Environmental Assessment for
Proposed Habitat Conservation Plan and Incidental Take Permit

Wildcat Wind Farm
Tipton and Madison Counties, Indiana

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USFWS
Bloomington Ecological Services Field Office
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List of Acronyms and Abbreviations

Applicant	Wildcat Wind Farm, LLC
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald and Golden Eagle Protection Act
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
Fowler Ridge Wind Farm	Fowler Ridge
FR	Federal Register
HCP	Habitat Conservation Plan
IC	Indiana Code
IDNR	Indiana Department of Natural Resources
INESCA	Indiana Nongame and Endangered Species Conservation Act
ITP	incidental take permit
m/s	meters per second
MBTA	Migratory Bird Treaty Act
Memorandum	Memorandum for Heads of Federal Departments and Agencies
MET	meteorological tower
mph	miles per hour
MRU	Midwest Recovery Unit
MW	megawatt
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
O&M	operations and maintenance
Plan Area	Habitat Conservation Plan Area
PM	particulate matter
Project	Wildcat Wind Farm

REA Model	Resource Equivalency Analysis Model for Wind Energy Projects
Recovery Plan	Indiana Bat Draft Recovery Plan: First Revision
Service	U.S. Fish and Wildlife Service
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WNS	white-nose syndrome
WWF	Wildcat Wind Farm, LLC

CHAPTER 1. PROJECT OVERVIEW AND BACKGROUND

1.1 INTRODUCTION

The U.S. Fish and Wildlife (the Service) received an application for an Incidental Take Permit (ITP), pursuant to the provisions of section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA;16 United States Code [USC] §§ 1531–1544.) for the Wildcat Wind Farm (Project) in Tipton and Madison counties, Indiana (Figure 1-1). If issued, the ITP will authorize the incidental take of Indiana bats (*Myotis sodalis*), a federally endangered species, and northern long-eared bats (*Myotis septentrionalis*), a federally threatened species, during operation of the Project. Under section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The Project is owned and operated by Wildcat Wind Farm, LLC (WWF or Applicant), a wholly owned subsidiary of E.ON Climate & Renewables, North America. WWF's ITP application includes their Habitat Conservation Plan (HCP) that specifies, among other things, the impacts that are likely to result from taking Indiana bats and northern long-eared bats and the measures WWF will undertake to minimize and mitigate such impacts. The Applicant is applying for an ITP to provide the Project with long-term assurances that no unauthorized take of the Indiana bat or northern long-eared bat will occur that could give rise to liability for WWF or individuals associated with the covered activities described in the proposed HCP. The following Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 to evaluate the effects of implementing the Applicant's proposed HCP.

It is the Applicant's intent to operate a wind energy facility while complying with the ESA. The Applicant has prepared an HCP to support their application for an ITP for Indiana bats and northern long-eared bats while operating, maintaining, and decommissioning the WWF. In the HCP, the Applicant has expressed a goal to maximize energy production using wind power to meet renewable energy objectives and stimulate economic opportunities in the local area, while at the same time minimizing impacts to wildlife. The HCP also states that implementing renewable energy will produce fewer emissions of greenhouse gases (GHG) and other air pollutants than traditional sources of energy production and will help in meeting state energy policies and goals, such as Indiana's Renewable Portfolio Standard.

1.1.1 The Wildcat Wind Farm

The Project is a wind energy facility located in central Indiana, north of the town of Elwood (Figure 1-1). The Project's nameplate capacity is 200-megawatts (MW) and comprises 125 1.6-MW wind turbine generators, turbine pads, an operations and maintenance building, access roads, collector line system, switching station, meteorological (MET) towers, and a substation. Approximately 1.5 miles of overhead transmission line extends along Madison County Road 1500N from Madison County Road 700W to 0.5 miles east of Indiana State Road 37.

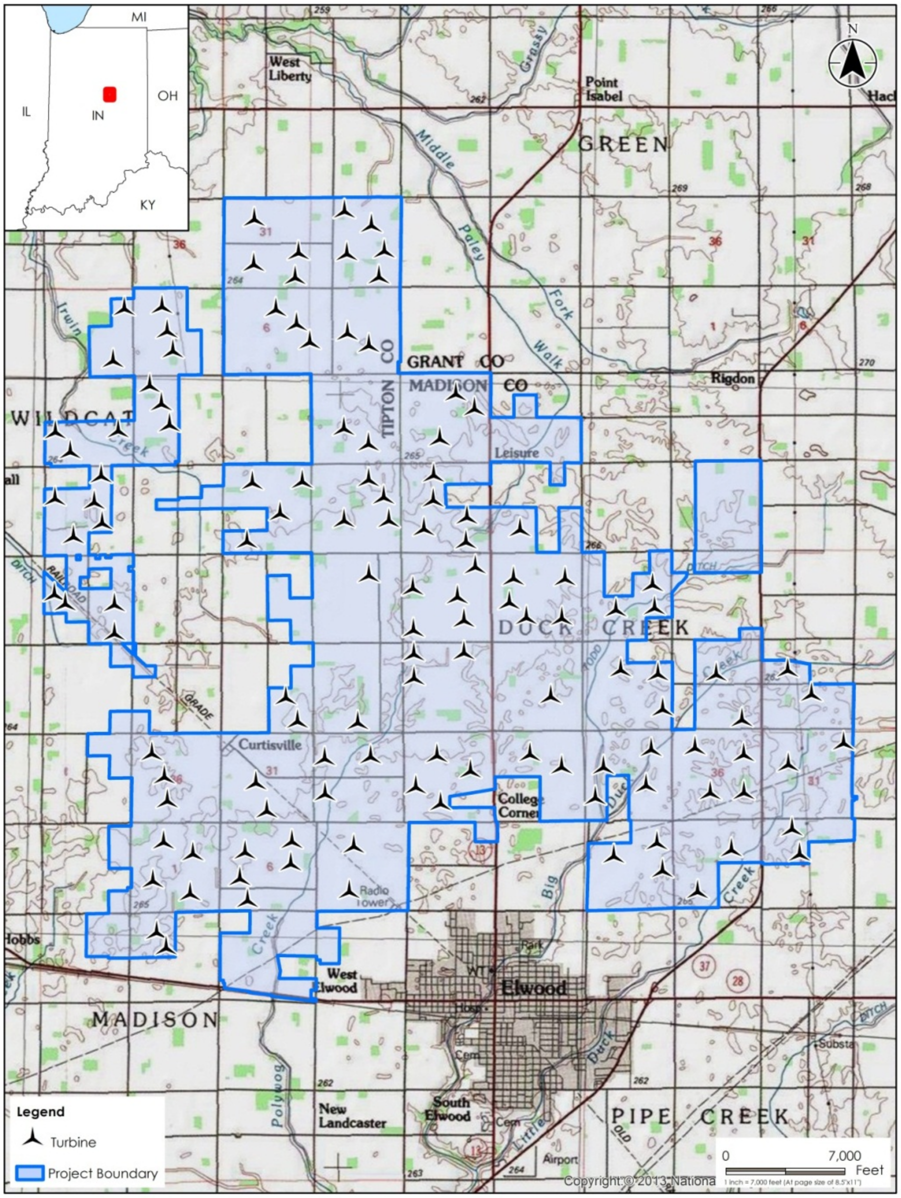

Figure 1-1. Project area, Wildcat Wind Farm, Tipton and Madison counties, Indiana.

1.1.1.1 Turbines

The Project includes 125 GE 1.6 MW wind turbines (Figure 1-1). Each turbine has three major components: tower, nacelle, and rotor. Turbine towers are two different heights from the foundation to the top known as "hub height;" 76 towers are approximately 100 meters (328 feet), and 49 towers are approximately 96 meters (315 feet). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. Each rotor consists of three composite blades that are approximately 49 meters (161 feet) creating a rotor diameter of 100 meters. Total turbine height (height when blade tip is in the highest position) is approximately 150 meters (492 feet) for the 100-meter towers and approximately 146 meters (479 feet) for the 96-meter towers. As per requirements of the FAA, the Project turbines are equipped with medium-intensity aviation warning lights that are flashing red strobes (L-864) and operate only at night.

The pitch angle of each rotor blade may be independently adjusted, thereby permitting control of rotor speed. Wind speed and direction are measured by anemometers located on each turbine nacelle. Under normal operations, wind speed and direction will inform the adjustment of the blade , either pitching into the wind (flat side of the blade facing wind), causing the rotor to spin and produce energy or feathering (flat side of blade parallel to wind), causing the rotor to spin at very low revolutions per minute, if at all.

As designed, the GE 1.6 MW turbines begin generating energy at wind speeds as low as 3.5 meters per second (m/s; 7.8 miles per hour [mph]) and cut out when wind speeds reach 25 m/s (60 mph). During periods of curtailment, the turbine will regulate its speed, cut in or cut out, according to adjusted operational criteria that have been programmed through the Project's Supervisory Control and Data Acquisition system. The adjusted operations are based on the prescribed curtailment criteria as opposed to the manufacturer ratings.

1.1.1.2 Access Roads and Turbine Pads

New access roads and improvement of existing access roads (including existing farm lanes) were constructed to provide access to turbines and substation site. The total length of access roads required to service all wind turbine locations is approximately 32 miles. The roads are gravel-surfaced and 16-18 feet wide. Access to each individual turbine includes a 14-foot wide ring-road around the turbine, also known as the turbine pad.

1.1.1.3 Collection System and Substation

A transformer located near the base of the tower raises the voltage of electricity produced by the turbine generator up to the 34.5 kV voltage level of the collection system. The collection system comprises 88 miles of buried lines and connects individual turbines to the substation located at the northwest corner of County Roads 700W and 1500N. The total length of these collection lines is approximately 88 miles.

The collector substation steps up voltage from 34.5 kV to 138 kV to allow connection with the existing transmission line. The substation is located on a 1.4-acre lot enclosed within a chain-link fence, and accessed from either County Road 700W or 1500N via gravel driveways.

1.1.1.4 Transmission Line and Switching Station

Consisting of electrical cables mounted on monopole towers, the transmission line connects the collector substation to the point of interconnect, also known as a switching station. The transmission line runs for approximately 1.5 miles along County Road 1500N, and runs for approximately 1.5 miles from County Road 700W to 0.5 mile east of Indiana State Road 37.

The switching station transmits the power from the Project to the existing transmission line. The switching station is located on a 1.4-acre lot, enclosed within a chain-link fence, and accessed by a gravel road from County Road 1500N.

1.1.1.5 Meteorological Towers

The Project has three MET towers that collect wind data and support performance testing of the Project. One tower is 100 meters (328 feet) tall and an unguyed, self-supporting lattice steel structure with wind monitoring and Supervisory Control and Data Acquisition instrumentation. Two are 60 meters (197 feet) tall and guyed lattice steel structures with wind monitoring instruments. The three MET towers are located in agricultural fields within the lease boundaries of the Project.

1.1.1.6 Operations and Maintenance Building

An operations and maintenance (O&M) building and associated storage yard is located in a former agricultural field. The O&M building houses operations personnel, equipment and materials, and provides staff parking. Site selection for the O&M building was based upon typical constructability criteria. The O&M structure is 11,925 square feet in size and located on 10 acres within the Project area. The site is in a relatively level, well-drained field and avoids sensitive features such as surface waters and subsurface cultural resources.

1.1.2 Plan Area

The Plan Area includes all areas that will be affected directly and indirectly by activities associated with Project operations and mitigation measures. Relative to the Project, the Plan Area includes the outermost boundary of the approximately 24,420 acres of participating landowner property (Figure 1-1). Relative to the mitigation measures, the Plan Area also includes the sites to be used for the HCP mitigation projects for compensating the impact of taking listed bats. The Applicant has not yet established the final sites for mitigation.

1.2 REGULATORY AND POLICY BACKGROUND

1.2.1 National Environmental Policy Act

The environmental review process under NEPA provides the acting agency with the framework for reviewing the federal action, alternatives, environmental effects, and possible mitigation of potentially harmful effects of the action. NEPA is an environmental law fashioned to ensure careful decision-making with respect to the environment. NEPA also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and recommend national policies to ensure that the programs of the Federal government exercise careful decision-making with respect to the environment. The CEQ has set forth regulations (40 Code of Federal Regulations [CFR] §§1500-1508) to assist federal agencies in implementing NEPA and to ensure that the environmental impacts of any proposed decisions are fully considered, and that appropriate steps are taken to mitigate potential environmental impacts. The NEPA review also provides an opportunity for the public to be involved in the acting agency's decision-making process. For this Project, the public had the opportunity to comment on the drafts EA and Project HCP for 45 days from June 17 through August 4, 2016. The culmination of the EA process is either a Finding of No Significant Impact (FONSI) or a decision to prepare an Environmental Impact Statement (EIS). This EA and its analyses assist the Service with making an informed decision on issuance of an ITP.

The Service concluded that an EA was the appropriate instrument for reviewing the Applicant's proposal. The Service made this determination based on the following:

1) the Project is not located near suitable winter or summer bat habitat;
2) the Project will not impact critical habitat;
3) the Applicant will implement a robust multi-year monitoring and adaptive management program;
4) the Applicant will share all data and information with the Service and make the information public;
5) the Project site is low risk for resident and migratory birds because of its size, distance from sensitive avian resource areas, lack of open water, and predominantly agricultural setting;
6) the Applicant's proposed mitigation measures will offset the impact of taking covered species;
7) the Project will not affect park lands, wetlands, wild and scenic rivers, or ecologically critical areas;
8) the action will not contribute to cumulatively significant impacts;
9)
10) the action will not result in any violation of federal, state, or local law or requirements imposed for the protection of the environment;
11) the issuance of an Incidental Take Permit is consistent with Service responsibilities under the ESA, Migratory Bird Treaty Act, and NEPA; and
12) the action does not expose future generations to increased safety or health hazards, does not conflict with local, regional, state or federal land use plans or policies, and does not impose adverse effects on designated or proposed natural or recreation areas.

1.2.2 Endangered Species Act

The Service is responsible for implementing and enforcing federal wildlife laws, including the ESA. Federally listed threatened and endangered species and designated critical habitat are governed by the ESA and its implementing regulations (50 CFR parts 13 and 17). The Service is authorized to identify species in danger of extinction and provide for their management and protection. The Service also maintains a list of species that are candidates for listing pursuant to the ESA.

Section 9 of the ESA prohibits certain activities that directly or indirectly affect endangered species. For the purpose of the EA and the proposed ITP, the most relevant activity is the prohibition of take of wildlife species listed under the ESA. The ESA defines the term take to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these acts (16 USC §1532(19)). Take of listed wildlife is illegal unless otherwise authorized by the Service (or National Marine Fisheries Service [NMFS] in marine systems) pursuant to section 10 of the ESA.

1.2.2.1 Endangered Species Act Section 10(a)(1)(B)

The ESA was amended in 1982 to allow the Service and NMFS to authorize the taking of listed species incidentally to an otherwise lawful activity by non-Federal entities, such as states, counties, local governments, and private landowners. To receive a permit, the applicant submits a conservation plan (also referred to as an HCP) that meets the criteria included in the ESA and its implementing regulations (50 CFR parts 17 and 222), as follows:

1) The taking will be incidental to otherwise lawful activities;
2) The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such takings;
3) The applicant will ensure that adequate funding for the HCP will be provided;

4) The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild;
5) The applicant has met the measures, if any, required by the Service as being necessary or appropriate, for the purposes of the plan; and
6) The Service has received such other assurances as may be required that the plan will be implemented.

HCP Handbook

The Service and NMFS later developed a comprehensive guidance on the incidental take permit program, HCP Handbook (USFWS and NMFS 1996). The HCP Handbook incorporates more than a decade of improvements and innovations in updated policies and procedures in the HCP program, and provides ways to reduce the regulatory burden on private landowners while addressing the habitat needs of listed species.

In June 2000, the Service and NMFS published a final addendum to the HCP Handbook, the Five-Point Policy (USFWS and NMFS 2000; 65 FR 35242-35257). This policy provides clarifying guidance to the Service and NMFS in conducting the HCP program and to permit Applicants. The final addendum supplements the HCP Handbook and "No Surprises" final rule (USFWS and NMFS 1998; 63 FR 8859-8873), and is to be applied within the context of the existing ESA statute and regulations. In addition to the permit issuance criteria (listed above), an HCP should address the following five points:

1. Biological Goals and Objectives
    a. Goals: A statement of the expected biological outcome for the covered species and habitats.
        i. What does the Plan hope to achieve?
    b. Objectives: the specific, measurable actions to be implemented to achieve the goals
        i. What will the Applicant do to achieve the goals?
2. Adaptive Management
    a. A method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.
3. Monitoring
    a. Assess compliance and project impacts, and verify progress toward the biological goals and objectives
    b. Provide the scientific data necessary to evaluate the success of the HCP's operating conservation programs with respect to possible use of those strategies in future HCPs or other programs for those covered species
4. Permit Duration
    a. Duration of the applicant's proposed activities
    b. Duration of expected positive and negative effects on covered species
5. Public Participation
    a. Public comment
        i. 30 days for low-effect HCP, individual permits under a Programmatic HCP, and major amendments to existing HCPs
        ii. 60 days (minimum)
        iii. 90 days for large-scale or regional projects

1.2.2.2 Endangered Species Act Section 7

Under section 7 of the ESA, issuance of an ITP is a federal action subject to section 7 compliance. This means the Service must conduct an internal formal section 7 consultation on permit issuance. For the purposes of the Project ITP, the section 7 consultation will be between the Assistant Regional Director for Ecological Services and the Field Office that assisted the Applicant in developing the HCP.

The Service's internal consultation on the section 10 action ensures that ITP issuance meets ESA standards under section 7. Section 10 issuance criteria includes the regulatory definition of jeopardy under section 7, and the section 7 consultation represents the last internal "check" that the fundamental standard of avoiding jeopardy has been satisfied. Formal consultation terminates with preparation of a biological opinion (BO), which provides the Services' determination as to whether the proposed action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

The section 7 consultation is also when the Service may develop reasonable and prudent measures and terms and conditions to minimize anticipated incidental take, or, if necessary, reasonable and prudent alternatives to eliminate the risk of jeopardy. Reasonable and prudent measures are required actions the Regional Director believes necessary or appropriate to minimize the impacts of incidental take. Reasonable and prudent measures, terms, and conditions are included in the BO.

The BO for a section 10(a)(1)(B) permit application must contain, at a minimum, a detailed discussion of the effects of the HCP and ITP on listed species or critical habitat. The BO must also provide the Service's opinion on whether the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. This constitutes the Service's "jeopardy" or "no jeopardy" determination with respect to the permit application.

1.2.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA; 16 USC 703-712) affords protection to all birds that occur in the U.S. with the exception of gallinaceous birds (i.e., game birds) and introduced species. Species protected under the MBTA are listed under 50 CFR 10.13. The MBTA prohibits the taking and disturbance (both intentional and unintentional) of migratory birds, their nests, or young without prior authorization from the Service. Because the Project has the potential to take or disturb birds protected under the MBTA, this EA addresses impacts to migratory birds.

1.2.4 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA; 50 CFR 22.26) prohibits the 'take' of a bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*). The Service published the Eagle Permit Rule on September 11, 2009 under BGEPA, authorizing limited issuance of take permits for bald eagles and golden eagles for cases where the take is compatible with the preservation of the eagle species and cannot practicably be avoided (USFWS 2009*b*; FR 46836-46879). On May 5, 2013, the Service made available their Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (Eagle Guidance; USFWS 2013*b*). The Eagle Guidance interprets and clarifies the Eagle Permit requirements in the regulations (50 CFR 22.26 and 22.27). The Eagle guidance also informs pre-construction survey requirements, avoidance and minimization measures, and monitoring requirements at commercial wind projects.

The Project has a low likelihood for taking or disturbing eagles. However, wind projects have killed eagles, including projects in the Midwest. Therefore, this EA addresses potential effects to eagles.

1.2.5 Indiana Nongame and Endangered Species Conservation Act

The State of Indiana enacted the Indiana Nongame and Endangered Species Conservation Act (INESCA; Indiana Code [IC] 14-22-34) in 1973 in response to the enactment of the federal ESA. INESCA defines "endangered species means any species or subspecies of wildlife whose prospects of survival or recruitment within Indiana are in jeopardy or are likely within the foreseeable future to become so…" (IC 14-22-34-1). Additionally, any species or subspecies of fish or wildlife protected under the federal ESA is also considered endangered under INESCA. The statute does not define the term "threatened," and there is no regulatory distinction between threatened and endangered in Indiana. Any species or subspecies considered vulnerable enough to require protection under INESCA is considered endangered.

The Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife maintains a list of endangered as well as a list of special concern species, i.e., any species requiring monitoring due to known or suspected limited abundance or distribution or due to a recent change in legal status or required habitat.

Because the Project has the potential to affect species protected under INESCA, this EA addresses effects to state-listed species.

CHAPTER 2. PURPOSE AND NEED

2.1 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The environmental review process under NEPA provides the Service with the framework for reviewing the federal action, alternatives, environmental effects, and possible mitigation of potentially harmful effects of the action. The NEPA process facilitates several agency goals and desired outcomes. It is the Service's purpose and need for action that determines the range of alternatives and provides a basis for the selection of an alternative in a decision. Most importantly, the NEPA review provides an opportunity for the public to be involved in the Service's decision-making process. Also, the Service can use a properly conducted NEPA analysis to review and improve plans, functions, programs, and resources under its jurisdiction. Furthermore, this EA is the mechanism for recording the results of a comprehensive planning and decision-making process surrounding WWF's application for an ITP.

The federal action triggering NEPA is the Service's receipt of an ITP application from WWF. The EA and its analyses provide the Service with the necessary tools to make an informed decision on issuance of an ITP. The Service has analyzed the impacts of the proposed covered activities on all elements of the natural and human environment that could be affected, including other wildlife species that occur within the Plan Area. Consistent with Service guidance, we will also considered, among other things, the effectiveness of the adaptive management strategy in reducing impacts to migratory birds and all bats.

2.2 PROPOSED ACTION – ISSUANCE OF THE PERMIT

The proposed action being evaluated by this EA is the request from WWF to the Service for an ITP authorizing take of the federally listed Indiana bat and northern long-eared bat at the Project, including implementation of WWF's associated HCP. WWF is seeking a 28-year permit term to implement their HCP. This term coincides with the 27-year operational life of the Project plus a 1-year decommissioning period. The Service's Proposed Action is to issue an ITP to WWF on the conditions predicated in WWF's proposed HCP. The purpose of issuing an ITP to WWF is to authorize take of listed species that is incidental to their otherwise lawful activities.

2.3 NEED FOR PROPOSED ACTION

The need for federal action is WWF's ITP application to which the Service must respond. The underlying issue to which the Service is responding is a need for WWF to comply with the ESA by either avoiding take of an ESA-listed species (in which case an ITP is not needed) or to acquire a permit that authorizes take of listed species under the ESA. WWF has chosen to apply for an ITP and the Service needs to respond to the permit application.

Take of the Indiana bat and northern long-eared bat is reasonably anticipated during Project operations. Consistent with the requirements of the ESA, the Applicant commits to a range of conservation measures proposed to minimize and mitigate the effects of taking Indiana bats and northern long-eared bats. Thus, the HCP, if approved, is designed to avoid and minimize take of the species in the course of carrying out the proposed covered activities as well as to mitigate the impact of such take. The ITP, if issued, is to authorize the limited, unavoidable take that may occur. The Service's goal within the context of the ESA is to protect both Indiana bats and northern long-eared bats and the ecosystems upon which they depend in the Project area and region for the continuing benefit of the people of the United States.

2.4 DECISION TO BE MADE

The Service must decide whether to issue or deny the ITP. If the permit issuance criteria contained in section 10(a)(1)(B) of the ESA (listed above) are satisfied, the Service is required to issue the ITP to the Applicant. The Service may decide to issue a permit conditioned upon implementation of the HCP as submitted by the Applicant, or to issue a permit conditioned upon implementation of the HCP as submitted together with other measures specified by the Service. If the ESA's criteria are not satisfied, the Service is required to deny the permit request. Thus the Service has limited discretion and authority within which to determine the range of alternatives.

The Service has analyzed the impacts of the proposed covered activities on all elements of the natural and human environment that could be affected, including other wildlife species that occur within the covered lands. The Service has indicated the selected alternative in the FONSI. The Service provides a summary of their rationale for issuing the permit in the BO, which is their findings document on the section 7 consultation.

CHAPTER 3. ALTERNATIVES

Pursuant to NEPA, federal agencies must consider a range of reasonable alternatives to the proposed action when evaluating the environmental effects of their actions (40 CFR 1505.1(e)). This chapter describes the Applicant's proposed action and alternatives to that action, including the no action alternative.

3.1 DEVELOPMENT OF ALTERNATIVES

The scope of reasonable alternatives is defined by the purpose and need for the action and guided by the goals and objectives of the acting agency. Reasonable alternatives include those that are practical or feasible from both a technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the Applicant. Alternatives were developed to address the potential for take of Indiana bats and northern long-eared bats during Project operation and are primarily operational alternatives relating to the dates and times of operation and changes in cut-in speed (i.e., the wind speed at which turbines begin generating power and sending it to the grid). The alternatives do not address other aspects of the wind farm, such as turbine siting and construction because:

1) The Project is constructed and operating;
2) No suitable Indiana bat or northern long-eared bat summer habitat is found within the Project area; and
3) The only proven mechanism to reduce mortality of migrating bats is operational adjustment of turbines.

The Project is a 125-turbine wind energy facility that has the potential to harm or kill Indiana bats and northern long-eared bats thus the necessity for an ITP. We considered reasonable project alternatives in response to the Applicant's request for take of Indiana bats and northern long-eared bats. Alternatives were evaluated for their capacity to meet the Service's purpose and need for the federal action. Alternatives are also included that were considered but eliminated from detailed analyses (pursuant to 40 CFR 1502.14(a)).

We retained 4 alternatives for detailed analyses:

Alternative 1: No-Action Alternative (No ITP Issued and No HCP Required)

Alternative 2: 5.0 m/s Cut-in Speed (Applicant's Proposed Action, ITP Issuance, HCP with Minimization and Mitigation Measures)

Alternative 3: 6.5 m/s Cut-in Speed (More Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures

Alternative 4: 4.0 m/s Cut-in Speed (Less Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures)

We evaluate these alternatives based on their capacity to meet stated goals and objectives of the Service's action and project intent (described in Section 2.3). The potential effects on the human environment for each of the retained alternatives are described in detail in Chapter 4 Environmental Consequences.

3.2 ALTERNATIVES RETAINED FOR DETAILED ANALYSIS

Alternatives vary by operational adjustments and the extent of mitigation for off-setting the unavoidable take of Indiana bats and northern long-eared bats. Because operational adjustments are assumed to affect the level of take of covered species, they also define the amount of mitigation needed to compensate for the impact of the taking.

3.2.1 Alternative 1: No-Action Alternative

3.2.1.1 Turbine Operational Protocol

The Project began operating in December 2012. In 2013, 2014, and 2015 WWF operated the Project under the terms of Technical Assistance Letters (dated June 18, 2012 and July 2, 2015; Appendix B of the Project HCP) from the Service. Currently, the Project is operating under the revised Technical Assistance Letter (July 2, 2015; Appendix B of Project HCP). In 2013 and 2014, from August 1 to October 15, WWF implemented operational adjustments and raised the cut-in speed of Project turbines from the manufacturer's rated cut-in speed of 3.5 m/s (7.8 mph) to 7.0 m/s (15.7 mph) from 30 minutes before sunset to 30 minutes after sunrise . The Service's revised Technical Assistance Letter requires a cut in speed of 5.0 m/s (11.2 mph) during spring migration (March 15 through May 15) and a cut-in speed of 6.9 m/s (15.4 mph) in the fall (August 1 through October 15) until such time an ITP is issued, in accordance with the Service's *Draft Requirements for Issuing a Technical Assistance Letter for Avoidance of Indiana Bat and Northern Long-eared Bat Take at Wind Energy Facilities* (USFWS 2015*b*). Project operations were curtailed at 6.9 m/s during the fall in 2015 and at 5.0 m/s during the spring of 2016.

Under the No-Action Alternative, WWF would continue to operate under these restrictions for the life of the project. Because take of Indiana bats and northern long-eared bats is unlikely under these restrictions, WWF would not obtain an ITP or implement an HCP. WWF would conduct post-construction monitoring at specified levels. The Project would implement the current Bird and Bat Conservation Strategy (BBCS; provided in Appendix A).

The No-Action Alternative would have an overall neutral effect on both bat species because no take would occur. To verify anticipated avoidance of take, WWF would conduct post-construction monitoring as specified in the Technical Assistance Letter and described in their Mortality Minimization and Monitoring Proposal (see Appendix A of the Project HCP).

3.2.1.2 No-Action Alternative Summary

The No-Action Alternative meets the Service's goals and objectives for protecting and conserving the Indiana bat and northern long-eared bat and its habitats in the context of the Project for the continuing benefit of the people of the United States. Under the No-Action Alternative, Project operations are unlikely to pose risks to Indiana bats or northern long-eared bats because the turbines would be feathered until wind speeds reach 5.0m/s during the spring (March 15 through May 15) and 6.9m/s during the fall (August 1 through October 15). The No-Action Alternative would be the alternative implemented if the Service denies the Applicant the ITP. However, the No-Action Alternative does not meet the Applicant's purpose and need for providing a source of renewable energy practicably and economically (see Sections 1.3 and 7.1 of the Project HCP).

3.2.2 Alternative 2: 5.0 m/s Cut-in Speed (Applicant's Proposed Action, ITP Issuance, HCP with Minimization and Mitigation Measures)

Under Alternative 2, the Applicant's Proposed Action, the Service will issue an ITP to authorize incidental take of Indiana bats and northern long-eared bats associated with the Project operation. WWF will implement an HCP that includes:

1) Operational measures to reduce take of listed bats:
    a) Feathering all turbines below 5.0 m/s cut-in speed from sunset to sunrise when the ambient temperature is above 10°C (50°F) based on a 10-minute rolling average from August 1 through October 15;
    b) Feathering all turbines below 3.5 m/s cut-in speeds from October 16 through July 31;
2) Off-site conservation measures to mitigate the impact of taking Indiana bats and northern long-eared bats that cannot be avoided; and
3) Post-construction monitoring and adaptive management plan to measure effectiveness of turbine operations in reducing bat mortality.

WWF will also implement the BBCS to reduce the potential for impacts to migratory birds. Elements in the BBCS that address Indiana bats, northern long-eared bats, and all other bats will be replaced by the conservation measures addressed in the HCP.

3.2.2.1 Operational Minimization Measures

WWF's curtailment plan is explained in detail in the Project HCP in Section 5.2.1. Under the Applicant's Proposed Action, turbines will be feathered up to 5.0 m/s cut-in speed for the period August 1 through October 15 each year from sunset to sunrise when the ambient temperature is above 10°C based on a 10-minute rolling average. The hub will not be locked, but blades will be feathered to the wind such that revolutions per minute are minimal during periods when wind speed is less than 5.0 m/s. The feathering/cut-in process will be computer-controlled on a real-time basis; turbines will feather or cut-in throughout the night as wind speed fluctuates below and above 5.0 m/s. The Applicant's rationale for 5.0 m/s cut-in speed in fall with nighttime temperatures above 10°C is based on curtailment studies (Baerwald et al. 2009, Arnett et al. 2010, Good et al. 2011) and bat activity studies (O'Farrell and Bradley 1970, Vaughan et al. 1997, Fiedler 2004, Reynolds 2006, USFWS 2007). In addition, WWF will feather all turbines at the manufacturer's rated cut-in speed of 3.5 m/s during the period from October 16 through July 31.

3.2.2.2 Mitigation

The Applicant proposes mitigation measures to compensate for the impact of take of Indiana bats and northern long-eared bats as described in Section 4.3 in the Project HCP. Due to similarities between the two Covered Species, the Service accepts that any mitigation efforts for Indiana bats will also partially benefit the northern long-eared bats. The Service also accepts that if habitat is suitable for multiple listed species that are being impacted by a Project, a single mitigation area may be used for those species for that particular project (USFWS 2003). WWF will mitigate for the impacts of take of Indiana bat and northern long-eared bats through improvements to winter habitat and/or summer maternity habitat. Specifically, WWF will protect, and possibly restore, summer maternity habitat in the vicinity of existing Indiana and northern long-eared bat maternity colonies in Vermillion County, Indiana. The WWF mitigation plan is described in detail in the Project HCP in Section 5.2.2.

3.2.2.3 Monitoring and Adaptive Management

The monitoring program that would be implemented as part of the HCP consists of two components: take limit compliance monitoring and mitigation effectiveness monitoring. The goal of take limit compliance monitoring is to ensure compliance with the terms of the ITP; whereas, the goal of mitigation effectiveness monitoring is to ensure the success of mitigation efforts at offsetting the impacts of unavoidable take of Indiana and northern long-eared bats from the Project. Based on information derived from monitoring, adaptive management would be used to make modifications to the proposed minimization and mitigation measures if WWF finds these measures have been ineffective at meeting the biological goals and objectives of the HCP. Details of the monitoring program and adaptive management are provided in the Project HCP in Section 5.3 and Section 5.4, respectively.

3.2.2.4 Alternative 2 Summary

Within the context of this Project, the Applicant's Proposed Action meets the Service's purpose to ensure ESA compliance for the Project to avoid, minimize, and mitigate take of listed species and legally authorize the incidental take of the Indiana bat and northern long-eared bat consistent with permit issuance criteria (section 10(a)(1)(B) of the ESA) and associated implementing regulations [50 CFR 17.22(b)(2) and 17.32(b)(2)]. The Service's goal within the context of the permit application is to conserve the Indiana bat and northern long-eared bat and their habitats in the Plan area and region for the continuing benefit of the people of the United States. The Proposed Action's compensation for the unavoidable Project impacts to covered species is to be achieved through suitable mitigation that offsets the impact of the taking, which is 176.2 female Indiana bats and 58.7 female northern long-eared bats. If the permit issuance criteria contained in section 10(a)(1)(B) of the ESA are satisfied, the Service is required to issue the permit to the Applicant.

The Proposed Action meets the Applicant's purpose and need for a Project that provides an affordable and reliable source of renewable energy that has relatively few environmental impacts as compared to energy sources derived from fossil fuels, helps to meet renewable energy goals for the U.S. and the State of Indiana, and supports the local and regional economies through job creation and increased tax revenue. The Proposed Action also serves the Applicant's purpose to comply with the ESA and avoid, minimize, and mitigate the Project's impact on the Indiana bat and northern long-eared bat. In the absence of an ITP, the Project would be unlawful if take of Indiana bats or northern long-eared bats occurred.

3.2.3 Alternative 3: 6.5 m/s Cut-in Speed (More Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures)

3.2.3.1 Operational Minimization Measures

Under Alternative 3, all turbines would be feathered at 6.5 m/s (14.5 mph) from sunset to sunrise when the ambient temperature is above 10°C based on a 10-minute rolling average from August 1 through October 15. Additionally, all turbines would be feathered at the turbine manufacturer's rated cut-in speed of 3.5 m/s during the period from October 16 through July 31, further minimizing collision risks for bats. The HCP would include mitigation to offset the impact of the taking of Indiana bats and northern long-eared bats. The Service would issue an ITP for the Project. WWF would implement post-construction monitoring to determine if adaptive management measures are warranted.

3.2.3.2 Mitigation

Under the 6.5 m/s Alternative, the Applicant would implement off-site mitigation measures. The Applicant would need to offset the impact of the take through gating vulnerable hibernacula and protection and/or restoration of lands adjacent to a known maternity colony. The type of mitigation under this alternative would be to the same as that described for Alternative 2 (in Section 3.2.2.2) and in Section 5.2.2 of the Project HCP. However less mitigation would be needed due to the estimated decrease in the impact of take when operating at a higher cut-in speed.

3.2.3.3 Monitoring and Adaptive Management

Under the 6.5 m/s Alternative, the Applicant would implement their BBCS and conduct monitoring as described for Alternative 2 (in Section 3.2.2.3) and in the Project HCP in Section 5.3. Monitoring results may trigger similar adaptive management measures as described for Alternative 2 (in Section 3.2.2.3) and in Section 5.4 of the Project HCP.

3.2.3.4 Alternative 3 Summary

Within the context of this Project, the 6.5 m/s Alternative meets the Service's purpose to ensure ESA compliance for the Project to avoid, minimize, and mitigate take of listed species and legally authorize the incidental take of the Indiana bat and northern long-eared bat consistent with the permit issuance criteria (section 10(a)(1)(B) of the ESA) and associated implementing regulations [50 CFR 17.22(b)(2) and 17.32(b)(2)]. Alternative 3's compensation for the unavoidable Project impacts to covered species would be achieved through suitable mitigation that offsets the impact of the taking. If the permit issuance criteria contained in section 10(a)(1)(B) of the ESA are satisfied, the Service is required to issue the permit to the Applicant.

In Section 7.2 of their proposed HCP, WWF indicates the 6.5 m/s Alternative does not meet the Applicant's purpose and need for a Project that provides an affordable and reliable source of renewable energy. The Applicant states the significant renewable energy production lost through an additional 1.5 m/s rise in cut-in speed relative to their Proposed Alternative would be proportionally much greater and place the Project at significant risk of not meeting its production targets. Therefore, WWF determined this alternative to be impracticable.

3.2.4 Alternative 4: 4.0 m/s (Less Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures)

3.2.4.1 Operational Minimization Measures

Under Alternative 4, all turbines would be feathered at 4.0 m/s from sunset to sunrise when the ambient temperature is above 10°C based on a 10-minute rolling average from August 1 through October 15. Additionally, all turbines would be feathered at the turbine manufacturer's rated cut-in speed of 3.5 m/s during the period from October 16 through July 31, further minimizing collision risks for bats. The HCP would include mitigation to offset the impact of the taking of Indiana bats and northern long-eared bats. The Service would issue an ITP for the Project. WWF would implement post-construction monitoring to determine if adaptive management measures are warranted.

3.2.4.2 Mitigation

Under the 4.0 m/s Alternative, the Applicant would implement off-site mitigation measures. The Applicant would need to offset the impact of the take through gating vulnerable hibernacula and protection and/or restoration of lands adjacent to a known maternity colony. The type of mitigation under this alternative would be to the same as that described for Alternative 2 (in Section 3.2.2.2) and in Section 5.2.2 of the Project HCP. However more mitigation would be needed due to the estimated increase in the impact of take under a lower cut-in speed.

3.2.4.3 Monitoring and Adaptive Management

Under the 4.0 m/s Alternative, the Applicant would implement their BBCS and conduct monitoring as described for Alternative 2 (above in Section 3.2.2.3) and in the Project HCP in Section 5.3. Monitoring results may trigger similar adaptive management measures as described for Alternative 2 (in Section 3.2.2.3) and in Section 5.4 of the Project HCP.

3.2.4.4 Alternative 4 Summary

Within the context of this Project, the 4.0 m/s Alternative addresses minimization and mitigation for the Indiana bat and northern long-eared bat. However, the 4.0 m/s Alternative does not meet the Service's purpose to ensure ESA compliance for the Project to avoid, minimize, and mitigate take of listed species to the maximum extent practicable. Available data suggest that a 4.0 m/s cut-in speed would reduce bat mortality by 47% or greater, but this assumption is based on just two studies. The Service would not be as confident in estimates in mortality reduction based on such insufficient evidence. Additionally, the Service is concerned that monitoring and subsequent adaptive management would result in larger or more frequent operational adjustments to meet the HCPs stated biological goals and objectives.

Given the experimental nature of any curtailment strategy, the Service would require the Applicant to minimize the impacts of the takings to the maximum extent practicable. Therefore, the Service would not opt to first select an alternative that would employ a less protective measure for a covered species in comparison to the applicant's proposal.

The 4.0 m/s Alternative meets the Applicant's purpose and need for a Project that provides an affordable and reliable source of renewable energy that has relatively few environmental impacts as compared to energy sources derived from fossil fuels, helps to meet renewable energy goals for the U.S. and the State of Indiana, and supports the local and regional economies through job creation and increased tax revenue. The 4.0 m/s Alternative also serves the Applicant's purpose to comply with the ESA and avoid, minimize, and mitigate the Project's impact on the Indiana bat and northern long-eared bat. Although the Applicant could realize cost savings by operating at 4.0 m/s cut-in speed versus the Proposed Alternative, those cost savings are likely to be diminished in light of additional mitigation costs and potentially significant changes in operations. In Section 7.3 of the Project HCP, WWF rejected this alternative based on the uncertainty of accurately estimating take at 4.0 m/s and the impact of the mitigation costs.

3.3 SUMMARY OF THE ALTERNATIVES ANALYSIS

Reasonable alternatives determined to minimize and mitigate adverse effects to Indiana bats and northern long-eared bats and other resources were compared and contrasted based on results of the detailed analysis. Table 3-1summarizes those elements that would vary among the No-Action and action alternatives.

Table 3-1. **Comparison of alternatives considered for detailed analysis for the Wildcat Wind Farm HCP.**

	Operations	Monitoring	ITP / Implement HCP	Implement BBCS
1. No-Action	5.0 m/s cut-in speed during spring migration (March 15 – May 15) and 6.9 m/s cut-in speed during fall (August 1 – October 15) from 30 minutes before sunset to 30 minutes after sunrise for the life of the Project	Yes; spring and fall for life of Project	No	Yes
2. 5.0 m/s (Applicant's Proposed Action)	5.0 m/s cut-in speed during fall migration (August 1 - October 15) each year from sunset to sunrise when the ambient temperature is above 10°C (50°F) and feathered up to 3.5 m/s October 16 – July 31	Yes; spring baseline; fall implementation and adaptive management for life of Project	Yes	Yes
3. 6.5 m/s (More Restrictive Operations)	6.5 m/s cut-in speed during fall migration (August 1 - October 15) from sunset to sunrise when the ambient temperature is above 10°C (50°F) and feathered up to 3.5 m/s October 16 – July 31	Yes; spring baseline; fall implementation and adaptive management for life of Project	Yes	Yes
4. 4.0 m/s (Less Restrictive Operations)	4.0 m/s cut-in speed during fall migration (August 1 - October 15) from sunset to sunrise when the ambient temperature is above 10°C (50°F) and feathered up to 3.5 m/s October 16 – July 31	Yes; spring baseline; fall implementation and adaptive management for life of Project	Yes	Yes

3.4 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

NEPA requires that federal agencies thoroughly consider and objectively evaluate all reasonable alternatives and briefly explain the basis for eliminating those alternatives that were not retained for detailed analysis (40 CFR 1502.14). Early discourse between the Service and the Applicant on potential minimization and mitigation measures resulted in an initial list of potential alternatives for achieving the purpose and need of the Project. Some of these alternatives were later determined to not meet the purpose and need of either the Service or Applicant. Other alternatives could not be legally undertaken, or were found to be lacking in sufficient protection for the covered species or other wildlife resources, or included conservation measures that were not practicable given the magnitude of potential effects. Therefore, a number of alternatives were considered but eventually dismissed from detailed analysis for reasons summarized below.

3.4.1 ITP with Full Implementation of HCP and Reduced Permit Term (5 years)

The Reduced Permit Term Alternative would be implemented as described for Alternative 2 with an ITP term for five years as opposed to 28 years. The HCP would also be modified to reflect implementation for a 5-year period. Upon nearing the end of the 5-year period, WWF would seek an extension of the ITP if they deemed appropriate. The length of the renewal period would be decided at the time of renewal and based on the results of the post-construction monitoring and any adaptive management implemented. At the time of the request for a permit renewal, greater certainty would be known about the effectiveness of turbine operational curtailment measures to reduce bat fatalities. The initial permit would authorize less take than Alternative 2, but if renewed, would likely have similar long-term effects as Alternative 2, including its adaptive management strategy.

Under this Alternative, an ITP would be issued contingent upon implementation of the conservation plan set forth in the Project HCP. Therefore, this alternative would meet the Service's purpose to provide a means to protect the Indiana bat and northern long-eared bat and habitats within the context of the Project. The Reduced Permit Term Alternative also meets the Agency's goals of minimizing and mitigating take of Indiana bats and northern long-eared bats.

This Alternative does not meet the Applicant's purpose and need because a permit of such short duration provides no assurances that additional permits would be re-issued repeatedly for the life of the Project. Additionally, this puts a considerable financial and labor-intensive burden on the Applicant to repeat the permitting process numerous times.

This alternative would not reduce further any estimated annual take, would create an additional administrative burden, and would likely have similar long-term biological effects as Alternative 2. The annual review process outlined in the Project HCP provides for a system of checks and balances for reducing uncertainty regarding the effectiveness of operational curtailment. This review process would implement procedures for evaluating the effectiveness of the HCP and ensuring that take levels specified in the ITP are not exceeded. Because it does not provide substantially different protection for Indiana bats and northern long-eared bats beyond what is proposed in the Project HCP, this alternative was dropped from consideration.

3.4.2 3.5 m/s Cut-in Speed (Unrestricted Operations, No ITP, No HCP)

Under the 3.5 m/s Alternative, the turbines would operate normally at the manufacturer's cut-in speed of 3.5 m/s at all times. The HCP would not be developed, and the Service would not issue an ITP for the Project. Therefore the Applicant would not have legal coverage for incidental take of the Indiana bat and northern long-eared bat and at risk of violating section 9 of the ESA. Implementation of an unrestricted operations alternative would not include any conservation benefits to the Indiana bat or northern long-eared bat, through winter habitat protection and summer habitat enhancement and protection.

This alternative does not meet the Service's goals and objectives for protecting and conserving the Indiana bat and northern long-eared bat and their habitats. This alternative meets the Applicant's purpose and need for providing a source of renewable energy practicably and economically. However, this alternative does not meet the Applicant's purpose and need to operate a wind project that is in compliance with the ESA.

3.4.3 6.9 m/s Cut-in Speed for Entire Bat-Active Season (No HCP, No ITP)

Under this alternative, WWF would implement operational adjustments to avoid take of Indiana and northern long-eared bats for the entire active season, from March 15 through October 15. WWF would raise the cut-in speed from the manufacturer's rated cut-in speed of 3.5 m/s to 6.9 m/s from 30 minutes before sunset to 30 minutes after sunrise. Because take of Indiana bats and northern long-eared bats would be unlikely at the Project, WWF would not need an ITP or implement an HCP. WWF would conduct post-construction monitoring at specified levels. The Project would implement the BBCS, provided in Appendix A.

This alternative meets the Service's goals and objectives for protecting and conserving the Indiana bat and northern long-eared bat and their habitats. Under this alternative, Project operations are unlikely to pose risks to Indiana bats or northern long-eared bats because the turbines would be feathered until wind speeds reach 6.9m/s during the entire bat-active season. However, the No-Action Alternative does not meet the Applicant's purpose and need for providing a source of renewable energy practicably and economically.

