reference data (Erickson et al., 2007). An impact gradient analysis could also involve measuring the number of breeding grassland birds counted at point count plots as a function of distance from the wind turbines (Johnson et al. 2000).

Sound and Wildlife

Turbine blades at normal operating speeds can generate levels of sound beyond ambient background levels. Construction and maintenance activities can also contribute to sound levels by affecting communication distance, an animal's ability to detect calls or danger, or to forage. Sound associated with developments can also cause behavioral and/or physiological effects, damage to hearing from acoustic over-exposure, and masking of communication signals and other biologically relevant sounds (Dooling and Popper 2007). Some birds are able to shift their vocalizations to reduce the masking effects of noise. However, when shifts don't occur or are insignificant, masking may prove detrimental to the health and survival of wildlife (Barber et al. 2010). Data suggest noise increases of 3 dB to 10 dB correspond to 30 percent to 90 percent reductions in alerting distances for wildlife, respectively (Barber et al. 2010).

The National Park Service has been investigating potential impacts to wildlife due to alterations in sound level and type. However, further research is needed to better understand this potential impact. Research may include: how wind facilities affect background sound levels; whether masking, disturbance, and acoustical fragmentation occur; and how turbine, construction, and maintenance sound levels can vary by topographic area.

Levels of fatality beyond those predicted

More intensive post-construction fatality studies may be used to determine relationships between fatalities and weather, wind speed or other covariates, which usually require daily carcass searches. Fatalities determined to have occurred the previous night can be correlated with that night's weather or turbine characteristics to establish important relationships that can then be used to evaluate the most effective times and conditions to implement measures to reduce collision fatality at the project.

Measures to address fatalities

The efficacy of operational changes (e.g. changing turbine cut-in speed) of a project to reduce collision fatalities has only recently been evaluated (Arnett et al. 2009, Baerwald et al 2009). Operational changes to address fatalities should be applied only at sites where collision fatalities are predicted or demonstrated to have significant adverse impacts.

Tier 5 Studies and Research

The Service makes a distinction between Tier 5 studies focused on project-specific impacts and research (which is discussed earlier in the Guidelines). For example, developers may be encouraged to participate in collaborative studies (see earlier discussion of Research) or asked to conduct a study on an experimental mitigation technique, such as differences in turbine cut-in speed to reduce bat fatalities. Such techniques may show promise in mitigating the impacts of wind energy development to wildlife, but their broad applicability for mitigation purposes has not been demonstrated. Such techniques should not be routinely applied to projects, but application at appropriate sites will contribute to the breadth of knowledge regarding the efficacy of such measures in addressing collision fatalities. In addition, studies involving multiple sites and academic researchers can provide more robust research results, and such studies take more time and resources than are appropriately carried out by one developer at a single site. Examples below demonstrate collaborative research efforts to address displacement, operational changes, and population level impacts.

Studies of Indirect Effects

The Service provides two examples below of ongoing studies to assess the effects of indirect impacts related to wind energy facilities.

Kansas State University, as part of the NWCC Grassland Shrub-steppe Species Collaborative, is undertaking a multi-year research project to assess the effects of wind energy facilities on populations of greater prairie-chickens (GPCH) in Kansas. Initially the research was based on a Before/After Control/Impact (BACI) experimental design involving three replicated study sites in the Flint Hills and Smoky Hills of eastern Kansas. Each study site consisted of an impact area where a wind energy facility was proposed to be developed and a nearby reference area with similar rangeland characteristics where no development was planned. The research project is a coordinated field/laboratory effort, i.e., collecting telemetry and observational data from adult and juvenile GPCH in the field, and determining population genetic attributes of GPCH in the laboratory from blood samples of birds and the impact and reference areas. Detailed data on GPCH movements, demography, and population genetics were gathered from all three sites from 2007 to 2010. By late 2008, only one of the proposed wind energy facilities was developed (the Meridian Way Wind Farm in the Smoky Hills of Cloud County), and on-going research efforts are focused on that site. The revised BACI study design now will produce two years of pre-construction data (2007 and 2008), and three years of post-construction data (2009, 2010, and 2011) from a single wind energy facility site (impact area) and its reference area. Several hypotheses were formulated for testing to determine if wind energy facilities impacted GPCH populations, including but not limited to addressing issues relating to: lek attendance, avoidance of turbines and associated features,

nest success and chick survival, habitat usage, adult mortality and survival, breeding behavior, and natal dispersal. A myriad of additional significant avenues are being pursued as a result of the rich database that has been developed for the GPCH during this research effort. GPCH reproductive data will be collected through the summer of 2011 whereas collection of data from transmitter-equipped GPCH will extend through the lekking season of 2012 to allow estimates of survival of GPCH over the 2011-2012 winter. At the conclusion of the study, the two years of pre-construction data and three years of post-construction data will be analyzed and submitted to peer-reviewed journals for publication.

Erickson et al. (2004) evaluated the displacement effect of a large wind energy facility in the Pacific Northwest. The study was conducted in a relatively homogeneous grassland landscape. Erickson et al. (2004) conducted surveys of breeding grassland birds along 300 meter transects perpendicular to strings of wind turbines. Surveys were conducted prior to construction and after commercial operation. The basic study design follows the Impact Gradient Design (Morrison et al. 2008) and in this application, conformed to a special case of BACI where areas at the distal end of each transect were considered controls (i.e., beyond the influence of the turbines). In this study, there is no attempt to census birds in the area, and observations per survey are used as an index of abundance. Additionally, the impact-gradient study design resulted in less effort than a BACI design with offsite control areas. Erickson et al. (2004) found that grassland passerines as a group, as well as grasshopper sparrows and western meadowlarks, showed reduced use in the first 50 meter segment nearest the turbine string. About half of the area within that segment, however, had disturbed vegetation and separation of behavior avoidance from physical loss of habitat in this portion of the area was impossible. Horned larks and savannah sparrows appeared unaffected. The impact gradient design is best used when the study area is relatively small and homogeneous.

Operational Changes to Reduce Collision Fatality

Arnett et al. (2009) conducted studies on the effectiveness of changing turbine cut-in speed on reducing bat fatality at wind turbines at the Casselman Wind Project in Somerset County, Pennsylvania. Their objectives were to: 1) determine the difference in bat fatalities at turbines with different cut-in-speeds relative to fully operational turbines; and 2) determine the economic costs of the experiment and estimated costs for the entire area of interest under different curtailment prescriptions and timeframes. Arnett et al. (2009) reported substantial reductions in bat fatalities with relatively modest power losses.