CHAPTER 4. AFFECTED ENVIRONMENT

The affected environment is the area and its resources (i.e., biological, physical, socioeconomic) potentially impacted by the Proposed Action and Alternatives. The purpose of describing the affected environment is to define the context in which the impacts will occur. To make an informed decision about which alternative to select, it is necessary to first understand which resources will be affected and to what extent. The affected environment section of this document attempts to provide the basis for this understanding.

Relative to the Applicant's proposal, the affected environment includes those settings where any covered activities will occur. This is the Plan Area, which includes 1) the Wildcat Wind Farm, the site of Project operations, maintenance, mortality monitoring, and decommissioning, and 2) the sites of mitigation for winter and summer habitat. The ITP will cover the entire Plan Area and all covered activities.

In defining potentially affected resources, we considered the potential impacts associated with the Proposed Action, namely potential issuance of an ITP to WWF for take of Indiana bats and northern long-eared bats and implementation of the associated HCP. Consistent with NEPA, we also considered three alternatives to the Proposed Action, where WWF will operate their 125-turbine wind farm, minimize and mitigate for impacts associated with take of Indiana bats and northern long-eared bats, and avoid and minimize impacts to other resources.

Project operations vary among the considered alternatives. With regard to implementation of any of the alternatives considered, bat and bird resources are likely to experience the most pronounced impact. Also, only bat mortality is likely to vary among alternatives. Hence, our analysis is commensurate with the estimated impacts and focuses predominately on these two resources. We recognize two other resources will experience project operational effects: noise and economics. However, these effects will be minor, thus we provide limited analyses for these resources. The proposed mitigation to summer habitat is likely to have impacts to vegetation resources.

Conversely, Project operations are unlikely to have significant effects to geology and soils, surface and ground water, environmental justice, land use, visual resources, cultural resources, transportation, and communications. The Applicant's proposed action and the alternatives are not anticipated to result in changes to these resources from their current condition. Therefore, our review does not extend to include detailed analyses of these resources.

In summary, the following descriptions of resources are limited to those affected by the alternatives under consideration, described in Chapter 3. The alternatives under consideration include four scenarios in which a 125-turbine wind farm could operate, i.e., four different operational adjustments associated with turbine cut-in speeds, along with the corresponding mitigation measures. Our detailed analysis is confined to the biological environment (vegetation; wildlife; avian; bats), physical environment (air quality and climate; noise), and socioeconomic environment (economics).

4.1 OVERVIEW OF THE PLAN AREA

The Project is located in Tipton and Madison counties in central Indiana just north of the town of Elwood. The Plan Area for the Project extends to the outermost boundary of the parcels leased for the wind farm and covers 24,420 acres (Figure 1-1). The setting comprises agricultural lands interspersed with creeks, ditches, and sparse residential and commercial development. The landscape is crisscrossed by a network of local and state roads, open ditches and subsurface tiled drains, electrical power lines, and an active railway. Small towns surrounded by farmsteads include Kempton, Sharpsville, Tipton, and Windfall City in Tipton County and Elwood, Frankton, Alexandria, Summitville, Chesterfield, Anderson, Edgewood, Lapel, Pendleton, Ingalls, and Markleville in Madison County.

The Project is situated in the Tipton Till Plain amidst flat terrain where low-level relief occurs along the breaks between uplands and drainages. Elevations in Tipton and Madison counties range from 803 to 997 feet above sea level.

Intermittent streams and drainages are common in the Project landscape. There are also a few perennial streams, including Duck Creek, Little Duck Creek, Polywog Creek, Irwin Creek, and Poley Walk, all of which are tributaries of larger waterways that drain to the Wabash River (Figure 4-1). National Wetlands Inventory data indicate small wetlands scattered throughout the Project area, occurring in higher densities along the creeks. Forested areas in these counties are limited to narrow bands of trees and shrubs or small woodlots often associated with streams, drainages, or wetlands (Figure 4-2).

The 200-MW wind farm comprises 125 wind turbine generators, access roads, and appurtenances, located on land leased from private landowners who continue their current uses of the agricultural lands. As a leaseholder, WWF's rights are limited to those incorporated in the lease agreement to allow for safe and effective operation, maintenance, and decommissioning of the Project. WWF has no control over landowner activities on the properties in which the Project is sited beyond what is specified in their lease provisions.

Project construction began in October 2011. WWF used standard construction procedures, including best management practices to minimize impacts to the existing environment and habitat. The Project began operations in December 2012.

WWF is working with a third-party contractor to identify and implement appropriate projects for suitable summer habitat mitigation. WWF has identified two sites in the Middle Wabash-Little Vermillion watershed in western Indiana that contain quality roosting and foraging habitat for both Indiana bats and northern long-eared bats (described in detail in Section 5.2.2.3 in the Project HCP). Both sites are oak-hickory forests with areas suitable for forest restoration and located <4 miles of documented occurrences of either Indiana bats or northern long-eared bats.

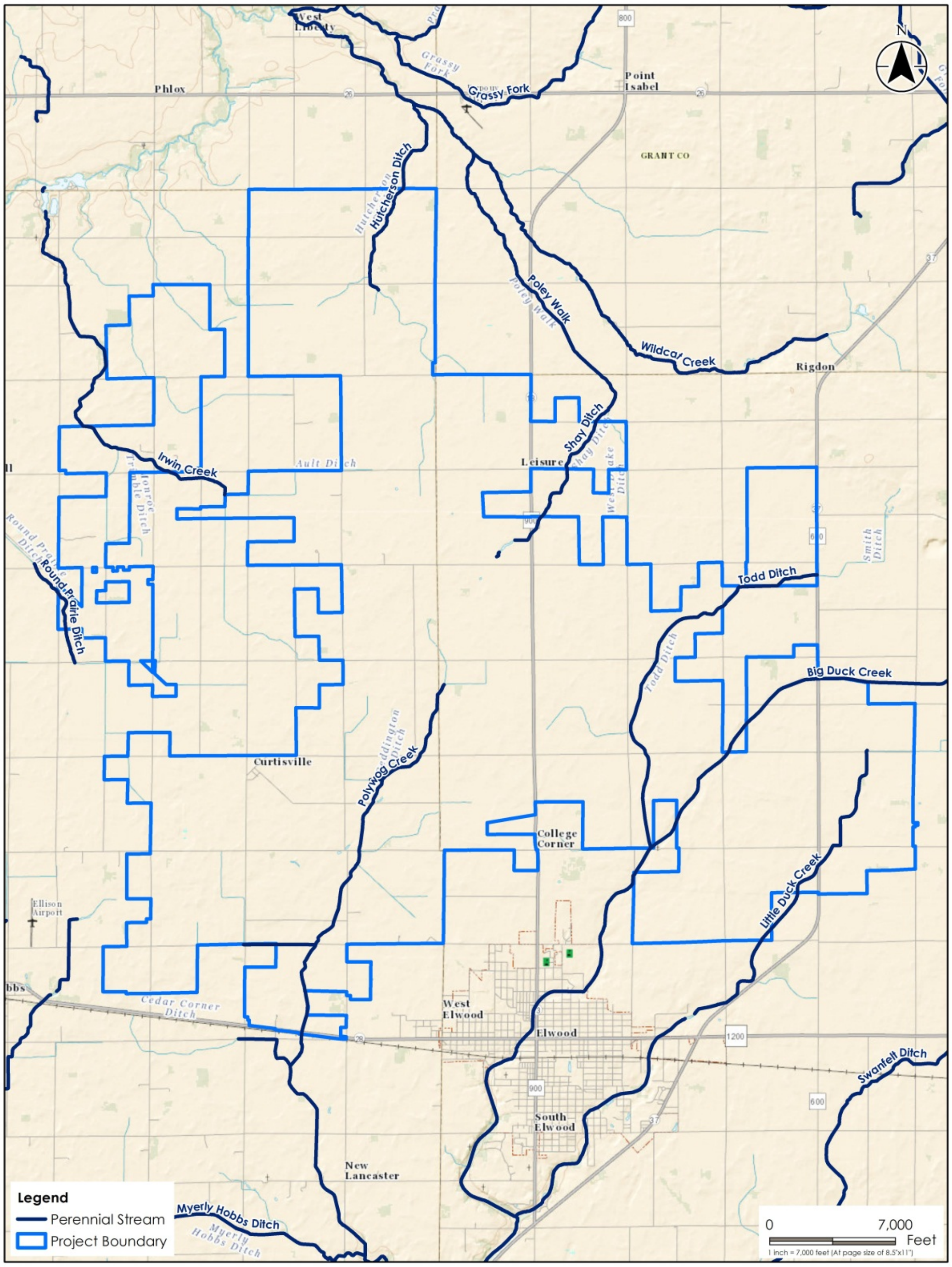

Figure 4-1. Perennial and intermittent streams and drainages in and proximal to the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

Figure 4-2. Agricultural fields interspersed with small fragments of trees and shrubs are characteristic of the vegetative cover types in the landscape of the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Vegetation

Vegetation resources include all plants, including rare, threatened, and endangered plants. Project operations under the Proposed Action and alternatives are not expected to affect vegetation. As stated previously, vegetation in the Project area is dominated by agricultural crops, primarily corn and soybeans. Based on current information from IDNR's Heritage Database and the Service's threatened and endangered species database, no state or federally listed plants are known to occur in the Project area.

During decommissioning, WWF will restore approximately those areas containing Project facilities to their original land uses, primarily agriculture. Decommissioning will have no benefits to native vegetation unless the lessee wishes to reclaim Project component sites to native vegetation. Winter habitat mitigation is not expected to affect vegetation. Potential vegetation impacts will be limited to the summer habitat mitigation project.

4.2.2 Wildlife Resources

This section addresses non-volant wildlife; birds and bats are addressed in Sections 4.2.3 and 4.2.4, respectively. General wildlife includes common terrestrial and aquatic animals and rare, threatened, and endangered animals. Project operations and the summer habitat mitigation project are likely to affect wildlife resources.

4.2.2.1 Habitat Conditions for General Wildlife

Project area

Much of the Project area (roughly 94%) is used for the production of cultivated crops and pasture hay. Roughly 5% of the Project area is developed, mainly as residences and farm infrastructure. There are several small patches of deciduous forest, hedgerows, scrub shrub, and grassland areas that make up roughly 1% of the Project area. Several small, perennial creeks, including Wildcat Creek, bisect the Project area (Figure 4-1). Several man-made ponds occur, including a 0.5-acre pond with minimal forest cover and emergent herbaceous vegetation (<0.1% of Project area). Larger waterways in the vicinity of the Project include the White and Mississinewa rivers. Consequently, the majority of the terrestrial wildlife in the Project area are generalist species adapted to an agricultural environment. Limited habitat for aquatic species exists in the Project area. There are no Natural Preserves or Fish and Wildlife Areas in Madison or Tipton counties (IDNR 2015).

Mammal species present may include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), squirrels (*Sciurus* spp.), eastern cottontail (*Sylvilagus floridanus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), and several shrew species (*Blarina brevicauda*, *Cryptotis parva*, *Sorex* spp.).

Creeks and drainages, although limited in the Project area, may be used by amphibians such as American toad (*Anaxyrus americanus*) and Fowler's toad (*Bufo woodhousii fowleri*), and reptiles such as common snapping turtle (*Chelydra serpentine serpentina*), midland painted turtle (*Chrysemys picta marginata*), and gartersnake (*Thamnophis sirtalis*).

4.2.2.2 Rare, Threatened, and Endangered Wildlife

Federally listed species are afforded protection under the ESA. In Indiana, state-listed species are afforded protection under INESCA (IC 14-22-34). Based on current information from IDNR's Heritage Database and the Service's threatened and endangered species database, no state or federally listed non-volant mammals, reptiles, or amphibians are known to occur in the Project area.

4.2.3 Avian Resources

4.2.3.1 Scope of Analysis

For the purposes of this EA, the scope of this analysis includes avian resources within the Plan Area. Birds are highly mobile, and dispersal and migration are important aspects of their life strategies and survival. Birds will occur within and travel through the Project area and mitigation sites while flying to and from natural resources within the surrounding landscape and during migration. All bird species known to occur within the plan area are addressed in this section, protected or otherwise.

4.2.3.2 Project Area

Avian species that occur in the Project area are diverse and use various habitats. To facilitate analysis, we considered avian resources based on the following group classifications, which are generalized from the taxonomic orders in the subclass Neornithes, or modern birds:

- Passerines (songbirds and corvids);
- Nocturnal non-passerines (nightjars);
- Shorebirds;
- Waterbirds (waterfowl, loons, grebes);
- Game birds; and
- Raptors (falcons, eagles, hawks), vultures, and owls.

Relative to the Project area and WWF's proposal, statutes that afford protection to birds are described in Section 1.2. This analysis focuses on species of birds protected under the ESA, BGEPA, and INESCA, but also considers species that are common to the Project area and region. Abundant species are expected to occur more frequently and are more likely to experience impacts from the Project.

This analysis considers site-specific habitat and land cover assessment information, site-specific avian survey data, and information previously provided by the Service and IDNR during the Applicant's correspondences with the agencies prior to Project construction.

Existing Conditions in the Project Area

Cultivated crops (mostly row crops of corn, soybeans, and wheat) represent 93.4% of the land use within the Project area. Other cover types include the following: developed open space (5.1%), deciduous forest (0.5%), grassland/herbaceous cover (0.5%), pasture/hay (0.2%), and low intensity development (0.2%). Forested tracts are fragmented and scattered across the Project area (Project HCP). Small wetlands occur infrequently and consist of emergent herbaceous wetlands, freshwater ponds and lakes, and riverine systems (Project HCP).

Potential resources for avian species include tilled row-crop fields that may be used by shorebirds, blackbirds, and waterfowl as over-wintering habitat and stopover habitat during migration. Tilled crop-fields also provide foraging opportunities for raptors, such as northern harrier (*Circus cyaneus*) and red-tailed hawk (*Buteo jamaicensis*). Wetlands and man-made ponds in the Project area may provide nesting and foraging opportunities for some species of waterfowl, such as Canada goose (*Branta canadensis*) and mallard (*Anas platyrhynchos*). Some species of waterfowl, shorebirds, and wading birds may use wetlands and large drainages as stopover habitat during migration. Raptors, eagles, owls, and American crow (*Corvus brachyrhynchos*) may perch on telephone poles, abandoned railroad structures, and in hedgerows along roadsides in the Project area. Farm and residential buildings may provide roosting habitat for some species of passerines and owls. Limited forest patches (Figure 4-2) provide minimal, low-quality habitat for forest-breeding birds and minimal stopover habitat for migrants. As many birds migrate at high altitudes, the airspace above the Project area is potential migration habitat for a variety of species of birds, including passerines, nightjars, shorebirds, waterbirds, and raptors.

Prior to Project construction, WWF consulted with the Service and IDNR to identify potential concerns related to birds and the need for studies to assess the potential for avian risk associated with development and operation of the Project. Federally listed bird species are not known to occur in or migrate through the Project area (ARCADIS 2011*a*). The IDNR indicated the potential presence of state-protected species within the Project area: black rail and peregrine falcon (*Falco peregrinus*). IDNR also indicated the potential presence of black-and-white warbler (*Mniotilta varia*), a state species of special concern (ARCADIS 2011*a*).

Site Surveys
WWF conducted pre-construction migratory and breeding bird point counts and raptor migration surveys in the Project area in 2010 and 2011 (ARCADIS 2011*a*, *b*). The surveys occurred in April and May to sample both migratory and breeding activity. In both years, ARCADIS conducted point counts in and proximate to the various habitats, including agricultural fields, herbaceous fields, woodlots, fencerows, woody drainage ditches, and herbaceous drainage ditches. Agricultural fields included crop fields planted with soy and corn, sometimes alternating between crops within the same spring season, and hot weather grass. Bird survey reports are provided in Appendix B of this EA.

In 2010, drainage ditches and agricultural fields had the highest utilization rates (both approximately 10%). Species diversity was higher in the actively farmed land than in the wetland habitats, including the grassland buffer surrounding ponds. In 2011, survey locations included a greater variety of habitats. Pastures with trees had the highest utilization rate (19%), followed by agricultural fields (12%).

Surveys documented a diverse assemblage of species in the Project area prior to construction. In both years, surveyors observed a similar number of species: 56 in 2010 and 52 in 2011. In both years, surveyors observed species within each group classification listed at the beginning of this section, with the exception of nocturnal non-passerines. No black-and-white warblers, black rails, peregrine falcons, or other rare, threatened, or endangered species were observed in 2010 or 2011. In both years, passerines and doves represented the greatest percentage of observations (89% in 2010 and 63% in 2011).

Passerines

Passerines using active farmland included horned lark (*Eremophila alpestris*), red-winged blackbird (*Agelaius phoeniceus*), American robin (*Turdus migratorius*), and barn swallow (*Hirundo rustica*). In wetlands, species included red-winged blackbird, song sparrow (*Melospiza melodia*), brown-headed cowbird (*Molothrus ater*), and gray catbird (*Dumetella carolinensis*). At the location for Turbine 98, surveyors documented large flocks of horned larks, brown-headed cowbirds, and vesper sparrows (*Pooecetes gramineus*).

Shorebirds

Shorebirds represented 9% of observations in 2010 and 32% of observations in 2011. American golden-plovers (*Pluvialis dominica*) were among the most abundant species. In both 2010 and 2011, the proportion of shorebirds was largely influenced by flocks of American golden-plover. In 2010, 25 individuals were observed foraging and roosting during early evening hours in newly tilled agricultural fields (location data were not reported for these observations). In 2011, 575 individuals were observed throughout the Project area. American golden-plovers were observed flying over the Project area in small-sized flocks (< 30 individuals) to medium-sized flocks (30-100 individuals) at 9 of the 40 point-count locations (23% of survey locations). Large flocks of flying or foraging golden-plovers were observed in the Project area in the vicinity of Turbines 97 and 98 (north-central; ARCADIS 2011*b*; see Figure 2), which are located in an actively managed agriculture. Additionally, 1,134 American golden-plover individuals were observed incidentally during non-survey periods. Surveyors also documented large flocks of pectoral sandpipers (*Calidris melanotos*).

American golden-plovers are known to stopover in counties in west-central Indiana (Johnson 2003) during spring migration. Prior to the Project pre-construction surveys, records of American golden-plovers in Madison and Tipton counties were not found (ARCADIS 2011*a*), but these surveys showed that they do use agricultural fields in these counties as a stopover location (ARCADIS 2011*a*, *b*). Freshly tilled agricultural fields of soybeans and corn appear to be favored for stopover locations.

Raptors

During the April survey period (migratory period) of the 2010 point-count surveys, surveyors documented three raptor individuals: one red-tailed hawk, one turkey vulture, and one rough-legged hawk (*Buteo lagopus*). Surveys targeting raptor migration were conducted in 2011, and occurred from April 26 to 29 at four proposed turbine locations for 30 minutes. Nine raptors were observed: five red-tailed hawks (*Buteo jamaicensis*), three turkey vultures, (*Cathartes aura*) and one American kestrel (*Falco sparverius*). During the 2011 point-count surveys, surveyors recorded 17 additional individual raptors, including one additional raptor species (Cooper's hawk [*Accipiter cooperii*]). In 2011, ARCADIS conducted raptor nest searches throughout the Project area during the weeks of April 26 and May 23, 2011. One possible active raptor nest was observed in the southwestern border of the Project area. The nest was a medium-sized stick nest and was monitored several times during the April survey period. No raptor activity was observed at the nest site location (ARCADIS 2011*b*).

Eagles

In 2014, the Service confirmed that no known bald eagle nests occur within a 10-mile radius of the Project turbine locations (Project HCP). Pre-construction surveys conducted at the Project in 2010 and 2011 documented a single bald eagle in the Project area incidental to standardized surveys (ARCADIS 2011*b*). Due to the lack of foraging and nesting habitat in the Project area, the timing of the observation in late April, and the northern flight direction, this individual likely was a migrant. Golden eagles could occur in the Project area as transients during migration or winter. Their occurrence is anticipated to be an uncommon event.

USFWS Birds of Conservation Concern

The Fish and Wildlife Conservation Act mandates the Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the ESA." The Service has identified those migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities (USFWS 2008).

The Project is located in the Tallgrass Prairie Bird Conservation Region (BCR). For this BCR, the Service has identified 39 species for which proactive management and conservation actions should be considered. Among these 39 species, bird surveys in the Project area documented the following: bald eagle, red-headed woodpecker (*Melanerpes erythrocephalus*), grasshopper sparrow (*Ammodramus savannarum*), and dickcissel (*Spiza americana*).

4.2.4 Bat Resources

4.2.4.1 Scope of Analysis

This section first describes bat resources in general then discusses the existing conditions for bats within the Plan Area. For the purpose of this NEPA analysis, federally listed and unlisted bats (those species not listed as threatened or endangered under the ESA) are addressed together in this section. In Section 4.2.4.5, we provide additional information specific to Indiana bats and northern long-eared bats pertinent to the analysis of covered species.

4.2.4.2 Distribution, Habitat Use, and Status

Thirteen bat species are known to occur in Indiana, nine of which could occur in Tipton and Madison counties (Table 4-1) based on their normal ranges (England et al. 2001, BCI 2015). Of these species, the Indiana bat is federally and state-listed as endangered, and the northern long-eared bat is federally listed as threatened and a state special concern species. The Service is also collecting information to review the status of the little brown (*Myotis lucifugus*) bat to determine if threats to the species may be increasing its risk of extinction. Listing considerations and status reviews for both the northern long-eared bat and little brown bat have largely focused on impacts from white-nose syndrome (WNS), a fungal disease affecting cave-hibernating bats (discussed in greater detail in Section 4.2.4.5 and Section 5.5.3.2).

Table 4-1. Status and typical winter habitat of bat species potentially occurring in Madison and Tipton counties.

Common Name	Scientific Name	Status	Typical Winter Habitat[1]
Indiana bat	*Myotis sodalis*	Federal and state endangered	Hibernates in caves and mines
Northern long-eared bat	*Myotis septentrionalis*	Federal threatened; state special concern	Hibernates in caves and mines
Little brown bat	*Myotis lucifugus*	State special concern[2]	Hibernates in caves and mines
Silver-haired bat	*Lasionycteris noctivagans*	State special concern	Tree-roosting, long-distance migrant
Tri-colored bat	*Perimyotis subflavus*	State special concern	Hibernates in caves and mines
Big brown bat	*Eptesicus fuscus*		Hibernates in caves, mines, structures
Eastern red bat	*Lasiurus borealis*	State special concern	Tree-roosting, long-distance migrant
Hoary bat	*Lasiurus cinereus*	State special concern	Tree-roosting, long-distance migrant
Evening bat	*Nycticeius humeralis*	State endangered	Probable long-distance migrant

[1] As per England et al. (2001) and BCI (2015).
[2] Regional population declines due to WNS have prompted evaluation for listing under the federal ESA.

Reliable population data are available for the Indiana bat rangewide (discussed in Section 4.2.4.5). Cave counts for Indiana bats have included counts of northern long-eared bats to some degree, providing some estimates of local winter populations for this species. However, there is little to no information that can be used to reliably estimate populations of northern long-eared bat and other bat species.

4.2.4.3 Roosting and Foraging

When not hibernating, bats in the region roost in a variety of habitats including tree crevices or cavities, underneath loose tree bark, and sometimes in buildings or other structures. Reproductive females of *Myotis* species, tri-colored bat, and evening bat typically form maternity colonies of up to 75 or more bats in suitable roosts, occasionally switching among various roosts. Males and non-reproductive females of these species are typically solitary during the spring and summer, but also use tree and/or buildings or other suitable structures for roosting habitat (England et al. 2001). Regional information is limited on seasonal roosting habitat and distribution of migratory tree-roosting species including the hoary bat, silver-haired bat, and eastern red bat. Although mortality patterns at existing wind farms and a growing body of long-term acoustic survey records indicate that migratory tree-roosting species move through the region between mid-August and mid-September, likely roosting in trees or foliage during the day.

Bat species likely to occur in the Project area forage in a variety of habitats and include species adapted to foraging in cluttered and open habitats. Foraging habitat preference varies among species, likely driven by distribution and abundance of suitable insect prey and morphology of each bat species. Little is known regarding bat use of agricultural areas in the Midwest.

4.2.4.4 Hibernation and Seasonal Migration

Bats listed in Table 4-1 include both short-distance migrants that hibernate colonially within the region in winter (typically in caves or mines) and long-distance migrants that migrate out of the region in winter and are thought to hibernate primarily in trees. Bats of all species are typically absent from the landscape in the region of the Project area between November and March and either emerge from hibernacula or migrate to the region in spring (April-May).

Little is known about the migratory behavior of bats. Cave-hibernating bats disperse up to several hundred miles from hibernacula during summer, with females often dispersing further from hibernacula than males (Fleming and Eby 2003). Seasonal timing and species composition of bat mortality at wind farms indicate bats are at increased risk of collision during migration, particularly during fall migration. This increased risk of mortality may be related to an attraction to tall structures, mating or courtship behavior, increased flight height, or failure to detect turbines during migratory flight (Kunz et al. 2007*a*, *b*, Cryan 2008).

4.2.4.5 Rare, Threatened, and Endangered Bats

Indiana Bat

Section 3.1 of the Project HCP provides an in-depth account of the Indiana bat. Below we provide a brief description of Indiana bat status, biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of the species, please refer to the Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision (Recovery Plan; USFWS 2007).

Status

The Service originally listed the Indiana bat as in danger of extinction on March 11, 1967 under the Endangered Species Preservation Act of 1966 (USFWS 1967; 32 FR 4001). The species remains listed as endangered under the ESA of 1973, as amended. The estimated rangewide Indiana bat population in 2015 was 523,636, down 9.8% from 2013 (580,717) and roughly 18% lower than the 2007 estimate (USFWS 2015*d*). As of 2015, the Service had records of extant winter populations in 17 states (USFWS 2015*d*).

The Indiana bat is listed as state endangered in Indiana, and the conservation of this species is the responsibility of the IDNR's Nongame and Endangered Wildlife Program. Neither Tipton nor Madison counties have summer reproductive records, though nearly all the surrounding counties do (USFWS 2007). Lewisburg Mine, a Priority 2 hibernaculum in Preble County, Ohio, is the closest known Indiana bat hibernaculum to the Project area. Coon Cave and Grotto Cave, both in Monroe County in Indiana, are the closest Priority 1 hibernacula for Indiana bats, and several other caves in Monroe County support hibernating populations.

Threats to Indiana bats have included modification to hibernacula that change the airflow and alter the microclimate, human disturbance and vandalism causing direct mortality during hibernation, natural events during winter affecting large numbers of individuals, disease, and loss and degradation of summer habitat (USFWS 2007). WNS is a new, potentially devastating threat to Indiana bats throughout their range. WNS is a fungal infection first identified in eastern New York during the winter of 2006-2007 and is named for the visible presence of a white fungus around the muzzle, ears, and wing membranes of some infected bats. A previously unreported species of cold-loving fungus (*Pseudogymnoascus destructans*, formerly *Geomyces destructans*) is the primary pathogen associated with WNS. It is an invasive fungus with probable origins in Europe (Lorch et al. 2011, Minnis and Lindner 2013) and thrives in conditions characteristic of bat hibernacula.

WNS causes bats to arouse more frequently during hibernation, with reductions in the length of bouts of torpor associated with increased mortality rates (Reeder et al. 2012). In 2012, the Service estimated the fungus has killed 5.7 to 6.7 million bats total since its discovery in 2006 (USFWS 2012*c*). WNS affects most species of bats that hibernate in the northeast, with the little brown bat, northern long-eared bat, and Indiana bat among the most impacted. The rangewide population data show a73% decline in the Indiana bat population in the Service's Region 5 (northeastern U.S.) between 2007 and 2015 due to WNS (USFWS 2015*d*).

The Recovery Plan (USFWS 2007) defines four Recovery Units based on "evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use." The Project area is within the Midwest Recovery Unit (MRU), which includes the Indiana bat's range in Indiana, Kentucky, Ohio, Tennessee, Alabama, southwest Virginia, and Michigan (USFWS 2007). The Indiana bat population in Indiana is approximately 185,720 (Table 4-2; USFWS 2015*d*). This represents 72% of the 2015 population in the MRU (259,508) and 35.5% of the rangewide population (523,636) (USFWS 2015*d*). The Indiana bat population in the MRU has declined by 22% between 2007 and 2015 (Table 4-2). WNS was first documented in the MRU (in southwest Virginia) during the winter of 2008-2009 and confirmed in Indiana (Crawford, Washington, and Monroe counties) in January 2011.

Table 4-2. Indiana bat population estimates for the Midwest Recovery Unit.

State	2007	2009	2011	2013	2015	% Change from 2013
Indiana	238,068	213,244	225,477	226,365	185,720	-18.0
Kentucky	71,250	57,325	70,598	62,233	66,024	6.1
Ohio	7,629	9,261	9,870	9,259	4,809	-48.1
Tennessee	2,929	1,657	1,791	2,369	2,551	7.7
Alabama	258	253	261	247	247	0.0
SW Virginia	188	217	307	214	137	-36.0
Michigan	20	20	20	20	20	0.0
Total	320,342	281,977	308,324	300,914	259,508	-13.8

Source: USFWS (2015*d*)

Indiana has 37 historical Indiana bat hibernacula, and most are located in the southern part of the state. Of these hibernacula, seven are Priority 1 (currently or historically containing more than 10,000 Indiana bats), and three are Priority 2 (1,000 – 10,000 Indiana bats) (USFWS 2009*a*). Based on counts from known hibernacula, wintering populations in Indiana and Missouri are the largest of all the states within the species' range.

Hibernation and Seasonal Migration

Indiana bat maternity colonies tend to disband beginning in the first 2 weeks of August, with most bats leaving their summer ranges by mid-September. Indiana bats are highly mobile during fall, eventually congregating near hibernacula between August and October and swarming on a nightly basis for up to several weeks. Although swarming occurs near cave entrances, bats roost in trees during the day at this time of year rather than in the caves, traveling long distances from hibernacula and occasionally moving between hibernacula (USFWS 2007). Bats mate near the end of the swarming period, with females entering hibernation soon after mating and males remaining active until later in fall.

Indiana bats typically begin hibernation between mid-October and mid-November, concentrating in a limited number of caves or abandoned mines with suitable characteristics. Spring emergence varies with latitude and weather conditions. Studies in Indiana and Kentucky document peak emergence of females in mid-April and males in early May (Cope and Humphrey 1977). After emerging from hibernacula in spring, Indiana bats travel up to several hundred miles to their summer range, with females typically traveling greater distances than males (USFWS 2007). Behavior and habitat needs of Indiana bats during spring migration are poorly understood, although they appear to move quickly to summer ranges.

Summer Roosting Habitat Requirements and Foraging Behavior

Indiana bats roost primarily in trees during summer, usually under exfoliating bark and occasionally using narrow crevices or cracks in trees located in semi-open areas of forest with greater solar exposure (USFWS 2007). Indiana bats switch among primary and secondary roosts throughout the summer, with maternity colonies focusing use on a small number of primary roosts but using up to 10-20 total trees throughout the summer (USFWS 2007).

Indiana bats are nocturnal insectivores, feeding exclusively on flying insects. They typically forage from 6 feet to 100 feet above the ground and hunt primarily around, not within, the canopy of trees (USFWS 2007). Indiana bats preferentially forage in wooded areas, with forest type varying among studies, including closed to semi-open forests and forest edges (USFWS 2007). Foraging habitat studies indicate floodplain forest is the most preferred habitat, followed by ponds, old fields, row crops, upland woods, and pastures (USFWS 2007).

Telemetry studies have documented nightly foraging distances for female Indiana bats ranging from 0.3 to 5.8 miles from nightly roosts, with mean distances from 1.6 to 3.0 miles (Murray and Kurta 2004, Sparks et al. 2005, USFWS 2007, Womack et al. 2013). The size of foraging areas likely depends on extent of suitable habitat, interspecific competition, and prey availability. Rather than crossing large areas of unsuitable habitat, Indiana bats tend to follow corridors of suitable habitat, even if it means flying a greater distance (USFWS 2007).

Northern Long-eared Bat

The HCP provides an in-depth account of the northern long-eared bat (see Section 3.2). Below we provide a brief description of northern long-eared bat biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of the species, please refer to the Service's final rule for listing the northern long-eared bat (USFWS 2015*a*), final 4(d) rule (USFWS 2016*a*), and programmatic BO (USFWS 2016*b*).

Status

The Service proposed listing the northern long-eared bat as endangered on October 2, 2013 (USFWS 2013*c*) and subsequently listed as threatened on April 2, 2015 (USFWS 2015*a*). The Service found listing is warranted due to the recent severe and ongoing decline of the species due to WNS. The finding and final rule list other threats to northern long-eared bats, but recognize that WNS is the primary threat to the species continued existence (USFWS 2013*c*, 2015*a*). (See Indiana bat section above for a brief description of WNS and its associated fungus.)

On January 14, 2016, USFWS published a final 4(d) rule that removes or exempts prohibitions for incidental take of northern long-eared bats (USFWS 2016*a*). In areas of the U.S. not affected by WNS, the 4(d) rule removes prohibitions of take. In areas impacted by WNS, the 4(d) rule prohibits incidental take that occurs in hibernacula or that results from tree removal activities near maternity roost trees or hibernacula However, the 4(d) rule allows incidental take that results from operating wind turbines and permanent conversion of forested lands to other uses (e.g., creation or expansion of rights-of-way and urban development).

The northern long-eared bat is a relatively wide-ranging bat, but it appears to be unevenly distributed and is found in low numbers in both roosts and hibernacula (Griffin 1940, Barbour and Davis 1969, Caire et al. 1979, Amelon and Burhans 2006, ASRD and ACA 2009). The Service categorizes the U.S. range of the species in four parts: eastern, midwestern, southern, and western populations (USFWS 2015*a*). The northern long-eared has been noted in typically small numbers in numerous hibernacula across its range, and insufficient data are available at this time to reliably estimate a rangewide population. However, the Service has calculated a rough estimate of the population size with limitations, as many of the data are from sampling that occurred prior to the WNS outbreak. In the Biological Opinion for the 4(d) rule (USFWS 2016*b*), the USFWS estimates summer adult populations for each state. These estimates are based on total forested acres in each state and occupancy rates using the proportion of sites occupied by northern long eared in the total number of sites sampled (typically using mist-net surveys). The Service estimates there are 127,842 northern long-eared bats in Indiana and roughly 2.8 million in the Midwest region.

Hibernation and Seasonal Migration

Depending on the geographic area, northern long-eared bats occupy summer habitats from approximately March through August and begin to swarm near their hibernacula in August or September (Caire et al. 1979). At Copperhead Cave in Indiana, Whitaker and Mumford (2009 as cited in USFWS 2015*a*) observed the majority of bats enter hibernation during October and emerge from the second week of March to mid-April. Hibernation periods farther north may begin earlier and end later (Stones and Fritz 1969 as cited in Fitch and Shump 1979). Northern long-eared bats share hibernacula with other bat species (Griffin 1940, Whitaker and Mumford 2009 as cited in USFWS 2015*a*), but Barbour and Davis (1969) did not find any in concentrations over 100 individuals in a hibernaculum. Individuals may also rouse and switch hibernacula throughout the winter, which makes it difficult to accurately estimate winter population numbers (Griffin 1940, Whitaker and Rissler 1992, Caceres and Barclay 2000).

Summer Roosting Habitat Requirements and Foraging Behavior

During the summer, northern long-eared bats inhabit forests and roost singly or in colonies in the cracks, crevices, and bark of both live and dead trees (Lacki and Schwierjohann 2001). They have been found roosting in structures such as buildings, barns, sheds, and cabins. Foster and Kurta (1999) have indicated that northern long-eared bats do not depend on any particular species of tree for roosting but tree characteristics, such as structure and decay, are important. Northern long-eared bats have been found roosting below the canopy in forests with a variety of canopy cover percentages, but Perry and Thill

(2007) found relatively open forests in Arkansas to be important for female roosts as compared to male roosts.

The northern long-eared bat forages on a variety of insects. The most common are moths, beetles, and spiders (Brack and Whitaker 2001, Feldhamer et al. 2009). Northern long-eared bats forage and commute primarily in forested interiors (Jung et al. 1999, Owen et al. 2003, Carter and Feldhamer 2005, Broders et al. 2006). Foraging techniques include hawking (catching insects in flight) and gleaning (catching insects from vegetation and water surfaces) (Ratcliffe and Dawson 2003, Feldhamer et al. 2009). Northern long-eared bats show preference for forested hillsides and ridges, as opposed to riparian areas (LaVal et al. 1977, Brack and Whitaker 2001). This preference corresponds with the suggestion expressed in Caceres and Pybus (1997) that mature forests are important foraging habitat for northern long-eared bats. Recent capture efforts have found northern long-eared bats in young stands and disturbed forests (Crampton and Barclay 1998, Foster and Kurta 1999, Cryan et al. 2001, Menzel et al. 2002, Henderson and Broders 2008, Henderson et al. 2008, ASRD and ACA 2009).

4.2.4.6 Existing Condition in the Project Area

Site Surveys

For the Project, pre-construction surveys included the following:

- Stationary, passive acoustic bat monitoring from early April to early November 2010 and 2011;
- Mobile, active acoustic bat surveys along driving transects in 2010; and
- Mist-net survey in 2011.

Stationary and mobile acoustic surveys are appropriate techniques for assessing bat activity patterns at proposed and existing wind farms (Redell et al. 2006, Kunz et al. 2007*a*, *b*). Below we summarize relevant results from the on-site surveys, and the Project HCP provides a brief synopsis in Section 3.3. The full survey reports are included in the Project HCP (Appendices D and E).

Acoustic Surveys
Between April 17 and November 4, 2010 and between April 8 and November 1, 2011, WWF conducted passive and active acoustic bat surveys in the Project area. Passive monitoring involved installing two acoustic receivers (Remote Bat Acoustic Technology System [ReBATTM]; Normandeau Associates, Inc., Gainesville, Florida), one at 190 feet and one at 16.5 feet above ground, on a MET tower to capture information about bat species flying at variable altitudes. Analysis of the acoustic data found bat activity to be 4.5 passes per night on average during the entire survey period for both years (Stantec 2010*c*, 2012). Table 3-2 in the Project HCP provides a summary of the acoustic data from both years.

Overall, bat activity was highest in the fall in both 2010 and 2011 (Stantec 2010*c*, 2012). During 2010, bat activity at the stationary detectors was lowest in the spring (83; mean 1.4 passes per detector per night) and highest in the fall (771; mean 3.5 passes per detector per night). Most of this activity in the fall occurred at the upper detector, while the lower detector recorded higher bat activity in the spring and summer. Low-frequency species were recorded more often than high frequency species across all three seasons.

During 2011, bat activity was lowest in spring (98; mean 1.3 passes per detector per night) and highest in the fall (996; mean 4.9 passes per detector per night) (Stantec 2012). As in 2010, more passes were recorded at the upper detector in the fall and at the lower detector in the summer; unlike 2010, more passes in the spring were recorded at the upper detector (Stantec 2010*c*, 2012). As in 2010, low-frequency species were recorded more often than mid-frequency and high frequency species during the entire 2011 survey.

In 2010, WWF surveyed six driving transects within the Project area on 15 nights over spring, summer, and fall seasons. The six survey routes were selected to cover a variety of habitat types (agricultural fields, woodlots, wetlands, and stream corridors). An Anabat detector (Titley Electronics, Australia) recorded bat calls from a slow moving (<5 mph) vehicle. Each transect was surveyed five times in spring, two times in summer, and eight times in fall (15 times per transect; 90 surveys). These active acoustic surveys recorded 93 definitive bat passes (mean = 1.0 pass per transect per night; see Table 3-3 in Project HCP).

During the 2010 mobile surveys, recorded bat activity was lowest in the summer (5; mean 0.4 passes per transect per night) and highest in the fall (76; mean 1.6 passes per transect per night) (Stantec 2010*c*). Low-frequency species were recorded more often than high frequency species across all three seasons.

Stationary and mobile acoustic surveys documented five species: big brown bat, silver-haired bat, eastern red bat, hoary bat, and tri-colored bat (Stantec 2010*c*). None of these species is state or federally listed as endangered or threatened. With the exception of the big brown bat, all of these are species of special concern in Indiana (Table 4-1).

Analysis of the acoustic data confirmed very few *Myotis* calls (Stantec 2010*c*, 2012). In 2010, the stationary low detector (16.5 feet above ground) recorded four *Myotis* calls, representing 0.4% of the identifiable call sequences. All four calls were recorded in late July and early August, and all exhibited characteristics found in both little brown bat and Indiana bat calls. The quality of the recorded calls did not allow for species-level determinations for any of the four calls. These four calls were recorded on the low detector and not detected in the rotor swept zone (>167 feet).

In 2011, stationary detectors recorded three *Myotis* calls, one in the summer and two in fall. The high receiver recorded one of the *Myotis* calls detected in the fall. The mobile surveys recorded one confirmed Myotis call on May 10, 2010, representing 1.5% of the identifiable calls recorded during the mobile survey. It was not possible to confidently identify these calls to species.

Migratory tree-roosting species made up greater than 80% of identifiable bat passes during stationary and acoustic surveys in each season (Stantec 2010*c*, 2012). During the 2010 acoustic surveys, red bats, hoary bats, silver-haired bats, and big brown bats were all recorded within the rotor-swept zone, and red bats, hoary bats, and silver-haired bats accounted for at least 67% of all detections and 87% of all identifiable calls at that height. In 2011, eastern red bats, hoary bats, and silver-haired bats accounted for 88% of identifiable bat passes recorded in the rotor zone (190-foot receiver) and 40% of identifiable bat passes recorded by the low (16.5-foot) receiver.

Mist-net Survey

WWF conducted mist-netting surveys between July 29 and August 5, 2011. Mist-nets were set at four locations along Wildcat Creek and its tributaries north of the Project area in Howard and Grant counties. The survey captured 25 bats of four species: 21 big brown bats, two eastern red bats, one tri-colored bat, and one northern long-eared bat (Stantec 2011*a*).

Summary

Limited information is available on how bats use agricultural areas in the Midwest. The active agricultural habitats in the Project area do not likely provide suitable roosting habitat for bats. Species, such as the big brown bat and little brown bat, will roost, and even overwinter, in attics or large buildings. The farmsteads in the Project area and buildings in Elwood likely provide suitable roosting locations for some species of bats. Barns and outbuildings of farms in the area may provide winter hibernacula for certain species such as the big brown bat and little brown bat. Based on the results of the pre-construction surveys and post-construction monitoring (discussed in Section 5.2.4.4) in the Project area, six species of bats have been found to occur in the Project area, including northern long-eared bats, one of which was captured during the mist-net survey.

In the Project area, foraging bats likely concentrate along existing woodland strips, streams, and other features that may attract a greater diversity and abundance of insect prey or serve as linear flight corridors. The woodland tracts in the Project area, although limited in size, provide potential roosting and foraging habitat.

No known bat hibernacula occur in Madison or Tipton counties (USFWS 2007), and there are no records of Indiana bat or northern long-eared bat maternity colonies in Tipton or Madison counties. Relative to the Project, the nearest Priority 1 hibernacula is more than 80 miles south in Monroe County. The nearest Priority 2 hibernaculum, Lewisburg Limestone Mine, is approximately75 miles to the southeast in Preble County, Ohio. There are records of Indiana bat maternity colonies in four counties adjoining Tipton and Madison counties: Clinton, Howard, Henry, and Hancock counties (USFWS 2007). It is probable that Indiana bats and northern long-eared bats would fly through the Project area during spring or fall traveling between summer colonies and hibernacula.

4.3 PHYSICAL ENVIRONMENT

4.3.1 Air Quality and Climate

The Clean Air Act (CAA) of 1970 (42 U.S.C. §7401 et seq.) is a comprehensive federal law that regulates air emissions from stationary and mobile sources. The CAA law authorizes the U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and regulate emissions of hazardous air pollutants. However, it is the responsibility of each state to develop and implement a plan for maintaining and enforcing the USEPA's established NAAQS.

We used data from the Indiana Department of Environmental Management air quality website (IDEM 2015) to assess air quality conditions relative to the Project.

4.3.1.1 Existing Condition in the Project Area

We reviewed data from the monitoring stations closest to the Project — Kokomo and Anderson monitoring stations (approximately 12 miles and 13 miles from the Project, respectively) (IDEM 2016). Both stations monitor only fine particulates (particulate matter 2.5 or PM-2.5). Fine particulates are most often emitted from activities involving combustion, e.g., industrial, residential, and vehicular. Fine particles can also form when certain gases emitted during combustion are transformed to a solid or liquid in the atmosphere. Large-scale agricultural burning or dust storms can also produce huge volumes of fine particulates.

The yearly summary report for 2014 (April 1-December 31) in Kokomo indicates PM-2.5 levels reached the unhealthy range on 2 days and the unhealthy for sensitive groups range on 25 days during the 9-month period. The yearly summary report for 2014 (January 1-December 31) in Anderson indicates PM-2.5 levels reached the unhealthy range on 2 days and the unhealthy for sensitive groups range on 17 days during the 12-month period. We note that the Anderson monitoring station did not collect valid data 18% of the time in 2014. Based on the available information, the air quality in the Project area is in attainment for all monitored criteria pollutants.

GHGs are gases that warm the Earth's atmosphere by absorbing solar radiation reflected from the Earth's surface. The most common GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). According to

USEPA (2016), scientists find that increasing GHG concentrations are warming the planet, and rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level — a phenomenon commonly referred to as “climate change.”

Electric power generation is the largest source of energy-related CO_2 emissions in the U.S., accounting for 40% of the nation’s total energy-related CO_2 emissions in 2011. Nationwide, the U.S. currently obtains 72% of its electricity from fossil fuels, with nearly 50% coming from coal. Coal has the highest CO_2 content per unit of electricity produced of all fossil fuels used to generate electricity in the U.S. Coal-fired power plants account for approximately 80% of CO_2 emissions from power plants. Indiana relies heavily upon coal for its electrical generation, with 83% of electricity generated in 2011 produced from coal. Indiana ranks sixth in the nation in terms of tons of CO_2 emissions produced annually, following California, Florida, Ohio, Pennsylvania, and Texas.

Project operations require a small amount of vehicular traffic resulting in the release of CO_2 emissions and particulates. These emissions are not estimated to have a significant effect on local or regional air quality or contribute greatly to the amount of GHGs. Project operations do not generate any new sources of air pollutants.

4.3.2 Noise

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that interferes or disrupts normal activities. Although exposure to high noise levels can cause hearing loss, the most common human response to environmental noise is annoyance. Reaction of individuals to similar noise events is diverse and influenced by numerous factors, such as the type of noise, its perceived importance, the time of day during which the noise occurs, its duration, frequency, level, and community attitudes towards the source of noise.

The noise analysis in this EA addresses the Project site where there are 125 operating wind turbines. The noise analysis is based on information from scientific literature and the results of an acoustical analysis of the Project conducted prior to construction (ARCADIS 2011*c*, *d*).

4.3.2.1 Existing Conditions

The Project area is located north of Elwood, Indiana in active cropland in a landscape dominated by agricultural activities. The Project’s 125 turbines are distributed in a loose group over 24,420 acres. The terrain is flat with minimal relief. Consequently, the wind turbines are in an exposed setting. Lightly traveled paved and unpaved roads cross the Project and surrounding areas. Farmsteads and residences dot the landscape.

Current ambient noise levels in the Project area are not measured. We assume that ambient noise is that of a typical farming landscape in Indiana with a community-scale wind project. Sound levels included both steady background and short-term intrusive sounds. Characteristic sound sources in the Project area include farming operations, vehicle road noise, wind turbines, wind moving through vegetation, human voices, dogs barking, bird song, and aircraft flying overhead. Sensitive receptors to these sounds include residences in and proximal to the Project area.

Tipton County regulations for noise at wind projects are detailed in Ordinance No. 522-09, Section C, Noise and Vibration. Madison County regulations are detailed in Ordinance No. 2002-BC-0-6, Article 15, Section J, Part 3, Noise and Vibration. Turbine noise in the Project area has not been measured since the Project was constructed. However, the pre-construction acoustic analysis found the Project will not exceed noise levels specified in the county ordinances at identified receptors. We assume the Project, when operating, is within the predicted noise levels indicated in the noise analysis (ARCADIS 2011*c*, *d*), does not exceed the levels specified in the county ordinances and is not excessively noisy.

4.4 SOCIOECONOMIC ENVIRONMENT

4.4.1 Economics

In this section, we describe the socioeconomic characteristics of Tipton and Madison counties. The Project affects economic conditions in the region largely through state and local taxes and lease and royalty payments to participating landowners.

4.4.1.1 Project Area

Economic Resources

Elwood is the nearest town to the Project with a population of approximately 8,500. Major economic centers are located in Kokomo (~22 miles northwest) and Indianapolis (~37 miles south). Income data for the state and Madison and Tipton counties are presented in Table 4-3 and are based on 2010 U.S. Census data.

Table 4-3. Income statistics in the region of the Wildcat Wind Farm.

	Population	Median Household Income	Persons Below Poverty Level (%)
State of Indiana	6,596,855 (2014)	$48,248	1,048,899 (15.9%)
Madison County	130,482 (2013)	$43,120	20,747 (15.9%)
Tipton County	15, 650 (2013)	$52, 686	5,268 (10.0%)
Town of Elwood	8,514 (2013)	$35, 625	1,703 (18.2%)

Source: U.S. Census data (2015)

Madison County is within the Anderson Metropolitan Statistical Area, which reported a 5.8% unemployment rate in September 2014 (IBRC 2014). Indiana Department of Workforce Development reported 4.5% and 5.8% unemployment rates for Tipton and Madison counties, respectively, in September 2014 (IDWD 2015).

WWF employs full-time, permanent workers to operate and maintain the wind farm. WWF also has contracted part-time, temporary workers to conduct post-construction carcass monitoring in spring (April 1 through May 15) and fall (August 1 through October 15).

CHAPTER 5. ENVIRONMENTAL CONSEQUENCES

5.1 OVERVIEW OF THE EFFECTS ANALYSIS

This chapter describes the environmental effects of each of the four alternatives retained for detailed analysis. The chapter is organized by resource and corresponds to the organization of Chapter 3. Each of the alternatives includes the operation of a wind project, implementation of the BBCS, and post-construction monitoring. The four alternatives differ with respect to operational adjustments and the extent of mitigation implemented to offset the impact of taking Indiana bats and northern long-eared bats (Table 5-1).

In each alternative, all 125 turbines would be curtailed and feathered at night until wind speeds reach the specified cut-in speed (Table 5-1). All three action alternatives have the same specified temperature criterion.

Our analysis is commensurate with the estimated impacts associated with Project operations and focuses predominately on bird and bat resources. We estimate that effects on vegetation, non-volant wildlife, noise, and socioeconomics (economics) will be minor. Hence, we provide limited analyses for these resources.

In each resource section, we first address direct and indirect effects common to all alternatives and then for each alternative. Each resource section concludes with a summary of effects each alternative will have on that resource. At the end of all resource sections, we address cumulative effects. As per the CEQ guidelines (CEQ 1997), resources that will be unaffected by the Proposed Action or other alternatives, experience beneficial effects, or are subject to temporary effects were excluded from our cumulative effects analysis. Upon using this screening process, we limited our cumulative effects analysis to bird and bat resources (provided in Sections 5.5.2 and 5.5.3, respectively).

Table 5-1. Summary of alternatives retained for detailed analysis.

Element	1: No-Action	2: Proposed Action	3: More Restrictive	4: Less Restrictive
Operations	5.0 m/s cut-in speed from March 15 through May 15 *and* 6.9 m/s cut-in speed from August 1 through October 15 from 30 minutes before sunset to 30 minutes after sunrise.	5.0 m/s cut-in speed from August 1through October 15 from sunset to sunrise when the ambient temperature is above 10°C (50°F) *and* turbines feathered up to 3.5 m/s cut-in speed October 16 through July 31 from sunset to sunrise.	6.5 m/s cut-in speed from August 1 through October 15 from sunset to sunrise when the ambient temperature is above 10°C (50°F) *and* turbines feathered up to 3.5 m/s cut-in speed October 16 through July 31 from sunset to sunrise.	4.0 m/s cut-in speed from August 1 through October 15 from sunset to sunrise when the ambient temperature is above 10°C (50°F) *and* turbines feathered up to 3.5 m/s cut-in speed October 16 through July 31 from sunset to sunrise.
HCP and ITP	No	Yes. Minimization and mitigation for summer and winter habitat for both species.	Yes. Minimization and mitigation for summer and winter habitat for both species.	Yes. Minimization and mitigation for summer and winter habitat for both species.
BBCS[1]	Yes	Yes	Yes	Yes
Indiana bat take	Take: 0	Annual take: 3 Project Take: 81.0 Females: 60.8 Reproductive Potential: 115.4 Impact of Take: 176.2	Annual take: 1.4 Project Take: 38.9 Females: 29.2 Reproductive Potential: 55.4 Impact of Take: 84.6	Annual take: 3.2 Project Take: 85.9 Females: 64.3 Reproductive Potential: 122.1 Impact of Take: 186.4
Northern long-eared bat take	Take: 0	Annual Take: 1.5 Project Take: 41.0 Females: 20.3 Reproductive Potential: 38.5 Impact of Take: 58.7	Annual Take: 0.7 Project Take: 19.4 Females: 9.7 Reproductive Potential: 18.5 Impact of Take: 28.2	Annual Take: 1.6 Project Take: 42.5 Females: 21.6 Reproductive Potential: 41.0 Impact of Take: 62.6

[1] Bird and Bat Conservation Strategy (see Appendix A).

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 Vegetation

5.2.1.1 Impact Criteria

Federally listed plants are afforded protection under the ESA. The State of Indiana monitors the introduction and spread of invasive plants and provides legal protection to those plants that are listed under the federal ESA. Presidential Executive Order 13112 addresses federal coordination and response to the problems associated with invasive species. There are no specific federal or state regulations pertaining to unlisted plants that are relevant to the analysis for the Applicant’s proposal. As per NEPA and CEQ guidelines, the human environment includes vegetation resources, and impacts to these resources can result in secondary effects to other resources.

Vegetation can be impacted at the individual, population, or community level. Major impacts to vegetation can occur when any of the following result:

- Naturally occurring population reduced in numbers below levels for maintaining viability at local or regional level;
- Substantial loss or degradation of soil stabilization services;
- Substantial loss or degradation of habitat for a rare, threatened, or endangered animal species; and
- Introduction of invasive species that results in substantial replacement of native species.

5.2.1.2 Direct and Indirect Effects

Project Operations and Maintenance

Implementation of any of the four alternatives will have minimal impacts to vegetation. In the Project area, the wind farm is already constructed and operating. Vegetation will be mowed periodically to facilitate carcass searches at the specified number of turbines requiring full plots. The No-Action Alternative would entail mowing at 25 turbines. Under any of the action alternatives (Alternatives 2, 3, and 4), plots would be mowed at 63 turbines. The mowed area measures 80 meters x 80 meters (262 feet x 262 feet or ~1.6 acres).

Under any of the four alternatives, mowing at turbines to create monitoring search plots will affect planted, non-native species. The Project area is not known to have populations of rare, threatened, or endangered plants or unique vegetation communities. Project operations under any alternative will not affect sensitive plant resources.

Mitigation for Taking Covered Species

Impacts to vegetation would largely occur in association with implementation of the summer habitat mitigation.

Alternative 1: No-Action Alternative
The No-Action Alternative does not include any mitigation projects because take of Indiana bats and northern long-eared bats would be avoided. The No-Action Alternative would not have effects to vegetation resources as a result of bat habitat mitigation.

Action Alternatives: Alternatives 2, 3, and 4

<u>Summer Habitat Mitigation Project</u>
Implementation of any of the three action alternatives would involve mitigation measures to offset the unavoidable impacts of taking Indiana bats and northern long-eared bats. The Applicant’s mitigation project will involve preservation and/or restoration of suitable habitat for the Covered Species. Preserving and/or restoring summer habitat for listed bats will have beneficial effects to native vegetation resources. Mitigation measures will not reduce any naturally occurring plant population to numbers below levels for maintaining viability at the local or regional level. Substantial loss or degradation of soil stabilization services or habitat for a rare, threatened, or endangered animal species are not expected. Mitigation is not expected to result in the introduction of invasive species, and may actually inhibit invasive plants from becoming established in the long-term. The Applicant’s mitigation plan will include monitoring and adaptively managing for invasive species.

5.2.1.3 Summary of Effects to Vegetation

Mowing at Project turbines for post-construction monitoring is not expected to cause reductions in the numbers of any naturally occurring plant populations or result in the loss or degradation of habitat for any rare, threatened, or endangered plant species, community, or population. Mowing will occur in cultivated agricultural land. The summer habitat mitigation for listed bats is likely to benefit vegetation resources at the mitigation site. Impacts to vegetation under all four alternatives will be minor.

5.2.2 General Wildlife

This section analyzes the effects of the Proposed Action and alternatives on terrestrial, non-volant wildlife. Refer to Sections 5.2.3 and 5.2.4 for impact analyses for birds and bats, respectively. This analysis uses information on wildlife for the region. Habitat for principally aquatic species in the Project area is limited, and Project operations are not expected to affect aquatic wildlife.

5.2.2.1 Impact Criteria

Major impacts to wildlife and aquatic resources are those that substantially affect a species' population (locally, regionally, or rangewide) or reduce its habitat quality or quantity. Impacts to species can be both direct and indirect. Examples of direct effects include disturbance, injury, mortality, and habitat alteration. Examples of indirect effects include habitat loss or degradation over time or effects to resources used by wildlife in different life stages (i.e., alterations to surface water or alterations to plant composition). Another indirect effect may be the creation of habitat such as edges and openings that favor a different mix of species and in some cases, increase predation pressure, thereby causing displacement or avoidance.

5.2.2.2 Direct and Indirect Effects

Operation of the Project under any of the four alternatives is expected to have similar effects to non-volant wildlife. We first describe these similar effects then effects unique to each alternative.

Project Operations

There are limited data available addressing impacts to mammals, reptiles, and amphibians associated with habitat loss due to displacement from operating wind farm developments in the U.S.; the majority of studies have focused on bird and bat collision mortality. However potential effects to mammals in particular likely depend on the species, geographic location, project size, and the spatial and temporal scales at which these effects are studied (Helldin et al. 2012).

Common species such as white-tailed deer, raccoon, and skunk become habituated to human activity and habitat modification. While habituation may not be immediate, species likely to occur in the Project area would adapt quickly to the presence of man-made features in their habitat, evidenced by the abundance of these species in suburban and working farm settings. White-tailed deer, coyote, red fox, and other terrestrial mammals have been observed at recently constructed wind projects in the eastern U.S. (Stantec 2010*a*, *b*). Marked displacement of common mammals from a wind project has not been reported.

Turbines are not located in the very few wet areas and are not likely to affect movements of amphibian species in the landscape or their habitat. We can expect that other wildlife that use agricultural fields would continue to occur, including common mammals, a few common reptiles, and insects.

The effect of shadow flicker on terrestrial animals currently is unknown. Reports from operational wind projects have documented the electrocution of hawks from overhead transmission lines (Stantec 2010*a*). However the effect of electrocution or stray voltage on other terrestrial wildlife is unknown. During times when ice can form on turbine blades, ice sheets could be thrown from tower blades. In rare events, turbine towers could collapse or fires could occur. However, the likelihood of these phenomena killing a mobile terrestrial animal is very low.

Project operations may attract terrestrial wildlife if they are drawn to investigate downed carcasses while searching for food. If consistent carcass presence is a regular event, carcasses may become a regular food source for some mammal species including coyote, raccoon, and red fox.

The agricultural habitat in the Project area is common and the terrestrial species known to inhabit agriculture areas are common; therefore, habitat loss, avoidance, or displacement effects to terrestrial wildlife populations, should they occur, are expected to be minor. Consequently, population level effects from operation of the Project under any of the four alternatives are not expected for any species of terrestrial wildlife.

Project Maintenance

Maintenance activities generally are restricted to inside the turbine tower and nacelle. Project maintenance activities may include periodic road maintenance (i.e., grading) and possibly herbicide application. During travel in the Project area for maintenance activities, maintenance vehicles may collide with terrestrial wildlife causing injury or death.

Disturbance from noise, vibration, and increased human activity and traffic associated with maintenance activities would occur infrequently and for relatively short durations. Species in the Project area likely are habituated to noise, vibration, and activity due to the intense farming activities involving tractors, plows, and other agricultural equipment in the Project area. Tools used during maintenance activities and turbine parts such as bolts have the potential to fall from the turbines during maintenance. However, the likelihood of such materials striking and killing a terrestrial animal is low.

Post-construction Monitoring

All four alternatives include post-construction monitoring to be implemented as described in the HCP. Effects to terrestrial wildlife resulting from post-construction monitoring may include disturbance or mortality due to increased vehicle traffic and human presence. Furthermore, any vehicle-induced fatalities may attract scavengers.

Post-construction monitoring would also include searcher efficiency and carcass persistence trials, in which carcasses are placed in the Project area to assess searcher success and carcass removal by scavengers (i.e., mammals and birds). Local wildlife such as coyote, raccoon, and red fox may be attracted to the Project during these trials. Cleared turbine pads would make fatalities easily detectable to scavengers. Smallwood (2013) estimates that on average 74% of bird carcasses and 70% of bat carcasses are taken by scavengers within 30 days at wind projects in North America. Non-volant wildlife would not be susceptible to turbine collisions, but may be susceptible to vehicle collisions while moving between turbine plots to scavenge.

Project Decommissioning

Impacts on wildlife from decommissioning activities would be disturbance or potential displacement via vehicular traffic, construction noise, overhead equipment and materials with the potential to fall, vibration, and increased human presence. However decommission impacts would be localized and for a relatively short duration. Species in the Project area likely are habituated to noise, vibration, and activity due to the intense farming activities in the Project area.

Project decommissioning would minimize the long-term impacts to terrestrial wildlife (as opposed to permanent presence and operation) by removing turbines from the Project area and restoring the area to the pre-existing agricultural condition. Decommissioning would increase habitat for species that use agricultural landscapes.

Mitigation for Taking Covered Species

In the long-term, any mitigation measures to preserve and/or restore summer bat habitat will benefit forest dwelling mammals, reptiles, and amphibians. Some native wildlife may be disturbed and potentially displaced during tree planting due to the presence of humans and disturbing soils. However these disturbances will be temporary, minor, and bear little lasting effect. Reforestation will expand woodland in the watershed providing cover for species that the site for feeding, drinking, and traveling.

In summary, mitigation for listed bats under any of the action alternatives is not expected to result in major adverse impacts to general wildlife that would substantially affect a species' population (locally, regionally, or rangewide) or significantly reduce its habitat quality or quantity. Conversely, the summer habitat mitigation project will have long-term beneficial effects to general wildlife at the local scale through forested habitat preservation and enhancement.

5.2.2.3 Summary of Effects to General Wildlife

Project operations under any considered alternative are not expected to result in impacts to non-volant and aquatic wildlife that would substantially affect a species' population (locally, regionally, or rangewide) or significantly reduce its habitat quality or quantity. Among the four alternatives, we do not expect project operations, maintenance, and decommissioning to have significantly different effects to terrestrial wildlife. Similarly, we do not expect significant differences in effects to general wildlife resulting from the mitigation measures for listed bats among the three action alternatives. Impacts to wildlife and aquatic resources under all four alternatives will be minor.

5.2.3 Avian Resources

5.2.3.1 Impact Criteria

Federally listed birds are protected under the ESA. The BGEPA protects bald and golden eagles. The MBTA affords protection of native migratory birds. As per NEPA and CEQ guidelines, the human environment includes avian resources. Under Executive Order 13186, federal agencies are expected to carry out, among other things, the following:

1. Ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern; and,
2. Identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors.

Birds can be affected at the individual and population-level. Impacts to avian resources would be considered major should implementation of an alternative result in any of the following:

- Naturally occurring population reduced in numbers below levels for maintaining viability at local or regional level;
- Substantial loss or degradation of habitat for a rare, threatened, or endangered bird species; or
- Substantial change in habitat conditions producing indirect effects that cause naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels.

In the Project area impacts to birds may occur as a result of turbine interactions (e.g., direct mortality, displacement, or avoidance).

5.2.3.2 Direct and Indirect Effects Common to All Alternatives

Project Operations

The operation of the Project under the Proposed Action or any of the alternatives is expected to have similar effects to avian resources. For the purposes of our analysis and based on what the currently available information suggests, we assumed operational differences among alternatives (i.e., turbine cut-in speeds) would not result in different potential direct or indirect impacts to avian resources. To date, there have been very few studies in the U.S. that focused on effects of turbine operational adjustments on bird mortality, and they targeted raptors (Smallwood 2010). The effectiveness of turbine curtailment, feathering, and even shutdown for reducing bird mortality have been found to be inconclusive and would likely be site- and species-specific.

Impacts to avian species due to operations of a wind project can be both direct and indirect. Examples of direct effects include mortality, injury, disturbance, and habitat loss and degradation. Examples of indirect effects include avoidance or displacement due to habitat alterations and decreased survival or breeding success due to the presence of operating Project structures or increased human presence or vehicle traffic. Indirect effects due to habitat alteration can result in changes in species abundance and diversity; these types of indirect effects can be complex and change over time.

This EA considers WWF's best management practices and minimization efforts related to birds during Project planning and development. Prior to Project construction, WWF consulted with USFWS and IDNR regarding rare bird species and conducted bird surveys in 2010 and 2011. These surveys assessed the species composition and level of activity of birds at the Project during spring migration and breeding seasons. The Project is located primarily in active agricultural fields, and the Project does not contribute to impacts associated with forest fragmentation.

Disturbance and Displacement

Avian species in the Project area may be susceptible to disturbance and displacement-related impacts during Project operations. Potential sources of disturbance include the presence of Project structures (particularly operating turbines and MET towers), human presence, and vehicle traffic during maintenance activities, and noise associated with spinning turbines. Other disturbances could include long- and short-term habitat alterations. The level of disturbance associated with habitat impacts at wind projects relates to the topography, the baseline condition of habitat(s) present, the amount of existing roads or infrastructure, and turbine layout (NRC 2007). Potential habitat disturbances are species-specific and would depend on the condition and availability of habitat prior to construction (NRC 2007). The Project largely consists of active agricultural fields. A smaller portion of the Project contains forest, hedgerows, herbaceous fields, drainage areas, and residences. Disturbance effects at the Project area will vary among species and habitats. Species with specific breeding habitat requirements, species of conservation concern, or species with specific migratory stopover habitat requirements, may be at increased risk as a result of disturbance or displacement.

Available literature suggests that varying degrees of bird displacement have been documented at operational wind projects. Observed effects vary among bird groups and species. Displacement effects can impact breeding birds, but also migrating, nesting, and foraging birds (Strickland 2004). Available literature suggests displacement effects can occur at distances from roughly 250-2,600 feet from turbines (Strickland 2004).

Some species of birds, including grassland nesting species or raptors, may be more sensitive to disturbance effects and displacement. At the Buffalo Ridge wind facility in Minnesota, grassland nesting birds were less dense in study plots near turbines than in reference plots (Leddy et al. 1999). However, displacement effects were considered small-scale, occurring out to a maximum distance of approximately 328 feet (Johnson et al. 2000). Although the majority of grassland nesting birds used areas adjacent to the turbines at the Buffalo Ridge wind facility less, waterfowl continued to use the area in the vicinity of turbines (Osborn et al. 1998). Waterfowl continued to nest in the area, including a mallard that nested 100 feet away from a turbine. These results suggest some waterfowl species may become habituated to the presence of operating turbines (Osborn et al. 1998). At a wind project in North and South Dakota, some species including killdeer (*Charadrius vociferus*), western meadowlark (*Sturnella neglecta*), and chestnut-collared longspur (*Calcarius ornatus*) did not show any avoidance to wind turbines, and killdeer appeared to be attracted to the bare ground surrounding turbine areas (Poulton 2010). However, some species, such as grasshopper sparrow (*Ammodramus savannarum*) and clay-colored sparrow (*Spizella pallida*), showed avoidance of turbine areas (Poulton 2010). Other studies conducted in Wisconsin and Iowa reported no clear relationships between bird abundance in turbine areas compared to reference areas and variable results among survey years (Poulton 2010).

At the Maple Ridge wind facility in upstate New York, nesting Savannah sparrow (*Passerculus sandwichensis*) did not exhibit observable displacement effects due to the presence of turbines. Nesting bobolinks (*Dolichonyx oryzivorus*) were minimally affected at distances within 328 feet from turbines (Kerlinger and Dowdell 2008). Ground nesting species demonstrated continued breeding in the direct vicinity of operating turbines. At the Cohocton wind project in western New York, observers documented successful nests of horned lark, savannah sparrow, vesper sparrow, and dark-eyed junco (*Junco hyemalis*) approximately 100 feet to 260 feet from operating turbines (Stantec 2010*b*). A red-winged blackbird (*Agelaius phoeniceus*) nested in a hayfield within 164 feet of a turbine at the Steel Winds wind project along Lake Erie (Stantec, unpublished data). Killdeer and their young came in close proximity to turbines at these New York projects (Stantec, unpublished data). We expect some ground nesting species, such as horned lark and killdeer, to continue to breed in the Project area and possibly relatively close to turbines.

Observed impacts to raptors among wind energy projects have been variable. Researchers found no raptor nests where they expected to find nests during an initial year of monitoring at Buffalo Ridge in Minnesota. At the Montezuma wind facility in California, observers found a similar number of nests before and after construction of the wind farm, and wind projects in Oregon and Wyoming documented successful breeding of raptors within a mile of turbines (Strickland 2004). A variety of eastern raptor species have demonstrated continued use of wind projects for foraging in forested and agricultural settings. At the Cohocton wind project, post-construction searchers recorded a variety of raptor species foraging and perching within the Project area (Stantec 2010*b*). Species included red-tailed hawk, northern harrier, turkey vulture, sharp-shinned hawk (*Accipiter striatus*), and American kestrel.

Turbines are not sited in sizable wetlands that could attract migrant waterfowl or wading birds. Flocking species, such as Canada geese, that stopover in the Project area may not be disturbed or displaced by Project operations as they are tolerant of human-disturbed environments. Species that used the agricultural portions of the Project area for foraging, resting, or roosting prior to Project construction are generally common, regionally abundant species that show little response to human-related disturbances. Brown-headed cowbird, horned lark, and red-winged blackbird, all abundant species within the Project area, are known to regularly use human-altered and disturbed habitats. One exception may be American golden-plover. Thousands of American golden-plovers were observed during pre-construction bird surveys conducted in 2010 and 2011. Several flocks of varying numbers were observed, and individuals' behaviors included foraging, resting, and flying. American golden-plovers are known to stopover in counties in west central Indiana (Johnson 2003) during their spring migration from northeastern South America to the Arctic coastal plain. Disturbance or displacement to the American golden-plover from habitats in the Project area is unknown. Turbine 98 and other turbines are now present where flocks of American golden-plover were documented pre-construction. However, no studies have been conducted at the Project that assess migrant or breeding activity post-construction. For European golden-plovers (*Pluvialis apricaria*) observations of disturbance and displacement effects vary at wind projects in the United Kingdom (Percival 2003, Pearce-Higgens et al. 2008, 2009). Abundance of European golden-plovers actually increased at a wind farm in northern England after construction and remained constant. The study concluded that the turbines had no displacement effect on the plovers (Percival 2000 as cited by Powlesland 2009).

During pre-construction surveys for the Project, ARCADIS (2011*a*, *b*) found American golden-plovers to prefer tilled or partially tilled agricultural fields, a habitat that is abundant locally and in the region. The wind turbines themselves affect 74.5 acres of agricultural habitat in the Project area (10.4 acres for turbine pads and 64 acres for roads). The rest of the Project area remains in agricultural production. Project turbines have not eliminated but possibly degraded stopover habitat for this species. Considering the wide range of this plover's migration route and the predominance of soybean and corn fields throughout Indiana and the Midwest, displacement of the American golden-plover from the Project does not adversely impact the species.

The Project area contains foraging habitat but low-quality breeding habitat for raptors. Raptor species observed during pre-construction surveys at the Project, such as red-tailed hawk, turkey vulture, American kestrel, Cooper's hawk, and rough-legged hawk, are likely to use the Project area for foraging. Pre-construction surveys documented a single bald eagle, likely a migrant. Bald eagle activity would occur primarily during migration. There are no known bald eagle nests in the Project area. Golden eagles may occur in the Project area as rare vagrants.

Operational turbines have the potential to obstruct the flight paths of migrants to the extent that birds may alter their flight path around the Project area. Flocks of Canada geese have been observed altering their flight paths to fly around wind projects rather than pass over them (Stantec, unpublished data). This avoidance could result in increased energy expenditure and possibly reduced survivorship. However, most migrants are expected to fly well above the height of the turbines during migration, thereby avoiding them. Further, the turbines are widely spaced in agricultural fields, so birds may fly between them.

Turbine Related Mortality

Avian collision mortality at wind projects is well documented. Smallwood (2013) estimated 573,000 bird fatalities per year (with 83,000 raptor fatalities) at 51,630 MW of installed wind-energy capacity in the U.S. as of 2012. Considering mortality estimates from wind projects in different regions of the U.S., weighted averages range from 1.5 birds per turbine per year in the Rocky Mountains to 4.27 birds per turbine per year in the East (NRC 2007). Among bird species, nocturnal migrating passerines represent the bird group most commonly involved in fatalities at wind-energy facilities (NRC 2007, Erickson et al. 2014), likely due to their abundance and migratory behaviors. Erickson et al. (2014) estimated that 62.5% of reported bird fatalities from wind projects in the U.S. and Canada consisted of small passerines. For all wind projects currently operating in North America, Erickson et al. (2014) estimated there are 2.10 to 3.35 passerine fatalities per installed MW per year. Avian collision mortality occurs during both the breeding and migration seasons, but observed mortality at communication towers, buildings, wind turbines, and other man-made structures suggest that the majority of fatalities occur during spring and fall migration (NRC 2007).

Birds have demonstrated turbine avoidance behaviors at operational projects. While the ability of birds to avoid turbines likely depends on a variety of factors, some studies have attempted to quantify or estimate turbine avoidance rates, through either visual observation or computer modeling. Birds presumably avoid encountering turbines during the day by seeing the blades or detecting the motion of spinning blades, or by hearing them (Dooling 2002). Visual observations of turbine avoidance behavior by birds have been studied at the Buffalo Ridge facility. Birds seen flying through turbine strings in daylight often adjusted their flight when turbine blades were rotating and typically made no adjustments when turbines were not operating (Osborn et al. 1998). Avian turbine avoidance rates have been estimated using the 'Band Model' (Band et al. 2007 as cited by Whitfield 2009) at several existing wind projects in the U.S. The avoidance rates of geese and raptor species have been estimated at greater than 95% (Fernley et al. 2006). Despite high numbers of golden eagle fatalities at Altamont Pass (Thelander et al. 2003, Smallwood and Thelander 2004), the avoidance rate for golden eagles at that site have been estimated as 99.95% (Fernley 2008 as cited in Whitfield 2009). Whitfield (2009) considered multiple parameters derived from visual eagle observation data at four projects (Altamont, Tehachapi, San Gorgonio, and Foote Creek Rim), and estimated that 99% was the avoidance rate or "correction factor" most appropriate for modeling eagle collision risk via the Band Collision Risk Model. The limitations to turbine avoidance estimates include failure to account for differences among bird flight patterns and behaviors under a range of conditions, as well as a general lack of information and data about avoidance behaviors of many species of birds (Chamberlain et al. 2006).

Birds traveling at high altitudes (>600 feet) would avoid colliding with turbines. Birds that migrate at night and fly at lower altitudes are at greater risk of collision. As at other sites, bird flight behaviors are expected to influence their risk of collision. Also, migrant passerines are expected to comprise the majority of fatalities, and are most at risk of collision with turbines when taking off or landing, or if flying low during inclement weather (rain or fog), particularly at night. Local birds or stopover birds are at lower risk of collision when making small-scale flights at low altitudes between foraging and roosting locations in the area, as they typically remain below the rotor-swept height during these activities. Most species of birds flying below rotor-zone during periods of good visibility will generally avoid turbine collisions. However, birds foraging at heights within the rotor-zone may be more at risk when distracted by prey. Additionally, birds engaged in territorial or courtship flights can be distracted putting these individuals at risk of collision if distracted when flying through the rotor swept zone.

A study of European golden-plovers (*Pluvialis apricaria*) indicated that they are at high risk for collision by turbines (Pearce-Higgins et al. 2009). However, no American golden-plover fatalities have been detected at wind facilities in 17 states (with publicly available post-construction monitoring results) and Ontario. Similarly, post-construction monitoring at the Project in 2013, 2014, and 2015 did not detect American golden-plover fatalities (Stantec 2014*a*, *b*, 2015).

Monitoring efforts documented bird fatalities but did not estimate bird fatality rates. In 2013, monitoring found 31 birds representing 14 identified species (Table 5-2). In 2014, monitoring found 41 birds also representing 14 identified species (Table 5-2). In 2015, searchers detected 16 bird carcasses representing 11 identified species and 1 unknown sparrow. As expected, passerines represented the largest proportion of birds (54%) found across all 3 years followed by unidentified birds (22%). Raptors represented 7% (n = 6) and shorebirds (killdeer) represented 6% (n = 5) of birds found. Horned larks made up 23% of all fatalities across years.

Table 5-2. Species and numbers of individuals documented during fatality monitoring in 2013 and 2014 at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

2013		2014	
Species	**Number**	**Species**	**Number**
American kestrel *Falco sparverius*	1	Brown creeper *Certhia americana*	1
Chipping sparrow *Spizella passerina*	1	Brown thrasher *Toxostoma rufum*	1
Gray catbird *Dumetella carolinensis*	1	European starling *Sturnus vulgaris*	2
Horned lark *Eremophila alpestris*	3	Golden-crowned kinglet *Regulus satrapa*	2
Killdeer *Charadrius vociferus*	2	Gray catbird *Dumetella carolinensis*	1
Mourning dove *Zenaida macro*ura	1	Horned lark *Eremophila alpestris*	12
Northern flicker *Colaptes auratus*	1	Killdeer *Charadrius vociferus*	2
Pine warbler *Setophaga pinus*	1	Red-eyed vireo *Vireo olivaceus*	1
Red-tailed hawk *Buteo jamaicensis*	1	Ruby-crowned kinglet *Regulus calendula*	2
Ruby-throated hummingbird *Archilochus colubris*	2	Sora *Porzana carolina*	1
Turkey vulture *Cathartes aura*	1	Swainson's thrush *Catharus ustulatus*	1
Unidentified bird	12	Tennessee warbler *Oreothlypis peregrina*	2
Unidentified raptor	1	Tree swallow *Tachycineta bicolor*	1
Yellow-bellied flycatcher *Empidonax flaviventris*	1	Unidentified bird	7
Yellow-bellied sapsucker *Sphyrapicus varius*	1	Unidentified gull	1
Yellow-throated vireo *Vireo flavifrons*	1	Unidentified raptor	1
		Unidentified passerine	2
		Vesper sparrow *Pooecetes gramineus*	1
Total	**31**	**Total**	**41**

WWF did not estimate annual bird fatality rates for the Project in 2013, 2014, or 2015. To derive a bird fatality rate for the Project, we reviewed publicly available data from operational wind projects in the region located in agricultural settings. Applicable post-construction data that estimated bird fatality rates came from post-construction monitoring results at the following eight wind projects: Buffalo Ridge, Minnesota (1994-1999; Osborn et al. 2000, Johnson et al. 2002); Kewaunee County, Wisconsin (1999-2000; Howe et al. 2002); Top of Iowa, Iowa (2003-2004; Koford et al. 2004, 2005); Crescent Ridge, Illinois (2005-2006; Poulton 2010); Blue Sky Green Field, Wisconsin (2008; Gruver et al. 2009); Forward Energy Center, Wisconsin (2008-2009; Grodsky and Drake 2011); Cedar Ridge, Wisconsin (2009; BHE 2010); and Fowler Ridge, Indiana (2009; Johnson et al. 2010). The results of these monitoring studies are provided in Table C-1 in Appendix C.

Annual bird fatality rates ranged from 0.33 to 11.83 birds per turbine per year. The mean mortality rate is 3.59 birds per turbine per year. We expect annual avian fatality for the Project to be within the range of mortality estimates from the projects listed above given the similarity in landscape, land cover, and region. In addition, the Project is not proximal to any Important Bird Areas and does not have unique landscape or aerosphere features to concentrate birds any differently from other wind projects in the region.

Based on the mean mortality rate of 3.59 birds per turbine per year, the Project is predicted to kill approximately 449 birds annually and 12,116 birds over the life of the Project. This mortality is expected to occur under any of the four alternatives. Confidence intervals were not provided for all of the 12 monitoring studies listed in Table C-1 (Appendix C). For those that did, mortality estimates range from a low of 0.05 birds per turbine per year to a high of 16.43 birds per turbine per year. Applying these values, the 125-turbine project possibly could result in annual mortalities of up to 2,054 birds per year in some years (a worst-case scenario), or as low as 6 birds per year in some years (in a best-case scenario). Realistically, however, in most years we would predict values closer to the average value than the extreme ends of variation.

Population Level Impacts

Species considered at risk from population-level effects would include those with relatively small or unstable populations. To date, no significant population level impact to any one species has been documented as a result of mortality from wind projects. This is largely because most of the nocturnal migrant passerines, which are at the greatest risk of collision, are considered to be abundant wherever they occur (NRC 2007, Johnson et al. 2002, Arnold and Zink 2011).

Available data suggest the species most at risk of collision are those that are regionally abundant and engage in flight behaviors leading to risk of collision and those that migrate through the area at night at lower altitudes. The summary by Erickson et al. (2014) indicates that the three species most frequently involved in collisions at wind projects in the U.S. and Canada include horned lark, red-eyed vireo (*Vireo olivaceus*), and western meadowlark (*Sturnella neglecta*). The Partners in Flight landbird population database estimates for the North American populations (PIF Science Committee 2013) of these species are provided in Table 5-3. The global population of red-eyed vireos appears to be stable. However, the Partners in Flight species assessment database (PIF Science Committee 2012) shows horned larks and western meadowlarks have experienced decreases in populations. Monitoring at the Project in 2013, 2014, and 2015 detected 18 horned lark carcasses, but no western meadowlarks.

Table 5-3. North American population estimates for regionally abundant species that have been involved in collision mortality at wind projects in North America.

Species	North American estimate[1]
horned lark	80 million
red-eyed vireo	130 million
western meadowlark	79 million

[1] PIF Science Committee (2013)

Erickson et al. (2014) indicated that compared to their North American populations estimates, the cumulative fatality rate per year by species was highest for black-throated blue warbler (*Setophaga caerulescens*) and tree swallow (*Tachycineta bicolor*) as 0.043% of the entire population of both of these species was estimated to die annually as a result of collision with wind turbines. The North American population of black-throated blue warbler is 2.1 million and the North American population of tree swallow is 17 million (PIF Science Committee 2013). Given such a small percentage of the estimated population, at this time this level of mortality cannot be considered a population-level impact. However, as the number of wind facilities increase in North America, the take of these species is expected to increase proportionally.

State-Listed Species

The state-protected species identified by IDNR, black rail and peregrine falcon, are not expected to collide with Project turbines during migration or stopover events. To date, no black rail or peregrine falcon fatalities have occurred at operational wind projects for which post-construction data are publicly available. Only two waterbird fatalities, both pied-billed grebes (*Podilymbus podiceps*), have been reported in the Midwest, both at Buffalo Ridge in Minnesota (Johnson et al. 2000). Black-and-white warbler, a state species of special concern identified by IDNR as possibly occurring in the Project area, is known to collide with operational turbines. To date, at operational projects in the Midwest for which post-construction monitoring data are public, three black-and-white warbler fatalities have occurred: two at Forward Energy Center (Grodsky and Drake 2011) and one at Buffalo Ridge (Johnson et al. 2000).

The habitat available and results of pre-construction field surveys indicate a low-likelihood of these species and other species of concern breeding in the Project area. However, these species and other species of concern could occur within or in the vicinity of the Project and the aerosphere above during migration. The occurrence of species of concern within the Project area is expected to be infrequent and for short durations, so displacement and disturbance effects would be minimal. The Project was designed with impact minimization measures to reduce the risk of avian collision. The new generation turbines have tubular support structures instead of lattice structures, which eliminate perching by avian species such as raptors. Newer turbines also have larger blades, which reduces motion blur. The turbines are adequately spaced within crop fields, allowing birds greater reaction times to avoid turbines when approaching them.

USFWS Birds of Conservation Concern

Four birds of conservation concern have been observed either in or flying over the Project area, bald eagle, red-headed woodpecker, grasshopper sparrow, and dickcissel. At wind projects in the Midwest, fatalities have included grasshopper sparrows, and a bald eagle was injured at a wind project in Iowa.

We do not anticipate the Project will kill or injure bald eagles, which are unlikely to occur and be at risk of collision. Pre-construction surveys conducted at the Project in 2010 and 2011 documented a single bald eagle in the Project area (ARCADIS 2011*a*, *b*). It is possible but unlikely that grasshopper sparrows will collide with Project turbines. Surveys of the Project area in 2010 and 2011 observed one grasshopper sparrow. Records show that two grasshopper sparrows have been detected during hundreds of fatality searches at Midwestern projects. The Partners in Flight species assessment database (PIF Science Committee 2012) shows grasshopper sparrows have experienced a significant large decrease in population, but this decline probably cannot be attributed to mortality at wind projects.

Other Sources of Mortality Associated with Project Operations

Birds are susceptible to other sources of mortality at wind projects beyond turbine collision. Other sources of mortality include collision with maintenance vehicles, collision or electrocution from transmission lines, and collisions with other project structures such as MET towers. Additionally, nighttime lighting that is improperly installed or operated at wind facility substations or Operations and Maintenance buildings can increase the risk of collision with Project structures or nearby turbines.

<u>Vehicle Collisions</u>
Birds may be susceptible to collision with maintenance vehicles when crossing roads within the Project area. Avian-vehicle collisions have been reported at other operational projects, but they represent a smaller proportion of fatalities than turbine collisions (Stantec, unpublished data). Implementing a slower traffic speed in the Project area, such as 15 mph, would allow for birds to better detect and avoid a vehicle and drivers to slow when approaching birds on roadways.

<u>Transmission Line Collisions and Electrocutions</u>
Transmission lines represent a significant source of collision and electrocution risk to birds including passerines, waterfowl, and raptors. To avoid the risk of transmission line collisions and electrocutions, WWF minimized the amount of aboveground collection and transmission lines and buried collection cables wherever possible. A buried 34.5 kV collection system connects the individual turbines to the substation. A recently constructed transmission line, approximately 1.5 miles long, connects the collector substation to the point of interconnect.

<u>Collisions with MET towers</u>
Collisions with MET towers at wind projects have been well documented, and in some cases, collisions with guyed MET towers have represented greater risk of avian collision than wind turbines (Johnson et al. 2000, Stantec 2013*a*). Avian risk of collision fatality at towers (including MET towers and communication towers) varies depending on tower height, lighting, color, structure, and the presence of guy wires (The Ornithological Council 2007). Avian risk increases with tower height (Longcore et al. 2008). Guywires substantially increase the risk of avian collision; birds are suspected to collide more frequently with guywires and not as frequently with the tower itself as documented collisions are substantially lower at unguyed towers (Longcore et al. 2008).

The Project has 3 MET towers. One 100-meter MET tower is a self-supporting lattice steel structure and is unguyed. Because the tower is unguyed, risk of collision with the tower is substantially reduced. However, there are two 60-meter guyed towers that pose a higher collision risk to birds. Post-construction monitoring does not typically include regular surveys at MET towers. There are insufficient data for estimating bird mortality at the Project from MET tower collision.

<u>Wind Facility Lighting</u>
Nocturnal migrants aggregate at artificial light sources when they become disoriented or “trapped” by lights (Longcore et al. 2008). The potential for this phenomenon to occur is increased when fog is present to reflect the light and when inclement weather or topographic factors influence migrating birds to fly at lower heights above ground level (Longcore et al. 2008). Post-construction studies have documented avian fatality events caused by facility lighting at night (such as steady burning lights at substations or Operations and Maintenance buildings, or lighting above tower doors) during periods of inclement weather (i.e., rain or fog). Facility lighting has resulted in large fatality events (from 33 to 500 birds in a single night) at three facilities in West Virginia (Kerns and Kerlinger 2004, Young et al. 2010, Kerlinger et al. 2010, Stantec 2011*c*).

Current federal regulations specify the use of nighttime lighting for aviation safety on all structures greater than 200 feet above ground level (Longcore et al. 2008). Strobe or flashing lights on towers decrease the risk of bird collisions compared to steady-burning lights (Longcore et al. 2008). However, Kerlinger et al. (2010) found no significant difference between fatality rates at turbines with FAA lights as opposed to turbines without FAA lighting.

Potential nighttime lighting impacts have been minimized at the Project. The Applicant designed the turbine lighting schemes at the Project to minimize the risk to nocturnal migrants. FAA lighting at the Project is not expected to increase risk of collision to nocturnal migrants. The Applicant has incorporated other measures to minimize impacts to nocturnal migrants. Personnel will turn off internal lights at turbine towers at night (when these lights are not required for safety or compliance). The Project substation lights are equipped with downward facing shields. Similar to the turbine lighting plan, these measures will minimize the potential for birds to be attracted to the site at night and therefore minimize the collision risk.

Project Maintenance

Maintenance effects on birds may include disturbance and possible mortality due to human activity, the presence of large equipment (e.g., cranes), nighttime lighting, and vehicle traffic. These impacts are expected to be minimal and temporary and would only be in effect when personnel are on-site for maintenance activities.

Birds in the immediate area may be temporarily displaced when personnel are on-site. However, they are expected to return to the area after maintenance activities. Many species that occur in the Project area commonly occupy human-disturbed habitats and are tolerant of some human activity. Other species are more sensitive to human presence and could be displaced. However, as maintenance activities are expected to be temporary, substantial impacts associated with disturbance and displacement are not expected. If a more long-term maintenance activity is required (e.g., blade repair or replacement), some species may be displaced from the area for the duration of the activity. The habitat in the Project area is relatively uniform and therefore birds would be expected to utilize similar surrounding habitat if displaced from the immediate area.

If a crane or other large equipment is required, there may be risk of mortality or decreased nesting success for birds breeding in the immediate area. Possible species impacted could include horned lark or killdeer which may nest on the bare ground surrounding towers. Nests or nestlings could be destroyed. However, the use of large equipment to maintain turbines is expected to occur infrequently. Most turbine maintenance happens by accessing the nacelle through the ladder located inside the tower. Therefore, impacts associated with decreased nesting success are expected to be minimal.

Birds could collide with large equipment such as cranes. Further, if lighting at towers is required for nighttime maintenance activities during rain or fog conditions, there may be an increased risk of avian collisions with towers or nearby equipment. These risks would be short-term and temporary. Therefore, impacts associated with collision impacts during maintenance are expected to be minimal.

Birds also could collide with maintenance vehicles or flush as maintenance vehicles drive by them. Slower traffic speeds would allow for birds to detect approaching vehicles from a greater distance, affording them more time to leave the immediate area. Slowly approaching vehicles allow drivers to slow when approaching birds on roadways or when groups of birds fly across roadways. As such, impacts associated with maintenance vehicle collisions are expected to be minimal.

Post-Construction Monitoring

All four alternatives would include post-construction monitoring to be implemented as described in the BBCS and HCP. Effects to birds resulting from post construction monitoring may include disturbance or fatality due to increased vehicle traffic and human presence. Furthermore, any vehicle-induced fatalities may attract scavengers.

Post-construction monitoring would also include searcher efficiency and carcass persistence trials, in which carcasses are placed in the Project area to assess searcher success and carcass removal by scavengers (i.e., mammals and birds). Local scavenging birds, such as vultures, raptors, and crows may be attracted to the Project area during either of these types of trials. Cleared turbine pads would make fatalities easily detectable to birds. Avian scavengers could collide with spinning turbine blades while attempting to scavenge a carcass. However, carcasses are collected when found and trial carcasses are removed after trials and the risk of this impact would be temporary.

Project Decommissioning

Decommissioning effects may include disturbance and fatality related to human activity, the presence of large equipment, nighttime lighting, and increased vehicle traffic. After decommissioning, the habitat and land-use activities would be restored to pre-construction conditions or as per landowner wishes. Impacts to birds associated with decommissioning activities at the Project are expected to be minimal and generally short term. Adverse impacts to birds are not expected from decommissioning of the Project.

Mitigation for Taking Covered Species

While the goal of the summer habitat mitigation is to preserve and/or restore Indiana bat and northern long-eared summer habitat, the mitigation project will also provide benefits to forest-dwelling birds. The mitigation will target preserving and/or restoring forest on lands that are located in a landscape dominated by agricultural. In the long-term, these forested parcels will offer enhanced habitat for breeding birds and may also provide high quality stopover habitat for migrants.

It is difficult to predict the species and density of birds that may be attracted to the preserved and/or restored habitat, as the Applicant has not finalized their mitigation plan. However, any protection and reforestation efforts will serve to increase the overall area of preserved tracts of land in the selected watershed.

5.2.3.3 Summary of the Effects on Avian Resources

No major adverse effects to the local bird community are anticipated under any of the four alternatives due to similar habitat available adjacent to all permanently disturbed areas. Implementation of any of the four alternatives is not expected to result in substantial loss or degradation of habitat for a rare, threatened, or endangered bird species.