In Kenedy County, Texas, investigators are refining and testing a real-time curtailment protocol. The projects use an avian profiling radar system to detect approaching "flying vertebrates" (birds and bats), primarily during spring and fall bird and bat migrations. The blades automatically idle when risk reaches a certain level and weather conditions are particularly risky. Based on estimates of the number and timing of migrating raptors, feathering (real-time curtailment) experiments are underway in Tehuantepec, Mexico, where raptor migration through a mountain pass is extensive.

Other tools, such as thermal imaging (Horn et al. 2008) or acoustic detectors (Kunz et al. 2007), have been used to quantify post-construction bat activity in relation to weather and turbine characteristics for improving operational change efforts. For example, at the Mountaineer project in 2003, Tier 4 studies (weekly searches at every turbine) demonstrated unanticipated and high levels of bat fatalities (Kerns and Kerlinger 2004). Daily searches were instituted in 2004 and revealed that fatalities were strongly associated with low-average-wind-speed nights, thus providing a basis for testing operational changes (Arnett 2005, Arnett et al. 2008). The program also included behavioral observations using thermal imaging that demonstrated higher bat activity at lower wind speeds (Horn et al. 2008).

Studies are currently underway to design and test the efficacy of an acoustic deterrent device to reduce bat fatalities at wind facilities (E.B. Arnett, Bat Conservation International, under the auspices of BWEC). Prototypes of the device have been tested in the laboratory and in the field with some success. Spanjer (2006) tested the response of big brown bats to a prototype eight speaker deterrent emitting broadband white noise at frequencies from 12.5–112.5 kHz and found that during non-feeding trials, bats landed in the quadrant containing the device significantly less when it was broadcasting broadband noise. Spanjer (2006) also reported that during feeding trials, bats never successfully took a tethered mealworm when the device broadcast sound, but captured mealworms near the device in about 1/3 of trials when it was silent. Szewczak and Arnett (2006, 2007) tested the same acoustic deterrent in the field and found that when placed by the edge of a small pond where nightly bat activity was consistent, activity dropped significantly on nights when the deterrent was activated. Horn et al. (2007) tested the effectiveness of a larger, more powerful version of this deterrent device on reducing nightly bat activity and found mixed results. In 2009, a new prototype device was developed and tested at a project in Pennsylvania. Ten turbines were fitted with deterrent devices, daily fatality searches were conducted, and fatality estimates were compared with those from 15 turbines without deterrents (i.e., controls) to determine if bat fatalities were reduced. This experiment found that estimated bat fatalities per turbine were 20 to 53 percent lower at treatment turbines compared to controls.

More experimentation is required. At the present time, there is not an operational deterrent available that has demonstrated effective reductions in bat kills (E. B. Arnett, Bat Conservation International, unpublished data).

Assessment of Population-level Impacts

The Altamont Pass Wind Resource Area (APWRA) has been the subject of intensive scrutiny because of avian fatalities, especially for raptors, in an area encompassing more than 5,000 wind turbines (e.g., Orloff and Flannery 1992; Smallwood and Thelander 2004, 2005). Field studies on golden eagles, a long-lived raptor species, have been completed using radio telemetry at APWRA to understand population demographics, assess impacts from wind turbines, and explore measures to effectively reduce the incidence of golden eagle mortality for this area. (Hunt et al. 1999, and Hunt 2002). Results from nesting surveys (Hunt 2002) indicated that there was no decline in eagle territory occupancy. However Hunt (2002) also found that subadult and floater components of golden eagle populations at APWRA are highly vulnerable to wind turbine mortality and results from this study indicate that turbine mortality prevented the maintenance of substantial reserves of nonbreeding adults characteristic of healthy populations elsewhere, suggesting the possibility of an eventual decline in the breeding population (Hunt and Hunt 2006). Hunt conducted follow-up surveys in 2005 (Hunt and Hunt 2006) and determined that all 58 territories occupied by eagle pairs in 2000 were occupied in 2005. It should be noted however that golden eagle studies at APWRA (Hunt et al. 1999, Hunt 2002, and Hunt and Hunt 2006) were all conducted after the APWRA was constructed and the species does not nest within the footprint of the APWRA itself (Figure 4; Hunt and Hunt 2006). The APWRA is an area of about 160 sq. km (Hunt 2002) and presumably golden eagles formerly nested within this area. The loss of breeding eagle pairs from the APWRA suggests these birds have all been displaced by the project, or lost due to various types of mortality including collisions with turbine blades.

Golden eagle. Credit: George Gentry, USFWS

Chapter 7: Best Management Practices

Site Construction and Operation

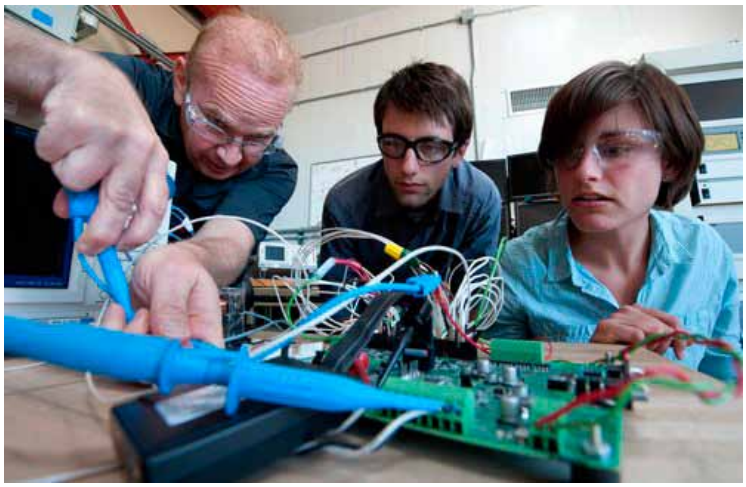
During site planning and development, careful attention to reducing risk of adverse impacts to species of concern from wind energy projects, through careful site selection and facility design, is recommended. The following BMPs can assist a developer in the planning process to reduce potential impacts to species of concern. Use of these BMPs should ensure that the potentially adverse impacts to most species of concern and their habitats present at many project sites would be reduced, although compensatory mitigation may be appropriate at a project level to address significant site-specific concerns and pre-construction study results.

These BMPs will evolve over time as additional experience, learning, monitoring and research becomes available on how to best minimize wildlife and habitat impacts from wind energy projects. Service should work with the industry, stakeholders and states to evaluate, revise and update these BMPs on a periodic basis, and the Service should maintain a readily available publication of recommended, generally accepted best practices.

1. Minimize, to the extent practicable, the area disturbed by pre-construction site monitoring and testing activities and installations.

2. Avoid locating wind energy facilities in areas identified as having a demonstrated and unmitigatable high risk to birds and bats.

3. Use available data from state and federal agencies, and other sources (which could include maps or databases), that show the location of sensitive resources and the results of Tier 2 and/or 3 studies to establish the layout of roads, power lines, fences, and other infrastructure.