During each year of operation, we anticipate that the bird fatality rate will be around 3.59 bird fatalities per turbine per year (based on the median of fatality estimates calculated for similar wind projects in the region), or approximately 449 birds per year. Likely affected species will be those already discovered during post-construction monitoring at the Project. Based on the mean mortality rate of 3.59 birds per turbine per year, the Project will kill approximately 12,000 birds over the life of the Project. This mortality is expected to occur under any of the four alternatives.

We do not anticipate the Project will have adverse population-level impacts to individual species under any of the alternatives. Implementation of any of the four alternatives would not result in reducing any naturally occurring population to numbers below that for maintaining viability at the local or regional level. None of the four alternatives would result in substantial changes in habitat conditions producing indirect effects that cause naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels. Any potential cumulative impacts to bird populations from wind energy development are addressed in Section 5.5.2.

No impacts to bald eagles or golden eagles from the Project are anticipated based on the location of the Project area and the low number of eagle observations during on-site surveys.

Impacts to American golden-plovers may include stopover habitat displacement. However stopover habitat in the region is not limited and displaced birds likely will seek similar habitat proximal to permanently disturbed areas.

No major adverse effects to the resident bird community or for any bird species as a result of maintenance or decommissioning are expected.

In summary, among the four alternatives we do not expect project operations, maintenance, post-construction monitoring, decommissioning, and mitigation to have significantly different effects to avian resources. No specific mitigation measures for birds would be implemented under any of the four alternatives.

5.2.4 Bat Resources

5.2.4.1 Impact Criteria

The following sections analyze potential impacts of each alternative on listed and unlisted bats (shown in Table 4-1). The Indiana bat, northern long-eared bat, and gray bat (*Myotis grisescens*) are protected under the federal ESA. The Indiana bat is also protected by Indiana state law as a state endangered species, as are the gray bat and evening bat. All other bat species that occur in Indiana, with the exception of big brown bats, are species of special concern in the state. With the exception of the Indiana bat, population data on bat species in Indiana is lacking. The Service has estimated regional populations of northern long-eared bats using documented occurrences and forest cover. We discuss Project impacts to all bat species, but we can assess the effects of the alternatives on the population of only the Indiana bat and northern long-eared bat.

Major impacts may occur to bats should implementation of an alternative result in any of the following:

- Observed Project mortality rates greatly exceed the estimated rate for a wind project in the region;
- Substantial loss or degradation of habitat; or
- Substantial change in habitat conditions producing indirect effects that result in additive reductions in naturally occurring populations.

Additionally, major impacts to listed bats could occur should implementation of an alternative result in the reduction of naturally occurring populations below levels for maintaining viability at local or regional levels. Reductions in populations of listed bats could be caused by fatalities at wind turbines or substantial changes in habitat conditions.

5.2.4.2 General Bat Mortality Patterns at Wind Projects

Bat mortality at rates of concern to wildlife agencies has occurred at commercial wind projects throughout the Midwest and eastern U.S. Mechanisms for bat mortality at wind turbines include trauma associated with direct collision with spinning turbine blades and barotrauma (i.e., tissue damage to lungs and respiratory organs that occurs when bats fly through a wake of low pressure that follows immediately behind fast-moving turbine blades). Barotrauma can cause mortality even when bats do not physically collide with turbine blades, as was the case for an estimated 50% of carcasses recovered during a mortality study at a wind farm in Alberta, Canada (Baerwald et al. 2008). More recent research found that the majority of the turbine-associated bat deaths are attributed to impact trauma (Houck et al. 2012, Rollins et al. 2012). Bats do not appear to be at risk of mortality when turbines are fully feathered (blades pitched to rotate at <2 revolutions per minute when wind speeds are below the indicated cut-in speed).

Migratory tree-roosting bats consistently account for the majority of fatalities in studies of wind farm mortality in the U.S. (Arnett et al. 2008, Arnett and Baerwald 2013). This pattern occurred during each of 3 years of post-construction monitoring at Fowler Ridge, approximately 75 miles west of the Project area (Johnson et al. 2010, Good et al. 2011, 2012). Furthermore, migratory tree-roosting bats account for 87% of bat mortality among eight wind projects in the Midwest (Table 5-4).

Table 5-4. Species composition of bat carcasses found and identified at wind projects in the Midwest that provided publicly available post-construction monitoring reports.

Project	State	Bat carcasses identified	Migratory tree-roosting [1]	Cave-hibernating [2]	Reference
Buffalo Ridge, Phases I-III	MN	163	93%	7%	Johnson et al. (2003)
Buffalo Ridge, Lake Benton I & II	MN	151	93%	7%	Johnson et al. (2004)
Blue Sky Green Field	WI	235	50%	50%	Gruver et al. (2009)
Kewaunee County	WI	72	90%	10%	Howe et al. (2002)
Cedar Ridge	WI	215	73%	27%	BHE (2010)
Crescent Ridge	IL	20	100%	0%	Kerlinger et al. (2007)
Top of Iowa	IA	76	64%	36%	Jain (2005)
Forward Energy Center	WI	108	78%	22%	Grodsky and Drake (2011)
Fowler Ridge	IN	809	95%	5%	Good et al. (2011)
Fowler Ridge	IN	573	96%	4%	Good et al. (2012)
Total		2,422	87%	13%	

[1] hoary bat, eastern red bat, silver-haired bat, Seminole bat (*Lasiurus seminolus*)

[2] *Myotis* species, big brown bat, tri-colored bat; includes evening bat, although not a cave-hibernating bat

Seasonal timing of bat mortality has also been consistent among wind projects, with most mortality occurring during the presumed fall migratory period between mid-August and mid-October (Arnett and Baerwald 2013). At Fowler Ridge, 90% of estimated bat mortality occurred between August 1 and October 15 (Good et al. 2012). Typically, wind farm mortality records do not show a comparable spring peak in collision mortality despite the fact that bats also migrate during spring. Although reasons for this remain unclear, factors may include differing flight height during spring and fall migration, different spring and fall migration routes, or mating behavior and courtship flight during fall migration (Cryan 2008, Cryan and Barclay 2009). Migratory tree-roosting bats are expected to account for the majority of bat mortality under any of the alternatives.

To date, post-construction studies have documented eight Indiana bat mortalities at six wind projects (Table.5-5). Due to the infrequency of Indiana bat mortality, risk factors for this species at wind projects are poorly understood. Patterns of mortality in similar species such as little brown bats have been used to quantify potential Indiana bat mortality rates and to predict mortality patterns. Of the eight documented Indiana bat mortalities, six occurred during the fall migration, one in summer, and one in spring.

Table.5-5. Documented Indiana bat mortalities at wind projects in the U.S.

Site	Location	Estimated Date	Reference
Fowler Ridge Wind Farm	Benton County, IN	September 8-9, 2009	Good et al. (2012)
Fowler Ridge Wind Farm	Benton County, IN	September 17, 2010	Good et al. (2012)
North Allegheny Wind Farm	Cambria and Blair counties, PA	September 25, 2011	USFWS (2011)
Laurel Mountain	Randolph and Barbour counties, WV	July 7, 2012	USFWS (2012*a*)
Blue Creek	Van Wert and Paulding counties, OH	October 2-3, 2012	USFWS (2012*b*)
Undisclosed site	Ohio	October 7-9, 2013	USFWS (2014)
Undisclosed site	Ohio	April 13-14, 2014	USFWS (2014)
Undisclosed site	Indiana	August 23, 2015	USFWS, personal communication

To date, post-construction studies have documented 30 northern long-eared bat mortalities at 12 wind projects and two undisclosed sites (Table 5-6). Like the Indiana bat, due to the rarity of northern long-eared bat fatalities, risk factors for this species at wind projects are poorly understood. Of the 30 northern long-eared bat mortalities, all but five were found in the summer/fall survey season (July 16–October 31).

Table 5-6. Summary of publicly available documented northern long-eared bat mortalities at wind projects in the U.S. and Canada.

Site	Location	Number	Study Period	Date Found	Reference
Fowler Ridge	Benton County, IN	1	Apr 6 – Oct 30, 2009	Aug 25	Johnson et al. (2010)
Cohocton and Dutch Hill	Steuben County, NY	1	Apr 26 – Oct 22, 2010	Jun 22	Stantec (2011*b*)
Mountaineer	Tucker and Preston counties, WV	6	Apr 4 – Jun 24, Jul 28 – 29, and Aug 18 – Nov 22, 2003	Aug 18 - Sep 8	Kerns and Kerlinger (2004)
Mt. Storm	Grant County, WV	1	Jul 18 – Oct 17, 2008	Aug 26	Young et al. (2009)
Meyersdale	Somerset County, PA	2	Aug 2 – Sep 13, 2004	Sep 11 Sep 13	Kerns et al. (2005)
Ellenburg	Clinton County, NY	1	Apr 28 - Oct 13, 2008	Unspecified	Jain et al. (2009)
Kingsbridge I	Huron County, Ontario	1	May 2 – 23 and Sep 6 – Oct 26, 2006	Oct 5	Stantec (2007)
Ripley	Bruce County, Ontario	2	Apr 13 – May 31 and Jul 1 – Oct 17, 2008	Aug 5 Sep 5	Jacques Whitford (2009)
Wethersfield	Wyoming County, NY	1	Apr 15 – Oct 15, 2010	Jun 11	Jain et al. (2011)
Bliss/Wethersfield	Wyoming County, NY	5	Aug 1 – Sep 30, 2011	July 17 Aug 6, 18 Sep 2, 3	Kerlinger et al. (2011)
Erie Shores	Elgin County, Ontario	6	Mar 13 – Jun 15 and Aug 21 – Nov 7, 2007 [1]	May 25 June 11, 12 Aug 28 (2), 30	James (2008)
California Ridge	Vermilion County, IL	1	2013, unspecified period	Fall	K. Shank, personal communication [2]
Undisclosed site	Pennsylvania	1	2009, unspecified period	September	Taucher et al. (2012)
Undisclosed site	Pennsylvania	1	2012, unspecified period	Jul 30	J. Taucher, personal communication [3]
	TOTAL	**30**			

[1] Dates of study period not specified in report; estimated based on dates recorded for bird and bat carcass detections.
[2] K. Shank, Illinois Department of Natural Resources, comments to USFWS on Pioneer Trail Wind Farm HCP.
[3] J. Taucher, Pennsylvania Game Commission, personal communication with M. Turner, USFWS.

While species composition and seasonal timing of bat mortality have been consistent across wind projects, magnitude of bat mortality, usually expressed as the estimated number of bats killed per MW or per turbine, has varied among projects and across regions. Estimated bat fatality rates have been lower at wind projects in agricultural landscapes of the Midwest versus those on forested ridges in the Appalachians. Estimated bat mortality rates in the Midwest ranged from 1.7 to 30.6 bats per MW per survey period for studies conducted between 1999 and 2011 (Table 5-7). The arithmetic mean among studies listed in Table 5-7 is roughly 12.64 bats per MW per study.

Table 5-7. Bat mortality estimates for wind projects in the Midwest with publicly available post construction monitoring reports. Fatality rates were averaged across multiple survey years.

Project	State	MW	Bat fatalities per MW per study[1]	Study Period	Reference
Buffalo Ridge, Phases I-III	MN	235.6	2.30	Mar 15 – Nov 15, 1996 Mar 15 – Nov 15, 1999	Johnson et al. (2003)
Buffalo Ridge, Lake Benton I & II	MN	210.8	2.88	Jun 15 – Sep 15, 2001 Jun 15 – Sep 15, 2002	Johnson et al. (2004)
Blue Sky Green Field	WI	145	24.60	Jul 21 – Oct 31, 2008 Mar 15 – May 31, 2009	Gruver et al. (2009)
Kewaunee County	WI	20.5	6.45	Jul 1999 – Jul 2001	Howe et al. (2002)
Cedar Ridge	WI	67.6	30.60	Sep – Nov 2005 Mar – May 2006 Aug 2006	BHE (2010)
Crescent Ridge	IL	54.5	1.71	Sep – Nov, 2005 August 2006	Kerlinger et al.(2007)
Top of Iowa	IA	80.1	8.57	Apr 15 – Dec 15, 2003 Apr 15 – Dec 15, 2004	Jain (2005)
Forward Energy Center	WI	129.0	17.50	Jul 15 – Nov 15, 2008 Apr 15 – May 31, 2009 Jul 15 – Oct 15, 2009 Apr 15 – May 31, 2010	Grodsky and Drake (2011)
Fowler Ridge	IN	600.0	19.12	Apr 13 – May 15, 2010 Aug 1 – Oct 15, 2010 Apr 1 – May 15, 2011 Jul 15 – Oct 29, 2011	Good et al. (2011, 2012)
	Arithmetic mean		**12.64**		

[1] Averaged across multiple surveys seasons.

5.2.4.3 Effectiveness of Turbine Curtailment at Reducing Bat Mortality

Wind turbine blades can be automatically feathered, or pitched such that turbines spin very slowly or not at all, under particular weather conditions. Under normal operation, turbine blades usually remain pitched so that the turbine spins, or freewheels below "cut-in speed," the wind speed at which the turbines begin to generate electricity. Turbine curtailment refers to increasing cut-in speed and feathering turbines so they spin very slowly or not at all, below this increased cut-in speed. Studies conducted at wind projects in a variety of landscapes have demonstrated that curtailment effectively reduces bat mortality and that an inverse relationship exists between cut-in speed and bat mortality rates (Fiedler 2004, Kerns et al. 2005, Baerwald et al. 2009, Arnett et al. 2011, Good et al. 2011,). A recent synthesis of publicly available curtailment studies reported at least a 50% reduction in bat fatalities when turbine cut-in speed was increased by 1.5 m/s above the manufacturer's rated cut-in speed (Arnett et al. 2013).

During post-construction monitoring at the Project, WWF estimated bat mortality rates were between 0.6 and 1.5 bats per turbine per season when turbines were curtailed at 6.9 m/s or 7.0 m/s cut-in speed (Stantec 2014*a*, *b*, 2015; provided in Appendix G of Project HCP). When compared to 2011 mortality rates at Fowler Ridge control turbines (Good et al. 2012), this is a 90 to 93% reduction in bat mortality. Pioneer Trail Wind Farm, located in east-central Illinois, monitored mortality at turbines curtailed at 6.9 m/s cut-in speed in 2012 and estimated mortality to be between 0.4 and 0.8 bats per turbine per season (ARCADIS 2013). This is a 95% reduction in bat mortality compared to rates at Fowler Ridge. Table 5-8 and Table 5-9 summarize the results of curtailment studies conducted to date that are publicly available.

Table 5-8. Summary of curtailment studies and bat fatality reductions at wind projects.

Study	Study Period	Cut-in speed (m/s)	% Reduction	Notes
Baerwald et al. (2009)	Aug 1-Sep 7, 2007	4.0	-- [1]	
		4.0	58	Feathered
		5.5	60	
Arnett et al. (2011)	Jul 27-Oct 9, 2008	3.5	--	
		5.0	87	
		6.5	74	
Arnett et al. (2011)	Jul 26-Oct 8, 2009	3.5	--	
		5.0	68	
		6.5	76	
Young et al. (2011)	Jul 15-Oct 15, 2010	4.0	--	
		4.0	34	Feathered. Based on average of first (47%) and second (22%) halves of night
Good et al. (2011)	Aug 1-Oct 15, 2010	3.5	--	
		5.0	50	
		6.5	79	
Good et al. (2012)	Jul 15-Oct 31, 2011	3.5	--	
		3.5	36	Feathered
		4.5	58	
		5.5	75	
Young et al. (2013)	Jul 15-Oct 15, 2012	5.0	62	Compared to 2011 uncurtailed operations; nominal cut-in speed is 4.0 m/s
Stantec (2013*b*)	Aug 15-Oct 31, 2011	3.5	--	
		3.5	34	Feathered
		4.5	72	
	Apr 1-Jul 31, 2012	3.5	--	
		4.5	71	
Shoener Environmental (2013)	Jul 1-Sep 30, 2012	6.9	82	Compared to the average of 2 rates from uncurtailed operations in 2010 and 2011
Tidhar et al. (2013)	Apr 1-Oct 28, 2012	6.9	88	Compared to average regional fatality rate
ARCADIS (2013)	Aug 15-Oct 15, 2012	6.9	95	Compared to fatality rate at Fowler Ridge in 2011
Wildcat Wind Farm	Aug 1-Oct 15, 2013	7.0	93	Compared to fatality rate at Fowler Ridge in 2011
	Aug 1-Oct 15, 2014	7.0	90	Compared to fatality rate at Fowler Ridge in 2011
	Aug 1-Oct 15, 2015	6.9	92	Compared to fatality rate at Fowler Ridge in 2011

[1] -- indicates unfeathered and uncurtailed operations (control)

Table 5-9. Average reductions in bat mortality by curtailed cut-in speed.

Cut-in speed (m/s)	Average % reduction in mortality
3.5 m/s (feathering only)	34.0 (n=1)
4.0 m/s (feathering only)	46.0 (n=2)
5.0 m/s	66.8 (n=4)
6.5 m/s	76.3 (n=3)
6.9 m/s	88.3 (n=3)

5.2.4.4 Estimating Seasonal Bat Mortality

To estimate seasonal bat mortality across the four alternatives, we looked at data from the Project, curtailment studies, and wind projects in the region, particularly Fowler Ridge. The Fowler Ridge post-construction monitoring studies provide robust data gathered and analyzed using sound scientific rigor. Also, the fall study period at Fowler Ridge matches the curtailment period for the Project, August 1 through October 15.

The Service has concluded that Indiana bats are most at risk of collision mortality during the fall migratory period, here defined as August 1 through October 15. However, a wind project in Ohio discovered an Indiana bat fatality in April 2014, and Indiana bat spring fatalities could occur at the Project. We expect that northern long-eared bats are most at risk of collision mortality during the fall migratory period, based on the majority of fatalities documented after July 31 (77%; Table 5-6). To address Covered Species mortality in this EA, we based our estimates of take among alternatives on the take estimate implemented in the HCP and assume take of Covered Species is most likely to occur during the fall migration.

As we indicated, migratory tree-roosting bats account for most of bat fatalities at wind projects. These fatalities tend to be much higher during the fall migration, but bat mortality at wind projects occurs throughout the bat-active season. Hence, we estimated unlisted bat mortality across alternatives using fatality rates during spring, summer, and fall.

Post-construction Monitoring at the Project

In 2013, 2014, and 2015 from August 1 through October 15, the Project operated during night-time hours (30 minutes before sunset to 30 minutes after sunrise) when wind speeds were 7 m/s (in 2013 and 2014) and 6.9 m/s (in 2015) or higher. In accordance with the Mortality Minimization and Monitoring Proposals (2012 and 2015 Monitoring Proposals; Appendix A in Project HCP) and the Service's Technical Assistance Letters (2012 and 2015; Appendix B in Project HCP), WWF conducted post-construction avian and bat mortality monitoring during the spring and fall in all 3 years. Monitoring and mortality estimation methods followed the protocol described in the Monitoring Proposals. The results of the monitoring are provided in Table 5-10. Numbers of carcasses include those found during scheduled searches and those discovered incidentally. A qualified bat biologist determined any unknown bat carcasses were not *Myotis* based on skull characteristics and dentition (Stantec 2014*a*, *b*).

Table 5-10. Numbers of carcasses by species found during post-construction monitoring conducted at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. Numbers include carcasses found during standardized searches and incidentally.

	2013		***2014***		***2015***		
	Spring Apr 3-May 14	**Fall Aug 5-Oct 17**	**Spring Apr 1-May 15**	**Fall Aug 4-Oct 16**	**Spring Mar 30-May 14**	**Fall Aug 3-Oct 16[1]**	**Species total**
Silver-haired bat	14	1	16	2	15	2	50
Hoary bat	4	11	4	12	2	18	41
Eastern red bat	5	6	2	13	1	13	40
Big brown bat	0	5	1	2	1	2	11
Evening bat	0	0	0	0	1	0	1
Unknown species[2]	1	2	0	0	0	0	3
Season total	24	25	23	29	20	35	
					3-year total		**156**

Data source: Stantec (2014*a*, *b*, 2015)

[1] Incidental carcasses (10 hoary bats, 8 eastern red bats, and 1 big brown bat) found last week of July while clearing search plots.

[2] Unidentifiable carcasses determined to be species other than *Myotis*.

WWF calculated adjusted mortality estimates based on carcasses found during searches (excluding carcasses found incidentally) (Table 5-11). Adjusted mortality estimates considered searcher efficiency trials, carcass removal trials, and area adjustments (Stantec 2014*a*, *b*, 2015).

Table 5-11. Results by fatality estimates of post-construction monitoring conducted at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. Turbines were curtailed at 7.0 m/s in fall 2013 and 2014 and 6.9 m/s in fall 2015.

	Spring Monitoring Period		Fall Monitoring Period	
	Full Plots	*Roads and Pads*	*Full Plots*	*Roads and Pads*
2013				
Estimated bats/MW/season by search type	0.40	0.40	0.40	0.50
Estimated bats/turbine/season by search type	0.64	0.64	0.64	0.80
Estimated bats/MW/season and /turbine/season[1]	0.40 0.64		0.45 0.72	
Estimated bats/MW and /turbine[2]	0.85 1.36			
2014				
Estimated bats/MW/season by search type	0.70	0.50	0.60	0.70
Estimated bats/turbine/season by search type	1.12	0.80	0.96	1.12
Estimated bats/MW/season and /turbine/season[1]	0.60 0.96		0.65 1.04	
Estimated bats/MW and /turbine[2]	1.25 2.00			
2015				
Estimated bats/MW/season by search type	0.44	0.75	0.62	1.25
Estimated bats/turbine/season by search type	0.70	1.20	0.99	2.00
Estimated bats/MW/season and /turbine/season[1]	0.60 0.95		0.94 1.50	
Estimated bats/MW and /turbine[2]	1.54 2.45			

Data source: Stantec (2014*a*, *b*, 2015).
[1] Averaged value using pooled variance.
[2] Summed value using pooled variance.

Selected Mortality Rate for Unlisted Bats for the Project

The seasonal estimates from Fowler Ridge at fully operational turbines and the results of post-construction monitoring at the Project can be used to inform our unlisted bat mortality estimates for the alternatives analyzed in Section 5.2.4.6. Based on data collected at Fowler Ridge in 2010 and 2011 at fully operational turbines, the average fall (August 1- October 15) mortality estimate for all bats was 30.17 bats per turbine (mean adjusted mortality based on empirical bias correction factor; Good et al. 2012). Based on data collected at Fowler Ridge only in 2011 at fully operational turbines, the mortality estimate was 0.66 bats per turbine in spring and 2.90 bats per turbine in summer (mean adjusted mortality based on empirical bias correction factor; Good et al. 2012).

WWF conducted 3 years of post-construction monitoring during the spring and fall seasons. Turbines operated at the manufacturer's rated cut-in speed (3.5 m/s) in spring and summer and at either 7.0 m/s or 6.9 m/s in fall (fatality estimates are shown in Table 5-11). The average fall mortality rate across the 3 years was 1.09 bats per turbine (0.68 bats per MW). The average spring mortality rate was 0.85 bats per turbine, which is slightly higher than that observed at control turbines at Fowler Ridge (0.66 bats per turbine). WWF did not monitor summer mortality at the Project, so we chose to employ the control summer rate from Fowler Ridge, 2.90 bats per turbine (1.72 bats per MW).

We also used the control fall rate from Fowler Ridge, 30.17 bats per turbine (17.85 bats per MW) to derive mortality reductions from implementation of raised cut-in speeds during fall operations for each of the action alternatives (Alternatives 2, 3, and 4).

5.2.4.5 Habitat Impacts

Land use within the Project area is primarily agricultural crops (93% of area), with forest accounting for approximately 0.6% of land area. Project construction did not affect known roosts or potential roosts. Because the Project is already constructed, no impacts to roost habitat are anticipated for any alternative. Similarly, potential impacts to foraging habitat within the Project area (i.e., behavioral displacement of foraging bats) are not anticipated and would be expected to be identical among alternatives. Similarly, alternatives are not expected to differ in their potential to cause habitat impacts during eventual repowering or decommissioning of the Project.

5.2.4.6 Direct and Indirect Effects Presented by Alternative

This section analyzes the potential effects to listed and unlisted bat species anticipated for each alternative. Operational adjustments are proposed for August 1 to October 15 under all alternatives. The No-Action Alternative would implement 5.0 m/s curtailment in spring. In contrast, we assumed potential impacts to bats outside the fall curtailment will not vary among the action alternatives. Table 5-12 identifies direct effects of each alternative, indicating the potential impacts unique to each alternative (italicized).

Estimated mortality for unlisted bats under each action alternative is based on first deriving the mortality predicted to occur at the Project operating with no restrictions (at the manufacturer's rated cut-in speed of 3.5 m/s) based on the rate of 30.17 bats per turbine per fall, which is based on observed rates at Fowler Ridge. Predicted reductions in bat mortality are based on results of available curtailment studies (Table 5-8) that tested the cut-in speed specified under each alternative (summarized in Table 5-9). The Applicant's methods for estimating take of Indiana bats and northern long-eared bats at the Project are explained in detail in Section 4.3 of the HCP and also use mortality data from Fowler Ridge.

We summarize anticipated general impacts first, and then evaluate impacts to listed and unlisted bats for each alternative.

Table 5-12. Comparison of direct effects to bats for each alternative; italics indicate effects are unique to that alternative.

Alternative and Operational Adjustments	Indiana Bat	Northern Long-eared Bat	Unlisted Bats
Alternative 1: No-Action (Take Avoidance) • 6.9 m/s cut-in speed; August 1 – October 15 • 5.0 m/s cut-in speed; March 15 – May 15	• No loss of summer maternity roost habitat • ***No mortality*** *anticipated during summer or either spring or fall curtailment periods*	• No loss of summer maternity roost habitat • ***No mortality*** *anticipated during summer or either spring or fall curtailment periods*	• No loss of roost habitat • Bat mortality during spring migration and early-summer comparable to projects in region • Migratory tree-roosting species primarily affected • ***~97% reduction in bat mortality*** *during fall curtailed period* [1] • ***~50% reduction in bat mortality*** *during spring curtailed period* [2]
Alternative 2: Restrictive Operations (Proposed Alternative) • 5.0 m/s cut-in speed; August 1 – October 15 • 3.5 m/s cut-in speed; October 16 – July 31	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality of ~**3 Indiana bats** annually between August 1 and October 15*	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality of ~**2 northern long-eared bats** for the facility annually between August 1 and October 15*	• No loss of roost habitat • Bat mortality during spring migration and early-summer comparable to projects in region • Migratory tree-roosting species primarily affected • ***~50% reduction in bat mortality*** *during curtailed period* [2]
Alternative 3: More Restrictive Operations • 6.5 m/s cut-in speed; August 1 – October 15 • 3.5 m/s cut-in speed; October 16 – July 31	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality ~**1.4 Indiana bats*** • *annually between August 1 and October 15*	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality ~**0.8 northern long-eared bats** annually between August 1 and October 15*	• No loss of roost habitat • Bat mortality during spring migration and early-summer comparable to projects in region • Migratory tree-roosting species primarily affected • ***~76% reduction in bat mortality*** *during curtailed period* [3]

Alternative and Operational Adjustments	Indiana Bat	Northern Long-eared Bat	Unlisted Bats
Alternative 4: Less Restrictive Operations • 4.0 m/s cut-in speed; August 1 – October 15	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality ~**3.2 Indiana bats** annually between August 1 and October 15*	• No loss of summer maternity roost habitat • **No mortality** anticipated during spring and early-summer • *Mortality ~**1.6 northern long-eared bats** annually between August 1 and October 15*	• No loss of roost habitat • Bat mortality during spring migration and early-summer comparable to projects in region • Migratory tree-roosting species primarily affected • *~**46% reduction in bat mortality** during curtailed period* [4]

[1] Based on mean fatality rate of 1.50 bats/turbine/fall during three seasons at the Wildcat Wind Farm (Stantec 2014 *a*, *b*, 2015) as compared to a rate of 30.17 bats/turbine/fall observed during two seasons at Fowler Ridge (Good et al. 2012).

[2] Reduction in bat mortality averaged from four studies that operated turbines at 5.0 m/s cut-in speed was >50%: Criterion (Young et al. 2013; 62%); Fowler Ridge (Good et al. 2011; 50%), and Casselman (Arnett et al. 2011; 87% and 68%). Although these operations were curtailed in fall, we assumed no difference for percent reductions in spring based on the limited number of studies that included spring curtailment and monitoring. The Service chooses to implement the more conservative estimate of 50%, just as the Applicant does in the Project HCP.

[3] Reduction in bat mortality averaged from three studies that operated turbines at 6.5 cut-in speed: Fowler Ridge (Good et al. 2011; 79%) and Casselman (Arnett et al. 2011; 74% and 76%).

[4] Reduction in bat mortality averaged from two studies that feathered uncurtailed turbines at 4.0 m/s cut-in speed: Summerview (Baerwald et al. 2009; 58%) and Mt. Storm (Young et al. 2011; 34%).

Alternative 1: No Action Alternative

Project Operations

The Service has concluded that feathering turbines in the fall at the Project when wind speeds are less than 6.9 m/s is unlikely to pose a risk of collision mortality for Indiana bats and northern long-eared bats (USFWS 2012*d*). Under Alternative 1, turbines will be curtailed in spring at 5.0 m/s and in fall at 6.9 m/s. The Service predicts that take of either Indiana bats or northern long-eared bats is unlikely with implementation of this curtailment strategy.

The results of three post-construction studies conducted at the Project (Stantec 2014*a*, *b*, 2015) found curtailing turbines below 7.0 m/s and 6.9 m/s cut-in speed in the fall results in an average bat mortality rate of 1.09 bats per turbine or 0.68 bats per MW, which is 3% of the fall mortality rate observed at Fowler Ridge (30.17 bats per turbine). During the spring curtailment period (March 15 to May 15), we assumed unlisted bat mortality would be reduced from the observed mortality rate of 0.85 bats per turbine to 0.42 bats per turbine (50% reduction[1]). Turbines will not be curtailed or feathered above the manufacturer's cut-in speed during summer, and we estimate the rate to be that observed at Fowler Ridge at control turbines in summer, i.e., 2.90 bats per turbine. Using these three estimates, we derive a combined rate of 4.41 bats per turbine (2.76 bats per MW).

Multiplying 4.41 bats per turbine by the installed turbine number (125) results in 551 bat fatalities annually, or approximately 15,000 bat fatalities over the 27 years the Project will operate. Bat mortality rates and totals are provided in Table 5-13 for each of the alternatives. Estimates for unlisted bats include project-related mortality alone and do not attempt to account for lost reproductive potential resulting from female fatalities.

Habitat Mitigation

The No-Action Alternative is not expected to result in take of listed bats; therefore mitigation would not be required.

[1] Even though higher percent reductions have been observed in curtailment studies that tested 5.0 m/s, the Service chooses to implement the more conservative estimate of 50%, just as the Applicant does in the Project HCP.

Table 5-13. Comparison of estimates of Indiana bat, northern long-eared bat, and unlisted bat mortality across alternatives. For covered species, expected take is based on the implementation of minimization measures, i.e., raised cut-in speeds during the period of risk. (Note: Values derived using a spreadsheet application and reflect rounding. Applying straight arithmetic will result in slight variations from the values in the table.)

		Alternatives for Project Operations			
Species	**Impact**	**1: No-Action**	**2: 5.0 m/s (Applicant's Proposal)**	**3: 6.5 m/s (More Restrictive)**	**4. 4.0 m/s (Less Restrictive)**
Indiana bat	*Expected annual take*	0	3.0	1.4	3.2
	Total expected take (annual x 27 years)	0	81.0	38.9	85.9
	Take of females (75% of take)	0	60.8	29.2	64.3
	Lost reproductive potential (lost female pups from every taken female)	0	115.4	55.4	122.1
	Impact of take to be mitigated (taken females + female pups)	0	176.2	84.6	186.4
Northern long-eared bat	*Expected annual take*	0	1.5	0.7	1.6
	Total expected take (annual x 27 years)	0	41.0	19.4	42.9
	Take of females (50% of take)	0	20.5	9.7	21.6
	Lost reproductive potential (lost female pups from every taken female)	0	38.5	18.5	41.0
	Impact of take to be mitigated (taken females + female pups)	0	58.7	28.2	62.6
Unlisted bats	*Annual mortality*	551[1]	2,189[2]	1,209[3]	2,465[4]
	Total mortality over 27 years	14,877	59,096	32,636	66,555

[1] Based on mortality rate of 4.41 bats per turbine per year or 2.76 bats per MW per year.
[2] Based on mortality rate of 17.51 bats per turbine per year or 10.94 bats per MW.
[3] Based on mortality rate of 9.67 bats per turbine per year or 6.04 bats per MW.
[4] Based on mortality rate of 19.72 bats per turbine per year or 12.33 bats per MW.

Alternative 2: 5.0 m/s Curtailment (Proposed Action)

Proposed Indiana Bat Take Limit and Impact of the Taking

The Applicant's method for estimating take of Indiana bats at the Project is explained in detail in Section 4.3 of the HCP. Indiana bat mortality is not expected to occur during maintenance, decommissioning, or mitigation activities. Project operation is the only activity expected to result in Indiana bat take.

Based on mortality data from Fowler Ridge, the Applicant estimates the Project could take approximately six Indiana bats per year in the absence of the proposed operational curtailment or minimization (Section 4.3.1 of the Project HCP). Implementing the proposed turbine operations, WWF predicts a reduction in Indiana bat fatalities of at least 50%, bringing the annual take to three Indiana bats per year. Hence, WWF expects to take 81 Indiana bats based on the estimated cumulative take over the 27 years the Project will operate (3 Indiana bats per year x 27 years = 81 bats).

The Service has assumed more female Indiana bats than male Indiana bats will migrate through the Project area based on the distance between the Project area and the nearest hibernaculum (75 miles). Evidence suggests female Indiana bats may occur more frequently than males as distances from hibernacula increase (USFWS 2012*f*). The Service estimates a 3:1 ratio of female to male Indiana bats migrating through the Project area each fall (USFWS 2012*f*). Consequently, approximately 75% of the 81 Indiana bats taken at the Project are expected to be female leading to an estimated take of 2.25 female bats per year, or roughly 60.75 female bats over the 27 years the Project will operate.

The loss of those 60.75 female bats is likely to result in lost reproductive potential in the population. Using the Service's REA Model (USFWS 2013*a*), the impact module calculates debit as the sum of the female take (direct take) and the consequent loss in reproduction (total lost reproduction) over the life of the Project. In a population with a stationary growth rate (lambda condition), the REA Model assumes there will be 1.9 female pups lost for every one female taken, or 115.4 pups over 27 years.

Thus, the impact of take for Indiana bats equals the loss of 60.75 female bats as well as the lost reproductive contribution of the take females, 115.4 female pups, resulting in approximately 176.2 Indiana bats. This represents 0.07% of the estimated 2015 population of the Midwest Recovery Unit (259,508 Indiana bats; USFWS 2015*d*), in which the Project is located. This take would be distributed over 27 years and mitigated by WWF as described in Section 5.2.2 of the Project HCP.

Proposed Northern Long-eared Bat Take Limit and Impact of the Taking

As for Indiana bats, the Applicant's method for estimating take of northern long-eared bats at the Project is explained in detail in Section 4.3 of the HCP. Northern long-eared bat mortality is not expected to occur during maintenance, decommissioning, or mitigation activities. Project operation is the only activity expected to result in northern long-eared bat take.

Using mortality data from Fowler Ridge, the Applicant estimates the Project would take approximately three northern long-eared bats per year in the absence of the proposed operational adjustments (Section 4.3.1 of the Project HCP). Implementing the proposed turbine operations, WWF predicts a reduction in northern long-eared bat fatalities of at least 50%, bringing the expected annual take to 1.5 northern long-eared bats per year. Hence, WWF expects to take41 northern long-eared bats based on the estimated cumulative take over the 27-year term of Project operations (1.5 northern long-eared bats per year x 27 years = 40.5 bats).

Section 5.2.2 in the Project HCP explains in detail how WWF determined the impact of take for northern long-eared bats. In summary, over the 27-year life of the Project, cumulative northern long-eared bat mortality includes taking 20.25 females, assuming a 1:1 ratio of male and female fatalities. The impact of taking 20.25 females includes the estimated lost reproductive contribution of taken females, the added impact of losing 38.5 female pups in the 27-year period (as calculated by the Indiana bat REA Model), which results in 58.7 northern long-eared bats (20.25 female fatalities + 38.5 lost female pups = 58.7 bats). This is roughly 0.002% of the estimated midwestern population (2.8 million). This take would be distributed over 27 years and mitigated by WWF as described in Section 5.2.2 of the Project HCP.

Unlisted Bat Mortality
Based on results of available curtailment studies, the Project HCP estimates that feathering turbines blades below a cut-in speed of 5.0 m/s during the fall migration season and below the manufacturer's rated cut-in speed (3.5 m/s) during the remainder of the year would reduce all bat mortality, including Indiana and northern long-eared bat mortality, by at least 50%. Based on this percentage, estimates during the curtailment period change from 30.17 bats per turbine to 15.08 bats per turbine (9.43 bats per MW). Outside of the fall curtailment period, the Applicant would feather turbines below the manufacturer's rated cut-in speed, potentially reducing bat mortality by 35%. The spring and summer bat mortality estimate would be 2.43 bats per turbine, and the sum of the seasonal rates for all bats would be 17.51 bats per turbine (10.94 bats per MW). Annual take of unlisted bats under this alternative would be approximately 2,189 bats, yielding a total of approximately 59,000 bat fatalities over the 27-year life of the Project. These estimates include Project-related mortality alone and do not attempt to account for lost reproductive potential.

Mitigation for Taking Covered Species
The Applicant plans to offset the taking of Indiana bat and northern long-eared bats through summer habitat mitigation. WWF or their third-party contractor will either acquire the mitigation lands in fee or legally encumber them with a permanent conservation easement to be held by a 501(c)(3) non-profit organization. The Service finds that the summer habitat mitigation for Indiana bats will also partially mitigate the impacts associated with taking northern long-eared bats over the life of the Project. The summer habitat mitigation project will enhance and protect forest habitat to the benefit of both species.

Protecting forested habitat and restoring forested habitat will also benefit unlisted bat species. Studies on habitat use by bats in the Midwest show that bat activity is positively correlated with amount of available forest habitat for *Myotis* species and tri colored bats and negatively correlated for big brown bats and eastern red bats, which frequently forage in more developed habitats (Duchamp et al. 2004). Because the landscape in northern Indiana is dominated by agricultural land use, creating and protecting any additional forested habitat will improve the habitat diversity of the area and will benefit all resident bats by increasing the extent and diversity of roosting and foraging habitat. Additional forest habitat in the region will also presumably provide stopover habitat for long-distance migratory species, possibly reducing mortality associated with migration.

Alternative 3: More Restrictive Operations (6.5 m/s Cut-in Speed) with Mitigation

Under Alternative 3, the Project is expected to take 1.4 Indiana bats annually, which is less than that expected for the Applicant's Proposed Alternative (Table 5-13). The reproductive loss of 55.4 female pups associated with removal of 29.2 female Indiana bats over the permit duration would also be less than that estimated for the Proposed Alternative, as would the impact of the combined take estimate and lost reproductive potential. Similarly, the northern long-eared bat take estimate of 0.7 bats annually, the reproductive loss of 18.5 female pups associated with removal of 9.7 female northern long-eared bats over the permit, and the combined take estimate and lost reproductive potential for this alternative would all be less than that estimated for the Applicant's Proposed Alternative (Table 5-13).

Based on two publicly available studies, under this alternative, bat mortality would be reduced by 76% during the curtailment period of August 1–October 15. (Curtailing turbines below 6.5 m/s reduced bat mortality by 74% in 2008 and 76% in 2009 at Casselman [Arnett et al. 2011] and 79% at Fowler Ridge [Good et al. 2011]; 76% on average.) This reduction would yield a mortality rate of 7.24 bats per turbine in the fall, as compared to 30.17 bats per turbine. Outside of the fall curtailment period, the Applicant would feather turbines below the manufacturer's rated cut-in speed, reducing bat mortality by 35%. The spring and summer bat mortality estimate would be 2.43 bats per turbine, and the sum of the seasonal rates for all bats would be 9.67 bats per turbine (6.04 bats per MW). Multiplying this by 125 turbines results in an annual fatality estimate of 1,209 bats, or approximately 33,000 bat fatalities over the 27 years the Project will operate.

Mitigation for Taking Covered Species

Under Alternative 3, the Applicant would need to offset the impact of taking listed bats, as described for Alternative 2, but to a lesser degree because this alternative would result in less take of covered species. Listed and unlisted bats would benefit from any summer habitat mitigation carried out by the Applicant.

Alternative 4: Less Restrictive Operations (4.0 m/s Cut-in Speed)

Under Alternative 4, the Project is expected to take 3.2 Indiana bats annually, which is greater than that estimated for the Applicant's Proposed Alternative (Table 5-13). The reproductive loss of 122.1 pups associated with removal of 64.3 female Indiana bats over the permit duration would also be greater than that estimated for the Applicant's Proposed Alternative, as would the impact of the combined take estimate and lost reproductive potential. Similarly, the northern long-eared bat take estimate of 1.6 bats annually, the reproductive loss of 41 female pups associated with removal of 21.6 female northern long-eared bats over the permit, and the combined take estimate and lost reproductive potential for this alternative would all be greater than that estimated for the Applicant's Proposed Alternative (Table 5-13).

Under Alternative 4, expected impacts to Indiana bats and northern long-eared bats during operations (i.e., collision) are higher than under Alternatives 1, 2, and 3. When compared to the Project operating at 3.5 m/s (the manufacturer's rated cut-in speed), overall bat mortality could be reduced by 46% based on an average of results in Baerwald et al. (2009) and Young et al. (2011). This reduction would yield a fall mortality rate of 17.29 bats per turbine as compared to 30.17 bats per turbine. Outside of the fall curtailment period, the Applicant would feather turbines below the manufacturer's rated cut-in speed, reducing bat mortality by 35%. The spring and summer bat mortality estimate would be 2.43 bats per turbine, and the sum of the seasonal rates for all bats would be 19.72 bats per turbine (12.33 bats per MW). Multiplying this by 125 turbines results in an annual fatality estimate of 2,465 bats, or approximately 67,000 bat fatalities over the 27-year life of the Project.

Mitigation for Taking Covered Species

Under Alternative 4, the Applicant would need to offset the impact of taking listed bats, as described for Alternative 2, but to a greater degree because this alternative would result in more take of covered species. Listed and unlisted bats would benefit from any summer habitat mitigation carried out by the Applicant.

5.2.4.7 Summary of Effects to Bat Resources

Table 5-13 provides a summary of mortality estimates under each alternative.

The Service predicts that the implementation of the No-Action Alternative is not likely to result in take of Indiana bats or northern long-eared bats. Under Alternative 2, the Applicant is requesting a take limit of 162 Indiana bats and 81 northern long-eared bats, but the Applicant expects the Project will actually take only 81 Indiana bats and 41 northern long-eared bats over the 27-year life of the Project. The total impact of the taking would be 176.2 female Indiana bats and 58.7 female northern long-eared bats over the life of the Project. Under Alternative 4, take of listed bats may be slightly higher, and take under Alternative 3 would be significantly lower (Table 5-13).

Under Alternatives 2, 3, and 4, the Applicant would fully mitigate for the impact of the take for Indiana bats and northern long-eared bats through summer maternity habitat protection/restoration.

Under the No-Action Alternative, the Service assumes the Project will kill unlisted bats but at a significantly reduced rate than in the absence of any curtailment. Under Alternative 2, annual mortality of unlisted bats is estimated be around 17.51 bats per turbine (10.94 bats per MW). Over the 27-year life of the Project, we estimate that under implementation of Alternative 2 the Project will kill approximately 59,000 unlisted bats. Compared to Applicant's Proposed Action, unlisted bat mortality would be 45% lower under Alternative 3 and 26% higher under Alternative 4. Knowledge of populations is necessary to understand the implications of cumulative bat mortality. Unfortunately, we currently have little information to inform current population estimates for most bat species in North America at local, regional, or continental scales (O'Shea et al. 2004, Kunz et al. 2007a). Hence, there is insufficient information to understand the population-level effects associated with this level of mortality, particularly for migratory tree-roosting bat species. The ongoing monitoring required at WWF and other facilities will allow tracking of impacts, including the proportions of fatalities among the various species.

5.3 PHYSICAL ENVIRONMENT

5.3.1 Air Quality and Climate

5.3.1.1 Impact Criteria

The Clean Air Act of 1970 (CAA), and the CAA Amendments of 1990 established National Ambient Air Quality Standards (NAAQS) for selected pollutants. The NAAQS established maximum levels of acceptable background pollution with a margin of safety to protect public health and welfare. NAAQS compliance in Indiana is monitored by the Indiana Department of Environmental Management.

5.3.1.2 Direct and Indirect Effects

Project Operations and Maintenance

Per the CAA and the Amendments of 1990, USEPA has established New Source Performance Standards to regulate air pollution emissions from new stationary sources. These standards apply to various facilities, but because wind turbines generate electricity without releasing air pollutants, New Performance Standards do not apply to the Project.

The Acid Rain Program, established by CAA Amendments of 1990 to lower sulfur dioxide and nitrogen oxides emissions, does not apply to the Project because wind turbines generate electricity without releasing air pollutants. Likewise, the Prevention of Significant Deterioration (PSD) does not apply to the Project for the same reason.

Recent federal greenhouse gas (GHG) policy has focused on voluntary initiatives to reduce GHG emissions. In 2010, the CEQ drafted guidance regarding GHG emissions in evaluating federal actions under NEPA. The guidance indicated that if the Project leads to 25,000 metric tons or more of carbon dioxide equivalent emissions then it may warrant some description in the appropriate NEPA analysis.

Regardless of the alternative implemented, Project operations will not release pollutants into the atmosphere or result in major adverse effects to air quality. Project operations require a small amount of vehicular traffic resulting in the release of carbon dioxide emissions and particulates. Project maintenance and post-construction monitoring will necessitate some increases in vehicular traffic and construction equipment in and around the Project, but this added impact to air quality is expected to be inconsequential and common among the alternatives. These emissions are not estimated to have a measurable effect on local or regional air quality or contribute greatly to the amount of greenhouse gases. Project operations will not generate any new sources of air pollutants.

Energy production would be highest under Alternative 4 (4.0 m/s cut-in speed), followed by the Proposed Action (5.0 m/s cut-in speed) then Alternative 3 (6.5 m/s cut-in speed). The No Action alternative would produce the least amount of electricity annually because the turbines would not operate at night between March 15 and May 15 when wind speeds are less than 5.0 m/s and between August 1 and October 15 when wind speeds are less than 6.9 m/s. Under any of the four alternatives under consideration, power delivered to the grid from the Project will not cumulatively add to the emissions produced at existing conventional power plants.