Wind electronic developers. Credit: NREL

4. Minimize, to the maximum extent practicable, roads, power lines, fences, and other infrastructure associated with a wind development project. When fencing is necessary, construction should use wildlife compatible design standards.

5. Use native species when seeding or planting during restoration. Consult with appropriate state and federal agencies regarding native species to use for restoration.

6. To reduce avian collisions, place low and medium voltage connecting power lines associated with the wind energy development underground to the extent possible, unless burial of the lines is prohibitively expensive (e.g., where shallow bedrock exists) or where greater adverse impacts to biological resources would result:

   a. Overhead lines may be acceptable if sited away from high bird crossing locations, to the extent practicable, such as between roosting and feeding areas or between lakes, rivers, prairie grouse and sage grouse leks, and nesting habitats. To the extent practicable, the lines should be marked in accordance with Avian Power Line Interaction Committee (APLIC) collision guidelines.

   b. Overhead lines may be used when the lines parallel tree lines, employ bird flight diverters, or are otherwise screened so that collision risk is reduced.

   c. Above-ground low and medium voltage lines, transformers and conductors should follow the 2006 or most recent APLIC "Suggested Practices for Avian Protection on Power Lines."

7. Avoid guyed communication towers and permanent met towers at wind energy project sites. If guy wires are necessary,

bird flight diverters or high visibility marking devices should be used.

8. Where permanent meteorological towers must be maintained on a project site, use the minimum number necessary.

9. Use construction and management practices to minimize activities that may attract prey and predators to the wind energy facility.

10. Employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights, to meet Federal Aviation Administration (FAA) requirements for visibility lighting of wind turbines, permanent met towers, and communication towers. Only a portion of the turbines within the wind project should be lighted, and all pilot warning lights should fire synchronously.

11. Keep lighting at both operation and maintenance facilities and substations located within half a mile of the turbines to the minimum required:

    a. Use lights with motion or heat sensors and switches to keep lights off when not required.

    b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.

    c. Minimize use of high-intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.

    d. All internal turbine nacelle and tower lighting should be extinguished when unoccupied.

12. Establish non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern identified in pre-construction studies. Determine the extent of the buffer zone in consultation with the Service and state, local and tribal wildlife biologists, and land management agencies (e.g., U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS)), or other credible experts as appropriate.

13. Locate turbines to avoid separating bird and bat species of concern from their daily roosting, feeding, or nesting sites if documented that the turbines' presence poses a risk to species.

14. Avoid impacts to hydrology and stream morphology, especially where federal or state-listed aquatic or riparian species may be involved. Use appropriate erosion control measures in construction and operation to eliminate or minimize runoff into water bodies.

15. When practical use tubular towers or best available technology to reduce ability of birds to perch and to reduce risk of collision.

16. After project construction, close roads not needed for site operations and restore these roadbeds to native vegetation, consistent with landowner agreements.

17. Minimize the number and length of access roads; use existing roads when feasible.

18. Minimize impacts to wetlands and water resources by following all applicable provisions of the Clean Water Act (33 USC 1251-1387) and the Rivers and Harbors Act (33 USC 301 et seq.); for instance, by developing and implementing a storm water management plan and taking measures to reduce erosion and avoid delivery of road-generated sediment into streams and waters.

19. Reduce vehicle collision risk to wildlife by instructing project personnel to drive at appropriate speeds, be alert for wildlife, and use additional caution in low visibility conditions.

20. Instruct employees, contractors, and site visitors to avoid harassing or disturbing wildlife, particularly during reproductive seasons.

21. Reduce fire hazard from vehicles and human activities (instruct employees to use spark arrestors on power equipment, ensure that no metal parts are dragging from vehicles, use caution with open flame, cigarettes, etc.). Site development and operation plans should specifically address the risk of wildfire and provide appropriate cautions and measures to be taken in the event of a wildfire.

22. Follow federal and state measures for handling toxic substances to minimize danger to water and wildlife resources from spills. Facility operators should maintain Hazardous Materials Spill Kits on site and train personnel in the use of these.

23. Reduce the introduction and spread of invasive species by following applicable local policies for invasive species prevention, containment, and control, such as cleaning vehicles and equipment arriving from areas with known invasive species issues, using locally sourced topsoil, and monitoring for and rapidly removing invasive species at least annually.

24. Use invasive species prevention and control measures as specified by county or state requirements, or by applicable federal agency requirements (such as Integrated Pest Management) when federal policies apply.

25. Properly manage garbage and waste disposal on project sites to avoid creating attractive nuisances for wildlife by providing them with supplemental food.

26. Promptly remove large animal carcasses (e.g., big game,

domestic livestock, or feral animal).

27. Wildlife habitat enhancements or improvements such as ponds, guzzlers, rock or brush piles for small mammals, bird nest boxes, nesting platforms, wildlife food plots, etc. should not be created or added to wind energy facilities. These wildlife habitat enhancements are often desirable but when added to a wind energy facility result in increased wildlife use of the facility which may result in increased levels of injury or mortality to them.

Retrofitting, Repowering, and Decommissioning

As with project construction, these Guidelines offer BMPs for the retrofitting, repowering, and decommissioning phases of wind energy projects.

Retrofitting

Retrofitting is defined as replacing portions of existing wind turbines or project facilities so that at least part of the original turbine, tower, electrical infrastructure or foundation is being utilized. Retrofitting BMPs include:

1. Retrofitting of turbines should use installation techniques that minimize new site disturbance, soil erosion, and removal of vegetation of habitat value.

2. Retrofits should employ shielded, separated or insulated electrical conductors that minimize electrocution risk to avian wildlife per APLIC (2006).

3. Retrofit designs should prevent nests or bird perches from being established in or on the wind turbine or tower.

4. FAA visibility lighting of wind turbines should employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights.

5. Lighting at both operation and maintenance facilities and substations located within half a mile of the turbines should be kept to the minimum required:

   a. Use lights with motion or heat sensors and switches to keep lights off when not required.

   b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.

   c. Minimize use of high intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.

6. Remove wind turbines when they are no longer cost effective to retrofit.

Repowering

Repowering may include removal and replacement of turbines and associated infrastructure. BMPs include:

1. To the greatest extent practicable, existing roads, disturbed areas and turbine strings should be re-used in repower layouts.

2. Roads and facilities that are no longer needed should be demolished, removed, and their footprint stabilized and re-seeded with native plants appropriate for the soil conditions and adjacent habitat and of local seed sources where feasible, per landowner requirements and commitments.

3. Existing substations and ancillary facilities should be re-used in repowering projects to the extent practicable.

4. Existing overhead lines may be acceptable if located away from high bird crossing locations, such as between roosting and feeding areas, or between lakes, rivers and nesting areas. Overhead lines may be used when they parallel tree lines, employ bird flight diverters, or are otherwise screened so that collision risk is reduced.

5. Above-ground low and medium voltage lines, transformers and conductors should follow the 2006 or most recent APLIC "Suggested Practices for Avian Protection on Power Lines."

6. Guyed structures should be avoided. If use of guy wires is absolutely necessary, they should be treated with bird flight diverters or high visibility marking devices, or are located where known low bird use will occur.

7. FAA visibility lighting of wind turbines should employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights.

8. Lighting at both operation and maintenance facilities and substations located within ½ mile of the turbines should be kept to the minimum required.

   a. Use lights with motion or heat sensors and switches to keep lights off when not required.

   b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.

Towers are being lifted as work continues on the 2 MW Gamesa wind turbine that is being installed at the NWTC. Credit: NREL

c. Minimize use of high intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.

Decommissioning

Decommissioning is the cessation of wind energy operations and removal of all associated equipment, roads, and other infrastructure. The land is then used for another activity. During decommissioning, contractors and facility operators should apply BMPs for road grading and native plant re-establishment to ensure that erosion and overland flows are managed to restore pre-construction landscape conditions. The facility operator, in conjunction with the landowner and state and federal wildlife agencies, should restore the natural hydrology and plant community to the greatest extent practical.

1. Decommissioning methods should minimize new site disturbance and removal of native vegetation, to the greatest extent practicable.

2. Foundations should be removed to a minimum of three feet below surrounding grade, and covered with soil to allow adequate root penetration for native plants, and so that subsurface structures do not substantially disrupt ground water movements. Three feet is typically adequate for agricultural lands.

3. If topsoils are removed during decommissioning, they should be stockpiled and used as topsoil when restoring plant communities. Once decommissioning activity is complete, topsoils should be restored to assist in establishing and maintaining pre-construction native plant communities to the extent possible, consistent with landowner objectives.

4. Soil should be stabilized and re-vegetated with native plants appropriate for the soil conditions and adjacent habitat, and of local seed sources where feasible, consistent with landowner objectives.

5. Surface water flows should be restored to pre-disturbance conditions, including removal of stream crossings, roads, and pads, consistent with storm water management objectives and requirements.

6. Surveys should be conducted by qualified experts to detect populations of invasive species, and comprehensive approaches to preventing and controlling invasive species should be implemented and maintained as long as necessary.

7. Overhead pole lines that are no longer needed should be removed.

8. After decommissioning, erosion control measures should be installed in all disturbance areas where potential for erosion exists, consistent with storm water management objectives and requirements.

9. Fencing should be removed unless the landowner will be utilizing the fence.

10. Petroleum product leaks and chemical releases should be remediated prior to completion of decommissioning.

Chapter 8: Mitigation

Mitigation is defined in this document as avoiding or minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts, as determined through the tiered approach described in the recommended Guidelines. The Service places emphasis in project planning on first avoiding, then minimizing, potential adverse impacts to wildlife and their habitats. Several tools are available to determine appropriate mitigation, including the Service Mitigation Policy (USFWS Mitigation Policy, 46 FR 7656 (1981)). The Service policy provides a common basis for determining how and when to use different mitigation strategies, and facilitates earlier consideration of wildlife values in wind energy project planning.

Under the Service Mitigation Policy, the highest priority is for mitigation to occur on-site within the project planning area. The secondary priority is for the mitigation to occur off-site. Off-site mitigation should first occur in proximity to the planning area within the same ecological region and secondarily elsewhere within the same ecological region. Generally, the Service prefers on-site mitigation over off-site mitigation because this approach most directly addresses project impacts at the location where they actually occur. However, there may be individual cases where off-site mitigation could result in greater net benefits to affected species and habitats. Developers should work with the Service in comparing benefits among multiple alternatives.

In some cases, a project's effects cannot be forecast with precision. The developer and the agencies may be unable to make some mitigation decisions until post-construction data have been collected. If significant adverse effects have not been adequately addressed, additional mitigation for those adverse effects from operations may need to be implemented.

Mitigation measures implemented post-construction, whether in addition to those implemented pre-construction or whether they are new, are appropriate elements of the tiered approach. The general terms and funding commitments for future mitigation and the triggers or thresholds for implementing such compensation should be developed at the earliest possible stage in project development. Any mitigation implemented after a project is operational should be well defined, bounded, technically feasible, and commensurate with the project effects.

NEPA Guidance on Mitigation

CEQ issued guidance in February 2011 on compliance with the National Environmental Policy Act (NEPA) entitled, "Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact." This new guidance clarifies that when agencies premise their Finding of No Significant Impact on a commitment to mitigate the environmental impacts of a proposed action, they should adhere to those commitments, publicly report on those efforts, monitor how they are implemented, and monitor the effectiveness of the mitigation.

To the extent that a federal nexus with a wind project exists, for example, developing a project on federal lands or obtaining a federal permit, the lead federal action agency should make its decision based in part on a developer's commitment to mitigate adverse environmental impacts. The federal action agency should ensure that the developer adheres to those commitments, monitors how they are implemented, and monitors the effectiveness of the mitigation. Additionally, the lead federal action agency should make information on mitigation monitoring available to the public through its web site;

Greater prairie chicken. Credit: Amy Thornburg, USFWS

and should ensure that mitigation successfully achieves its goals.

Compensatory Mitigation

Compensatory mitigation as defined in this document refers to replacement of project-induced losses to fish and wildlife resources. Substitution or offsetting of fish and wildlife resource losses with resources considered to be of equivalent biological value.

- **In-kind** – Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate to those lost.

- **Out-of-kind** – Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically or biologically different from those lost. This may include conservation or mitigation banking, research or other options.

The amount of compensation, if necessary, will depend on the effectiveness of any avoidance and minimization measures undertaken. If a proposed wind development is poorly sited with regard to wildlife effects, the most important mitigation opportunity is largely lost and the remaining options can be expensive, with substantially greater environmental effects.

Compensation is most often appropriate for habitat loss under limited circumstances or for direct take of wildlife (e.g., Habitat Conservation Plans). Compensatory mitigation may involve contributing to a fund to protect habitat or otherwise support efforts to reduce existing impacts to species affected by a wind project. Developers should communicate with the Service and state agency prior to initiating such an approach.

Ideally, project impact assessment is a cooperative effort involving the developer, the Service, tribes, local authorities, and state resource agencies. The Service does not expect developers to provide compensation for the same habitat loss more than once. But the Service, state resource agencies, tribes, local authorities, state and federal land management agencies may have different species or habitats of concern, according to their responsibilities and statutory authorities. Hence, one entity may seek mitigation for a different group of species or habitat than does another.