Operation of the Project will avoid direct emissions of 25,000 metric tons or more of carbon dioxide-equivalent greenhouse gas emissions annually. The Applicant estimates that the electricity generated by the Project provides emissions-free power for the equivalent of 60,000 homes while displacing fossil fuel generation equivalent to taking approximately 62,000 cars off the road and avoiding the release of approximately 360,000 tons of carbon dioxide per year and 1,800 tons of sulfur dioxide, the leading cause of acid rain. Therefore, the Project will displace greenhouse gas emissions that could contribute to problems associated with climate change.

Project Decommissioning

Implementation of any of the four alternatives will include decommissioning the Project at the end of its operational life or if the Project is non-operational for an extended period of time with no expectation of returning to operation. Decommissioning activities will involve large construction equipment and other vehicles that will have temporary and localized impacts to air quality. Impacts will occur as a result of emissions from engine exhaust (criteria pollutants and GHGs) and fugitive dust generation during earth-moving and travel on unpaved roads. Dust may annoy existing residents and travelers and be deposited on surfaces at certain locations in public areas or near residences. Fugitive dust associated with vehicle travel on gravel roads and with agricultural practices is a normal occurrence in the Project area. Decommissioning may increase the amount of fugitive dust in some areas within Project area, but this would be temporary and last only during the decommissioning process.

No significant adverse effects to air quality would occur as a result of Project decommissioning under the Proposed Action or any other alternative.

5.3.1.3 Summary of Effects to Air Quality and Climate

There would not be significant differences among alternatives with regard to impacts to air quality. Under any of the alternatives, Project operations, maintenance, and decommissioning would have minor effects on air quality. Project operations would not produce greenhouse gases or contribute to the problems generally accepted to contribute to climate change issues.

No specific mitigation measures for air quality and climate will be implemented under any of the four alternatives.

5.3.2 Noise

Sound pressure level is measured in decibels (dB). The quietest sound level that can be heard by a healthy human ear is around 0 dB. A moderate sound level is 55 dB to 60 dB, about the level of normal conversation. What one considers to be loud becomes somewhat subjective; generally, sounds around 80 dB and higher often are interpreted to be loud. Sound frequency or tonality is measured in Hertz (Hz), and most sounds include a composite of frequencies. The normal range of healthy human hearing extends from 20 Hz to 20,000 Hz. Hearing sensitivity varies, and humans generally hear best in the frequency range of human speech, around 500 Hz to 4,000 Hz.

5.3.2.1 Impact Criteria

In Indiana, standards for wind projects, including those for noise, are defined at the county level. Both Tipton and Madison counties have standards for wind projects and procedures for siting approval.

Tipton County

In Tipton County, established noise limits are based on land use for evaluating predicted noise levels at a residence. Residence types are defined as participating (have turbines on property) or non-participating (no turbines on property). Noise limits are as follows:

Residence type	Noise limit (dBA) [1]
Non-participating	45
Non-participating on agriculture, commercial, or industrial zoned land	51
Participating	55

[1] Shall not exceed this value for a period >10% out of every hour.

Madison County

At no point within 200 feet of a primary residence may the sound pressure levels from a wind turbine exceed the following sound levels:

Octave band in Hertz (Hz)	Maximum permitted sound level (dB) measured 200 feet from edge of any primary structure
63	75
125	70
250	65
500	59
1,000	53
2,000	48
4,000	44
8,000	41

5.3.2.2 Direct and Indirect Effects

Project Operations

Ambient noise levels in the Project were not measured pre- and post-construction. WWF conducted predictive noise modeling for the Project prior to construction that showed compliance with local ordinances. WWF provided reports to Tipton and Madison counties regarding those results as part of their conditional use permit applications.

Across the four alternatives, daytime operations will have the same noise impacts. Turbines will operate at the 3.5 m/s cut-in speed and generate the same levels of noise. Project vehicles and maintenance repairs will generate the same levels of noise regardless of alternative. Conversely, nighttime noise would vary among alternatives based on the operational restriction implemented for bat mortality minimization.

Alternative 1: No Action Alternative
Under the No Action Alternative, the Project would operate at a cut in speed of 5.0 m/s from 30 minutes before sunset to 30 minutes after sunrise from March 15 through May 15 and a cut-in speed of 6.9 m/s from 30 minutes before sunset to 30 minutes after sunrise from August 1 through October 15 for the life of the Project. Under these restricted operations, on nights during these periods when wind speeds are less than the designated cut-in speeds, turbines would not be operating and emit no noise.

Alternative 2: Proposed Action
Under the Proposed Action, turbine operations will be curtailed at the raised cut-in speed of 5.0 m/s from sunset to sunrise when the ambient temperature is above 10°C (50°F) for the period from August 1 to October 15. This is a less restrictive operating regime than the No-Action Alternative. Generally speaking, on nights during this period when wind speeds are less than 5.0 m/s, turbines will not be operating and emit no noise.

Alternative 3: More Restrictive Operations
Under Alternative 3, turbine operations would operate at the cut-in speed of 6.5 m/s from sunset to sunrise when the ambient temperature is above 10°C (50°F) for the period from August 1 to October 15. Under these restricted operations, on nights during this period when wind speeds are less than 6.5 m/s, turbines would not be operating and emit no noise. This is a more restrictive operating regime compared to the Proposed Action and would likely emit less nighttime noise during the curtailment period.

Alternative 4: Less Restrictive Operations
Under Alternative 4, turbine operations would operate at the cut-in speed of 4.0 m/s from sunset to sunrise when the ambient temperature is above 10°C (50°F) for the period from August 1 to October 15. Under these restricted operations, on nights during this period when wind speeds are less than 4.0 m/s, turbines would not be operating and emit no noise. This is a less restrictive operating regime compared to the Proposed Action and would likely emit more nighttime noise during the curtailment period.

Project Decommissioning

Decommissioning activities would generate noise that will be audible at homes and public areas within and surrounding the Project area. The location and levels of noise from decommissioning activities will vary. Noise levels will be elevated mostly during daylight hours. Audible sounds may include heavy truck traffic, earthmoving equipment, and clanking metal tracks. Noise audible to surrounding residences or businesses would be similar to that of a few days to a few weeks of a typical road construction project or the sound of farm machinery operating on a nearby farm. No significant adverse effects associated with noise levels are expected from decommissioning activities under any of the four alternatives under consideration. Decommissioning noise is not expected to have adverse effects on receptors.

5.3.2.3 Summary of Effects Related to Noise

There is a potential for nighttime Project noise to vary among alternatives during the fall and when applicable, spring curtailment periods. However, nighttime noise is not expected to have adverse effects to receptors under any of the four alternatives. Under the Alternatives 2, 3, and 4 some residences will have increased nighttime noise levels compared with the No-Action Alternative. However, these differences are not expected to be significant. The predictive noise modeling assumed unrestricted operations and found Project noise levels would be in compliance with Tipton and Madison counties' noise standards.

5.4 SOCIOECONOMIC ENVIRONMENT

5.4.1 Economics

Pursuant to NEPA, effects to the human environment include those to socioeconomic conditions (40 CFR 1508.14). This section of the EA describes the effects of the four alternatives under consideration on socioeconomic conditions of Indiana, Madison and Tipton counties, and the incorporated Town of Elwood. Current socioeconomic conditions are described in Section 4.4.1.1.

This section addresses effects to economics associated with Project operations. We do not anticipate that the bat habitat mitigation projects will have significant effects to social or economic conditions in the region.

5.4.1.1 Impact Criteria

Effects would be considered significant if any of the following occurred as a result of implementing any of the four alternatives:

- Decline in local or regional employment;
- Decrease in local or regional property values;
- Decline in valuable community services; or
- Disproportionate share of adverse environmental effects placed on any minority or low-income community.

5.4.1.2 Direct and Indirect Effects

Project Operations and Maintenance

Implementation of any of the four alternatives would likely have the same effect, if any, on property values. Losses in property values in those lands in and surrounding the Project have not been documented. For one Project in Illinois, Hinman (2010) found an initial stigma associated with wind farms may have caused property values to diminish during the proposal and planning stage. However, property values rebounded and some increased around the facility once constructed. Similarly, Hoen et al. (2009) looked at data from roughly 7,500 homes situated within 10 miles of wind facilities and found no conclusive evidence of any widespread property value impacts in these communities. Specifically, Hoen et al. (2009) found no consistent, measurable, or statistically significant effect on home sales prices relative to the view of a wind facility or the distance of the home to the facility. Vyn and McCullough (2014) suggest wind turbines at one of Ontario, Canada's oldest wind projects have not significantly impacted nearby property values.

Implementation of any alternatives is not expected to result in reduced valuation in properties in and proximal to the Project area. No minority or low-income communities would be disproportionately affected by operation of the Project under any of the four alternatives.

Implementation of any of the four alternatives would result in an average of $1 million and $1.1 million in annual property taxes paid to Madison and Tipton counties, respectively. Implementation of any of the four alternatives would result in similar benefits to those community services that receive funding derived from taxes paid by WWF. The education systems in both counties are the principle beneficiary of funds derived from the Project.

Additional personal income is generated for residents in the local area and the state through circulation and recirculation of dollars in the form of the Applicant's as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services benefit businesses in Madison and Tipton counties and in Indiana.

Implementation of any of the four alternatives is not expected to affect community services such as water and wastewater services. Any of the four alternatives would have the same effect on those community-based services that derive funding from the tax revenue provided by the Project. Project operation and maintenance would not cause additional impacts on leading industries within the Project area. None of the four alternatives would indirectly affect those community-based services that derive funding from the tax revenue provided by the Project. Property taxes and the number of permanent jobs would not be affected.

Landowners with turbines receive royalty payments, which are in part based on the actual generation of the turbine on their land. As production is reduced, the landowner receives less income down to a minimum value. Energy production would be highest under Alternative 4, the 4.0 m/s alternative, followed logically by the 5.0 m/s, 6.5 m/s, and No-Action alternatives. Insufficient data exist to characterize the extent of the effect that restricted operations under any individual alternative would have on royalty payments to the landowners.

Impacts associated with maintaining the Project will not vary among the four alternatives. The Project is expected to need the same level of maintenance in the event or absence of operational restrictions. Effects to socioeconomic conditions from project maintenance will not vary among alternatives. The Project will necessitate approximately 8 to 10 full-time jobs to monitor and maintain the site and two to four seasonal jobs to conduct mortality monitoring.

Decommissioning Effects

There is little information on the effects to economic conditions associated with decommissioning large, commercial-scale wind farms. In the eastern U.S., older wind projects are only now approaching the decommissioning or re-powering stage. Impacts associated with decommissioning will not vary among the four alternatives, and WWF's decommissioning plan will be implemented regardless of the Project's operational regime. Implementation of any alternative is expected to require the same level of effort for decommissioning. During this stage, the added temporary labor force would have benefits to state and local economies. Total wages and salaries paid to contractors and workers would increase temporarily and contribute to the total personal income in the region. Additional personal income will be generated for residents in the local area and the state through circulation and recirculation of dollars derived from the burst in decommissioning activities. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services will benefit businesses in Madison and Tipton counties and in Indiana.

5.4.1.3 Summary of Effects to the Socioeconomic Environment

We do not anticipate there will be adverse effects to the socioeconomic conditions at the state or local levels as a result of any of the four alternatives under consideration. A disproportionate share of adverse environmental effects resulting from operation, maintenance, and decommissioning the Project would not be placed on any minority or low-income community. No specific mitigation measures for socioeconomics or environmental justice would be implemented under any of the four alternatives.

5.5 CUMULATIVE EFFECTS

The CEQ guidelines acknowledge, " . . .in a broad sense all the impacts on affected resources are probably cumulative." Nonetheless, it is important to "count what counts" and narrow the focus of the analysis to important national, regional, and local issues (CEQ 1997). The CEQ recommends the NEPA analysis should include those potential cumulative effects with direct influence on the agency's action and decision-making. Thus, as per the CEQ guidelines, resources that would not be impacted by the Proposed Action or action alternatives, have beneficial effects, or are only subject to temporary effects were excluded from this analysis (CEQ 1997).

Following the tiered approach recommended by the CEQ guidelines for analyzing cumulative effects, we focus our analysis on potential impacts to birds, Indiana bats, northern long-eared bats, and unlisted bats, as these are the only resources on which Project operations will have potentially adverse effects. Furthermore, only bats will be affected to varying degrees by the alternatives considered in this EA as we have assumed based upon the available studies that operational adjustments do not affect bird mortality. Similarly, this analysis largely focuses on cumulative effects of current, proposed, and projected wind energy development on birds and bats. We also analyze impacts associated with WNS for bats and other mortality sources for birds.

For decades, researchers have monitored bird mortality to some degree at other sources, such as communications towers and other tall structures. That wind projects would be a source of bird mortality is not surprising, and turbines can be stationary and pose a collision risk for birds. However, wind energy development has emerged as a new and substantial source of bat mortality in the past decade. While some level of bat mortality likely went unnoticed at wind projects previously, the rapid expansion of wind development and the increased awareness of bat mortality at wind turbines have revealed the potential for substantial cumulative impacts to bats from the wind industry. This mortality is particularly disconcerting in the wake of WNS and its fatal effects on cave-dwelling bats.

This section analyzes cumulative effects of the alternatives and other past, current, proposed, or reasonably foreseeable future actions on birds, Indiana bats, northern long-eared bats, and unlisted bats. The spatial scope of analysis for birds is the Partners in Flight Physiographic Area 31, the Prairie Peninsula (Figure 5-1; PIF 2000). The spatial scope of analysis for Indiana bats is the MRU, and for northern long-eared bats and unlisted bats, it is the Service's Region 3. The 27-year operational life of the project is the temporal scope for all animal resources.

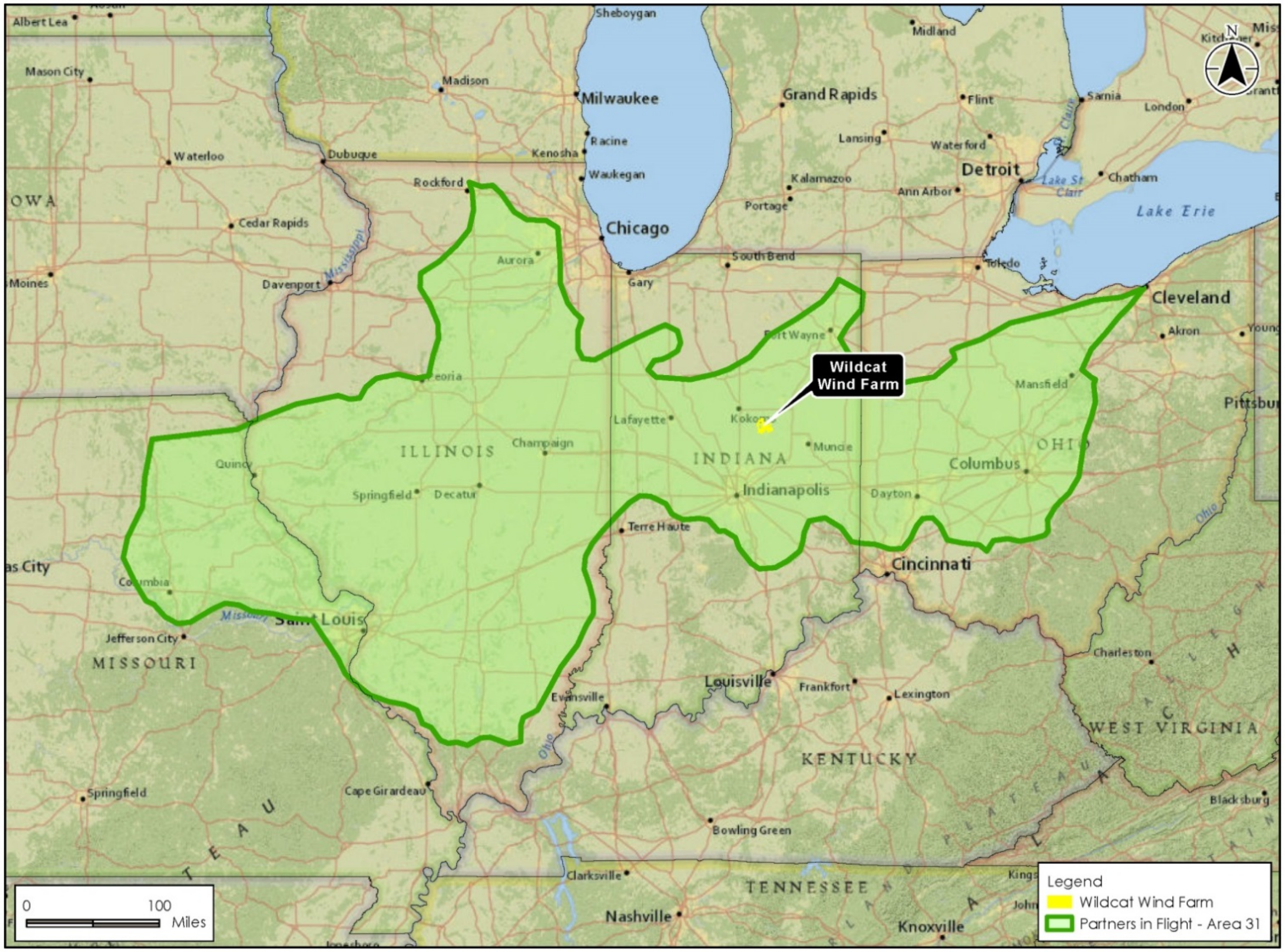

Figure 5-1. **Partners in Flight Physiographic Area 31.**

5.5.1 Wind Energy Development

According to 2015 data compiled by the American Wind Energy Association (AWEA 2015), 11,168 turbines totaling 18,265 MW are currently installed in the eight states that make up USFWS Region 3 (Table 5-14). Growth in the wind sector has been rapid over the previous few years, and the U.S. Energy Information Administration's energy forecasts recently indicated a nationwide growth rate of 2.2% annually for installed wind energy capacity between 2012 and 2040 (USEIA 2015). Applying this growth rate to installed and proposed capacity in the states in Region 3 over the 27-years of project operation, we estimate a total capacity of 33,593 MW in the Region by year 2043. We estimated wind energy development in the MRU by adding the estimates for Indiana, Michigan, Ohio, and Tennessee. Although the MRU includes Kentucky, northern Alabama, and the southwest tip of Virginia, no wind projects occur in these areas. Currently, the MRU includes 2,254 turbines, totaling 3,898 MW of installed capacity. Applying the same 2.2% annual growth rate to the installed capacity in the MRU yields an estimate of 4,466 turbines and 7,145 MW of installed capacity by year 2043.

Table 5-14. Installed and projected wind energy development in Service Region 3 and MRU.

	Current Installed [1]		**Projected growth up to 2043 (27 years)** [2]	
State	*# MW*	*# Turbines*	*# MW*	*# Turbines* [3]
Illinois	3,842	2,348	7,066	4,416
Wisconsin	648	417	1,192	745
Michigan	1,531	887	2,816	1,760
Minnesota	3,235	2,257	5,950	3,719
Iowa	6,212	3,658	11,425	7,141
Missouri	459	252	844	528
Indiana	1,895	1,096	3,485	2,178
Ohio	443	253	815	509
Region 3 Total	18,265	11,168	33,593	20,995
Tennessee	29	18	--	--
MRU Total [4]	3,898	2,254	7,145	4,466
Area 31 [5]	6,180	3,697	11,366	7,104

[1] From state fact sheets at AWEA.org showing installed capacity as of the end of 2015, accessed March 4, 2016.
[2] Assuming 2.2% annual growth, the nationwide trend estimated for net summer capacity for wind energy from 2016 to 2043 (USEIA 2015).
[3] Assuming 1.6-MW turbines, the average turbine size currently installed; MW divided by 1.6.
[4] MRU total based on sums from Indiana, Michigan, Ohio, and Tennessee. Tennessee has two wind projects with 29 MW and 18 turbines. Currently, there are no proposals for new wind projects in Tennessee. Hence growth projections only include estimates from Indiana, Michigan, and Ohio.
[5] Partners in Flight Physiographic Area 31 total based on sums from Ohio, Indiana, and Illinois. Area 31 also includes the northeast corner of Missouri, a part of the state where there are no wind projects.

Partners in Flight Physiographic Area 31 stretches from northeastern Missouri, across much of Illinois and through the middle of Indiana into Ohio (Figure 5-1) and is contained entirely within the Service's Region 3, covering approximately 39% of Region 3 in Illinois, Indiana, Missouri, and Ohio. We estimated wind energy development in Area 31 by adding the estimates for Indiana, Illinois, and Ohio. Although Area 31 includes the northeast corner of Missouri, no wind projects occur in this part of the state, and no new wind projects are currently proposed for Missouri. Currently, these three states have

3,697 turbines, totaling 6,180 MW of installed capacity. Applying the same 2.2% annual growth rate to the installed capacity in these three states yields an estimate of 7,103 turbines and 11,366 MW of installed capacity by year 2043.

We recognize that wind development, realistically, is likely to vary among states. Also, we derived these estimates using only one method among several that could be implemented. Nonetheless, our method represents a straightforward means of estimating reasonably foreseeable wind energy development in the Region.

5.5.2 Avian Resources

Our cumulative effects analysis for birds primarily focuses on mortality attributable to the Project in the context of other existing and future wind facilities in Partners in Flight Physiographic Area 31 (Area 31). This analysis also considers some other anthropogenic sources of bird mortality. We briefly discuss on a national scale those elements that are known to cause avian mortality. Researchers typically use data at the national scale to provide estimates of bird mortality from an anthropogenic source.

This analysis includes past and present actions and reasonably foreseeable future sources of impacts to birds during the 27-year operation of the Project. Based on our analysis of direct and indirect effects to avian resources in Section 5.2.3.2, the Project will kill, disturb, and displace birds due to Project presence and operations. We recognize that birds are likely to sustain these same effects at all wind projects in Area 31.

Wind Project Mortality

Based on mortality rates reported for 10 post-construction studies at wind power projects in the Midwest (see Appendix C, Table C-1), we estimate the Project's average rate of mortality will be 3.59 birds per turbine per year (2.24 birds per MW per year) resulting in 449 bird deaths per year of which roughly 70% will be passerines. This is roughly 3.4% of the total bird mortality from installed wind projects in Area 31. Based on the average mortality rate, over the permit term the Project will kill approximately 12,000 birds. This is roughly 2.2% of the total bird mortality estimated to occur from installed wind projects in Area 31 through year 2043. Table 5-15 shows a summary of the current and future cumulative effects of the Project and wind energy in Area 31.

Table 5-15. Cumulative bird mortality estimates at Wildcat Wind Farm and current and projected installed wind power capacity in the Partners in Flight Physiographic Area 31.

		Wildcat Wind Farm		Area 31				
		Annual mortality	27-year cumulative mortality	Annual mortality in 2015	Project % contribution to annual	Annual mortality in 2043	27-year cumulative mortality	Project % contribution to Region
Mortality rate (birds per turbine per year)		125 turbines	125 turbines	3,697 turbines[1]	125 turbines	7,104 turbines[2]	3,697-7,104 turbines	125 turbines
Minimum	0.33	41	1,114	1,220	3.4	2,344	~50,000	2.2
Maximum	11.83	1,479	39,926	43,736	3.4	84,039	~1.8 million	2.2
Mean	3.59	449	12,116	13,272	3.4	25,503	~541,000 thousand	2.2

[1] Current installed capacity in those states in Area 31 (Illinois, Indiana, and Ohio).
[2] Based on a projected annual growth of 2.2% a year (USEIA 2015).

We applied our Midwestern regional average avian mortality rate of 3.59 birds per turbine per year to the current installed capacity of wind projects in Area 31, 3,697 turbines. Using the mean rate, wind energy facilities in Area 31 currently kill roughly 13,000 birds each year. Again, about 70% of these fatalities will be passerines, i.e., 9,000 birds each year. As discussed, bird mortality at the Project is expected to be the same regardless of the alternative under which the Project operates, on average 449 birds per year. Therefore, the Project will contribute 3.4% of the annual bird mortality from wind projects in Area 31.

The rate at which wind energy will develop over the next 27 years is difficult to predict. We assumed installed wind energy capacity in Area 31 will grow by 2.2% annually, the rate estimated in USEIA (2015), resulting in approximately 7,104 turbines by year 2043. Based on the average rate of bird mortality (3.59 birds per turbine per year), wind projects in Area 31 may kill more than 500,000 birds over the permit term (range ~13,000 to 26,000 annually).

In Appendix C, Table C-1 lists bird species and numbers documented during post-construction monitoring at projects in the Midwest. This list includes four Birds of Conservation Concern for Bird Conservation Region 22 (USFWS 2008), where the Project is located. Carcass searches during monitoring at these wind projects found two pied-billed grebes, two grasshopper sparrows, one black-billed cuckoo, and one loggerhead shrike out of 245 birds, a combined total over several years. We do not expect that wind projects in either Bird Conservation Region 22 or Partners in Flight Physiographic Area 31 will cause population-level effects to avian resources, even those species of conservation concern.

5.5.2.1 Anthropogenic Sources of Avian Mortality Other than Wind Power Facilities

Discussed below and included in Table 5-16 are estimates of anthropogenic sources of bird mortality for the U.S. in general. We recognize that the national level is not the cumulative effects analysis area selected for birds in this EA. However, similar data scaled to any region of the U.S. are not available.

Table 5-16. Estimated annual avian mortality from anthropogenic causes in the U.S.

Mortality source	Estimated annual mortality	% of overall mortality
Depredation by domestic cats	1.4–3.7 billion	71-75
Collisions with buildings (including windows)	97-1,200 million	5-23
Collisions with power lines	130-174 million	3-7
Legal harvest	120 million	6
Automobiles	50-100 million	2-3
Pesticides	67-72 million	4
Communication towers	4-50 million	<1
Oil pits	1.5-2 million	<1
Wind turbines	20,000-440,000	<1
Total mortality	1.9-5.2 billion	

Sources: USFWS (2002), Erickson et al. (2005), Thogmartin et al. (2006), Dauphiné and Cooper (2009), Manville (2009), Loss et al. (2013).

Communication Towers

Avian collisions with communication towers in the U.S. present a significant source of annual mortality, particularly for nocturnally migrating songbirds; namely warblers, vireos, and thrushes (Erickson et al. 2005). Erickson et al. (2005) suggest the number of communication towers in the U.S. may be as high as 200,000 towers; and that 5,000 to 10,000 new towers are being built each year. Cellular, radio, and television towers range in height from less than 100 feet to over 2,000 feet (Kerlinger 2000). Mortality estimates range from 4-5 million to 40-50 million birds per year in the U.S. and involve over 230 species (Kerlinger 2000, Shire et al. 2000, Erickson et al. 2005, Manville 2005, Thogmartin et al. 2006). Collisions occur throughout the year but are most frequent during migration periods. Studies indicate fatality rates are highest at taller, guyed towers (Gehring et al. 2009, 2011). Data associate higher collision rates at pulsating beacons and steady burning FAA obstruction lighting as compared to towers lit only with flashing or white-strobe beacons (Erickson et al. 2005, Gehring et al. 2009, 2011). During nights with fog or low, cloud-ceiling heights, researchers believe nocturnal migrants become disoriented by strobe or steady burning lights on towers (Erickson et al. 2005). Estimates of mean annual collisions per tower have ranged from 82 birds per year at a 250-meter (825 feet) tower in Alabama, to 3,199 birds per year at a 305-meter (1,000-foot) tower in Wisconsin (Erickson et al. 2005).

Buildings

USEIA (2008) estimates there were 4.9 million commercial buildings in 2003. More than 130 million residential housing units existed in the U.S. in 2009 (U.S. Census Bureau 2011). Estimates of collisions with buildings and windows suggest a range of 97 million to 1.2 billion bird deaths per year (Erickson et al. 2005, Thogmartin et al. 2006). Loss et al. (2014) estimate that between 365 and 988 million birds (median 599 million) are killed annually by building collisions in the U.S. The vast majority of avian collisions with buildings and windows involve passerines (Erickson et al. 2005). A study conducted in 1996 in Toronto, Ontario estimated 733 avian fatalities per building per year (Erickson et al. 2005). A study of avian collisions with residential windows indicated that avian fatalities range from 0.65 to 7.7

birds per house per year (Erickson et al. 2005). Collisions with other tall structures such as smoke stacks are estimated to result in tens to hundreds of thousands of collisions.

Power Lines

Manville (2005) estimated that there are collectively 500,000 miles of transmission lines in the U.S. There is an estimate of 116,531,289 distribution poles in the U.S. An accurate estimate of the collective distance of distribution lines is not feasible, but Manville (2005) suggests the length may be in the millions of miles. In general, avian collision and electrocution mortality at power transmission and distribution lines are not systematically monitored or subject to observational biases. Collision estimates range from hundreds of thousands to 175 million birds annually, and estimates of electrocutions range from tens to hundreds of thousands of birds annually. Raptors, particularly eagles, are most commonly reported for collision or electrocution with transmission or distribution lines in the U.S. (Manville 2005).

The species composition of birds involved in power line collisions is largely dependent on location. For example, power lines located in wetlands have resulted in collisions of mainly waterfowl and shorebirds; while power lines located in uplands and away from wetlands have resulted in collisions of mainly raptors and passerines (Erickson et al. 2005, Manville 2005).

Legal Harvest

Banks (1979 as cited in Thogmartin et al. 2006) estimated that 120 million game birds are legally harvested by hunters each year in the U.S. State and federal wildlife managers' census waterfowl and monitor harvests annually. These data are used to regulate harvest levels through bag limits such that hunting does not contribute to population declines.

Vehicles and Airplanes

Vehicle strikes are estimated to result in 50 million to 100 million avian fatalities per year (Thogmartin et al. 2006). Numbers and species involved in vehicle collisions are dependent on habitat and geographical location (Erickson et al. 2005). Including both United States Air Force and civil aircraft strikes, it is estimated that over 28,500 avian collisions occur each year (Erickson et al. 2005). The majority of bird species involved in airplane strikes includes gulls, waterfowl, and raptors (Erickson et al. 2005).

Pesticides

The USDA 2007 Census of Agriculture (USDA 2009) indicates there were approximately 406.5 million acres of cropland in the U.S. Pesticides are used on the vast majority of U.S. cropland, totaling approximately 359,622,774 acres. This value is based on the agricultural census and does not include those acres treated with pesticides associated with other commercial uses (e.g., utility corridors, forest management, golf courses) or residential use. Piemental et al. (1991 as cited by USFWS 2002) estimate 67.2 million birds die from exposure to pesticides in the U.S. annually. Other estimates indicate 72 million pesticide-related avian fatalities per year (USFWS 2002). One study indicated that there are 0.1 to 3.6 avian fatalities per acre of pesticide-treated cropland (Mineau 1988 as cited by Erickson et al. 2005).

Domestic Cats

Dauphiné and Cooper (2009) estimate that 117 to 157 million feral and free-ranging domestic cats within the U.S. kill at least 1 billion birds annually. Loss et al. (2013) estimate that free-ranging domestic cats kill 1.4 to 3.7 billion birds annually in the U.S. Based on these estimates and others (Manville 2005, Erickson et al. 2005), cat predation is considered the most significant anthropogenic source of bird mortality in the U.S. (Dauphiné and Cooper 2011). Butchart et al. (2006) cited domestic cats as significant threats to rare, threatened, and endangered birds and sources of species extinction worldwide.

Habitat Loss and Displacement

In Area 31, avian resources have experienced impacts due to land conversion (habitat loss) associated with oil and gas development, urbanization, agriculture, and residential development. All of these activities are likely to continue into the reasonably foreseeable future. Most of these land conversion activities often include extensive road networks.

Agriculture activities, urbanization, and residential development convert habitat for the length of time that the development is maintained. Development that results in pavement (asphalt, concrete) results in an extreme conversion of habitat with a very slow recovery rate unless pavement is removed. Conversely, some active agricultural lands may become inactive and revert to native habitats within the 28-year permit term.

Reasonably foreseeable future actions in the Project area for the next 27 years that will affect avian resources include low-density development for residences. This will largely affect those birds that are likely to use agriculture lands.

5.5.2.2 Summary of Cumulative Effects to Avian Resources

We acknowledge that bird mortality at wind projects does contribute to overall mortality. Compared to other anthropogenic sources of avian mortality (see Table 5-16), the effect of avian mortality at wind energy facilities is minor.

None of the alternatives considered is expected to cause naturally occurring populations of common birds to be reduced to numbers below levels for maintaining viability at local or regional levels. The alternatives will not result in substantial losses or degradation of habitat for a rare, threatened, or endangered animal species. None of the alternatives is expected to result in substantial changes in habitat conditions producing indirect effects that cause naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels. The conversion of approximately 50 acres of agricultural land to developed land cannot be considered a major loss of this habitat type given the Project is located in a landscape dominated by extensive agriculture.

Project mortality will contribute cumulatively to other causes of mortality, specifically wind projects and other anthropogenic sources as described above. Less than 0.1% of all anthropogenic bird mortality is attributed to wind projects (Table 5-16). The Service finds that this amount of bird mortality is not likely to result in population-level impacts to any species of bird. To be implemented under any of the four alternatives, the BBCS includes a monitoring plan and adaptive management framework designed to monitor bird mortality and respond to significant events should they occur.

5.5.3 Bat Resources

5.5.3.1 Wind Project Mortality

Our cumulative effects analysis for bats primarily focuses on mortality attributable to the Project in the context of other existing and future wind facilities in Region 3 and the MRU for the Indiana bat. This analysis also considers the effects of WNS and habitat impacts.

This analysis includes past and present actions and reasonably foreseeable future sources of impacts to bats during the 27-year operation of the Project. Based on our analysis of direct and indirect effects to bat resources in Section 5.2.4.6, the Project has the potential to kill bats during operations. We recognize that bats will sustain these same effects at all wind projects in Region 3.

Indiana Bats

Six Indiana bat fatalities have occurred at wind projects in the MRU, with five of these fatalities occurring in fall and one in spring (Table 5-5). Any project within the MRU has the potential to take an Indiana bat during the fall or spring migratory season. At the Fowler Ridge Wind Farm, 2 years of monitoring led to a baseline mortality estimate of 0.05 Indiana bats per turbine per fall (0.03 Indiana bats per MW per fall) at fully operational turbines.[2] Applying this same estimate to the current installed wind energy capacity in the MRU (2,254 turbines and 3,898 MW) yields between 100 and 200 Indiana bats taken per year within the MRU. By year 2043, the annual take estimate will be between 200 and 350 Indiana bats based on the projected wind development indicated in Table 5-14. This represents 0.13% of the 2015 Indiana bat population in the MRU (259,508 bats). Summing the mortality over the permit duration results in approximately 7,600 Indiana bats taken by wind projects cumulatively in the MRU over the next 27 years (Table 5-17). This estimate assumes no operational curtailment, no mitigation benefit, and baseline Indiana bat populations remain constant, none of which is a likely scenario. However, this represents a worst-case scenario for the purposes of assessing cumulative effects of wind projects and the contribution of each alternative to the cumulative impact.

Table 5-17 provides a summary of cumulative effects to bats from each of the analyzed alternatives and from the future installed capacity of wind projects in the MRU. The Service predicts the No-Action Alternative for the Project is unlikely to result in Indiana bat mortalities and, therefore, will not contribute to cumulative impacts to Indiana bats. The Proposed Action will take an estimated three Indiana bats per year and 81 bats over the duration of the permit, accounting for 1.1% of the cumulative take estimated for the MRU during the same period. The More Restrictive Alternative would take an estimated 1.4 Indiana bats per year and 39 Indiana bats over the full permit duration, accounting for 0.5% of the cumulative take estimated for the MRU during this period. Lastly, the Less Restrictive Alternative would take an estimated 3.2 Indiana bats per year and 86 Indiana bats over the full permit duration, accounting for 1.2% of the cumulative take estimated for the MRU during this period. The action alternatives are not substantially different in the extent to which they contribute to cumulative impacts to Indiana bats, particularly considering that the Applicant would offset estimated take associated with Alternatives 2, 3, and 4 using mitigation of summer habitat.

[2] The per turbine and per MW rates used here are from one wind project, Fowler Ridge. Because the ratio of MW to turbines will change from project to project and within a group of projects, one will derive a range of mortality when applying both the per turbine and per MW rates simultaneously.

Table 5-17. Cumulative effects to Indiana bats, northern long-eared bats, and unlisted bats from the Wildcat Wind Farm and projected installed wind power capacity in the Midwest.

Species	Impact	1: No-Action 125 Turbines	2: Proposed Action 125 Turbines	3: More Restrictive 125 Turbines	4: Less Restrictive 125 Turbines	MRU 2043 Wind Installation, 4,466 Turbines[1]	Region 3 2043 Wind Installation, 20,995 Turbines[1]
Indiana bat	Annual mortality	0	3.0	1.4	3.2	357	--
	Cumulative mortality	0	81.0	38.9	85.9	~7,600	--
	Project % contribution to cumulative mortality	0	1.1	0.5	1.1	--	--
Northern long-eared bat	Annual mortality	0	1.5	0.7	1.6	--	506
	Cumulative mortality	0	41.0	19.4	42.9	--	~11,000
	Project % contribution to cumulative mortality	0	0.4	0.2	0.4	--	--
Unlisted bats	Annual mortality	551	2,189	1,209	2,465	--	~434,000
	Cumulative mortality	~15,000	~59,000	~33,000	~67,000	--	~9 million
	Project % contribution to cumulative mortality	0.17	0.66	0.36	0.72	--	--

[1] Estimation of MRU and Region 3 mortality assumes all projects will operate with no adjustments (curtailment or feathering). Indiana bat fatality rate is 0.05 bats per turbine per fall (0.03 bats per MW per fall). Northern long-eared bat fatality rate is 0.02 bats per turbine per fall (0.01 bats per MW per fall). Unlisted bat mortality rate is 20.67 bats per turbine per year (12.64 bats per MW per year), the average of rates observed at eight wind projects over multiple years (shown in Table 5-7).

Northern Long-eared Bats

Publicly available post-construction monitoring results in Region 3 reported two northern long-eared bat fatalities at two wind projects (Table 5-6). However, any project within the species' range has the potential to take northern long-eared bats, particularly during the fall migratory season. Such was the case for the one documented fatality at Fowler Ridge over 3 years of monitoring leading to a baseline mortality estimate of 0.024 northern long-eared bats per turbine per fall (0.014 bats per MW per fall) at fully operational turbines. Applying this same estimate to the current installed wind energy capacity in Region 3 (11,168 turbines) yields 269 northern long-eared bats taken each year within Region 3. By year 2043, the annual take estimate will be roughly 506 northern long-eared bats based on the projected wind development indicated in Table 5-14. Summing the annual mortality over the operational life of the Project (27 years) results in approximately 11,000 northern long-eared bats taken by wind projects cumulatively in Region 3 (Table 5-17). This estimate assumes no operational curtailment and no mitigation benefit, neither of which will be a likely scenario. However, this represents a worst-case scenario for the purposes of assessing the contribution of each alternative to the cumulative totals.

The Service estimates there are 2,785,032 northern long-eared bats in the Midwest region (USFWS 2016*b*). An annual mortality of 506 northern long-eared bats is 0.02% of the regional population. The 27-year cumulative mortality of roughly 11,000 is 0.39% of the regional population. We conclude that this extent of mortality at the Project-level and regional-level is not likely to lead to population-level declines in northern long-eared bats.

Table 5-17 provides a summary of cumulative effects to bats from each of the analyzed alternatives and from the future installed capacity of wind projects in Region 3. The Service predicts the No-Action Alternative for the Project is unlikely to result in northern long-eared bat fatalities and, therefore, will not contribute to cumulative impacts to northern long-eared bats. The Proposed Action will take an estimated 1.5 northern long-eared bats per year and 41 individuals over the course of the permit duration, accounting for 0.4% of the cumulative take estimated for Region 3 during the same period (Table 5-17). The More Restrictive Alternative would take an estimated 0.7 northern long-eared bats per year and 19.4 northern long-eared bats over the permit duration, accounting for 0.2% of the cumulative take estimated for Region 3 during this period. Lastly, the Less Restrictive Alternative would take an estimated 1.6 northern long-eared bats per year and 42.9 northern long-eared bats over the permit duration, accounting for 0.4% of the cumulative take estimated for Region 3 during this period.

The action alternatives are not substantially different in the extent to which they contribute to cumulative impacts to northern long-eared bats, particularly considering that the Applicant would offset estimated take associated with Alternatives 2, 3, and 4 through implementation of summer and/or winter habitat mitigation.

Unlisted Bats

Rates of mortality of unlisted bats vary substantially among projects and depend to a large extent on operational decisions and turbine characteristics, both of which are subject to change over time as the wind industry grows and becomes more sophisticated. Nevertheless, for the purposes of assessing cumulative impacts to unlisted bats, we use an average mortality rate of 20.67 bats per turbine per year (12.64 bats per MW per year), which is based on publicly available information from eight wind projects in Region 3 (Table 5-7). The bat fatality rates from these projects were based on uncurtailed operations, and roughly 80% of the fatalities were migratory tree-roosting bats (eastern red bat, hoary bat, and silver-haired bat). We assumed this rate is applicable for all wind projects in Region 3 and will remain constant during the 27 years of Project operation. Applying this rate to the 11,168 turbines currently installed in Region 3 yields a mortality estimate of roughly 231,000 unlisted bats, and 185,000 of these will be migratory tree-roosting bats. Applying this rate to the projected installed capacity of 20,995 turbines in year 27 of the permit (year 2043) indicates annual mortality of approximately 434,000 unlisted bats in Region 3, for a cumulative total of roughly 9 million bats taken during this 27-year period, of which more than 7 million will be migratory tree-roosting bats. We have assumed that the rate of 20.67 bats per turbine per year is the appropriate rate, but regional fatality rates for bats are likely to be less as operational curtailment is becoming more common and may significantly reduce unlisted bat mortality regionwide. Nonetheless, this value provides a reasonable fatality rate for estimating cumulative effects to bats in Region 3.

Cumulative mortality for unlisted bats across the four alternatives ranges from roughly 15,000 bats to 67,000 bats over the 27 years the Project will operate, accounting for less than 1% of cumulative mortality for Region 3, with the Proposed Action accounting for 59,000 bats or 0.66% of cumulative mortality (Table 5-17). The action alternatives are not substantially different in the extent to which they contribute to cumulative impacts to unlisted bats. Additionally, mortality of unlisted bats at the Project is not expected to be a significant addition to the cumulative bat mortality at wind energy facilities in Region 3, particularly with implementation of operational adjustments.

Looking at future wind project development, it is impossible to determine to what extent the cumulative estimate of 9 million bat fatalities over 27 years causes population level impacts to unlisted bats as no baseline population estimates exist for unlisted species. This particularly applies to the migratory tree-roosting bat species, the species group most susceptible to wind turbine mortality. Although implementation of any action alternative will require the Applicant to offset estimated take of listed bats using mitigation measures, it is unknown if these measures will provide any benefit to the migratory tree-roosting bats.

Operational decisions made by individual wind projects will have a substantial effect on cumulative bat mortality on a regional level. Because bats are relatively long-lived and reproduce at a slow rate, removal of a substantial number of adults from the population is more likely to have adverse effects on bat populations than similar impacts to a species group with higher fecundity (Kunz et al. 2007*a*, *b*; NRC 2007).

5.5.3.2 White-nose Syndrome

WNS has emerged as the largest single source of mortality for cave-hibernating bats in recent years. As of April 2015, WNS has been confirmed in 28 states and five Canadian provinces and as far west as Jackson County, Missouri (USFWS 2015*c*). Current estimates of total bat mortality reach 6.7 million bats since discovery of the disease in 2006 (USFWS 2012*c*). Turner et al. (2011) documented an 88% decline in overall numbers of hibernating bats comparing pre- and post-WNS counts at 42 sites in five northeastern states with declines varying by species. At these sites, northern long-eared bats decreased by 98%, little brown bats by 91%, tri-colored bats by 75%, Indiana bats by 72%, big brown bats by 41%, and eastern small-footed bats by 12% (Turner et al. 2011). To date, WNS has not been documented in migratory tree-roosting bat species (hoary bat, silver-haired bat, eastern red bat), which account for the majority of wind turbine related mortality.

The Service estimated a decline of 46% in the number of Indiana bats across the Appalachian Mountain Recovery Unit between 2011 and 2013 (USFWS 2013*d*) more than likely due to WNS, while Indiana bat mortality estimates in individual hibernacula have reached 100% (Turner et al. 2011). This does not necessarily represent the total decline due to WNS, although certain northeastern bat populations appear to be stabilizing or even increasing gradually several years following the initial discovery of WNS. As of winter 2015, the disease has been confirmed in multiple hibernacula in the MRU. Mortality associated with the disease in the MRU and Region 3 could be similar to that documented in the Appalachian Mountain Recovery Unit. A 46% decline in Indiana bat population in the MRU from 2011 will amount to a loss of nearly 142,000 Indiana bats. Such a decline in Indiana bat populations across the region would likely reduce the probability of Indiana bat mortality at wind projects, but would also increase the ecological impact of all sources of mortality.

As described in the HCP (see Section 8.2.2.3), if the USFWS determines that declines in the Indiana bat population in the MRU and/or northern long-eared bat population locally constitutes a changed circumstance, the Project will reassess the degree to which the authorized take impacts the population and will determine whether additional minimization or mitigation measures are warranted.

5.5.3.3 Habitat Loss and Fragmentation

Cumulative impacts of land use conversion and habitat fragmentation on bats in the Midwest have largely taken place in the past, as agricultural land use has dominated the region for decades. Construction of the Project and most other Midwestern wind projects does not result in additional forest clearing and may even create forested habitat through efforts to mitigate impacts to bats. Therefore, the Project and expansion of wind energy in the region are not expected to contribute to any incremental cumulative effects of summer bat habitat loss.

Similarly, winter bat habitat (caves and mines) are relatively static features on the landscape and are not being threatened by specific threats associated with habitat loss. WNS may have drastic impacts on hibernating bat populations, but will not alter the physical characteristics of hibernacula.

5.5.3.4 Summary of Cumulative Effects to Bat Resources

We acknowledge that bat mortality at wind projects contributes to overall bat mortality, and the Project mortality will contribute cumulatively to other wind project mortality. Compared to the effects of WNS, cave-dwelling bat mortality at wind energy facilities is minor. However, wind energy facilities kill more migratory tree-roosting bats than any other known documented source.