Migratory Birds and Eagles

Some industries, such as the electric utilities, have developed operational and deterrent measures that when properly used can avoid or minimize "take" of migratory birds. Many of these measures to avoid collision and electrocution have been scientifically tested with publication in peer-reviewed, scientific journals. The Service encourages the wind industry to use these measures in siting, placing, and operating all power lines, including their distribution and grid-connecting transmission lines.

E.O. 13186, which addresses responsibilities of federal agencies to protect migratory birds, includes a directive to federal agencies to restore and enhance the habitat of migratory birds as practicable. E.O. 13186 provides a basis and a rationale for compensating for the loss of migratory bird habitat that results from developing wind energy projects that have a federal nexus.

Regulations concerning eagle take permits in 50 CFR 22.26 and 50 CFR 22.27 may allow for compensation as part of permit issuance. Compensation may be a condition of permit issuance in cases of nest removal, disturbance or take resulting in mortality that will likely occur over several seasons, result in permanent abandonment of one or more breeding territories, have large scale impacts, occur at multiple locations, or otherwise contribute to cumulative negative effects. The draft ECP Guidance has additional information on the use of compensation for programmatic permits.

Endangered Species

The ESA has provisions that allow for compensation through the issuance of an Incidental Take Permit (ITP). Under the ESA, mitigation measures are determined on a case by case basis, and are based on the needs of the species and the types of effects anticipated. If a federal nexus exists, or if a developer chooses to seek an ITP under the ESA, then effects to listed species need to be evaluated through the Section 7 and/or Section 10 processes. If an ITP is requested, it and the associated HCP must provide for minimization and mitigation to the maximum extent practicable, in addition to meeting other necessary criteria for permit issuance. For further information about compensation under federal laws administered by the Service, see the Service's Habitat and Resource Conservation website http://www.fws.gov/habitatconservation.

Bald eagle. Credit: USFWS

Chapter 9: Advancing Use, Cooperation and Effective Implementation

This chapter discusses a variety of policies and procedures that may affect the way wind project developers and the Service work with each other as well as with state and tribal governments and non-governmental organizations. The Service recommends that wind project developers work closely with field office staff for further elaboration of these policies and procedures.

Conflict Resolution

The Service and developers should attempt to resolve any issues arising from use of the Guidelines at the Field Office level. Deliberations should be in the context of the intent of the Guidelines and be based on the site-specific conditions and the best available data. However, if there is an issue that cannot be resolved within a timely manner at the field level, the developer and Service staff will coordinate to bring the matter up the chain of command in a stepwise manner.

Bird and Bat Conservation Strategies (BBCS)

The Service has recommended that developers prepare written records of their actions to avoid, minimize and compensate for potential adverse impacts. In the past, the Service has referred to these as Avian and Bat Protection Plans (ABPP). However, ABPPs have more recently been used for transmission projects and less for other types of development. For this reason the Service is introducing a distinct concept for wind energy projects and calling them Bird and Bat Conservation Strategies (BBCS).

Typically, a project-specific BBCS will explain the analyses, studies, and reasoning that support progressing from one tier to the next in the tiered approach. A wind energy project-specific BBCS is an example of a document or compilation of documents that describes the steps a developer could or has taken to apply these Guidelines to mitigate for adverse impacts and address the post-construction monitoring efforts the developer intends to undertake. A developer may prepare a BBCS in stages, over time, as analysis and studies are undertaken for each tier. It will also address the post-construction monitoring efforts for mortality and habitat effects, and may use many of the components suggested in the Suggested Practices for Avian Protection on Power Lines (APLIC 2006). Any Service review of, or discussion with a developer, concerning its BBCS is advisory only, does not result in approval or disapproval of the BBCS by the Service, and does not constitute a federal agency action subject to the National Environmental Policy Act or other federal law applicable to such an action.

Electricity towers and wind turbines. Credit: NREL

Project Interconnection Lines

The Guidelines are designed to address all elements of a wind energy facility, including the turbine string or array, access roads, ancillary buildings, and the above- and below-ground electrical lines which connect a project to the transmission system. The Service recommends that the project evaluation include consideration of the wildlife- and habitat-related impacts of these electrical lines, and that the developer include measures to reduce impacts of these lines, such

as those outlined in the Suggested Practices for Avian Protection on Power Lines (APLIC 2006). The Guidelines are not designed to address transmission beyond the point of interconnection to the transmission system. The national grid and proposed smart grid system are beyond the scope of these Guidelines.

Confidentiality of Site Evaluation Process as Appropriate

Some aspects of the initial pre-construction risk assessment, including preliminary screening and site characterization, occur early in the development process, when land or other competitive issues limit developers' willingness to share information on projects with the public and competitors. Any consultation or coordination with agencies at this stage may include confidentiality agreements.

Collaborative Research

Much uncertainty remains about predicting risk and estimating impacts of wind energy development on wildlife. Thus there is a need for additional research to improve scientifically based decision-making when siting wind energy facilities, evaluating impacts on wildlife and habitats, and testing the efficacy of mitigation measures. More extensive studies are needed to further elucidate patterns and test hypotheses regarding possible solutions to wildlife and wind energy impacts.

It is in the interests of wind developers and wildlife agencies to improve these assessments to better mitigate the impacts of wind energy development on wildlife and their habitats. Research can provide data on operational factors (e.g. wind speed, weather conditions) that are likely to result in fatalities. It could also include studies of cumulative impacts of multiple wind energy projects, or comparisons of different methods for assessing avian and bat activity relevant to predicting risk. Monitoring and research should be designed and conducted to ensure unbiased data collection that meets technical standards such as those used in peer review. Research projects may occur at the same time as project-specific Tier 4 and Tier 5 studies.

Research would usually result from collaborative efforts involving appropriate stakeholders, and is not the sole or primary responsibility of any developer. Research partnerships (e.g., Bats and Wind Energy Cooperative (BWEC)[9], Grassland and Shrub Steppe Species Collaborative (GS3C)[10]) involving diverse players will be helpful for generating common goals and objectives and adequate funding to conduct studies (Arnett and Haufler 2003). The National Wind Coordinating Collaborative (NWCC)[11], the American Wind Wildlife Institute (AWWI)[12], and the California Energy Commission (CEC)'s Public Interest Energy Research Program[13] all support research in this area.

Study sites and access will be necessary to design and implement research, and developers are encouraged to participate in these research efforts when possible. Subject to appropriations, the Service also should fund priority research and promote collaboration and information sharing among research efforts to advance science on wind energy-wildlife interactions, and to improve these Guidelines.

Service - State Coordination and Cooperation

The Service encourages states to increase compatibility between state guidelines and these voluntary Guidelines, protocols, data collection methods, and recommendations relating to wildlife and wind energy. States that desire to adopt, or those that have formally adopted, wind energy siting, permitting, or environmental review regulations or guidelines are encouraged to cooperate with the Service to develop consistent state level guidelines. The Service may be available to confer, coordinate and share its expertise with interested states when a state lacks its own guidance or program to address wind energy-wildlife interactions. The Service will also use states' technical resources as much as possible and as appropriate.

The Service will explore establishing a voluntary state/federal program to advance cooperation and compatibility between the Service and interested state and local governments for coordinated review of projects under both federal and state wildlife laws. The Service, and interested states, will consider using the following tools to reach agreements to foster consistency in review of projects:

- Cooperation agreements with interested state governments.
- Joint agency reviews to reduce duplication and increase coordination in project review.
- A communication mechanism:
  - To share information about prospective projects
  - To coordinate project review
  - To ensure that state and federal regulatory processes, and/or mitigation requirements are being adequately addressed

[9] www.batsandwind.org
[10] www.nationalwind.org
[11] www.nationalwind.org
[12] http://www.awwi.org
[13] http://www.energy.ca.gov/research

  - To ensure that species of concern and their habitats are fully addressed

- Establishing consistent and predictable joint protocols, data collection methodologies, and study requirements to satisfy project review and permitting.
- Designating a Service management contact within each Regional Office to assist Field Offices working with states and local agencies to resolve significant wildlife-related issues that cannot be resolved at the field level.
- Cooperative state/federal/ industry research agreements relating to wind energy -wildlife interactions.

The Service will explore opportunities to:

- Provide training to states.
- Foster development of a national geographic data base that identifies development-sensitive ecosystems and habitats.
- Support a national database for reporting of mortality data on a consistent basis.
- Establish national BMPs for wind energy development projects.
- Develop recommended guidance on study protocols, study techniques, and measures and metrics for use by all jurisdictions.
- Assist in identifying and obtaining funding for national research priorities.

Service - Tribal Consultation and Coordination

Federally-recognized Indian Tribes enjoy a unique government-to-government relationship with the United States. The United States Fish and Wildlife Service (Service) recognizes Indian tribal governments as the authoritative voice regarding the management of tribal lands and resources within the framework of applicable laws. It is important to recall that many tribal traditional lands and tribal rights extend beyond reservation lands.

Wind turbine in California.. Credit: NREL

The Service consults with Indian tribal governments under the authorities of Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments" and supporting DOI and Service policies. To this end, when it is determined that federal actions and activities may affect a Tribe's resources (including cultural resources), lands, rights, or ability to provide services to its members, the Service must, to the extent practicable, seek to engage the affected Tribe(s) in consultation and coordination.

Tribal Wind Energy Development on Reservation Lands

Indian tribal governments have the authority to develop wind energy projects, permit their development, and establish relevant regulatory guidance within the framework of applicable laws.

The Service will provide technical assistance upon the request of Tribes that aim to establish regulatory guidance for wind energy development for lands under the Tribe's jurisdiction. Tribal governments are encouraged to strive for compatibility between their guidelines and these Guidelines.

Tribal Wind Energy Development on Lands that are not held in Trust

Indian tribal governments may wish to develop wind energy projects on lands that are not held in trust status. In such cases, the Tribes should coordinate with agencies other than the Service. At the request of a Tribe, the Service may facilitate discussions with other regulatory organizations. The Service may also lend its expertise in these collaborative efforts to help determine the extent to which tribal resource management plans and priorities can be incorporated into established regulatory protocols.

Non-Tribal Wind Energy Development – Consultation with Indian Tribal Governments

When a non-Tribal wind energy project is proposed that may affect a Tribe's resources (including cultural resources), lands, rights, or ability to govern or provide services to its members, the Service should seek to engage the affected Tribe(s) in consultation and coordination as

early as possible in the process. In siting a proposed project that has a federal nexus, it is incumbent upon the regulatory agency to notify potentially affected Tribes of the proposed activity. If the Service or other federal agency determines that a project may affect a Tribe(s), they should notify the Tribe(s) of the action at the earliest opportunity. At the request of a Tribe, the Service may facilitate and lend its expertise in collaborating with other organizations to help determine the extent to which tribal resource management plans and priorities can be incorporated into established regulatory protocols or project implementation. This process ideally should be agreed to by all involved parties.

In the consultative process, Tribes should be engaged as soon as possible when a decision may affect a Tribe(s). Decisions made that affect Indian Tribal governments without adequate federal effort to engage Tribe(s) in consultation have been overturned by the courts. See, e.g., Quechan Tribe v. U.S. Dep't of the Interior, No. 10cv2241 LAB (CAB), 2010 WL 5113197 (S.D. Cal. Dec. 15, 2010). When a tribal government is consulted, it is neither required, nor expected that all of the Tribe's issues can be resolved in its favor. However, the Service must listen and may not arbitrarily dismiss concerns of the tribal government. Rather, the Service must seriously consider and respond to all tribal concerns. Regional Native American Liaisons are able to provide in-house guidance as to government-to-government consultation processes. (See Service - State Coordination and Cooperation, above).

Non-Governmental Organization Actions

If a specific project involves actions at the local, state, or federal level that provide opportunities for public participation, non-governmental organizations (NGOs) can provide meaningful contributions to the discussion of biological issues associated with that project, through the normal processes such as scoping, testimony at public meetings, and comment processes. In the absence of formal public process, there are many NGOs that have substantial scientific capabilities and may have resources that could contribute productively to the siting of wind energy projects. Several NGOs have made significant contributions to the understanding of the importance of particular geographic areas to wildlife in the United States. This work has benefited and continues to benefit from extensive research efforts and from associations with highly qualified biologists. NGO expertise can – as can scientific expertise in the academic or private consulting sectors – serve highly constructive purposes. These can include:

- Providing information to help identify environmentally sensitive areas, during the screening phases of site selection (Tiers 1 and 2, as described in this document)
- Providing feedback to developers and agencies with respect to specific sites and site and impact assessment efforts
- Helping developers and agencies design and implement mitigation or offset strategies
- Participating in the defining, assessing, funding, and implementation of research efforts in support of improved predictors of risk, impact assessments and effective responses
- Articulating challenges, concerns, and successes to diverse audiences

Non-Governmental Organization Conservation Lands

Implementation of these Guidelines by Service and other state agencies will recognize that lands owned and managed by non-government conservation organizations represent a significant investment that generally supports the mission of state and federal wildlife agencies. Many of these lands represent an investment of federal conservation funds, through partnerships between agencies and NGOs. These considerations merit extra care in the avoidance of wind energy development impacts to these lands. In order to exercise this care, the Service and allied agencies can coordinate and consult with NGOs that own lands or easements which might reasonably be impacted by a project under review.