All four alternatives will contribute cumulatively to effects associated with bat mortality. Based on results of post-construction monitoring (Stantec 2014*a*, *b*, 2015), we find that the No-Action Alternative will result in a relatively small amount of bat mortality (Table 5-10 and Table 5-11). Among the three action alternatives, Alternative 3 will contribute the least to cumulative bat mortality, and Alternative 4 will contribute the most. Under any of the four alternatives, there will be some impact associated with either avoidance or displacement should bats react to the presence of turbines. However, the extent of this effect is unknown.

As compared to the No-Action Alternative, the Applicant's Proposed Action will increase annual mortality of unlisted bats by nearly 400%. The Applicant's Proposed Action also includes mitigation to offset mortality to Indiana bats and northern long-eared bats and may benefit other bats. The HCP, as part of the Applicant's Proposed Action, and BBCS, for all alternatives, both include a monitoring plan and adaptive management framework designed to monitor bat mortality and respond to significant bat mortality should it be identified.

By 2043, the cumulative impact of wind power projects in Region 3 is predicted to result in mortality of roughly 9 million unlisted bats, most of these being migratory tree-roosting bats (>80%). The effect of cumulative mortality on unlisted bat populations is highly uncertain because estimates of current population sizes are unknown.

Under the Applicant's Proposed Action, bat mortality will be reduced by 50% or more due to the curtailment strategy. We cannot assess completely the cumulative effect of wind mortality on Indiana bats in the MRU and on northern long-eared bats in Region 3 in combination with WNS. Possibilities include a synergistic effect of two new stressors affecting the species at the same time. It is also possible that as the population of either species is reduced by WNS, the numbers of bats taken at wind facilities will also be reduced. However, the impacts of taking fewer bats are likely to increase because each individual will become more important. Research into these questions is ongoing and will likely focus in part on how these new stressors will affect rare bat populations and ecology.

In Section 8.2.2, the Applicant's HCP discusses changed circumstances and the Applicant's proposed measures for addressing them should they occur, including those circumstances surrounding WNS (Section 8.2.2.3 in the Project HCP). The responses are designed to reduce the impact to the MRU population of Indiana bats and local population of northern long-eared bats if the Service finds reduced population numbers brought about by WNS. In addition, it is reasonable to assume that other wind projects regulated under the ESA would have similar measures in place. This would presumably lessen the cumulative impact of wind project mortality on the MRU population of Indiana bats and local population of northern long-eared bats.

CHAPTER 6. CONSULTATION AND COORDINATION

6.1 CONSULTATION AND COORDINATION

6.1.1 AGENCY COORDINATION

In support of their application to build a wind energy project in Tipton and Madison counties, the Applicant consulted with the Service, IDNR, Indiana State Historic Preservation Agency (IHPA), and other state and local agencies. The Service has engaged IDNR in discussions on possible sites for conducting projects suitable for mitigating the unavoidable impacts of taking Indiana bats and northern long-eared bats.

6.1.2 DISTRIBUTION OF THE DRAFT EA

In accordance with NEPA, the Draft EA was circulated for public review and comment on June 17, 2016. The public review period was initiated with the publication of the Notice of Availability (NOA) in the Federal Register, and the public comment period extended for 45 days from the date of publication ending on August 4, 2016. During this time, the Service received no comments on the Draft EA.

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CHAPTER 8. REFERENCES

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APPENDICES

APPENDIX A: Wildcat Wind Farm

Bird and Bat Conservation Strategy

Bird and Bat Conservation Strategy

Wildcat Wind Farm
Tipton and Madison Counties, Indiana

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1.0 INTRODUCTION

Wildcat Wind Farm, LLC (WWF), a wholly owned subsidiary of E.ON Climate & Renewables, North America (E.ON), developed and is operating the Wildcat Wind Farm (Project) in Tipton and Madison Counties, Indiana (Figure 1). The Project is designed to generate approximately 200 megawatts (MW) with 125 1.6-MW wind turbine generators (WTGs) and associated operations and maintenance building, access roads, collector line system, and substation. The Project began Commercial Operation on 19 January, 2012.

1.1 PURPOSE OF THE BIRD AND BAT CONSERVATION STRATEGY

Wind energy is one of the fastest-growing sources of renewable energy in the United States. Construction and operation of wind energy projects provides a competitive source of inexhaustible, zero-emissions energy to meet the nation's rapidly growing energy demands, but does have the potential to impact bird and bat populations through habitat fragmentation, displacement, and mortality due to collision with or proximity to WTG blades (NWCC 2010). WWF has developed this Bird and Bat Conservation Strategy (BBCS) in a good faith effort to avoid and reduce potential impacts to birds and bats at the Project. This BBCS is a living document that will evolve in response to Project conditions. It will remain in effect through the life of the Project and will complement the Habitat Conservation Plan (HCP) developed and implemented in connection with the issuance of an Incidental Take Permit (ITP) for Indiana bats and northern long-eared bats issued pursuant to Section 10(a)(1)(B) of the federal Endangered Species Act (ESA).

Specific goals of the Wildcat Wind Farm BBCS are to:

1) Develop measures that will avoid and reduce potential impacts to birds and bats during operation, maintenance, and decommissioning of the Project;
2) Ensure the potential for impacts to protected and sensitive bird and bat species is reduced;
3) Develop effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project.

1.2 REGULATORY FRAMEWORK

1.2.1 Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, injuring, or capture of listed migratory birds. Neither the MBTA nor its implementing regulations found in 50 CFR Part 21 provide for the permitting of "incidental take" of migratory birds that may be killed or injured by wind turbines. While the MBTA has no provision for allowing unauthorized take, the USFWS recognizes that some birds may be taken during normal commercial practices, despite adhering to "best management practices" to avoid and minimize impacts. In its Voluntary Land Based Wind Energy Guidelines, the USFWS indicated that it will regard "voluntary adherence and communication as evidence of due care with respect to avoiding, minimizing, and mitigating significant adverse impacts to species protected under the MBTA" (USFWS 2012). WWF has voluntarily implemented several pre-construction avian studies to assess the occurrence of migratory birds within the Project area, and communicated the results of these studies to the USFWS as evidence of due care. Additionally, WWF has conducted post-construction monitoring for the first three years of Project operations.

To further avoid and reduce potential impacts to species protected under the MBTA at the Project, WWF will implement this BBCS throughout the remaining life of the Project. This BBCS incorporates the results of pre-construction avian use surveys within the Project area, patterns of bird mortality observed at the Project to date and reported at other wind energy facilities in the Midwest, and recommendations obtained through consultation with the Service and the Indiana Department of Natural Resources (IDNR) for reducing impacts to birds. Avoidance and minimization measures for reducing impacts to MBTA-listed species at the Project were developed based on these data and are described in this BBCS.

1.2.2 Bald and Golden Eagle Protection Act (16 U.S.C §§ 668-668d)

The Bald and Golden Eagle Protection Act of 1940 (BGEPA), and its implementing regulations provide additional protection to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) such that it is unlawful to take an eagle. In this statute, the definition of "take" is to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest, or disturb (16 U.S. Code § 668c)." The term "disturb" is defined in regulations to include "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" (50 C.F.R. § 22.3).

The Service published a final rule (Eagle Permit Rule) on September 11, 2009 under BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles ''for the protection of...other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (74 FR 46836-79).

On May 5, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance [ECPG]: Module 1 – Land-based Wind Energy, Version 2 (78 FR 25758). The ECPG provides a means of compliance with BGEPA by providing recommendations for:

- Conducting early pre-construction assessments to identify important eagle use areas;
- Avoiding, minimizing, and/or compensating for potential adverse effects to eagles; and,

- Monitoring for impacts to eagles during construction and operation.

The ECPG interprets and clarifies the permit requirements in the regulations at 50 C.F.R. 22.26 and 22.27, and does not impose any binding requirements beyond those specified in the regulations.

As it does for other MBTA-listed species, this BBCS incorporates site-specific, regional, and agency information and measures developed based on this information to avoid and reduce impacts to bald and golden eagles at the Project.

1.2.3 Endangered Species Act (16 U.S.C. §§ 1531-1544)

The purpose of the ESA is to provide a means whereby the ecosystems upon which threatened and endangered species depend may be conserved, and to provide a program for the conservation of such species.

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered; under Federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation. Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species, or attempt to engage in any such conduct" (ESA §3(19)).

The Service's implementing regulations further define the term "harm" to mean "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 C.F.R. § 17.3). They also define harass 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 C.F.R. § 17.3).

The 1982 amendments to the ESA established a provision in Section 10 of the ESA that allows for "incidental take" of endangered and threatened species of wildlife by non-Federal entities. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (50 C.F.R. § 402.02). Section 10 of the ESA establishes a program whereby persons seeking to pursue activities that otherwise could give rise to liability for unlawful "take" of federally-protected species as defined in Section 9 of the ESA, may receive an ITP, which exempts them from such liability. Under Section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

WWF is currently developing an HCP and working to obtain an ITP (Section 10(a)1(B)) for the Indiana and northern long-eared bat. WWF has also developed a Mortality Minimization and Monitoring Proposal (MMMP) to ensure the Project is in compliance with the ESA until the HCP is approved and an ITP is received. WWF received a Technical Assistance Letter from the Service indicating that the Project, operated under the terms of the MMMP, is not expected to take any Indiana bats (*Myotis sodalis*). The northern long-eared bat (*Myotis septentrionalis*) was proposed for listing after the TAL was issued, but it is assumed that all avoidance measures for Indiana bats are also relevant to northern long-eared bats. WWF intends this BBCS to serve as a complimentary document to the HCP that demonstrates the measures taken to avoid and minimize the Project's impacts to birds and bats not listed under the ESA. Upon issuance of the ITP the HCP and this BBCS shall take effect and the MMMP and TAL shall no longer apply.

1.2.4 Indiana Nongame and Endangered Species Conservation Act (Ind. Code § 14-22-34 et seq.)

The Indiana Nongame and Endangered Species Conservation Act (INESCA) is maintained by the Office of Code Revision Indiana Legislative Services Agency. Any species or subspecies of wildlife whose survival or reproductive parameters are in jeopardy or are likely to be within the foreseeable future and any species or subspecies designated under the Federal ESA are deemed endangered species under INESCA (Ind. Code § 14-22-34-1).

INESCA prohibits the unlawful taking or possession of designated endangered species (Ind. Code § 14-22-34-12), but authorizes the director of the IDNR to permit take "for scientific, zoological, or educational purposes, for propagation in captivity or the wildlife, or for other special purposes" (Ind. Code § 14-22-34-15). While there is no general provision under the Act for a permit authorizing incidental take, Section 14-22-34-17 authorizes the director to adopt such rules as are necessary to carry out the purposes of the Act. Pursuant to that section, the IDNR has adopted rules authorizing the agency to issue limited take permits to individuals, organizations, corporations or government agencies (312 Ind. Admin. Code 9-10-18). This administrative rule was specifically designed in a manner that complements the federal HCP/ITP program.

1.3 BBCS TERM

This BBCS will be in effect through operation, maintenance, and decommissioning of the Project (Term). This Term will cover the 30-year life of the Project. WWF will update this BBCS, as needed, including through adaptive management as set forth in Section 5.2, throughout the Term. Should the Project be re-powered at the end of the Project's expected life, the BBCS will automatically renew and remain in effect until the Project is decommissioned.

1.4 BBCS PROJECT AREA

This BBCS applies to all those lands leased by WWF for construction and operation of the Project (Figure 1). These lands include the locations for all 125 turbines and associated Project facilities.

2.0 PROJECT DESCRIPTION

Wildcat Wind Farm is a state-of-the-art wind energy facility located in Tipton and Madison counties, Indiana, immediately north of the town of Elwood and east of Windfall City (Figure 1). The Project is designed to generate approximately 200 MW with 1.6-MW WTGs and associated operations and maintenance building, access roads, collector line system, and substation.

2.1 SITE SELECTION

The Project site was first identified through a review of available wind resource mapping in 2008. E.ON identified areas of potentially commercially viable wind resource in Madison and Tipton Counties, and subsequently validated the potential of the resource through onsite meteorological monitoring.

In addition to a strong, reliable wind resource, wind energy must be well supported by transmission that will provide the generated power to the electrical grid. E.ON identified a nearby 138 kilovolt (kV) transmission line with capacity available to support the Project and entered the transmission queue to begin the process of reaching an interconnection agreement with the utility that owns the line. Initial landowner contacts began, and WWF contracted with ARCADIS to conduct a fatal flaw evaluation of a preliminary Project area.

WWF's Project boundaries were refined over the next several years by carefully considering environmental, landowner, and community concerns in the siting of WTGs and associated components within a given property. Throughout the process of designing the Project, WWF placed great emphasis on avoiding stream and wetland areas wherever possible, as well as avoiding the disturbance of mature trees. Wetland impacts were avoided except for temporary disturbances associated with underground cable installation.

2.2 PROJECT CHARACTERISTICS

Land use throughout much of the Project area is dominated by agriculture (i.e., row crops and pasture), with several creeks and unnamed drainageways found throughout the Project area. The Project is located on private land leased from landowners who continue their existing use of the land, primarily agriculture. As a leaseholder, WWF's rights are limited to those incorporated in the lease agreement to allow for safe and effective construction, operation, maintenance and decommissioning of the Project. WWF has no control over landowner activities to the extent not covered in specific lease provisions.

Construction began in October 2011 and was completed in December 2012. The Project was constructed using standard construction practices including erosion and sediment control best management practices to minimize impacts to the existing environment and habitat. Construction of access roads, underground and overhead collection system lines, and concrete turbine foundations began first, followed by turbine erection. As turbines arrived at the Project area, they were set individually on concrete foundations. General construction equipment included pick-up trucks, cranes, tractor-trailers, bulldozers, compaction equipment, and graders.

Additional detail of various Project components is provided in the following sections.

2.2.1 Turbines

The Project includes 125 GE 1.6 MW wind turbines. Each wind turbine consists of three major components; the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from foundation to top of tower) is approximately 328 feet (100 meters [m]). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The total turbine height (i.e., height at the highest blade tip position) is approximately 492 feet (150 m). Descriptions of each of the turbine components are provided below.

Tower: The tubular towers used for this Project are conical steel structures manufactured in multiple sections. The towers have a base diameter of 14 feet (4.2 m) and a top diameter of approximately 8.4 feet (2.6 m). Each tower has an access door, internal lighting, and an internal ladder to access the nacelle. The towers are painted light gray to make the structure visible to aircraft (viewing against the ground) but decrease visibility against the sky.

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

Rotor: A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three composite blades that are approximately 161 feet (49 m) in length (total rotor diameter of 328 feet [100 m]). The rotor attaches to the drive train at the front of the nacelle. In order to control rotor speed, three independent electric pitch motors and associated controllers provide the adjustment of blade pitch angle during operations. This blade pitch adjustment, under normal operations, is informed by the wind speed and direction as measured by anemometry on each turbine nacelle, and when sent through the turbine's electronics, tells the blades to pitch or feather into or out of the wind. When wind speeds are sufficient the blades will pitch into the wind to allow the turbine to begin operating; during high wind events, the blades will pitch out of the wind. This pitch control not only controls cut-in and cut-out but also adjusts pitch angle to maximize the turbine's efficiency across all wind speeds. The GE 1.6 MW turbines begin generating energy at wind speeds as low as 7.8 mph (3.5 meters per second [m/s]) and cut out when wind speeds reach 60 mph (25 m/s) for 10 minutes. During periods of curtailment the turbine will regulate its speed, cut-in or cut-out, according to adjusted (not manufacturer ratings) prescribed operational criteria programmed through the Project's Supervisory Control and Data Acquisition (SCADA) system. Operational adjustments based on the new curtailment criteria are also informed by the on-board turbine anemometry, and each turbine will adjust in and out accordingly based on real-time conditions.

Each WTG is anchored in a steel reinforced concrete foundation. A pad mounted transformer is located at the base of each WTG and collects electricity generated by each turbine through cables routed down the inside of the tower.

2.2.2 Access Roads

The Project required the construction of new access roads and improvement of existing access roads to provide access to the turbines and substation site. The total length of access roads required to service all wind turbine locations is approximately 32 miles (51 kilometers [km]), some of which was upgrades to existing farm lanes. The roads were initially constructed to a width of 40 feet (12 m) to allow for crane travel, but have a final width of approximately 16-18 ft (5-5.5 m). The roads are gravel-surfaced.

2.2.3 Collection System and Substation

A transformer located near the base of the tower raises the voltage of electricity produced by the turbine generator up to the 34.5 kV voltage level of the collection system. From the transformer, cables join the collector circuit and turbine communication cables (electrical collection) that run underground. This buried 34.5 kV collection system connects the individual turbines to the substation located at the northwest corner of Madison County Roads 700W and 1400N. The cables range from approximately 2 to 5 inches (5 to 13 centimeters [cm]) in outside diameter.

The total length of buried and above ground 34.5 kV collection lines carrying electricity to the substation is approximately 88 miles (142 km). All collection lines have been installed belowground.

The collector substation steps up voltage from 34.5 kV to 138 kV to allow connection with the existing transmission line. The substation includes 34.5 and 138 kV busses, transformers, circuit breakers, towers, control houses, and related structures. It is approximately 200 by 300 feet (61 to 91 m) in size, enclosed within a chain link fence, and accessed by a new gravel access road from either County Road 700W or 1500N.

2.2.4 Transmission Line

A newly-constructed transmission line connects the collector substation to the point of interconnect (a new switching station, discussed below). The transmission line consists of electrical cables mounted on monopole towers. The towers are located along Madison County Road 1500N, and run for approximately 1.5 miles (2.4 km) from Madison County Road 700W to 0.5 mile (0.8 km) east of Indiana State Road 37.

2.2.5 Switching Station

An on-site switching station is located on the south side of Madison County Road 1500N, approximately one-half mile (0.8 km) east of Indiana State Road 37, adjacent to the existing AEP 138 kV transmission line. The switching station does not change the voltage of the electrical current, but transmits the power from the Project to the existing transmission line. The switching station is approximately 200 by 300 feet (61 by 91 m) in size, enclosed within a chain link fence, and accessed by a new gravel access road from County Road 1500N.

2.2.6 Meteorological Tower

One 328-foot (100-m) tall meteorological (MET) tower was installed to collect wind data and support performance testing of the Project. The tower is a self-supporting lattice steel structure and is unguyed. The tower includes wind monitoring and SCADA instrumentation. Two separate additional MET towers also were installed to collect wind data and support performance testing. These towers are 197 feet (60 m) guyed lattice steel structures and include wind monitoring instruments. The wind measurement towers are located in agricultural fields within the boundaries of the current Project area.

2.2.7 Operations and Maintenance Building

An operations and maintenance (O&M) building and associated storage yard was constructed in a former agricultural field to house operations personnel, equipment, and materials and provide staff parking. Site selection for the O&M building was based primarily upon typical constructability criteria. The O&M structure is 11,925 feet2 (1,108 m2) in size and is located on 10 acres (4 hectares [ha]) within the Project area. The building site is in a relatively level, well drained field, avoiding sensitive features such as surface waters and subsurface cultural resources.

2.3 PROJECT OPERATIONS, MAINTENANCE, AND DECOMMISSIONING

The Project is being operated according to the turbine operational protocol described in Section 2.3.1 of the WWF HCP. Modifications to the Project's operational protocol may be implemented as described in the adaptive management plan (Section 5.2). Project maintenance activities during operation may include turbine maintenance as needed, vegetation control if necessary, periodic re-grading, and reviewing the Project drainage plans.

Commercial WTGs such as the Project's WTGs typically have a life expectancy of 20 to 25 years; after which time, or if turbines are non-operational for an extended period of time with no expectation of their returning to operation, they will be decommissioned. Decommissioning will be performed under a decommissioning plan that addresses removal of Project components/improvements as well as site/land reclamation. Complete decommissioning of the facility or individual wind turbines will be completed within 12 months after the end of the useful life of the facility or of individual WTGs. Areas disturbed during decommissioning will be re-graded, reseeded, and restored when feasible.

3.0 AVIAN AND BAT RESOURCES

3.1 HABITAT DESCRIPTION

The Project area is located in central Indiana, within the Till Plains section of the Central Lowland physiographic province (Indiana Geological Survey 2011). This region is characterized by flat to gently rolling topography produced by glacial processes. Elevation within Tipton and Madison counties ranges from 803 to 997 feet (245 to 304 m) above sea level; there is even less topographic relief in the immediate Project area (Figure 1). Tipton and Madison Counties are comprised of small towns surrounded by farmsteads. Land use is primarily agricultural interspersed with commercial and industrial activity.

Land use within the Project area is dominated by agriculture (approximately 93.4%), mostly row crops of corn, soybeans, and wheat (Figure 2). Developed open space (approximately 5.1%), deciduous forest (0.5%), grassland/herbaceous cover (0.5%), pasture/hay (0.2%), and low intensity development (0.2%) cover nearly all of the remaining land within the Project area (Table 1). Small, perennial creeks and drainages are common within the Project area. Other wetlands within the Project area include emergent herbaceous wetlands, freshwater ponds and lakes, and riverine systems. Larger waterways that are located outside of the Project area include the Mississinewa River, White River, Pipe Creek, Cicero Creek, and Wildcat Creek. Forested tracts are fragmented and scattered across the landscape.

No designated conservation areas occur within 10 miles (16 km) of the Project area. Additionally, no Audubon Important Bird Areas (IBAs), which are sites that provide crucial breeding wintering, and/or migratory habitat for one or more species of bird, are known to occur in the vicinity of the Project.

Table 1 National Land Cover Database Land Cover Types and Extents within the Wildcat Wind Farm – Phase 1 Project Area (Tipton and Madison Counties, Indiana)

Land Cover Type	Acres (ha)	Approximate Percent Composition
Developed, Open Space	1,239.6 (501.6)	5.1%
Developed, Low Intensity	54.5 (22.1)	0.2%
Developed, Medium Intensity	1.9 (0.8)	<0.1%

Land Cover Type	Acres (ha)	Approximate Percent Composition
Developed, High Intensity	1.8 (0.7)	<0.1%
Deciduous Forest	124.1 (50.2)	0.5%
Shrub/Scrub	10.9 (4.4)	<0.1%
Grassland/Herbaceous	121.6 (49.2)	0.5
Pasture Hay	47.6 (19.3)	0.2%
Cultivated Crops	22,815.0 (9,232.9)	93.4%
Emergent Herbaceous Wetlands	2.7 (1.1)	<0.1%
Total	24,419.7 (9,882.3)	100%

Due to high levels of disturbance and lack of native vegetation, agricultural habitats are of limited quality for birds and bats. Cultivated agriculture is rarely used as nesting habitat by birds, although certain, disturbance-tolerant species may forage in crops. Agricultural fields may attract large flocks of birds, such as blackbirds and Canada geese (*Branta canadensis*), during the fall migration and winter seasons (Erickson et al. 2002). Agricultural habitat does not provide roosting habitat for bats, but certain bat species, primarily big brown bat (*Eptesicus fuscus*) and evening bat (*Nycticeius humeralis*), may forage over agricultural fields within the Project area. Other bat species in the region may occasionally forage over crops within the Project area but are more likely to use forested and open water habitats (BCI 2013). Fallow fields and areas of pasture or hay within the Project area may provide habitat for grassland birds and may support grassland-breeding birds.

Forest fragments such as those found within the Project area are typically not considered high-quality nesting habitat due to their limited size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism. These small patches of forest habitat may receive higher levels of bird use during migration, as forest fragments often provide stopover habitat for migrating passerines and other birds (Packett and Dunning 2009). Forest fragments within the Project area may also provide limited amounts of foraging or roosting habitat for the nine bat species whose geographic distributions include Tipton and Madison counties. Many of these species also forage along stream corridors or over water and may use the small areas of open water within the Project area (BCI 2013).

3.2 PRE-CONSTRUCTION AVIAN SURVEYS

Two avian survey periods were identified for the Project, scheduled to overlap with the spring migratory (April 22 to 25) and breeding/residential periods (May 24 to 27) for birds in the Project area. The spring migratory survey was timed to coincide with the spring migration of the American golden-plover (*Pluvialis dominica*), which has been identified as a species of particular interest in WWF's affiliates' Illinois surveys. This species frequents counties in west central Indiana (Johnson 2003) as a stopover location during its spring migration from northeastern South America to the Arctic coastal plain (fall migration is along a different route). The breeding/residential survey period selected was timed later in the spring to reflect more generalized avian activity. The two survey periods together provided a representative view of general migratory bird activity at the Project area. This section presents a summary of the survey results: refer to the survey report (ARCADIS 2011) for more information.

Survey methods were similar for the spring migratory surveys and the breeding/resident bird surveys. Five transects were chosen to represent a range of habitat types characteristic of the overall Project area. Along each of the five transects, birds were surveyed at five points during three time periods (post-dawn, afternoon, and pre-dusk) for a total of 15 surveys per transect. Each point was surveyed for a period of 10 minutes. Birds observed during both the April and May surveys were combined for analysis as a more comprehensive list of the species that occupy the Project area.

3.2.1 Survey Results

There were 1,350 total observations of 56 different species observed during the migratory and resident/breeding bird surveys. Species included:

- Six shorebird species: American golden-plover, common snipe (*Gallinago gallinago*), great blue heron (*Ardea herodias*), killdeer (*Charadrius vociferus*), sandhill crane (*Grus canadensis*), and unidentified sandpiper species (*Charadriiformes spp*.)
- Three raptor species: red-tailed hawk (*Buteo jamaicensis*), rough legged hawk (*Buteo lagopus*), turkey vulture (*Cathartes aura*),
- Two corvid species: blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*),
- Two waterfowl species: Canadian goose, mallard (*Anas platyrhynchos*),
- Two apodidae species: chimney swift (*Chaetura pelagic*), unidentified swift species, and
- One strigidae species: great horned owl (*Bubo virginianus*).

Passerines and near passerines comprised the remaining 40 species. Passerines comprised 88.6% of all birds observed during the surveys. Shorebirds comprised of 8.6% of all bird observations; all other bird species accounted for 1% or less of the bird observations. Approximately 25 total American golden-plovers were observed in newly tilled agriculture fields. No species listed as threatened or endangered by the State of Indiana were observed during the spring migratory and resident/breeding bird surveys. No eagles were observed during either bird survey.

Flight height for nearly all of the species that were observed was generally below the rotor sweep zone of turbines. A few birds flew above the rotor sweep zone, but flights in the rotor sweep zone were limited to birds landing or taking flight and were short in duration. Flight paths tended to be sporadic and limited to movements between habitats to gather nesting materials or forage. American golden-plovers mostly observed resting or foraging on the ground or flying at heights well above the rotor sweep zone. Plovers were occasionally observed flying through the rotor sweep zone, but only to land or take to wing.

The highest percentage of habitat use by birds was agricultural habitat (81%), which is the most dominant habitat type in the Project area. Although most bird observations were in actively farmed land (748 observations), actively farmed lands were used by only 55.4% of all observed species. Wetlands were the next most commonly used habitat with 183 (15%) bird observations in this habitat. Only 58 bird observations (4%) were in residential habitat types.

3.3 PRE-CONSTRUCTION BAT SURVEYS

Acoustic bat surveys were conducted in the Project area from 17 April through 4 November, 2010, and between 8 April and 1 November, 2011. This section presents a brief summary of the survey results: refer to Section 3.3 of the WWF HCP for a more detailed summary, and to the survey reports (Stantec 2010, Stantec 2011) for more complete information.

Acoustic surveys incorporated both stationary (i.e. passive) and mobile (i.e. active) echolocation detectors, which have been proven to be acceptable methodologies for bat/wind farm screening (e.g. Kunz et al. 2007a, Redell et al. 2006). Stationary surveys were completed at the same location in both 2010 and 2011, while mobile surveys were completed only in 2010. Surveys were divided among time periods, or seasons, generally recognized as appropriate for pre-construction screening-level surveys at wind farms.

The stationary surveys utilized Remote Bat Acoustic Technology System (ReBAT™; Pandion Systems, Inc., Gainesville, Florida) detector arrays deployed at two different heights on one 197-foot (60-m) tall MET tower within the Project area to determine species presence and relative activity levels at varying altitudes. Based on accepted methodology, receivers were placed at 16.5 feet (5 m) and 190 feet (58 m; within the rotor swept zone).

In 2010, bats were recorded on 167 of 201 (83.1%) survey nights at the tower. A total of 1,509 classifiable bat passes (mean = 3.8 passes/night) were recorded by the stationary detectors during the activity season. It is estimated that 291 unclassifiable passes were removed during the filtering process. Therefore, the adjusted total bat passes for the 2010 activity season at the WWF was 1,800 passes (mean = 4.5 passes/night).

In 2011, bats were recorded on 140 of 189 (74.1%) survey nights at the tower. A total of 1,414 classifiable bat passes (mean = 3.7 passes/night) were recorded by the stationary detectors during the 2011 activity season. It is estimated that 331 unclassifiable passes were removed during the filtering process. Therefore, the adjusted total bat passes for the 2011 activity season was 1,745 passes (mean = 4.6 passes/night).

Mobile surveys with hand-held Anabat detectors (Titley Electronics, Australia) were used to supplement stationary surveys. Six mobile transects were selected along roads within the Project area. Survey routes were selected in a variety of habitat types to adequately represent the

Project area (e.g., agricultural fields, woodlots, wetlands, or stream corridors). A total of 15 mobile surveys were conducted (spring-5, summer-2, fall-8), with emphasis placed on the critical fall migration period. During the 90 mobile surveys (15 surveys of 6 transects), 93 definitive bat passes (mean = 1.0 passes/transect/night) were recorded.

Using classifiable calls and files that contained high quality bat passes, a species list was developed for the Project area. In 2010, approximately 73% of the 1,509 classifiable calls recorded during the stationary survey and 71% of the 93 calls recorded during the mobile surveys were identifiable to species or species group (e.g. big brown bat/silver-haired bat, *Myotis* spp.). In 2011, approximately 75% of the 1,414 classifiable calls recorded were identifiable to species or species group. Five bat species were confirmed to be present at the Project:

- Big brown bat
- Silver-haired bat (*Lasionycteris noctivagans*)
- Eastern red bat (*Lasiurus borealis*)
- Hoary bat (*Lasiurus cinereus*)
- Tri-colored bat (*Perimyotis subflavus*)

3.4 ADDITIONAL SITE-SPECIFIC BIRD AND BAT INFORMATION

3.4.1 Birds

Consultation with the Service identified no known site-specific bird concerns. No federally endangered bird species are listed for either Madison or Tipton County, Indiana; however, the bald eagle, a recovered species, is listed for both. The bald eagle is still protected under BGEPA (see Section 1.2.2).

Consultation with the IDNR prior to Project construction identified three state-listed avian species whose ranges overlap with the Project area:

- Black-and-white warbler (*Mniotilta varia)* –special concern (state)
- Black rail (*Laterallus jamaicensis*) –endangered (state)
- Peregrine falcon (*Falco peregrinus)* – special concern (state; previously state-endangered)

There are no records as of March 2015 of either the black-and-white warbler or the peregrine falcon from Madison or Tipton Counties[1], though the black rail is known to occur in Madison County. The issues with these species, and WWF's strategy for them, are described in Table 2.

[1] http://www.in.gov/dnr/naturepreserve/4666.htm

Table 2 Identified Avian Species Issues Prior to Construction and the WWF Project Strategy

Species	Status	Comments	Strategy
Black and white warbler (*Mniotilta varia*)	IN species of special concern	Breeds in forested habitat; issues of potential concern are associated with courtship behavior or foraging.	Risk considered low. Limited forest patches located throughout study area. Turbines will not be placed in breeding habitat, but will be in open, agricultural fields. Preconstruction point counts[1] did not identify any black and white warblers onsite.
Black rail (*Laterallus jamaicensis*)	IN endangered	Issues of potential concern are associated with migration. Black rail is found in aquatic habitats and flooded fields. Suitable on-site habitat does not exist or would be limited at this site, although species have been observed in less suitable habitat.	Risk considered low. Turbines will not be placed in or near aquatic habitats or flooded fields. Preconstruction point counts[1] did not identify any black rails onsite.
Peregrine falcon (*Falco peregrinus*)	IN endangered	Nesting habitat is on cliffs which are not found on this Site or buildings which will not be impacted. Issues of potential concern are associated with migration and foraging. Habitats that would attract these species are limited in the Project area.	Risk considered low. Preconstruction point counts[1] did not identify any peregrine falcons onsite.

[1]Survey results are presented in Section 3.2.1
Table Source: ARCADIS 2011

Additional state-listed species with records from Madison or Tipton Counties include:

- Loggerhead shrike (*Lanius ludovicianus*) –endangered (state)
- Black-crowned night heron (*Nycticorax nycticorax*) – endangered (state)
- King rail (*Rallus elegans*) – endangered (state)

These species were not identified as part of the pre-construction consultation with the IDNR; however, they are now being incorporated into the Project's BBCS.

Pre-construction surveys were conducted in part to address these species and assess potential risk from the Project. No bird species listed as threatened or endangered under the ESA or by the State of Indiana was observed during pre-construction surveys in April and May, 2010 (ARCADIS 2011). Early spring pre-construction surveys were scheduled specifically to coincide with American golden-plover migration through the Project area (based upon WWF's affiliates' Illinois surveys); these surveys documented use of agricultural fields in the Project area by migrating plovers. However, most plovers were observed resting or foraging on the ground. Post-construction monitoring studies at WWF and at other wind energy facilities located within the plover spring migration corridor, including the Buffalo Ridge Wind Resource Area in Minnesota (Johnson et al. 2000), and the Fowler Ridge Wind Farm, which is located in close proximity to a plover IBA in Benton County, Indiana (Good et al. 2011), have not reported any plover mortalities to date.

The Project area is within the historic breeding, wintering, and migration range of the bald eagle. Although Indiana's bald eagle population suffered dramatic declines due to a loss of wetland habitat and the use of industrial pesticides in the 1950's and 1960's, midwinter surveys and nest monitoring indicate that the species has significantly increased within the state. A small population winters in Indiana, primarily along major rivers and large, open bodies of water such as the Monroe and Patoka reservoirs. Wintering eagles are known to use large trees for roosting. A population of re-introduced bald eagles now nests in the south-central part of Indiana, mostly on larger reservoirs and along the Wabash and White rivers (IDNR 2011). Bald eagles are not currently known to winter or nest in the Project area (personal communication, Daniel Elbert, USFWS, 17 December 2012 and 9 January 2013). There are no major rivers or reservoirs within Tipton and Madison Counties; both counties include only smaller creeks. Bald eagles were not observed during spring migration or breeding/residential bird surveys conducted at the Project area (ARCADIS 2011). Based on the small population of bald eagles in Indiana, the species' limited geographic distribution within the state, and the lack of highly suitable wintering or breeding habitat in the Project area, bald eagles are expected to occur only rarely within the Project area.

Golden eagles have never been common in the eastern U.S., and are not currently known to occur in Indiana except as occasional transient visitors. Golden eagles will occupy a wide variety of plant communities within open habitats, but prefer cliffs and large trees with large horizontal branches for roosting, perching, and nesting (Tesky 1994). Nesting habitat for golden eagles is very limited within the Project area and the species was not observed during spring migration or breeding/residential bird surveys conducted at the Project area (ARCADIS 2011). Golden eagles are, therefore, not expected to occur within the Project area.

3.4.2 Bats

Twelve species of bats occur in Indiana, and nine species, all members of the family Vespertilionidae, have geographic distributions that include Tipton and Madison Counties (BCI 2013):

- Indiana bat – Endangered (federal and state)
- Northern long-eared bat – proposed endangered (federal), special concern (state)
- Evening bat – endangered (state)
- Little brown bat (*Myotis lucifugus*) – special concern (state)
- Silver-haired bat – special concern (state)
- Eastern red bat – special concern (state)
- Hoary bat – special concern (state)
- Tri-colored bat – special concern (state)
- Big brown bat

The big brown bat is the only one of the nine bat species potentially found in the Project area that is not listed as either endangered or special concern (IDNR 2009). The Service is also collecting information for a status review of the little brown bat to determine if threats to the species may be increasing its risk of extinction. Listing considerations and status reviews for the northern long-eared bat and little brown bat are focused on the impacts of white-nose syndrome (WNS) on these species.

A full discussion of the federally-listed Indiana bat and the federally proposed-endangered northern long-eared bat, and their status within the Project area, can be found in Section 3.0 of the WWF HCP.

4.0 POTENTIAL IMPACTS TO BIRDS AND BATS

4.1 BIRDS

4.1.1 Overview of Potential Impacts

Operational impacts of wind energy facilities on birds include varying degrees of displacement from the wind turbines and surrounding habitat, as well as mortalities resulting from collisions with turbines, transmission lines, and other facility structures (Winegrad 2004).

Wind turbines may displace birds from an area due to the creation of edge habitat, the introduction of vertical structures and/or disturbances directly associated with turbine operation (e.g., noise, shadow flicker). Disturbance impacts are often complex, involving shifts in abundance, species composition, and behavioral patterns. The magnitudes of these impacts vary across species, habitats, and regions. Concerns have been raised that displacement from habitat may significantly affect certain avian populations (The Ornithological Council 2007). Although most research to date has focused on collision mortality associated with wind energy facilities, the limited data available indicate that avoidance impacts to birds generally extend approximately 246-2,625 feet (75-800 m) from a turbine, depending on the environment and the bird species affected (Strickland 2004). Studies in the western and Midwestern U.S. consistently show small-scale (<328 feet [100 m]) impacts on birds (Strickland 2004).

Direct collisions with the wind turbine rotors, towers, or overhead utility lines can result in bird injury or fatality. A number of factors affect the probability of a bird colliding with a turbine, such as flight height, weather, and turbine avoidance behaviors.

The number of avian fatalities at wind energy facilities is generally low when compared to the total number of birds detected at these facilities (Erickson et al. 2002). The low fatality rates detected at wind energy facilities are primarily due to three factors:

- Most migrating birds fly at altitudes higher than the maximum turbine height;
- A very high percentage of birds flying toward wind turbines will detect and avoid them; and
- Of those birds that do not alter their flight path in time to avoid the rotor-swept area of a turbine, a majority will still avoid a collision.

AWWI (2014) compiled overall bird fatality rates (number of fatalities/MW/year) from approximately 100 studies across North America that published post-construction fatality data. Based on this compilation, overall bird fatality rates are relatively similar across North America (bird fatality was estimated at 3 to 5 fatalities/MW/year), though fatality rates at sites in the Great Plains appear to be lower than sites in the rest of the U.S., and fatalities in the Pacific region may be significantly higher but it is unknown to what extent these differences reflect sample bias (AWWI 2014, Loss et al. 2013, Strickland et. al. 2011). Mortality rates at sites in the west and Midwest, particularly agricultural ones, have typically been at the low end of the national range. Publicly available estimates for the Midwest have been found to range from 0.00 to 11.83 birds/turbine/year (Barclay et al. 2007, Poulton 2010).

No particular species or family has been identified as incurring greater numbers of fatalities at wind energy facilities. However, likely due to differences in abundance and use of habitat, bird groups have experienced varied impacts from wind turbines. Passerines, both resident and migrant, represent the majority (approximately 75%) of mortalities at wind turbines nation-wide (Erickson et al. 2001, Johnson et al. 2002) and result in spring and fall peaks of bird mortality rates at most wind energy facilities (Johnson et al. 2002). Although waterbird (waterfowl, shorebirds, and seabirds) mortality at wind energy facilities has been highly variable, national research has demonstrated that waterbirds rarely collide with inland turbines (Everaert 2003, Kingsley and Whittam 2007). The only sites experiencing regular waterfowl fatalities have been those located on the shores of large, open expanses of water (Erickson et al. 2002). Raptor mortality rates at

Midwest sites have been very low; generally one or two carcasses are found per study (Poulton 2010).

4.1.2 Potential Impacts from the Project

The Project is sited within previously altered habitat that is dominated by tilled and untilled agriculture (corn and soybeans). Turbines are located only in actively farmed land, the most dominant habitat type in the Project area. However, only 55.4% of all birds observed during pre-construction surveys were observed using this habitat. Although Project operations have the potential to cause displacement of birds from the Project area, bird species sensitive to disturbance currently exhibit low use of the Project area and minimal suitable habitat for these species is present. Most birds observed using actively farmed habitat were members of common, disturbance-tolerant passerine species (ARCADIS 2011). The passerine utilization rate in actively farmed land was 8.44 birds per survey. Utilization of actively farmed land by other species groups was lower, between 0.001 birds per survey (raptors) and 1.36 birds per survey (shorebirds) (ARCADIS 2011). Therefore, it is unlikely that displacement impacts from the turbines would greatly alter the composition of the area's avian community. For species or individuals that are displaced, it is unclear if displacement impacts would persist for the life of the Project; certain species may adapt to the presence of the turbines (The Ornithological Council 2007). Studies of displacement impacts to birds from operating turbines are limited; clear and consistent patterns of impacts have yet to be established.

The operating turbines also pose a risk of bird mortalities from collisions. Bird mortality rates at other wind energy facilities in the Midwest have ranged from 0.00 to 11.83 birds/turbine/year (Barclay et al. 2007, Poulton 2010). Studies at the Fowler Ridge Wind Farm, located in an agricultural landscape in Indiana, reported moderate mortality rates of 5.26 bird/turbine during the 2009 study for Phase 1 (Johnson et al. 2010). Fatality at the Project was expected to also be at a moderate level within the Midwestern range because avian use at the site is low, habitat is disturbed and homogenous, other risk factors contribute to a site's risk profile (e.g., facility lighting [Kerlinger et al. 2010]), and WWF has incorporated wildlife protection measures that reduce risk into the Project's design (Section 4.3). Bird fatality rates at the WWF are likely to peak during the spring and fall migration seasons, as has been observed at most wind energy facilities (Johnson et al. 2002). Passerines, both resident and migrant, represents the majority (75%) of mortalities at wind turbines nationwide and was by far the group most frequently observed during surveys within the Project area (ARCADIS 2011, Erickson et al. 2001, Johnson et al. 2002). Night-migrating passerines have accounted for over 50% of avian fatalities at certain sites. However, no particular passerine species or group of species has been identified as incurring greater numbers of fatalities (Erickson et al. 2002). Fatality at the Project was expected to be moderate, as most birds, including passerines, observed using the Project area during the daytime pre-construction surveys in spring 2010 exhibited flight heights typically below the rotor-swept area and flight durations typically limited to localized movements for foraging and gathering nest materials (ARCADIS 2011). Birds taking off at dusk or landing at dawn or birds traveling in low cloud or fog conditions (which lower the flight altitude of most migrants) are likely at the greatest risk of collision (Kerlinger 1995). Nationally, mortality at wind farms has not been known to result in a significant population level impact to any one species, mainly because the migratory species impacted most by mortality are regionally abundant.

Collision risk is likely to be much lower for other bird groups in the Project area. Waterfowl and shorebirds together comprised 9.6% of the total species observed during pre-construction spring surveys. Waterfowl use may be increased in the Project area during the winter months if the croplands within the Project area attract large flocks of Canada geese (Erickson et al. 2002). National research has demonstrated that waterfowl and shorebirds rarely collide with inland turbines (Everaert 2003, Kingsley and Whittam 2007), perhaps because of the consistently high (500- 5,000 feet [150-1,500 m]) altitudes at which these species migrate over land (Kerlinger 1995). Raptors comprised only 0.2% of the total species observed during the pre-construction surveys (ARCADIS 2011). The Project area lacks strong topographic features, such as ridgelines and large bodies of water that are known to funnel migrating raptors into narrow migration paths. Given the lack of major raptor migration routes through the Project area and the relatively low raptor use of the Project area, raptor fatality rates at the Project were expected to be lower than or similar to those at other Midwestern sites, not likely to exceed one or two strikes a year (Poulton 2010).

Post-construction monitoring during the first two years of Project operations has confirmed low risk to birds. A total of 31 bird carcasses were found in 2013 (5 during spring and 26 during fall), and a total of 41 bird carcasses were found in 2014 (14 during spring and 27 during fall). None of the identified bird carcasses have been state- or federally-listed species. Of the 48 individuals identified to the species level, 73% (35) were passerines, 11% (5) were shorebirds, and 6% (3) were raptors. The remaining 10% consisted of doves, woodpeckers and hummingbirds.

<u>American Golden-Plovers</u>

Risk of disturbance or displacement impacts to the American golden-plovers from the Project is unknown and has varied for other sites. The avian risk assessment conducted by ARCADIS subsequent to the pre-construction surveys cited studies on the European golden-plovers (*Pluvialis apricaria*) that indicated they are a species of high risk for collision or disturbance by turbines (Pearce-Higgins et al. 2009 as cited in ARCADIS 2011), as well as studies that showed no effect on the European plovers (Percival 2000, 2003 as cited in ARCADIS 2011). Because American golden-plovers were observed using habitat in which turbines have been constructed within the Project area, there is a possibility of these birds being displaced to avoid the turbines. American golden-plover use rates were observed to average 0.3 birds per 10-minute survey in actively farmed habitat. However, plovers are expected to be present and at risk within the Project area during only one month each year (ARCADIS 2011). The avian risk assessment noted that at a wind farm in Scotland, bird surveys were conducted four years after the turbines were in place and while the numbers of European golden-plovers remained constant at a control site, the overall abundance at the wind farm actually increased. The Scotland survey concluded that the turbines had no effect on the plovers and no sign of displacement was noted (Percival 2000 as cited in ARCADIS 2011).

The favored habitat of the American golden-plover (tilled or partially tilled agricultural fields of soybeans and corn) is locally abundant, abundant throughout Tipton and Madison Counties, and abundant throughout the state of Indiana. Moreover, migration of the plover is not restricted to the state of Indiana but can occur throughout the Great Plain states (The Wilderness Society 1998 as cited in ARCADIS 2011). The Project area includes 22,815 acres (9,233 ha) of cultivated soybeans and corn, less than 7% of actively managed soybean and corn fields in Tipton and Madison Counties, and less than 0.2% of similar agricultural lands throughout the state. In addition, WTGs will only affect a very small percentage of habitat within the Project area itself; the remaining area will continue in agricultural production and areas away from turbines would retain habitat value. Therefore, because the impact area where the turbines are located is such a small fraction of the overall available habitat for plovers, and alternative suitable habitat is readily available, potential disturbance and displacement impacts to plovers are expected to be relatively minimal (ARCADIS 2011).

Pre-construction surveys conducted during the 2010 plover spring migration period demonstrated plovers using actively farmed agricultural habitat, the habitat in which all Project WTGs have been located. Most plovers were observed resting or foraging on the ground. In the absence of WTGs, plovers were occasionally observed flying through the rotor-swept area to land or take to wing (ARCADIS 2011). Flocks of plovers are expected to continue to fly at altitudes within the rotor-swept area as they migrate into and out of stopover habitat in the Project area, which may present a risk of collision with the WTGs. However, plover mortality at the Project is expected to be low relative to the number of individuals present. Post-construction monitoring studies at WWF and at other wind energy facilities located within the plover spring migration corridor, including the Buffalo Ridge Wind Resource Area in Minnesota (Johnson et al. 2000), and the Fowler Ridge Wind Farm, which is located in close proximity to a plover IBA in Benton County, Indiana (Good et al. 2011, 2012), have not reported any plover mortalities to date.