Appendix A: Glossary

Accuracy – The agreement between a measurement and the true or correct value.

Adaptive management – An iterative decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Comprehensively applying the tiered approach embodies the adaptive management process.

Anthropogenic – Resulting from the influence of human beings on nature.

Area of interest – For most projects, the area where wind turbines and meteorological (met) towers are proposed or expected to be sited, and the area of potential impact.

Avian – Pertaining to or characteristic of birds.

Avoid – To not take an action or parts of an action to avert the potential effects of the action or parts thereof. First of three components of "mitigation," as defined in Service Mitigation Policy. (See mitigation.)

Before-after/control-impact (BACI) – A study design that involves comparisons of observational data, such as bird counts, before and after an environmental disturbance in a disturbed and undisturbed site. This study design allows a researcher to assess the effects of constructing and operating a wind turbine by comparing data from the "control" sites (before and undisturbed) with the "treatment" sites (after and disturbed).

Best management practices (BMPs) – Methods that have been determined by the stakeholders to be the most effective, practicable means of avoiding or minimizing significant adverse impacts to individual species, their habitats or an ecosystem, based on the best available information.

Buffer zone – A zone surrounding a resource designed to protect the resource from adverse impact, and/or a zone surrounding an existing or proposed wind energy project for the purposes of data collection and/or impact estimation.

Community-scale – Wind energy projects greater than 1 MW, but generally less than 20 MW, in name-plate capacity, that produce electricity for off-site use, often partially or totally owned by members of a local community or that have other demonstrated local benefits in terms of retail power costs, economic development, or grid issues.

Comparable site – A site similar to the project site with respect to topography, vegetation, and the species under consideration.

Compensatory mitigation – Replacement of project-induced losses to fish and wildlife resources. Substitution or offsetting of fish and wildlife resource losses with resources considered to be of equivalent biological value.

- **In-kind** – Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate to those lost.

- **Out-of-kind** – Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically or biologically different from those lost. This may include conservation or mitigation banking, research or other options.

Cost effective – Economical in terms of tangible benefits produced by money spent.

Covariate – Uncontrolled random variables that influence a response to a treatment or impact, but do not interact with any of the treatments or impacts being tested.

Critical habitat – For listed species, consists of the specific areas designated by rule making pursuant to Section 4 of the Endangered Species Act and displayed in 50 CFR § 17.11 and 17.12.

Cumulative impacts – See impact.

Curtailment – The act of limiting the supply of electricity to the grid during conditions when it would normally be supplied. This is usually accomplished by cutting-out the generator from the grid and/or feathering the turbine blades.

Cut-in Speed – The wind speed at which the generator is connected to the grid and producing electricity. It is important to note that turbine blades may rotate at full RPM in wind speeds below cut-in speed.

Displacement – The loss of habitat as result of an animal's behavioral avoidance of otherwise suitable habitat. Displacement may be short-term, during the construction phase of a project, temporary as a result of habituation, or long-term, for the life of the project.

Distributed wind – Small and mid-sized turbines between 1 kilowatt and 1 megawatt that are installed and produce electricity at the point of use to off-set all or a portion of on-site energy consumption.

Ecosystem – A system formed by the interaction of a community of organisms with their physical and chemical environment. All of the biotic elements (i.e., species, populations, and communities) and abiotic elements (i.e., land, air, water, energy) interacting in a given geographic area so that a flow of energy leads to a clearly defined trophic structure, biotic diversity, and material cycles. Service Mitigation Policy adopted definition from E. P. Odum 1971 Fundamentals of Ecology.

Edge effect – The effect of the juxtaposition of contrasting environments on an ecosystem.

Endangered species – See listed species.

Extirpation – The species ceases to exist in a given location; the species still exists elsewhere.

Fatality – An individual instance of death.

Fatality rate – The ratio of the number of individual deaths to some parameter of interest such as megawatts of energy produced, the number of turbines in a wind project, the number of individuals exposed, etc., within a specified unit of time.

Feathering – Adjusting the angle of the rotor blade parallel to the wind, or turning the whole unit out of the wind, to slow or stop blade rotation.

Federal action agency – A department, bureau, agency or instrumentality of the United States which plans, constructs, operates or maintains a project, or which reviews, plans for or approves a permit, lease or license for projects, or manages federal lands.

Federally listed species – See listed species.

Footprint – The geographic area occupied by the actual infrastructure of a project such as wind turbines, access roads, substation, overhead and underground electrical lines, and buildings, and land cleared to construct the project.

G1 (Global Conservation Status Ranking) Critically Imperiled – At very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors.

G2 (Global Conservation Status Ranking) Imperiled – At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.

G3 (Global Conservation Status Ranking) Vulnerable – At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.

Guy wire – Wires used to secure wind turbines or meteorological towers that are not self-supporting.

Habitat – The area which provides direct support for a given species, including adequate food, water, space, and cover necessary for survival.

Habitat fragmentation – Habitat fragmentation separates blocks of habitat for some species into segments, such that the individuals in the remaining habitat segments may suffer from effects such as decreased survival, reproduction, distribution, or use of the area.

Impact – An effect or effects on natural resources and on the components, structures, and functioning of affected ecosystems.

- **Cumulative** – Changes in the environment caused by the aggregate of past, present and reasonably foreseeable future actions on a given resource or ecosystem.
- **Direct** – Effects on individual species and their habitats caused by the action, and occur at the same time and place.
- **Indirect impact** – Effects caused by the action that are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts include displacement and changes in the demographics of bird and bat populations.

Infill – Add an additional phase to the existing project, or build a new project adjacent to existing projects.

In-kind compensatory mitigation – See compensatory mitigation.

Intact habitat – An expanse of habitat for a species or landscape scale feature, unbroken with respect to its value for the species or for society.

Intact landscape – Relatively undisturbed areas characterized by maintenance of most original ecological processes and by communities with most of their original native species still present.

Lattice design – A wind turbine support structure design characterized by horizontal or diagonal lattice of bars forming a tower rather than a single tubular support for the nacelle and rotor.

Lead agency – Agency that is responsible for federal or non-federal regulatory or environmental assessment actions.

Lek – A traditional site commonly used year after year by males of certain species of birds (e.g., greater and lesser prairie-chickens, sage and sharp-tailed grouse, and buff-breasted sandpiper), within which the males display communally to attract and compete for female mates, and where breeding occurs.

Listed species – Any species of fish, wildlife or plant that has been determined to be endangered or threatened under section 4 of the Endangered Species Act (50 CFR §402.02), or similarly designated by state law or rule.

Local population – A subdivision of a population of animals or plants of a particular species that is in relative proximity to a project.