<u>Eagles</u>

Bald eagles have been noted to occur in many Indiana counties; however, they are not currently known to winter or nest in the Project area (personal communication, Daniel Elbert, USFWS, 17 December 2012 and 9 January 2013). No known occurrences were listed for Tipton and Madison Counties and no bald eagles were observed during pre-construction avian surveys in April and May, 2010 (ARCADIS 2011). The Project area lacks primary bald eagle habitat in the form of mature forest and large, fish-bearing waters. The lack of open water and tree cover in the Project area and surrounding vicinity is expected to result in minimal risk of species presence, as bald eagles feed on fish and prefer to roost in trees near open water. Bald eagles winter and congregate primarily along the Wabash and White Rivers, as well as the Monroe and Patoka reservoirs, none of which are within 10 miles (16 km) of the Project area. There are no large reservoirs, lakes, or rivers within the Project area or in Tipton and Madison Counties; only smaller creeks can be found in the Project vicinity. The Project area and surrounding vicinity also lacks cliff lines, ridges, and escarpments along which bald eagles tend to migrate (USFWS 2011). No bald eagles were observed during the pre-construction surveys (April-May 2010) (ARCADIS 2011).

Golden eagles have never been common in the eastern U.S., and are not currently known to occur in Indiana except as occasional transient visitors. No golden eagles were observed during pre-construction avian surveys in April and May, 2010 (ARCADIS 2011). The Project area and surrounding vicinity lacks primary golden eagle habitat in the form of grasslands and other native habitat. Foraging and nesting opportunities in the Project area are considered very low for golden eagles, as flat tilled and untilled agriculture (soybean and corn fields) comprises the majority of the habitat. The Project area is located outside of the breeding range of the golden eagle (Cornell University 2011). Finally, the Project area lacks cliff lines, ridges, and escarpments along which golden eagles tend to migrate (USFWS 2011).

The USFWS (2013) Eagle Conservation Plan Guidance was released after the Project was operational. The guidance considers eagle nests, foraging areas, migration corridors and stopover sites, and communal roost sites that eagles rely on for breeding, sheltering, or feeding, to be important eagle-use areas (USFWS 2013). No important eagle-use areas for bald or golden eagles are currently known to occur within 10 miles (16 km) of the Project area (M.Reed, personal communication dated 25 July 2014). Based on this data, the lack of suitable habitat within the Project area and the lack of eagle observations during pre-construction surveys in the Project area, it is expected that the Project will pose little risk to eagles. Mortality monitoring and a plan of action if eagles are taken during Project operation are included in Section 5, in accordance with the guideline recommendations. To date, no bald or golden eagle mortality has been observed at WWF.

4.2 BATS

4.2.1 Overview of Potential Impacts

Direct mortality at wind turbines is currently the greatest concern for bats in general at wind facilities (Cryan 2008a); commercial wind facilities have been found to impact many bat species (Arnett et al. 2008). Whether bats are attracted to wind turbines and the exact mechanisms by which wind turbines cause mortality are unclear (reviewed in Kunz et al. 2007a); however, several hypotheses have recently been put forth and tested, including the role of land cover and environmental conditions in attracting bats to wind turbine locations, behavioral factors that might make wind turbines attractive to bats, pressure changes from rotating blades causing "barotrauma", or direct impact of unsuspecting migrant bats (Baerwald et al. 2008, Horn et al. 2008, Johnson et al. 2004, Kerns et al. 2005, reviewed in Kunz et al. 2007a).

The influence of landcover on bat mortality at wind turbine sites is unclear (Arnett et al. 2008). Johnson et al. (2004), for example, found no significant relationship between bat fatalities and landcover type within 328 feet (100 m) of wind turbines. They also found no significant relationship between bat mortality and distance to wetlands or woodlands (Johnson et al. 2004). Weather conditions, such as wind speed, rainfall, and temperature, have been found to have a significant impact on bat mortalities (Arnett et al. 2008). Bat mortality and insect activity are both high on nights with low wind speed when wind turbines are adjusted to rotate near their maximum revolutions per minute (Kerns et al. 2005). Bat fatalities decrease with increases in wind speed and precipitation intensity (Kerns et al. 2005; Arnett et al. 2009: Baerwald et al. 2009).

The primary bat species affected by wind facilities are believed to be migratory tree-roosting species that mostly emit low frequency calls (Johnson et al. 2004, reviewed by Kunz et al. 2007a). Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States and Canada and found that mortality has been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, nearly 75 percent were the migratory, foliage-roosting hoary bat, eastern red bat, and silver-haired bat (Kunz et al. 2007b).

Some researchers have suggested that bats that roost in foliage of trees for most of the year may be attracted to wind turbines because of their migratory and mating behavior patterns (e.g. Kunz et al. 2007a, Cryan 2008b). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of mortality (Kunz et al. 2007a). Cryan (2008b) suggested that male tree bats may be using tall trees as lekking sites, calling from these sites to passing females. If this is the case, then tree bats may be more attracted to wind turbine sites after the turbines are erected. Migrating tree bats are also thought to depend on sight for navigation rather than echolocation, possibly resulting in the bats being unaware of the presence of wind turbines during migration (Cryan and Brown 2007). As further support for these hypotheses, the majority of bat fatalities occur mid-summer through fall, during approximately the same time frame as southward migration of tree bats (Arnett et al. 2008). Tree bats tend to be larger species that emit low frequency calls. Bats that use low frequency calls may be more inclined to forage above tree tops where there are few obstructions. Migratory bats may also fly higher to maximize efficiency. Thus, tree bats may be more likely to fly in the rotor-swept area of wind turbines when compared to smaller bat species that have different foraging and migration strategies.

Although the number of bat fatalities recorded at wind energy facilities varies regionally, reports of mortality have been highest along forested ridge tops in the eastern U.S. and lowest in open landscapes of Midwestern and western states (Kunz et al. 2007a). However, it is difficult to make direct comparisons among projects due to differences in study length, metrics used for searches, and calculations for compensating for study biases (Arnett et al. 2008). Fatality rates ranged from 0.00 bats/turbine/year to 42.7 bats/turbine/year and averaged 7.12 bats/turbine/year in 21 studies conducted at wind energy facilities across North America (Barclay et al. 2007). In the Midwestern U.S., bat fatalities range from 0.1 to 50.5 bats killed/turbine, but higher fatality rates (up to 69.6 bats/turbine) have been reported in the eastern U.S. (Poulton 2010, Arnett et al. 2008). Estimates from the Fowler Ridge Wind Farm in Indiana averaged 17.85 bats/MW/year at uncurtailed turbines, based on two years of intensive monitoring (Good et al. 2011, 2012).

An in-depth discussion of Project impacts on Indiana and northern long-eared bats is presented in Section 4 of the WWF HCP.

4.2.2 Potential Impacts from the Project

Pre-construction acoustic bat surveys are described in detail in Section 3.3 of the WWF HCP. They included pre-construction acoustic surveys (stationary and mobile), and were used to assess the risk potential at the Project.

The Project turbines present a risk of bat mortality due to collisions or barotrauma. Due to the lack of unique bat species or habitat features that may attract bats, it was expected that bat mortality within the Project area would follow patterns similar to those observed at other Midwestern wind energy facilities, but mortality rates would be lower due to Project siting and micro-siting (i.e., WTGs are sited on active agricultural plots in an agriculture-dominated landscape). Bat mortalities in the Midwest have mostly occurred in the swarming and migration seasons, typically between mid-July and mid-September (e.g., Kerlinger et al. 2007, Johnson et al. 2003, Howe et al. 2002). Migratory tree bat species have comprised the majority of fatalities in the Midwest and nationally (Erickson et al. 2002, Kunz et al. 2007a). Mortality risk at the current Project were therefore expected to primarily affect bats that migrate through the Project area during the late summer or early fall. Additionally, certain weather conditions, including low wind speeds and warmer temperatures are likely to increase the risk of bat mortality at the Project area, as these conditions have been demonstrated to coincide with nights of high bat mortality at wind energy facilities (Good et al. 2011, Gruver et al. 2009, Kunz et al. 2007a).

The lack of forested habitat and open water within the Project area likely reduces risk to bats, as most bat species in Indiana prefer forests and bodies of open water for foraging and migration stopover roosting habitat (BCI 2013). Bats migrating through the vicinity of the Project area may prefer streams, unnamed creeks, and associated forests compared to the open landscape within the Project area. The Project has been sited to avoid high-quality bat habitat altogether, but the presence of the turbines, even in open, non-forested areas, poses some risk of bat mortality. Bat mortality has been documented at Midwestern wind energy facilities in agricultural areas during the migration season, demonstrating that some migrating bats will fly over open land (Good et al. 2011, Kerlinger et al. 2007, Johnson et al. 2003, Howe et al. 2002). Bat migration patterns and behaviors, and subsequently, indicators of bat fatality risk at wind energy sites, are not well understood (Poulton 2010). However, WWF has used the best science available to incorporate avoidance and minimization strategies, including a turbine curtailment strategy, into the siting, design, and operation strategies for this Project (described in Section 4.3) in an attempt to reduce bat risk at the Project area to the best of our current understanding. The operational strategies are intended to avoid take of federally listed bat species at the Project; although tree bat species not listed under the ESA, including the red bat, hoary bat, and silver-haired bat, are particularly likely to benefit from the operational strategies, as these species are expected to comprise the majority of bat mortality at the Project.

The first two years of post-construction monitoring at the Project have confirmed low bat mortality rates, with seasonal mortality ranging from 0.4 to 0.7 bats/MW/season in both the spring (1 April to 15 May) and the fall (1 August to 15 October). The Project was operating uncurtailed during the spring season, and at 6.9 m/s cut-in speed during the fall season.

4.3 AVOIDANCE AND MINIMIZATION

4.3.1 Summary of Measures Incorporated into the Project during Siting and Design

The Project's approach to siting was designed to avoid or reduce potential impacts to birds and bats. Pre-construction surveys were conducted to assess potential impacts to avian and bat resources, and assist in developing measures to avoid and minimize the identified potential impacts. These studies are described in Section 3.3 of the WWF HCP. The Project siting process incorporated considerations to avoid and minimize impacts to birds and bats, including eagles and Indiana bats. The Project was developed in an agricultural setting to avoid fragmentation or other impacts to native habitats (i.e., riparian, grassland, wooded areas) and the sensitive species they support. All Project WTGs have been constructed in tilled agriculture. This avoids direct and indirect impacts to many of the sensitive bird and bat species identified during consultation with IDNR and the Service as potentially occurring in the Project vicinity.

Because bat summer habitat is not present within the Project area and all WTG's are sited more than 1,000 feet from suitable summer habitat, all impacts to potential summer habitat have been avoided. The Project area is located more than 10 miles (16 km) from any known eagle nests, foraging habitat, and communal roosting areas in Indiana. The Project's setting also avoids landscape features known to channel migrating eagles and other raptors into narrowed migration routes.

The planning and development stages of the Project incorporated industry best practices and measures based on the best available scientific data to reduce risk to birds and bats. WTGs were constructed with conical steel towers; lattice structures were not used to avoid creating perches for raptors and other bird species. The MET towers are self-supporting, unguyed, lattice steel structures. Turbines around the perimeter of the Project area and at some additional locations within the Project area are lighted per FAA specifications, with a single, medium-intensity aviation warning light. These lights are flashing red strobes (L-864) and operate only at night. During nights of inclement weather and/or poor visibility, passerines may fly at lower altitudes and may be attracted to lights, especially steady (i.e., not blinking) lights; therefore, by utilizing a FAA-minimum flashing red strobe light plan, this lighting effort will reduce the potential for birds to collide with the turbines.

All WWF employees are required to immediately turn off internal lights in turbines at night when lights are not required for safety or compliance purposes. All of the Project substation lights are equipped with downward facing shields. Similar to the turbine lighting plan, these measures will minimize the potential for birds to be attracted to the site at night and therefore minimize the collision risk. The power collection system was buried underground in all areas where interference with other features would not preclude it. No substantial tree clearing was conducted during Project construction, and construction staging areas were sited to avoid sensitive features, including surface waters.

The avoidance and minimization measures incorporated during Project siting and design, described above were the initial methods of reducing potential avian and bat impacts at the Project. Overall impacts to birds and bats are expected to remain low at the Project area, based on the Project area's agricultural landscape, moderate levels of bird and bat use, lack of attractive habitat characteristics, lack of use by protected species (ARCADIS 2011), low mortality rates the first two years of post-construction monitoring, and implementation of the above-listed avoidance and minimization measures.

4.3.2 Turbine Operational Protocols

Pre-construction surveys recorded relatively low bird use and low species density in the Project area, as well as a lack of sensitive species, eagles, and native avian habitats. Based on these data and the results from preliminary post-construction monitoring, the Project is not expected to pose a high level of risk to sensitive avian species, eagles, or birds in general. Therefore, no operational minimization measures for birds are determined to be necessary at this time. This determination will be re-evaluated throughout the life of the Project, through the adaptive management framework described in Section 5.2, below.

Although the Project is not located in an area of high concern for bats, and avoids bat habitat in the form of forested areas and open water, studies at other wind energy facilities have shown that bat mortality during the fall migration season is a potential concern at all wind energy facilities, even those located in agricultural landscapes (Good et al. 2011, Kerlinger et al. 2007, Johnson et al. 2003, Howe et al. 2002). Additionally, because of known mortalities of Indiana and northern long-eared bats at other wind facilities, WWF will implement turbine operational protocols as described in Section 5.2.1 of the WWF HCP in order to minimize take of both listed and non-listed bat species. During the remainder of the year, turbines will cut-in or feather throughout the night as the wind speed fluctuates above and below 7.8 mph (3.5 m/s).

All curtailment studies to date show a consistent inverse relationship between cut-in speeds and bat mortality (Baerwald et al. 2009, Arnett et al. 2009, Good et al. 2011, Kerns et al. 2005, Fiedler 2004). WWF will monitor bird and bat fatalities in accordance with the monitoring plan presented in Section 5.3 of the WWF HCP to verify the effectiveness of the avoidance and minimization strategies incorporated into the Project.

5.0 MONITORING AND ADAPTIVE MANAGEMENT PLAN

5.1 POST-CONSTRUCTION MONITORING

The WWF post-construction monitoring plan is described in Section 5.3 of the WWF HCP. The post-construction monitoring plan will address all bird and bat fatalities observed within the Plan Area. The goals of the post-construction monitoring are to determine overall bird and bat fatality rates from the Project, estimate Indiana and northern long-eared bat mortality, and understand the circumstances under which fatalities occur (e.g., weather conditions, season, turbine location, etc.). Post-construction monitoring results will also indicate when and if triggers have been met for implementation of adaptive management, as described in Section 5.2 of this BBCS and Section 5.4 of the HCP.

5.1.1 Wildlife Incident Reporting Procedure

In addition to the scheduled post-construction monitoring periods, WWF has also implemented E.ON's Wildlife Incident Reporting Procedure to standardize the procedures taken by Project personnel in response to the discovery of wildlife injuries and fatalities. This reporting is designed to assist with the following:

- Identifying impacts to species that may require notification to USFWS (i.e., Indiana or northern long-eared bats, bald eagles, or other listed/protected species);
- Determining if the Project may have unexpected impacts to sensitive wildlife species; and
- Evaluating the need for implementing adaptive management as outlined in Section 5.3 of the WWF HCP and Section 5.2 of this BBCS;

All O&M personnel, site managers, visiting personnel, and other staff or subcontractors at the Project site will use the Wildlife Incident Reporting Procedure. All personnel on site should be attentive to possible bird and bat fatalities while working around the turbines, driving between turbine s, or conducting other activities within the Project area. The operators and technicians will conduct sweeps of the turbine base area for avian and bat fatalities when conducting maintenance activities. Every wildlife fatality or injury found by personnel, contractors, or others on the Project site must be reported to the Site Supervisor, even if the incident may not be associated with any of the WWF Project components. Incidents that must be reported include the following:

- Fatality of any bird, bat or other wildlife species. This includes complete or partial carcasses, feathers (10 or more at one location), fur or bones;
- Injury of any bird, bat or other wildlife species.

5.2 ADAPTIVE MANAGEMENT

This BBCS establishes a process through which WWF plans to reduce impacts to birds and bats at the wind energy facility while maintaining optimal Project operation and generating electricity from renewable, emissions-free wind. WWF has sited the Project and incorporated measures to avoid and minimize impacts to birds and bats, including sensitive and listed species. The effectiveness of these measures will be informed by post-construction monitoring of fatality rates. Adaptive management is a process that will allow WWF to adjust the minimization measures outlined in this BBCS to reflect new information or changing conditions in order to reach a goal – in this case minimization of impacts to all bird and bat species, while minimizing effects on the operation of the Project. Changes to the Project's avoidance and minimization plan may be triggered by certain events, but no changes to the agreed-upon turbine operational protocols will occur without USFWS concurrence (except temporary cessation of turbine operations for maintenance). The adaptive management plan will apply throughout the life of the Project; on-going evaluation and adaptation of the Project will provide effective measures for avoiding and reducing impacts to birds and bats.

Adaptive management will allow WWF to minimize the uncertainty associated with gaps in scientific information or biological requirements. Information used in the adaptive management process will come from the post-construction mortality monitoring activities described in Section 5.3 of the WWF HCP and from other new research as it becomes available. Monitoring data will be analyzed to determine if the objectives of this BBCS are being met. If the minimization measures are not producing the desired results, adjustments will be made as necessary to achieve the biological objectives of this BBCS. If post-construction mortality monitoring indicates that the minimization measures specified in this BBCS exceed those necessary to achieve the biological objectives, adaptive management will enable WWF to conservatively scale back conservation measures to reduce the impact on the Project's operations while still avoiding direct mortality of the Indiana bat and minimizing mortality of birds and bats in general.

Adaptive management at WWF will be implemented as described below, and in Section 5.4 of the HCP (as it pertains to Indian and northern long-eared bats). All references to a monitoring year shall mean one fall season (1 August through 15 October) of monitoring and one spring season (1 April through 15 May) provided that spring monitoring has not been discontinued in accordance with Section 5.3.4.1 of the HCP. All cut-in speed limitations shall be applied only during the period from sunset until sunrise when the ambient temperature is above 50° F (10° C) during the fall season.

Adaptive management consideration triggers for WWF, as it relates to non-listed species, will be triggered by such events as:

- Take of a bald or golden eagle
- Discovery of a mass avian or non-listed bat mortality event
- New research or results of post-construction mortality monitoring at WWF provide compelling evidence that the BBCS minimization measures exceed those necessary to achieve the biological objectives of the BBCS

Take of a bald or golden eagle

If take of a bald or golden eagle occurs at WWF, the event will be reported to the Service within 24 hours. WWF will work with the Service to determine the cause and circumstances of the mortality, if possible, and develop specific mitigation measures. Such measures may include raising the cut-in speed at the offending turbine or a group of turbines during specific weather conditions or seasonal periods, followed by a year of mortality monitoring to assess whether the mitigation measures are sufficient. WWF will work with the Service to determine the need to pursue a permit under BGEPA.

Discovery of a mass avian or bat mortality event

Mass avian or bat mortality events are not expected to occur at WWF, based on the assessment of potential impacts presented in Section 4 of this BBCS. However, should post-construction monitoring or incidental observation detect a mass mortality event, WWF will take remedial actions. WWF will notify the Service of the discovery within 48 hours and investigate, based on the available data, the circumstances under which the mortality event occurred. WWF will coordinate with the Service to identify potential minimization and mitigation measures.

New research or results of post-construction mortality monitoring at WWF provide compelling evidence that the BBCS minimization measures exceed those necessary to achieve the biological objectives of the BBCS

If new research or results of post-construction mortality monitoring at WWF produce compelling evidence that the BBCS minimization measures exceed those necessary to achieve the objectives of the BBCS, WWF will consult with the Service to determine if the minimization measures, specifically turbine operational protocols, may be adjusted to allow for greater operation of the Project. WWF will not implement adjustments to the agreed-upon turbine operational protocol without approval from the Service (except temporary cessation of turbine operations for maintenance), and any adjustments must be consistent with the approved HCP.

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FIGURES

Figures

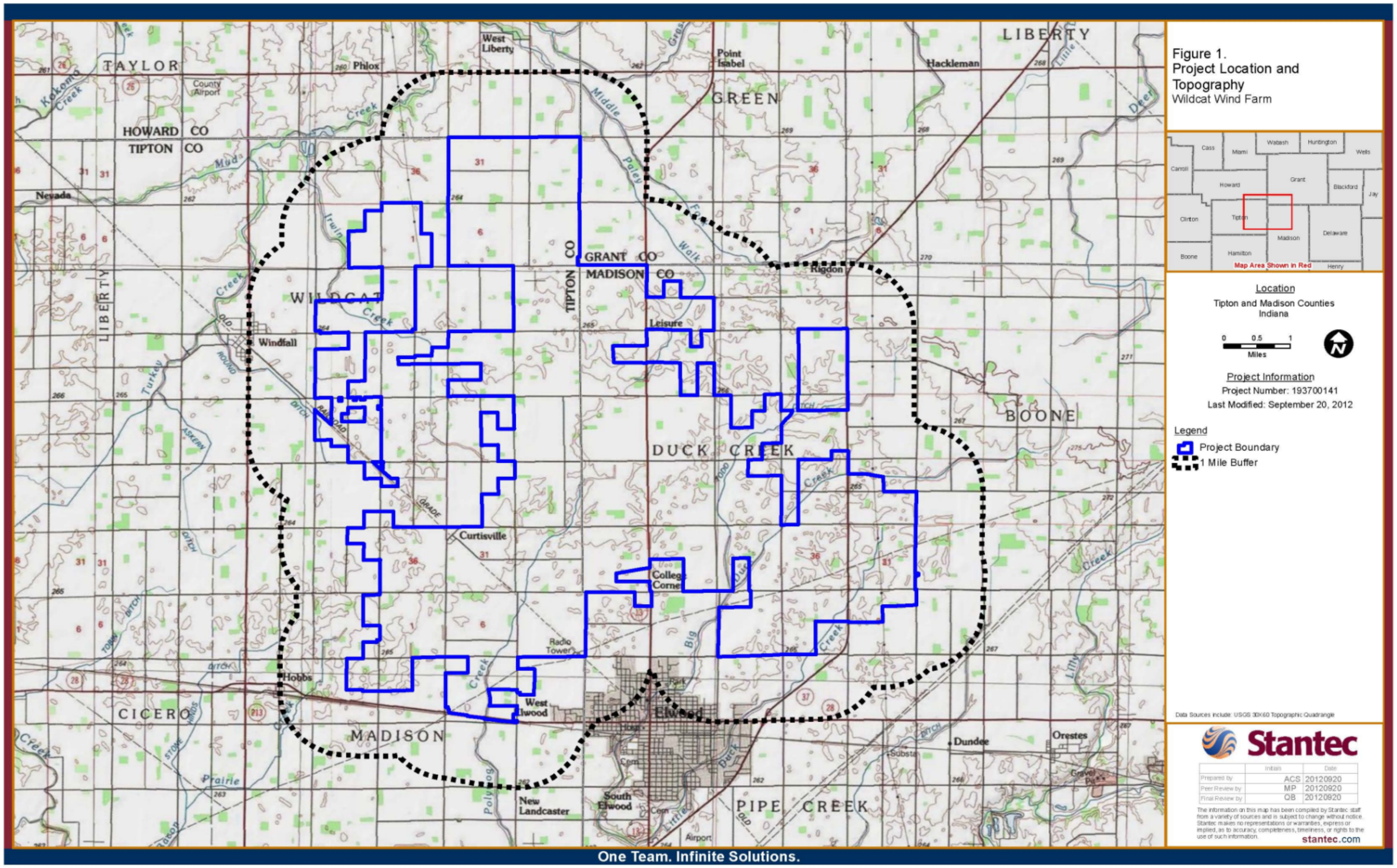

Figure 1. Project Location and Topography

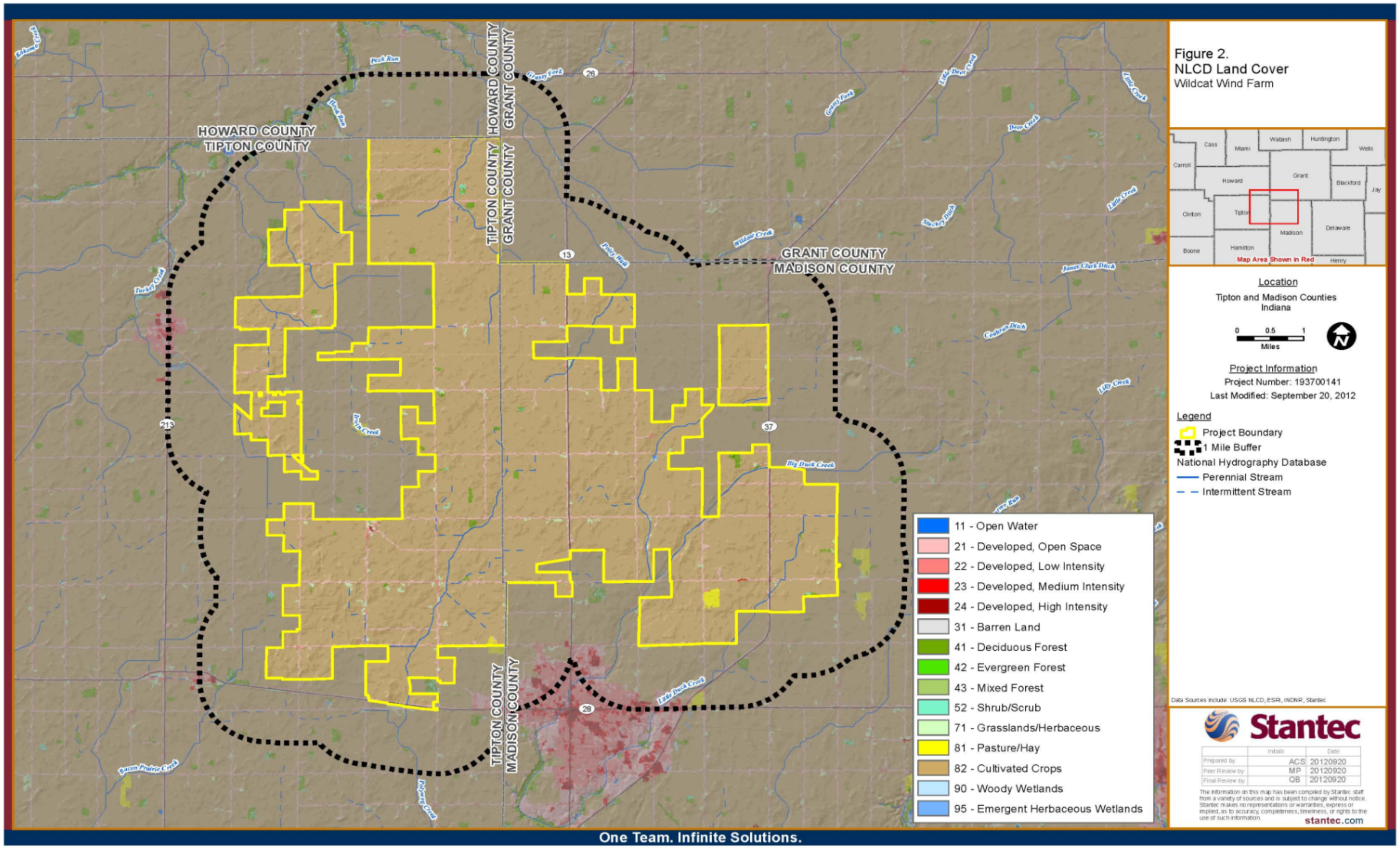

Figure 2. National Land Cover Database

APPENDIX B: Wildcat Wind Farm
Avian Reports

ARCADIS

Infrastructure, environment, buildings

Imagine the result

Wildcat Wind Farm, LLC

Wildcat Wind Farm - Phase I Avian Risk Assessment

Madison and Tipton Counties, Indiana

April 29, 2011

ARCADIS

Wildcat Wind Farm – Phase I Avian Risk Assessment

Madison and Tipton Counties, Indiana

Prepared for:
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CO001397.0003

Date:
April 29, 2011

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Appendices

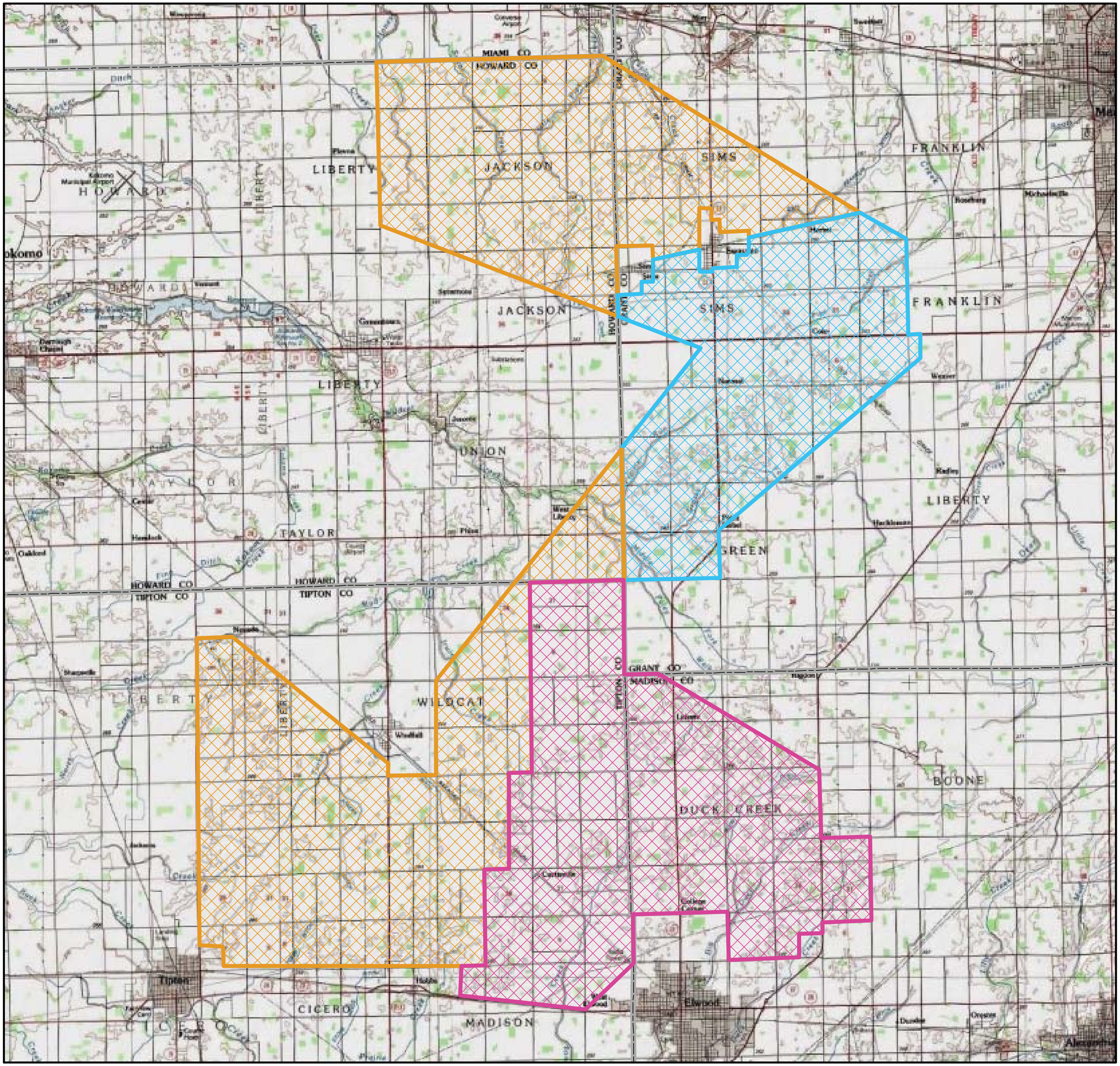
1. Introduction

The Wildcat Wind Farm-Phase I project is a wind energy facility proposed within approximately 13,000 acres of agricultural properties located in Madison and Tipton Counties, northeast of Indianapolis, Indiana. The project area is identified in Figure 1.

Topography is relatively flat; the majority of the project area is in active agricultural use for corn, soy, and hot weather grass crop production; residences and ancillary structures are scattered throughout. Trees are present along several drainage tributaries, around homesteads, and in concentrated areas of 2-5 acres scattered within the project area. Wetlands are rare, and are limited to small areas of manmade ponds within residential areas, active agriculture lands, and along low-relief drainage features of agricultural lands. No major differences between land cover within the project area and the surrounding areas are apparent.

Wind is considered an important source of renewable energy and recent advances in wind turbine technologies have led to an increase in the generation of electricity from wind. The U.S. wind industry had 40,180 megawatts (MW) of wind power capacity installed at the end of 2010, with 5,115 MW installed in 2010 alone. The U.S. wind industry has added over 35% of all new generating capacity over the past four years, second only to natural gas, and more than nuclear and coal combined. Today, U.S. wind power capacity represents more than 20 percent of the world's installed wind power (AWEA, 2011). Bird mortality as a result of wind turbines has been studied as one of many human-caused threats affecting bird populations. The purpose of this Avian Risk Assessment is to determine the potential risk to birds at the Wildcat Wind Farm location (hereafter, the Site).

Several federal laws exist that afford protection to avian species. The Endangered Species Act (ESA) and the Bald and Golden Eagle Protection Act (BGEPA) each address specifically identified species. In addition, the Migratory Bird Treaty Act (MBTA) makes it unlawful to kill or otherwise take a protected migratory bird. This report, prepared on behalf of Wildcat Wind Farm, LLC (WWF), a project company of E.ON Climate & Renewables North America, Inc., documents WWF's consultation with federal and state agencies to identify whether particular risk to species protected under the ESA would be anticipated, and describes field surveys and analyses completed to facilitate compliance with the MBTA and BGEPA.



Legend

Wildcat Boundary 02/02/2010

- Wildcat Wind Phase I
- Wildcat Wind Phase II
- Wildcat Wind Phase III

N
W E
S

0 1 2 4
Miles

ARCADIS

E.ON WIND

WILDCAT WIND FARM SITE LOCATION

06/18/2010 | **FIGURE 1**

2. Agency Consultation

WWF has consulted with the United States Fish and Wildlife Service (USFWS) and the Indiana Department of Natural Resources (IDNR) to identify potential concerns and the need for studies associated with understanding the potential for avian risk associated with the project.

2.1 United States Fish and Wildlife Service

Scott Pruitt of the USFWS provided information on March 24, 2010 that identified the Site as a location with no known federally listed threatened or endangered species of birds present. According to the USFWS, there are no known Site-specific bird issues. Correspondence with USFWS is provided in Appendix A.

2.2 Indiana Department of Natural Resources

Correspondence from Ronald Hellmich of the Indiana Natural Heritage Data Center of IDNR on March 2, 2010 identified a number of state-protected species potentially occurring within the project area. Table 1 summarizes each avian species identified as species of special concern, threatened, or endangered by the State of Indiana that have the potential to be in the project area and WWF's strategy for addressing each species. Correspondence with IDNR is provided in Appendix B.

WWF requested recommendations from IDNR concerning appropriate survey protocols for the identified species. IDNR has not yet responded to that request. In order to capture the spring migration season, WWF proceeded with a pre-construction point count survey similar to those conducted for its affiliates' projects in Illinois. The spring survey incorporated two periods scheduled to provide a snapshot of two migratory windows within the spring season (April and May). During the April migratory survey, particular emphasis was placed on identifying the American golden plover (*Pluvialis dominica*), which had been identified as a species of particular interest in WWF's affiliates' Illinois surveys. This species frequents counties in west central Indiana (Johnson 2003) as a stopover location during its spring migration from northeastern South America to the Arctic coastal plain (fall migration is along a different route). During the May migratory survey, both migratory and more generalized avian activity representing resident breeding birds could be observed. The two survey periods together provided a representative view of general bird activity through and at the project Site. The completed field efforts and subsequent analysis are the subjects of this report.

Table 1. Potential Avian Species Issues and Proposed Project Strategy

Species/Resource	Status	Comments	Strategy
Black and white warbler (*Mniotilta varia*)	State species of special concern	Breeds in forested habitat; issues of potential concern are associated with courtship behavior or foraging.	Risk considered low[1]. Limited forest patches located throughout study area. Turbines will not be placed in breeding habitat, but will be in open, agricultural fields. Pre-construction point counts did not identify any black and white warblers onsite.
Black rail (*Laterallus jamaicensis*)	State endangered	The black rail is found in aquatic habitats and flooded fields.	Risk considered low[1]. Turbines will not be placed in or near aquatic habitats or flooded fields. Pre-construction point counts did not identify any black rails onsite.
Peregrine falcon (*Falco peregrinus*)	State endangered	Nesting habitat is on cliffs which are not found on this Site or buildings which will not be impacted. Issues of potential concern are associated with migration and foraging. Habitats that would attract these species are limited in the project area.	Risk considered low[1]. Pre-construction point counts did not identify any peregrine falcons onsite.

[1]As mentioned in Appendix A, the USFWS did not identify any Site-specific bird issues and, given avoidance of sensitive habitats associated with these species, ARCADIS considers risk to these species to be low.

3. Survey Methodology

Avian monitoring at the Site was conducted in two separate spring surveys, one in April and one in May. The first survey was timed to coincide with spring migration, including the anticipated migratory period for the American golden plover, and the second survey was conducted later to reflect other migratory species as well as a survey of resident and breeding bird populations.

3.1 Study Objectives

This study was designed with three objectives: 1) document migratory use of the Site habitat, including by the American golden plover; 2) document what other avian species are present at the Site and characterize their habitat use; and 3) using information from 1) and 2), evaluate the potential risk to bird populations at the Site associated with the proposed construction and operation of wind turbines.

3.2 Methods

Survey methods were similar for the April and May point count surveys. Five transects were chosen to represent a range of habitat types that are characteristic of the overall Site environment (see Table 2). At each of the five transects, birds were surveyed during three time periods: 1) post-dawn; 2) afternoon; and 3) pre-dusk at five points for a total of 15 surveys per transect.

Table 2. Habitat Types and Dominant Characteristics

Primary Habitat Type	Secondary Habitat Type	Dominant Habitat Features
Agriculture	Actively Farmed	Soy field (tilled or newly planted), corn field (tilled, newly planted, or harvested/untilled), hot weather grass field (planted or cut harvested)
	Drainage Ditch	Grassland habitat fringe on bank of agricultural drainage ditch. Also includes power lines or fence rows where ditches are present
	Forested	~4 acres of mature forest area within center of agriculture/actively farmed field.
Wetlands	Standing Water	Man-made pond in low lying areas of active agriculture fields and residential areas.
	Canopy	Mature and immature trees and shrubs surrounding and within the wetland area.
	Grassland Buffer	Grassland habitat bordering wetland within agricultural field
Residential	Housing and Landscape	Fragmented habitat associated with residential structures (house/barn), trees and grass

Surveys consisted of walking a distance of approximately 100 meters (m) from the road or habitat edge and stopping at the first of five points. This point was surveyed for 10 minutes and the following recorded:

- All birds seen, heard, or flushed;
- Habitat type the bird was utilizing;
- Approximate distance to the bird when it was first noted;
- If the bird was a repeat sighting from an earlier point; and
- Bird behavior (i.e., nesting, resting, foraging, in flight).

After ten minutes, the surveyors walked another 200 m to the second point of the transect. The same survey was conducted until a total of five points at each of the five separate transect locations was completed. This method is used to standardize observation time along transects.

Birds that were identified by call but were not observed (audibles) and birds that were observed flying overhead (flyovers) were also noted, but assigning these observations to a specific habitat type was not always possible. Birds observed in this manner are discussed in this report but are not included in the analysis where observations of habitat use are included.

Species of birds that were observed at each transect were grouped into seven taxonomic categories corresponding to a family level of classification:

- ***Passerines*** were considered in two separate groups to account for potential habitat utilization differences:
  - ***Corvids*** are in the Corvidae family and are sometimes considered medium to large passerine birds.
  - ***Passerines*** are of the order Passeriformes and include almost one-half of all the bird species. They are considered perching or songbirds. Near passerines were observed in the surveys and grouped with passerines.
- ***Shorebirds*** are considered long-legged wading birds of the order Charadriiformes.
- ***Waterfowl*** are of the order Anseriformes and include duck, geese and swans.
- ***Raptors*** are diurnal birds of prey.
- ***Falcons*** are diurnal birds of prey.

- ***Apodidae*** include the swifts.
- ***Strigidae*** are true owls or typical owls.

3.2.1 Habitat Classification

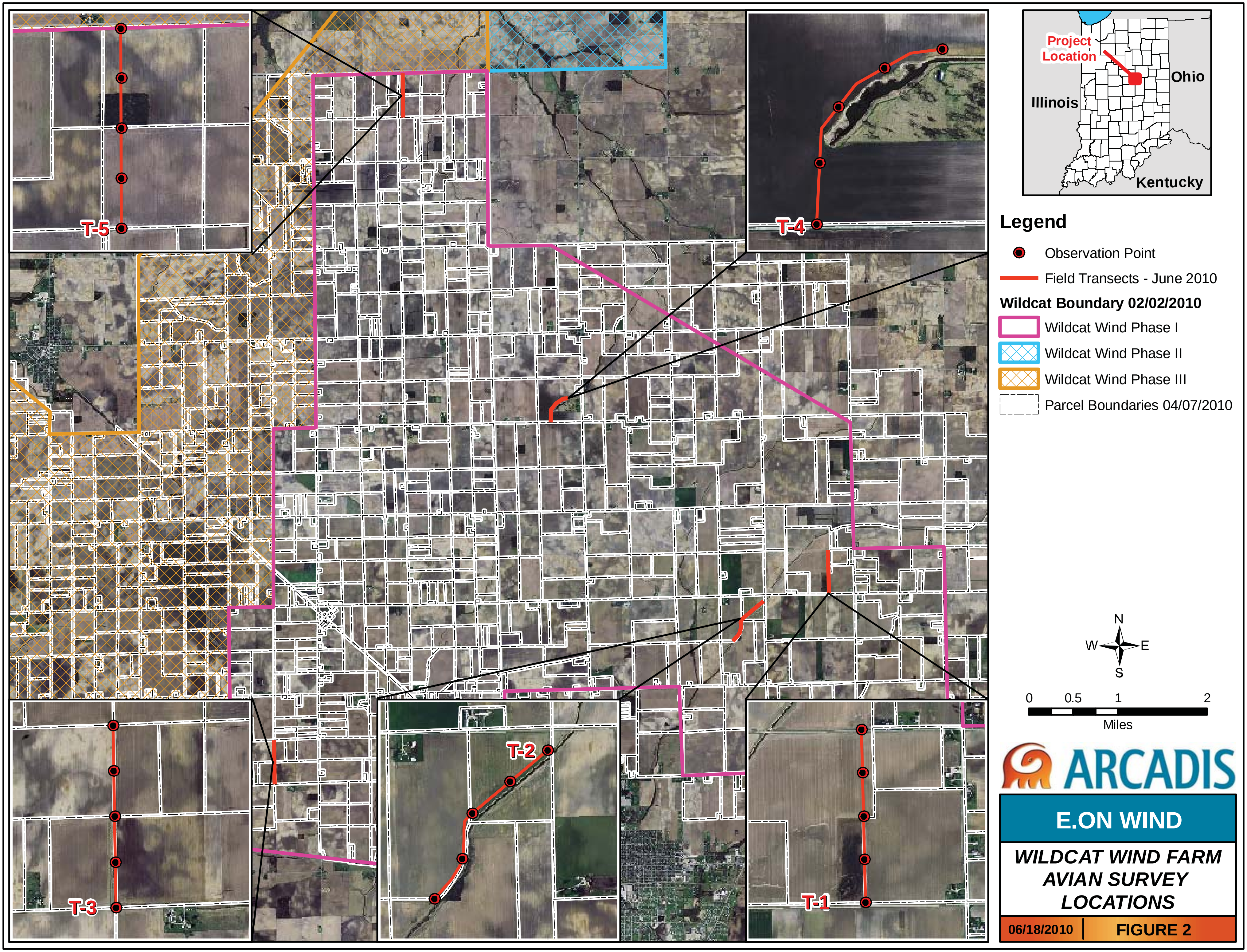
The Wildcat Wind Farm is located on relatively flat converted farmland. Most waters and wetlands observed during this survey have been converted into active farmland or have been managed to sustain only small, isolated wetlands and agricultural runoff ditches. There are areas of forest 2-5 acres in size scattered throughout the Site along with rows of trees located along drainages, wetlands and residential properties. The majority of potential habitat on the Site is agricultural land that is actively farmed for corn, soy, and/or hot weather grass.

Habitats were classified as either primary or secondary depending on land use. Three primary habitat types and seven secondary habitat types were identified in the project area (Table 2). The seven secondary habitats were used to evaluate bird utilization rates for purposes of the risk analysis. Photographs of representative habitats are provided in Appendix C.

3.2.2 Transect Locations

Five transects were chosen to represent the range of possible habitat types that exist in the project area. The five transects established for the surveys were used throughout the survey period; however, two transects during the April survey were cut short because of severe weather moving in during the completion of surveys. In addition, farming activity was much greater during the May point counts then during the April point counts and it was noted that fields that were once classified as corn now were planted with soy or what were once soy fields were now planted with corn. Figure 2 shows the locations of the transects. The habitat characteristics at each transect are discussed below.

The April migratory bird surveys were conducted from April 22 to April 25, 2010 at a time intended to coincide with migration of the American golden plover. Temperature during the surveys ranged from a low in the 40s to a high in the 70s (°F). It was cloudy with the threat of rain and severe weather most days. During the surveys two transects, Transects 3 and 5 (dusk and post dawn, respectively) were not completely observed for all five data points because of severe weather entering the Site area. ARCADIS scientists feel that these transects were adequately surveyed and did not need to be revisited during these survey times; because these transects were



Project Location
Illinois
Ohio
Kentucky
T-5
T-4
T-3
T-2
T-1
Legend
Observation Point
Field Transects - June 2010
Wildcat Boundary 02/02/2010
Wildcat Wind Phase I
Wildcat Wind Phase II
Wildcat Wind Phase III
Parcel Boundaries 04/07/2010
N
W
E
S
0
0.5
1
2
Miles
ARCADIS
E.ON WIND
WILDCAT WIND FARM AVIAN SURVEY LOCATIONS
06/18/2010
FIGURE 2

observed fully for the other two observation times that took place during the Site surveys.