Loss – As used in this document, a change in wildlife habitat due to human activities that is considered adverse and: 1) reduces the biological value of that habitat for species of concern; 2) reduces population numbers of species of concern; 3) increases population numbers of invasive or exotic species; or 4) reduces the human use of those species of concern.

Megawatt (MW) – A measurement of electricity-generating capacity equivalent to 1,000 kilowatts (kW), or 1,000,000 watts.

Migration – Regular movements of wildlife between their seasonal ranges necessary for completion of the species lifecycle.

Migration corridor – Migration routes and/or corridors are the relatively predictable pathways that a migratory species travel between seasonal ranges, usually breeding and wintering grounds.

Migration stopovers – Areas where congregations of wildlife assemble during migration. Such areas supply high densities of food or shelter.

Minimize – To reduce to the smallest practicable amount or degree.

Mitigation – (Specific to these Guidelines) Avoiding or minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts.

Monitoring – 1) A process of project oversight such as checking to see if activities were conducted as agreed or required; 2) making measurements of uncontrolled events at one or more points in space or time with space and time being the only experimental variable or treatment; 3) making measurements and evaluations through time that are done for a specific purpose, such as to check status and/or trends or the progress towards a management objective.

Mortality rate – Population death rate, typically expressed as the ratio of deaths per 100,000 individuals in the population per year (or some other time period).

Operational changes – Deliberate changes to wind energy project operating protocols, such as the wind speed at which turbines "cut in" or begin generating power, undertaken with the object of reducing collision fatalities. Considered separately from standard mitigation measures due to the fact that operational changes are considered as a last resort and will rarely be implemented if a project is properly sited.

Passerine – Describes birds that are members of the Order Passeriformes, typically called "songbirds."

Plant communities of concern –Plant communities of concern are unique habitats that are critical for the persistence of highly specialized or unique species and communities of organisms. Often restricted in distribution or represented by a small number of examples, these communities are biological hotspots that significantly contribute to the biological richness and productivity of the entire region. Plant communities of concern often support rare or uncommon species assemblages, provide critical foraging, roosting, nesting, or hibernating habitat, or perform vital ecosystem functions. These communities often play an integral role in the conservation of biological integrity and diversity across the landscape. (Fournier et al. 2007) Also, any plant community with a Natural Heritage Database ranking of S1, S2, S3, G1, G2, or G3.

Population – A demographically and genetically self-sustaining group of animals and/or plants of a particular species.

Practicable – Capable of being done or accomplished; feasible.

Prairie grouse – A group of gallinaceous birds, includes the greater prairie-chicken, the lesser prairie-chicken, and the sharp-tailed grouse.

Project area – The area that includes the project site as well as contiguous land that shares relevant characteristics.

Project commencement – The point in time when a developer begins its preliminary evaluation of a broad geographic area to assess the general ecological context of a potential site or sites for wind energy project(s). For example, this may include the time at which an option is acquired to secure real estate interests, an application for federal land use has been filed, or land has been purchased.

Project Site – The land that is included in the project where development occurs or is proposed to occur.

Project transmission lines – Electrical lines built and owned by a project developer.

Raptor – As defined by the American Ornithological Union, a group of predatory birds including hawks, eagles, falcons, osprey, kites, owls, vultures and the California condor.

Relative abundance – The number of organisms of a particular kind in comparison to the total number of organisms within a given area or community.

Risk – The likelihood that adverse effects may occur to individual animals or populations of species of concern, as a result of development and operation of a wind energy project. For detailed discussion of risk and risk assessment as used in this document see Chapter One - General Overview.

Rotor – The part of a wind turbine that interacts with wind to produce energy. Consists of the turbine's blades and the hub to which the blades attach.

Rotor-swept area – The area of the circle or volume of the sphere swept by the turbine blades.

Rotor-swept zone – The altitude within a wind energy project which is bounded by the upper and lower limits of the rotor-swept area and the spatial extent of the project.

S1 (Subnational Conservation Status Ranking) Critically Imperiled – Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.

S2 (Subnational Conservation Status Ranking) Imperiled – Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.

S3 (Subnational Conservation Status Ranking) Vulnerable – Vulnerable in the jurisdiction due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.

Sage grouse – A large gallinaceous bird living in the sage steppe areas of the intermountain west, includes the greater sage grouse and Gunnison's sage grouse.

Significant – For purposes of characterizing impacts to species of concern and their habitats, "significance" takes into account the duration, scope, and intensity of an impact. Impacts that are very brief or highly transitory, do not extend beyond the immediate small area where they occur, and are minor in their intensity are not likely to be significant. Conversely, those that persist for a relatively long time, encompass a large area or extend well beyond the immediate area where they occur, or have substantial consequences are almost certainly significant. A determination of significance may include cumulative impacts of other actions. There is probably some unavoidable overlap among these three characteristics, as well as some inherent ambiguity in these terms, requiring the exercise of judgment and the development of a consistent approach over time.

Species of concern – For a particular wind energy project, any species which 1) is either a) listed as an endangered, threatened or candidate species under the Endangered Species Act, subject to the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act; b) is designated by law, regulation, or other formal process for protection and/or management by the relevant agency or other authority; or c) has been shown to be significantly adversely affected by wind energy development, and 2) is determined to be possibly affected by the project.

Species of habitat fragmentation concern—Species of concern for which a relevant federal, state, tribal, and/or local agency has found that separation of their habitats into smaller blocks reduces connectivity such that the individuals in the remaining habitat segments may suffer from effects such as decreased survival, reproduction, distribution, or use of the area. Habitat fragmentation from a wind energy project may create significant barriers for such species.

String – A number of wind turbines oriented in close proximity to one another that are usually sited in a line, such as along a ridgeline.

Strobe – Light consisting of pulses that are high in intensity and short in duration.

Threatened species – See listed species.

Tubular design – A type of wind turbine support structure for the nacelle and rotor that is cylindrical rather than lattice.

Turbine height – The distance from the ground to the highest point reached by the tip of the blades of a wind turbine.

Utility-scale – Wind projects generally larger than 20 MW in nameplate generating capacity that sell electricity directly to utilities or into power markets on a wholesale basis.

Voltage (low and medium) – Low voltages are generally below 600 volts, medium voltages are commonly on distribution electrical lines, typically between 600 volts and 110 kV, and voltages above 110 kV are considered high voltages.

Wildlife – Birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent.

Wildlife management plan – A document describing actions taken to identify resources that may be impacted by proposed development; measures to mitigate for any significant adverse impacts; any post-construction monitoring; and any other studies that may be carried out by the developer.

Wind turbine – A machine for converting the kinetic energy in wind into mechanical energy, which is then converted to electricity..

Appendix B: Literature Cited

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Appendix C: Sources of Information Pertaining to Methods to Assess Impacts to Wildlife

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