In addition to recording observations while on transects, sightings of American golden plovers were noted if they were flying in the vicinity, or observed at locations as surveyors drove between transects. Because of the migratory behavior of American golden plovers, it was important to note American golden plovers that were observed and may have been missed if the surveyors only recorded those present within the transect boundaries.

In addition to observations of American golden plovers, other bird species observed at transects were recorded and included in the species list for the Site. The habitat type at each transect for migratory bird surveys is listed in Table 3.

Table 3. Habitat Types at Transect Locations

Transect Number	Habitats (Primary/Secondary)	Dominant Habitat Features
Transect 1	Agricultural/Actively Farmed	Farmed (corn, soy)
	Wetland/Grassland Buffer	Man-made pond with small wooded area along with grassland buffer area
Transect 2	Agricultural/Actively Farmed	Farmed (corn, soy, hot weather grass)
	Agricultural/Drainage Ditch	Canopy and grassland buffer
Transect 3	Agricultural/Actively Farmed	Farmed (soy, corn)
	Agricultural/Drainage Ditch	Drainage ditch, with grass land buffer
Transect 4	Agricultural/Actively Farmed	Farmed (soy and corn)
	Residential/Housing Landscape	House, and barn structures
	Wetland/Standing Water	Man-made pond in low laying areas of active agriculture fields and residential areas
	Wetland/Grassland Buffer	Pond with grassland buffer that is mowed
	Wetland/Canopy	Mature and immature trees and shrubs surrounding and within wetland area
Transect 5	Agricultural/Actively Farmed	Farmed (soy and corn) and road side
	Agriculture/Forested Area	~4 acres of mature forest area within center of Agriculture/Actively Farmed fields

May point count surveys were conducted between the dates of May 24 to May 27, 2010 to evaluate migratory birds, as well as the residential and breeding bird populations. Weather during this survey period was warm, ranging from the 70s to high 80s (°F). Wind was variable at 5 to 20 mph, and there was an occasional morning fog that burned off during the day. The May surveys utilized the same methodology as the surveys in April.

3.2.3 Analysis

Avian risk from exposure to wind farms can be evaluated by estimating the utilization of habitats by birds at locations where turbines are planned for construction (Anderson et al. 2005, NWCC 1999). Bird utilization of each habitat type was calculated by dividing the total number of individual birds in a taxonomic group (defined in Section 3.2) observed using a habitat by the total number of surveys that were completed for that habitat. The equation is:

$$\text{Utilization}_{\text{(Habitat Y)}} = \frac{\text{Total No. of Individuals}_{\text{(Taxonomic Group X)}} \text{ Observed in Habitat Y}}{\text{Total No. of Surveys in Habitat Y}}$$

The total number of surveys in a habitat was calculated by multiplying the frequency of habitat presence by the number of transect survey points. For example, as shown in Table 3, wetland/grassland buffer habitats were observed at two transect locations. However, at those two transects, only three out of the potential 10 survey points were located in wetland/grassland buffer habitats. Those three points were visited three different times of the day (post-dawn, mid-day, and pre-dusk) during both the April and May surveys for a total of 18 surveys.

$$\text{Total No. of Surveys}_{\text{(Wetland Habitat)}} = \text{3 survey points * 3 times per day *2 survey dates (April and May)} = 18$$

The total number of surveys varied for each habitat type and was dependent on the frequency that a habitat was present among the five transects. Oftentimes, two or more habitat types were observed at one survey location. For example, within an actively farmed agricultural field, a wetland was observed. Therefore, the total number of surveys for both of those habitat types was calculated at that one survey location.

The purpose of deriving utilization rates is for calculating bird risk which establishes a relationship between bird utilization and bird deaths in an area. Bird mortality is calculated as the number of dead birds per number of searches. Using bird mortality, estimated risk to birds can be calculated as:

$$\text{Bird Risk} = \frac{\text{Bird mortality}}{\text{Bird utilization rate}}$$

Bird utilization rates and bird fatality can increase proportionally without changing the bird risk index. When there is an increase or decrease in fatality with no change in the utilization (use) of the site, the risk index will change. Therefore, bird risk can be used to compare different variables on wind farms (i.e., geographic location, avian group, turbine size, and turbine type) while accounting for the observed differences in use and fatality rates associated with each variable (Anderson et al. 2005). For the purposes of this report, the utilization rates were calculated as a measure of habitat use by bird type for comparison purposes. Bird collision risk cannot be calculated using this formula until turbines are in place and mortality can be quantified.

4. Survey Results

A total of 56 species of birds (Table 4) and 1,350 individuals were observed during the resident/breeding and migratory bird surveys. Of the 1,350 observed, 1,261 birds were observed within a definable habitat (Table 5). Species that were observed audibly or flying by that could not be associated with a specific habitat type were not included in habitat analysis estimates. No species that were listed as threatened, endangered or special concern species for the State of Indiana were observed during the spring point count surveys.

4.1 American Golden Plover Surveys

American golden plovers were observed resting/foraging in agricultural fields. The total number of American golden plovers observed was 25 birds. Birds were seen foraging and roosting within newly tilled agriculture field (Table 6). American golden plovers were observed during the early evening hours. It should be noted that the soil at the Site was very dark in coloring and the weather conditions made it difficult to identify plovers within the agricultural fields. Therefore, the actual counts in this survey may be biased low.

Table 4. Bird Species Observed During Resident/Breeding and Migratory Surveys

Common Name	**Genus / species**	**Species Type**	**Observed During Resident/Breeding Bird Survey?**	**Observed During Migratory Bird Survey?**
American crow	*Corvus brachyrhynchos*	Corvid		Y
American golden plover	*Pluvialis dominica*	Shorebird		Y
American goldfinch	*Carduelis tristis*	Passerine	Y	
American robin	*Turdus migratorius*	Passerine	Y	Y
Baltimore oriole	*Icterus galbula*	Passerine	Y	
barn swallow	*Hirundo rustica*	Passerine	Y	Y
blue jay	*Cyanocitta cristata*	Corvid	Y	Y
brown-headed cowbird	*Molothrus ater*	Passerine	Y	Y
brown thrasher	*Toxostoma rufum*	Passerine	Y	Y
Canadian goose	*Branta canadensis*	Water Fowl	Y	Y
chimney swift	*Chaetura pelagic*	Apodidae	Y	Y
chipping sparrow	*Spizella passerina*	Passerine		Y
common snipe	*Gallinago gallinago*	Shorebird		Y
common yellow throat	*Geothlypis trichas*	Passerine	Y	
Eastern kingbird	*Tyrannus tyrannus*	Passerine	Y	
Eastern meadowlark	*Sturnella magna*	Passerine	Y	
European starling	*Sturnus vulgaris*	Passerine	Y	Y
common grackle	*Quiscalus quisicula*	Passerine	Y	Y
gray catbird	*Dumetella carolinensis*	Passerine	Y	
great blue heron	*Ardea herodias*	Shorebird		Y
great horned owl	*Bubo virginianus*	Strigidae		Y
horned lark	*Eremophila alpestris*	Passerine	Y	Y
house sparrow	*Passer domesticus*	Passerine	Y	Y
indigo bunting	*Passerina cyanea*	Passerine	Y	Y
Killdeer	*Charadrius vociferus*	Shorebird	Y	Y
Mallard	*Anas platyrhynchos*	Water Fowl	Y	Y

Common Name	Genus / species	Species Type	Observed During Resident/Breeding Bird Survey?	Observed During Migratory Bird Survey?
mourning dove	*Zenaida macroura*	Near Passerine	Y	Y
Northern cardinal	*Cardinalis cardinalis*	Passerine	Y	Y
Northern flicker	*Colaptes auratus*	Near Passerine		Y
Northern rough-winged swallow	*Stelgidopteryx serripennis*	Passerine	Y	Y
red-bellied woodpecker	*Melanerpes caronlinus*	Near Passerine	Y	
red-headed woodpecker	*Melanerpes erythrocephalus*	Near Passerine	Y	
red-tailed hawk	*Buteo jamaicensis*	Falcon		Y
red-winged blackbird	*Agelaius phoeniceus*	Passerine	Y	Y
rock dove	*Columba livia*	Near Passerine		Y
rough legged hawk	*Buteo lagopus*	Falcon		Y
ruby-throated hummingbird	*Archilochus colubris*	Near Passerine	Y	
sand hill crane	*Grus canadensis*	Shorebird		Y
Savannah sparrow	*Passerculus sandwichensis*	Passerine	Y	Y
song sparrow	*Melospiza melodia*	Passerine	Y	Y
tree swallow	*Tachycineta bicolor*	Passerine		
turkey vulture	*Cathartes aura*	Raptor		Y
flycatcher*	*Muscicapidae*	Passerine	Y	
hummingbird*	*Apodiformes*	Near Passerine	Y	
pigeon*	*Columba*	Near Passerine	Y	
meadow lark*	*Sturnella*	Passerine		Y
sandpiper*		Shorebird		Y
swallow*		Passerine		Y
swift*		Apodidae		Y
vireo*	*Vireo*	Passerine	Y	
wren*	*Troglodytidae*	Passerine	Y	
woodpecker*		Near Passerine		Y
vesper sparrow	*Pooecetes gramineus*	Passerine	Y	Y

Common Name	**Genus / species**	**Species Type**	**Observed During Resident/Breeding Bird Survey?**	**Observed During Migratory Bird Survey?**
white-breasted nuthatch	*Sitta carolinensis*	Passerine	Y	
warbling vireo	*Vireo gilvus*	Passerine	Y	
willow flycatcher	*Empidonax traillii*	Passerine	Y	

Notes:
* = unidentified to the species level

Table 5. Resident/Breeding Bird and Migratory Bird Species – Analysis of Habitat Usage

Species Type	Habitat (Primary/Secondary)	Number Observed	Percentage Representation[1]
Apodidae	Agriculture/Actively Farmed	3	0.2%
	Agriculture/Forested area	3	0.2%
Apodidae Total		***6***	***0.5%***
Corvid	Agriculture/Actively Farmed	5	0.4%
	Agriculture/Drainage Ditch	3	0.2%
	Agriculture/Forested area	4	0.3%
Corvid Total		***12***	***1.0%***
Falcon	Wetland/Grassland Buffer	1	0.1%
Falcon Total		***1***	***0.1%***
Passerine	Agriculture/Actively Farmed	633	50.2%
	Wetlands/Standing Water	8	0.6%
	Wetland/Grassland Buffer	159	12.6%
	Agriculture/Drainage Ditch	236	18.7%
	Agriculture/Forested area	21	1.7%
	Wetlands/Canopy	2	0.2%
	Residential/Housing and Landscape	58	4.6%
Passerine Total		***1,117***	***88.6%***
Picidae	Agriculture/Drainage Ditch	1	0.1%
Picidae Total		***1***	***0.1%***
Raptor	Agriculture/Forested area	1	0.1%
Raptor Total		***1***	***0.1%***
Shorebird	Agriculture/Actively Farmed	102	8.1%
	Wetland/Grassland Buffer	4	0.3%
	Wetlands/Standing Water	3	0.2%
Shorebird Total		***109***	***8.6%***
Strigidae	Agriculture/Drainage Ditch	1	0.1%
Strigidae Total		***1***	***0.1%***
Water Fowl	Agriculture/Actively Farmed	4	0.3%
	Agriculture/Drainage Ditch	3	0.2%
	Wetlands/Standing water	6	0.5%
Water Fowl Total		***13***	***1.0%***
Total [2]		**1,261**	**100.0%**

[1] Individual percentages may not add to total percentages due to rounding.
[2]The total includes all species that were observed on a specific habitat type – including audibles and flyovers that could be associated with habitat.

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Table 6. Total Number of American Golden Plovers Observed by Time of Day and for Each Habitat Type

Primary Habitat Type	Secondary Habitat Type	AM	Noon	PM	Total	Relative Percent
Agriculture	Actively Farmed	0	0	25	25	100%
Wetlands	Standing Water	0	0	0	0	0%
	Totals	0	0	0	0	100%

Utilization of habitats by the American golden plover is shown in Table 7. The highest rate of habitat utilization (0.3 birds/survey) was observed in actively farmed agriculture fields. This utilization rate is significantly lower than the utilization of habitats by resident and breeding bird populations, as a result of low numbers of American golden plovers observed in a specific habitat for an equal level of survey effort. Utilization of wetland habitats by the American golden plover is lower than the utilization observed by resident and breeding birds for other habitats. Utilization of agricultural fields by the American golden plover for resting and foraging is further assessed in the following sections, as wind turbines would be placed directly in this habitat.

Table 7. Utilization of Habitats by American Golden Plovers

Primary and Secondary Habitat Type	Total Number Observed	Total Surveys	Utilization Rate
Agriculture Actively Farmed	25	75	0.3
Wetland Standing Water	0	18	0
Total	25	75	0.3

4.2 Migratory and Resident/Breeding Bird Surveys

Birds observed during both the April and May surveys were combined for analysis as a more comprehensive list of the species that occupy the Site.

The percent composition of bird groups that were observed during both surveys is shown in Table 5. Passerines were the most abundant species group observed (89 percent), followed by shorebirds at 9 percent.

Table 8 lists all of the habitat types and the total number of birds observed, at post-dawn (a.m.), afternoon (noon), and pre-dusk (p.m.) surveys. Overall, there was an even distribution of birds observed during all survey time periods. The highest percentage of habitat used by resident and breeding birds was agricultural habitat (81%), which is the most dominant habitat type at the Site. Most birds were observed within actively farmed land (n=748). The most common species in actively farmed land were horned larks, followed by red-winged blackbirds, killdeer, American robin and barn swallows. Tall grasses bordering drainage ditches (n=244) and grassland buffers along wetlands (n=164) also appeared to provide useful habitat for cover and nesting materials. Red-winged black birds and song sparrows were two of the more common residents observed nesting in these grassland buffers. Other passerines that appeared to favor these grassy habitats were brown headed cowbirds and vesper sparrows. Small, scattered forest area within actively farmed land provided useful habitat cover and avoidance of predators (n = 28). Blue jays and brown headed cowbirds were two of the more common residents observed on the edge of the forested area. Other bird species that appeared to prefer this forested habitat were chimney swifts, grackles, wrens and woodpeckers.

Wetland habitats – particularly the grassland buffer within the actively farmed land surrounding the ponds– were used by 15 percent of birds observed in the survey. Species diversity in this habitat type was higher than in actively farmed land. Red-winged blackbirds, as well as song sparrows, brown headed cowbirds, and gray catbirds were among the most common species observed here.

Flight height for nearly all of the species that were observed was generally below the rotor sweep zone of turbines. For the few birds that flew above the rotor sweep zone, flights in the rotor sweep zone were limited to birds landing or taking flight and were short in duration. Flight paths tended to be sporadic and limited to movements between habitats to gather nesting materials or forage. Perching behavior was observed (most commonly in male red-winged blackbirds and brown-headed cowbirds) during nest construction. Power lines were common for perch locations for red winged blackbirds and mourning doves.

Utilization of habitats by all bird groups is shown in Table 9. Agricultural actively farmed land was the most dominant land use at the Site and provided the most abundant habitat for birds that could forage or find cover. The utilization rate in this habitat was the second highest (9.97 species/survey). The habitat with the highest utilization rate was agricultural/drainage ditch habitat, at 10.17 species/survey.

Wetland grassland buffer habitat was with the third most utilized habitat, with 9.11 species observed per survey.

Table 8. Total Number of Birds Observed by Time of Day and for Each Habitat Type

Primary Habitat Type	Secondary Habitat Type	AM	Noon	PM	Total	Relative Percent[1]
Agriculture	Actively Farmed	260	245	243	748	81%
	Drainage Ditch	70	70	104	244	
	Forested area	10	7	11	28	
			Total Agriculture		1,020	
Wetlands	Standing Water	1	13	3	17	15%
	Grassland Buffer	72	57	35	164	
	Canopy (light tree cover and shrubs)	1	1	0	2	
			Total Wetlands		183	
Residential	Housing and Landscape	26	7	25	58	5%
			Total Residential		58	
	TOTALS	440	400	421	1,261	

[1]Individual percentages do not add to 100% due to rounding.

Table 9. Utilization of Habitats

Primary and Secondary Habitat Type	Species Type	Total Number Observed	Total Surveys	Utilization Rate	Total Percent of Habitat Utilization by Bird Type
Agriculture Drainage Ditch	Corvid	3	24	0.13	1%
	Passerine	236	24	9.83	97%
	Water Fowl	3	24	0.13	1%
	Picidae	1	24	0.04	0%
	Strigidae	1	24	0.04	0%
	Total	**244**		**10.17**	
Agriculture Actively Farmed	Corvid	5	75	0.07	1%
	Apodidae	3	75	0.04	0%
	Passerine	633	75	8.44	85%
	Shorebird	102	75	1.36	14%
	Water Fowl	4	75	0.05	1%
	Raptor	1	75	0.01	0%
	Total	**748**		**9.97**	
Agriculture Forested Area	Passerine	21	9	2.33	75%
	Apodidae	3	9	0.33	11%
	Corvid	4	9	0.44	14%
	Total	**28**		**3.11**	
Wetland/Standing Water	Passerine	8	18	0.44	47%
	Shorebird	3	18	0.17	18%
	Water Fowl	6	18	0.33	35%
	Total	**17**		**0.94**	
Wetland/Grassland Buffer	Passerine	159	18	8.83	97%
	Falcon	1	18	0.06	1%
	Shorebird	4	18	0.22	2%
	Total	**164**		**9.11**	
Wetland/Canopy	Passerine	2	15	0.13	100%
	Total	**2**		**0.13**	
Residential/Housing and Landscape	Passerine	58	9	6.44	100%
	Total	**58**		**6.44**	
	Grand Total	**1,261**	**75**	**16.8**	

Utilization rates for this site are similar to the reference site in a study by Strickland et al. (2003), in which 9.38 birds/survey were used as the reference number for their spring surveys. The highest utilization rate observed in that study was 7.53 birds/survey. Turbines at the WWF project will only be placed in agricultural actively farmed lands. Other habitat types including the grassland buffer surrounding wetlands will not be significantly impacted.

5. Avian Risk Estimation

5.1 Review of Avian Risk and Wind Power Projects in the United States

Many studies have been completed to assess avian risk of collision with or displacement by wind turbines pre- and post-construction. In order to estimate avian risk at the Wildcat Wind Farm Site, it is valuable to compare the habitat and species observed at similar sites where studies have been completed. Two main types of risk to avian species are usually addressed and will be discussed here: 1) disturbance and displacement of birds due to construction and operation of the turbines; and 2) collision mortality with turbines, meteorology towers and related infrastructure.

5.1.1 Disturbance and Displacement

For agricultural environments, actual loss in habitat from turbine construction is reportedly minimal (NRC 2007). At this Site, where agricultural use will continue in the areas surrounding the turbines, actual direct impact to avian habitat is anticipated to be relatively small.

Studies have been conducted that evaluate whether increased human activity around wind turbines associated with construction and maintenance alters bird populations, and whether birds tend to avoid turbines and are potentially displaced from their natural habitat (Erickson et al. 2001). Although these studies are not conclusive, a study in Oklahoma (Mabey and Paul 2007) showed no negative effect on breeding grassland birds near turbines compared to those studied at intermediate (i.e., 1 to 5 kilometers [km] away) and distant (i.e., 5 to 10 km away) locations. Similarly, bird use within 200 m of turbines at the San Gorgonio Pass site in California was not found to be different compared to reference sites (Anderson et al. 2005). A study at the Altamont Pass Wind Resource Area of California indicated that, after a few weeks of exposure, trained red-tailed hawks appeared to become acclimated to the turbines and began flying in similar behaviors compared to resident red-tailed hawks (as cited in Curry and Kerlinger, 2002).

Certain studies (e.g., Leddy et al. 1999, which studied grasslands surrounding a wind project in Minnesota) indicate the importance of restoration of surrounding areas to original habitat conditions. At this site, where seasonal crops are planted, restoration is anticipated to readily occur in the surrounding areas.

Details regarding the risk associated with disturbance and displacement as a result of this project will be discussed below.

5.1.2 Collision Mortality

Erickson et al. (2005) estimates a potential annual mortality of one billion birds in the United States as a result of human-caused sources. Mortalities to birds due to wind turbines amounted to less than 0.01 percent of that estimate. The highest source of bird mortality due to collisions with human-caused sources is buildings (window collisions or tall buildings) at 58.2 percent, averaging 550 million (Klem 1990). The second highest source of fatalities is power lines, 13.7 percent or 130 million (Koops 1987), then cats at 10.6 percent or 100 million (Coleman and Temple 1996), cars at 8.5 percent or 80 million (Hodson and Snow 1965, Banks 1979), pesticides at 7.1 percent or 67 million (Erickson et al. 2005), and communication towers at 0.5 percent or 4.5 million (Erickson et al. 2005). Therefore, compared to the other sources of human-caused bird mortality, mortality from collisions with wind turbines is extremely low.

Fatality of birds due to collision with wind turbines throughout the United States was estimated at approximately 20,000 to 37,000 birds annually, based on the number of turbines present in 2003. This was estimated by an average mortality of 2.11 birds per turbine and 3.04 birds per MW per year. Due to the heightened sensitivity to raptor fatality at turbines, a separate fatality estimate was established for raptors as approximately 933 raptors killed annually. Of this estimate, 80 percent will occur at the older wind project sites in California (advances in siting considerations and turbine design are considered strong influences) and only approximately 195 deaths (20%) outside California (Erickson et al. 2005).

Each species group has a different behavior and flight pattern. The mortality risk due to collision with the turbines is addressed for each species group below.

5.1.2.1 Passerines and Corvids

A wind power facility in Minnesota with approximately 350 1.8-MW turbines had low numbers of avian mortalities. The fatality rate ranged from one bird per turbine to four birds per turbine per year. However, the highest percent of mortality was for night-migrating passerine species. They composed about 70 percent of the overall fatalities (Johnson et al. 2002). Similarly, in Wisconsin at a wind power facility with 31 0.7-MW turbines, 24 songbird fatalities were recorded in two years. Only two waterfowl fatalities were recorded. It was estimated that the fatality rate per turbine was 1 to 2 birds per year. The total height of the turbines at this study site was 89 m (Howe et al. 2002).

At the San Gorgonio wind facility in California, it was estimated that approximately 69 million birds pass through the Coachella Valley annually during spring and fall migrations. The site consists of approximately 3,000 wind turbines located at various elevations. A study was conducted to monitor nocturnal migrant fatalities, and fatalities of only 38 birds were observed for 25 different species. Of those 25 species, 15 were passerines, seven waterfowl, two shorebirds, and one raptor. Considering the high level of migration that occurs in this area, the fatality number was determined to be insignificant (McCrary et al. 1983, 1984, 1986).

Erickson et al. (2001) summarized avian fatality data from numerous wind turbine sites. In particular, a range of three to 69 turbines were monitored at ten separate sites located outside of California. Of the fatalities due to collisions, 78 percent were passerines (excluding house sparrows, *Passer domesticus,* and European starlings, *Sturnus vulgaris*) and only 2.7 percent were raptors. As many as 59.9 percent of the passerines are nocturnal migrants. Although most nocturnal migrating bird species fly higher than most turbine heights, weather or other external factors may affect flight pattern and result in collisions with wind turbines (Erickson et al. 2001).

5.1.2.2 Raptors

Most studies show that raptor mortality is low compared to other species (Johnson et al. 2000; Erickson et al. 2001; Strickland et al. 2003). The Altamont Pass Wind Resource Area in California is one of the few locations to have had a significant negative effect on avian populations, particularly for raptors. In one study over a four year period 108 raptor fatalities were recorded (CEC 1989). A separate two-year study recorded 182 fatalities, of which 68 percent were raptors and 26 percent were passerines (Orloff and Flannery 1992). Bird fatality studies at other wind plants in

California have not reported similar results. This may be due to the fact that Altamont Pass has: 1) a large number of turbines (5,400) concentrated in a small area; 2) turbines spaced 10 m apart rotor-to-rotor distance; 3) a high prey base of California ground squirrels that attract more raptor species; 4) steep topography with turbines in valleys and canyon edges; 5) turbines that sweep within 10 m of the ground, affecting raptor foraging habitat; 6) turbines with lattice type towers that allow for perching and nesting; and 7) small turbine rotors that turn quickly, making it difficult for birds to see (Orloff and Flannery 1996; Thelander and Rugge 2000). Recent improvements in technology as well as spacing the turbines farther apart and on higher points of the topography instead of in valleys or low areas are believed to have contributed to reduced mortalities at more recent wind plant sites when compared to the Altamont Study.

Turkey vultures have been observed to have higher mortality numbers compared to other bird species in two studies (Schnell et al. 2007; Tierney 2007). A study at a wind plant in Texas recorded 21 avian mortalities at 21 turbines, of which 15 were turkey vultures, mostly juveniles. However, adults were observed flying around the turbines and appeared to be able to avoid the blades (Tierney 2007). In Oklahoma, of 15 casualties at 50 turbines, 11 were turkey vultures and two were red-tailed hawks (Schnell et al. 2007). No age was reported in order to compare if juveniles were equally affected compared to the Tierney study.

The studies that observed high raptor mortalities have typically been in high elevation areas where the prey base is diverse and abundant. These conditions are not common in actively managed farmland.

5.1.2.3 Waterfowl and Shorebirds

A wind power facility in Iowa with 89 turbines was studied over a two-year period. The turbines were approximately 100 m high and rotated at a speed of 130 mph. There were no fatalities to Canadian geese or other waterfowl. This is significant because the wind power facility studied is located within 1 – 2 miles of waterfowl management areas and a significant number of waterfowl (>1.5 million duck and goose days per year) were observed utilizing the habitat (Koford et al. 2005).

Another study at the San Gorgonio wind power facility in California that occurred over 15 months documented a higher number of waterfowl fatalities (9) compared to passerines (6), rock doves (6), owls (5), waterbirds (2), diurnal raptors (2) and shorebirds (1). It was noted that the waterfowl and shorebird mortality was higher in areas where water was present in the vicinity of the project site (Erickson et al. 2001). Also, in Europe, shorebirds (golden plovers and lapwings) kept a distance of 250-500 m from wind turbines (Winkelman 1990).

The Buffalo Ridge Wind Resource Area in Minnesota had three phases of development. Strickland et al. (2003) studied the use, behavior and mortality at Phase I and Phase II. Phase I had 33 m diameter turbines with a rotor-swept area of 19.5 to 52.5 m above the ground. For Phase II, the sweep zone area of the larger 48 m turbines was 26 to 74 m above the ground. During the passerine and small bird surveys, a total of 26 percent of all flying birds were observed within the sweep zone of the Phase I turbines and 16 percent were observed within the sweep zone of the Phase II turbines. However, there was no significant difference in the number of birds observed within the sweep zone of the Phase I turbines compared to the Phase II turbines.

During the raptor and large birds surveys (which included waterfowl species), 47 percent of all flying birds were observed within the sweep zone of the Phase I turbines, and 36 percent within the sweep zone of the Phase II turbines. Combining all the species, there were significantly ($p<0.10$), more species observed flying within the sweep zone of the Phase I turbines compared to the Phase II turbines. The most abundant species types within the sweep zones were shorebirds, raptors and waterfowl. Strickland et al. (2003) concluded that the larger turbines installed during Phase II have less of a risk to avian fatalities than the smaller turbines installed in Phase I.

5.1.2.4 Game Birds

Game bird mortality is generally low compared to other fatalities observed at the wind power facilities. For example, a study was conducted over three years at Buffalo Ridge, Minnesota at a 350 (0.3 to 0.75 MW) turbine wind farm. The study identified an annual mortality of 2.8 birds per turbine based on a total of 55 fatalities observed. Of these, 76.4 percent were passerines, 9.1 percent waterfowl, 5.5 percent water birds, and 5.5 percent game birds. Most of the fatalities were determined to be night migrants (Johnson et al. 2000).

5.2 Avian Risk at the Wildcat Wind Farm

The habitat at the Wildcat Wind Farm consists of farmland with tilled, untilled and newly planted corn and soybean fields as the primary crops; and hot weather grasses as a secondary crop. Many of the habitat types that are described in this report – such as forest patches, agricultural ditches, urban roads, residential properties, and wetlands – will be actively avoided in the development of the turbine layout and disturbance to agricultural habitats will be minimal. The following lists the potential risks of disturbance and displacement as well as risk of collision with the turbines that could occur as a result of this project.

5.2.1 Disturbance and Displacement

Disturbance and displacement of resident and migratory birds may occur as a result of increased activity during construction and maintenance and improved road access as a result of development, especially in areas where there was little traffic before. In addition, the presence and noise of turbines may deter birds from using habitat close to them (Powlesland 2009). However, some studies appear to show little to no behavioral impact of turbines on birds and spacing turbines widely in an attempt to reduce the likelihood of blocking bird movement may potentially increase the area from which birds will be displaced by disturbance (Powlesland 2009).

Potential risk of disturbance and/or displacement from construction activities are expected to be minimal and temporary in nature. Typically, construction of wind plants is completed in six months to a year and, therefore, any impacts as a result of heavy machinery, increased road traffic, and the presence of workers is temporary and also not concentrated in one area. The workers will be moving across the Site installing the turbines at the designated areas. Agricultural uses will continue on the property except in the relatively small footprint area of the turbines and access ways.

5.2.1.1 Passerines

The majority of the species observed on the Site in actively farmed land where the turbines will be placed were passerine species (89 percent, Table 5). However, potential risk of disturbance and displacement to these passerines is considered to be low because this species group has been exposed to changes in habitat from one crop to another, workers actively tilling and/or harvesting the fields, and activity at residential properties or along roads. Furthermore, nesting and breeding habitats are not typically altered during construction, there are few to no species that nest in actively managed croplands, and overall impacts are not considered to be significant (Curry and Kerlinger 2002).

5.2.1.2 Raptors/Falcons

Forested habitat at the Wildcat Wind Farm Site is limited to scattered stands of mature trees and shrubs throughout the Site (the largest 2-5 acres in size) surrounded by actively farmed agricultural fields, as well as rows of single trees along fence lines and urban roads. Therefore, raptors and/or falcons that depend on forested habitat for perching, nesting, etc., are not as common and these species tend to not have a high risk of displacement. In addition, of all the species observed on the Site, raptors and falcons made up only 0.2 percent of the total (Table 5).

5.2.1.3 Other Species

Other species, including waterfowl, shorebirds (excluding the American golden plover), Apodidae (chimney swift), and Strigidae (great horned owl), use habitats that are not dominant at the Site or will be actively avoided during construction. Excluding the American golden plovers, the total percentage of waterfowl, shorebirds, Apodidae and Strigidae observed on the Site in a specific habitat type was less than 10 percent. Potential disturbance risk for these species would be temporary and displacement highly unlikely.

It has been documented that the American golden plover frequents counties in west central Indiana (Johnson 2003) as a stopover location during their spring migration from northeastern South America to the Arctic coastal plain. Records of American golden plovers in Madison and Tipton counties were not found, but this survey showed that they do use agricultural fields in these counties as a stopover location. Fall migration of the plover is through the Canadian provinces and along the eastern United States coast back to their wintering grounds and is, therefore, not evaluated here.

Risk of disturbance or displacement to the American golden plover on this Site is unknown and has been found to vary between sites (Clay et al. 2009; Percival 2003). There are studies on the European golden plovers (*Pluvialis apricaria*) that indicate they are a species of high risk for collision or disturbance by turbines (Pearce-Higgins et al., 2009), as well as studies that show no effect on the European plovers (Percival 2000, 2003). Because this species utilizes habitat on the Site where the turbines will be placed, there is a possibility of these birds being displaced to avoid the turbines. However, at a wind farm in Scotland, bird surveys were conducted four years after the turbines were in place and while the numbers of European golden plovers remained constant at a control site, the overall abundance at the wind farm actually increased. The study concluded that the turbines had no effect on the plovers and no sign of displacement was noted (Percival 2000).

The favored habitat of American golden plover – tilled (or partially tilled) agricultural fields of soy and sometimes corn – are locally abundant, abundant throughout the county, and abundant throughout the state. Moreover, migration of the plover is not restricted to the state of Indiana but can occur throughout the Great Plain states (The Wilderness Society 1998). Table 10 shows that the approximate footprint of the Wildcat Wind Farm Site (estimated 13,000 acres of cultivated soy and corn) would impact approximately four percent of actively managed soy and corn fields in Madison and Tipton counties which is 0.1 percent of this same agricultural use throughout the state. With the wide range of the migration route and the predominance of soy and corn fields throughout the State of Indiana (and the Midwest), American golden plover populations should not be significantly displaced. In addition, within the project Site itself, wind turbines will only displace only a very small percentage of the Site's habitat; the remaining area will continue in agricultural production and retain its habitat value. Therefore, because the impact area where the turbines are placed is such a small fraction of the overall available habitat for the American golden plover, the expected disturbance and displacement should be comparatively low.

Table 10. Estimated Size of Site Relative to Total Available Agricultural Land Use Habitat

Total Soy and Corn Planted	Acreage	Percent of Site Related to County/State
Site*	13,000	NA
Madison and Tipton Counties	340,300	3.8%
Indiana	11,050,000	0.1%

Source (USDA 2010): http://www.nass.usda.gov/QuickStats/Create_County_All.jsp

5.2.2 Collision with Wind Turbines

The potential collision risk for avian species at the Wildcat Wind Farm varies according to the bird type. For example, species that are ground nesters and foragers and do not spend much time flying near the sweep zone of the turbines would have a lower risk of collision. However, birds characterized as "fly overs" were not resting in a particular habitat, but were observed in flight. The majority of the birds were either observed high above the sweep zone or flying low (below the sweep zone) across the fields. Time spent in the sweep zone was minimal and included flocks flying in and landing in a field to rest or forage. The various species groups are discussed below.

5.2.2.1 Passerines and Corvids

Research has shown that most collisions of passerine birds at the turbines occur during night migrations and are usually of single birds (Curry and Kerlinger 2002). Erickson et al. (2001) estimated that passerines will make up 45.5 percent of the total fatalities due to collisions with the wind turbines.

Johnson et al. (2000) surveyed both wind turbines and guyed meteorological (met) towers, both approximately 60 m in height. The two types of towers were surveyed once a month for a year, and an annual average of 7.5 and 1.8 bird fatalities per year were identified for met towers and turbines, respectively. Wind turbines do not pose as great a risk to passerine birds compared to communication towers because of three factors: 1) they are relatively shorter in height compared to the tall communication towers (152-183 m), 2) they lack guy wires which are less visible and provide additional obstructions, and 3) the Federal Aviation Administration (FAA) obstruction lights do not appear to attract nocturnal migrants like the sodium-vapor lights on the communication towers do (Johnson et al. 2000). Currently there are no data that indicate a difference in the fatality rate at turbines with lights versus unlit turbines (Kerns and Kerlinger 2004; Kerlinger 2004). The guy wires on the communication towers account for most collisions of night-migrating passerines. There are no data that support collision fatalities at free-standing towers such as met towers at wind power sites (Kerns and Kerlinger 2004).

The majority of the birds observed on the Wildcat Wind Farm Site were passerine species (including near passerines) and corvids.[1] Overall, these species groups comprised 90 percent of the total birds observed on a specific habitat type during both survey dates with most observations in actively farmed land (Table 5). Passerines appear to be most susceptible to collision with wind turbines during seasonal movements and while migrating at night; however, once these species have established residence at a site the risk of collision with turbines appears to decrease. Passerine behavior observed during this study indicates that, in the absence of wind turbines, flight heights were typically below the sweep zone of turbines, and flight durations are typically restricted to localized movements for foraging, finding nest materials, guarding nests, etc. Potential for impact is also reduced through minimizing the use of guy wires, limiting the area of disturbance, maintaining substantial turbine spacing and limiting lighting to that required for FAA safety purposes. As a result, potential risk of collision with wind turbines by this group is expected to be moderate to low.

5.2.2.2 Raptors/Falcons

Although the Altamont Pass Wind Resource Area has experienced a large number of raptor collisions with turbines, the Wildcat Wind Farm is designed to avoid the project features that were determined to contribute to the high fatality rate there (Orloff and Flannery 1996; Thelander and Rugge 2000). For example, project turbines will be on flat terrain, the rotation of the blades will be much slower as compared to the Altamont rotation, turbines will be spaced father apart, there will be no lattice tower allowing perching, the prey base is low and few raptors were observed during bird surveys.

Overall, raptors and falcons comprised only 0.2 percent of the total species observed on a specific habitat type during the two surveys (Table 5). Falcons were only 0.1 percent of the birds observed in active agriculture and grassland transition habitats. According to a comprehensive study conducted by Erickson (2001), diurnal raptors comprised 34.3 percent of the total fatalities due to collisions with wind turbines. Since so few raptors were observed on this Site and the prey base for these species did not

[1] Corvids are sometimes included with passerines because their behavior is similar. Corvids are treated as a separate group in this risk evaluation but their numbers are small compared to those considered as “true” or “near” passerines.

appear to be overly abundant, the potential risk of raptor collision with proposed wind turbines at this location is expected to be low.

5.2.2.3 Waterfowl and Shorebirds

Waterfowl species observed on the Site include the Canadian goose and mallard. The shorebirds observed include the great blue heron, American golden plover and killdeer. Together these species comprised only 10 percent of the total species observed during the two surveys (Table 5). In the comprehensive study by Erickson et al. (2001), the total percent of fatalities to water birds including waterfowl and shorebirds comprised only 4.3 percent of total fatalities.

At the Wildcat Wind Farm Site, the great blue heron, killdeer and mallard were all observed flying well below the sweep zone. The Canadian goose, American golden plover and sand hill crane were the only water birds observed higher in the sky, but they were seen generally flying higher than the sweep zone. American golden plover were occasionally observed flying through rotor sweep zone height, although only to land or take to wing. Potential risk of collision with wind turbines by this group is expected to be low.

The American golden plover was listed in the top ten species of birds with the highest exposure potential for impact with wind turbines at the Buffalo Ridge Wind Resource Area in Minnesota (Johnson et al. 2000). However, of the available mortality data for wind farms in their migratory pathway, mortalities of American golden plovers have not been reported. One reason for this is that many of the wind farms are constructed at higher elevations and not in agricultural fields where American golden plovers are likely to forage and rest, and so American golden plovers are less likely to move within sweep zones (The Wilderness Society 1998). However, because this Site is located within agricultural fields, the expected results are less certain. Although, most observations of American golden plovers were when birds were resting or foraging on the ground, or when flocks were flying at heights well above a "typical" sweep zone of wind turbines. American golden plover were occasionally observed flying through rotor sweep zone height, although only to land or take to wing.

Another reason American golden plover mortalities associated with wind farms have not been reported is that American golden plovers appear to actively avoid turbines to land in fields. Open spaces (even space beneath active turbines) is important to the American golden plover to defend against raptors that are the main cause of population mortality – estimated at nearly 50 percent (The Wilderness Society 1998). However, because the turbines will be placed in habitat that the American golden plovers utilize and they were observed at times flying into the sweep zone, there is a potential for collision with the turbines.

5.2.2.4 Other

A few Apodidae and Strigidae (chimney swift and great horned owl respectively) species were observed during the surveys, but the numbers were low and the total together compromised only 0.6 percent of the birds observed (Table 5). The great horned owl was observed and flushed from the drainage canal within Transect 2. The potential risk to these species are termed low as they were not observed within active agriculture fields; therefore, there is a lower probability that they would come into contact with the turbines and be displaced during construction.

5.2.3 Temporal Considerations in Estimating Risk

In ecological risk assessments involving the evaluation of wildlife exposure to environmental contaminants in media (surface waters, soils, sediments or prey), exposure factors are derived that consider the species life history requirements. Temporal considerations are given to exposed species that would use an environment at only certain times of the year. Factors related to the species behavior (migration, hibernation, home range for foraging), and the conditions of the habitat (snow cover, ice, poor habitat for foraging) can limit species exposure and associated risk. For these reasons, Temporal Use Factors (TUFs) are derived in ecological risk assessments to characterize more accurately the potential risk of exposure at a site rather than assuming the organism is at risk 100 percent of the time. The United States Environmental Protection Agency (EPA) Region 5, which includes the State of Indiana, provides guidance on the use of TUFs for ecological risk assessments.

A similar technique can be used to better understand potential risk issues associated with the Wildcat Wind Farm. Resident and breeding birds are not always present at the Site, as habitat conditions are not always favorable to sustain populations of these birds. Similarly, migratory birds like the American golden plover only spend a brief period of time in Indiana before moving north to their breeding grounds. Therefore, estimates of habitat utilization for these species are “biased high,” because the calculations require that species counts are presented as a function of the number of surveys taken, and these surveys are generally conducted at the time when birds are most abundant.

An example of how TUFs provide a more accurate representation of "risk" to avian species at the Wildcat Wind Farm is provided in Table 11. This table shows temporally adjusted utilization rates for passerines and American golden plover in the most abundant habitat type on site (agriculture/actively farmed), with the assumption that each would utilize habitats at the Site for eight and one month(s) of the year, respectively. The results clearly show that if the migratory behavior of the American golden plover is factored into an estimate of habitat utilization at the Site, that the resulting "average" utilization for the year drops significantly from the originally estimated 0.3 birds surveyed within actively farmed areas to 0.027 birds. The adjusted population for passerines is somewhat higher, at 5.65 birds within the actively farmed areas. Understanding the temporal utilization of the Site provides important context for risk assessment to bird species.

Table 11. Utilization Rates of Bird Groups Adjusted for Temporal Use of the Wildcat Wind Farm Site

Species	Primary and Secondary Habitat Type	Total Number Observed	Total Surveys	Utilization Rate	TUF	Adjusted Utilization Rate
Passerines	Agriculture Actively Farmed	633	75	8.44	0.67	5.65
American Golden Plover	Agriculture Actively Farmed	25	75	0.3	0.08	0.027

Temporal Use Factor (TUF) for passerines assumes that this group is present for 8 out of 12 months (0.67).
TUF for migratory American golden plovers assumes that this group is present for 1 out of 12 months (0.08).
The adjusted utilization rate is simply the original utilization rate multiplied by the TUF.

6. Summary and Conclusions

Although American golden plover and general avian usage was observed at and near the Site, the Wildcat project Site will not result in significant levels of potential risk to resident, breeding, and migratory species for the following reasons:

- **Avian utilization rates are average and no critical or unique habitat will be impacted by the project.** Turbines will be located on agricultural actively farmed lands, which is abundant within the project area and the county. There is no "critical" or unique habitat used by birds that is threatened by the presence of turbines. This is supported by avian utilization rates observed throughout the project area that are comparable to those found in other studies (Strickland et al. 2003 and Anderson et al. 2005).

- **The life history requirements and behavior of birds limit exposure to wind turbines.** Birds are not uniformly present at the Site throughout the year and migrating birds that are not nesting in the area would be exposed to turbines even less then resident and breeding populations. In addition, published studies confirm that for most species, abnormally high fatalities are not expected at wind farms. In the event of bird collision and mortality with turbines, it is rarely considered significant to the success of populations. Most birds appear to actively avoid (or adjust to) the presence of turbines.
- **For resident and breeding bird populations:** Many resident or breeding birds were observed at the Site; however, most were observed flying well below rotor sweep zone height. Few birds that did fly above the rotor sweep zone flew into the potential sweep zone during takeoff and landing with little time actually spent in the sweep zone. Flight patterns were restricted to localized movements among habitat types and of short duration. Potential risk of exposure to turbines is not expected to result in significant impacts to the bird populations that utilize habitats at the Wildcat Wind Farm Site.
- **For migratory birds:** American golden plover were occasionally observed flying through rotor sweep zone height, although only to land or take to wing. The one flock of plovers that was flying into an active agriculture field was predicted to have flown through the sweep zone only as they were coming in to land in the field.
- **Best management practices have been incorporated in the pre-construction design of the project to reduce risk of mortality to bird populations.** In addition to the above ecological factors, best management practices are planned in the pre-construction design of the project that is expected to reduce mortality to birds by: 1) using tubular towers without guy wires and turbine designs that reduce or eliminate perching opportunities; 2) establishing adequate spacing of turbines in farmlands; 3) avoiding heavily utilized or sensitive habitats such as drainage ditches, wetlands, and associated habitats; and 4) burying electrical collection and transmission lines to the greatest extent practicable.

The project has been designed to consider and avoid potentially sensitive biological resources wherever possible. The proposed project area does not appear to contain any unique habitat or topographic features compared to other wind projects in Indiana. The proposed project occurs within an area that is predominantly active agricultural use. Construction and operation of the project, taking place predominantly within areas of active agricultural cropland, are not expected to significantly impact migratory birds or jeopardize any protected species or their essential habitat.

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APPENDIX A

USFWS CORRESPONDENCE

United States Department of the Interior
Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

March 24, 2010

Ms. Lynn Gresock
ARCADIS
2 Executive Drive, Suite 303
Chelmsford, Massachusetts 01824

Dear Ms. Gresock:

Thank you for your letter dated February 23, 2010 concerning a proposal for the Wildcat wind power generation project in Grant, Howard, Madison and Tipton Counties, Indiana.

These comments are being provided pursuant to the Endangered Species Act (ESA), the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Fish and Wildlife Act of 1956. This information is being provided to assist you in making an informed decision regarding site selection, project design, compliance with applicable laws, and to determine whether a permit to cover anticipated take of species is appropriate under the ESA.

The Fish and Wildlife Service (Service) supports the development of wind power as an alternative energy source, however, wind farms can have negative impacts on wildlife and their habitats if not sited and designed with potential wildlife and habitat impacts in mind. Selection of the best sites for turbine placement is enhanced by ruling out sites with known high concentrations of birds and/or bats passing within the rotoswept area of the turbines or where the effects of habitat fragmentation will be detrimental. In support of wind power generation as a wildlife-friendly, renewable source of power, development sites with comparatively low bird, bat and other wildlife values, would be preferable and would have relatively lower impacts on wildlife.

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. Bald and golden eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Unlike the Endangered Species Act, neither the MBTA nor its implementing regulations at 50 CFR Part 21, provide for permitting of "incidental take" of migratory birds.

While the MBTA has no provision for allowing unauthorized take, the Service recognizes that some birds may be killed at structures such as wind turbines even if all reasonable measures to avoid it are implemented. While it is not possible under the MBTA to absolve individuals, companies, or agencies from liability if they follow these recommended guidelines, the Service's Office of Law Enforcement and Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals, companies, or agencies who have made good faith efforts to avoid the take of migratory birds.

There has been increasing concern regarding mortality of bats associated with wind power facilities. Although not federally protected (unless on the endangered species list), many species of bats are declining and are listed as endangered or special concern by individual states. Factors contributing to bat mortality at wind farms are not completely understood, but there seems to be a strong association with migrating bats, especially of certain species, and adequate information on bat migration patterns is lacking for many species.

The Service's "voluntary" Interim Guidelines on Avoiding and Minimizing Impacts from Wind Turbines may be helpful as you evaluate your proposed wind power generation site (http://www.fws.gov/habitatconservation/wind.htm). The guidance contains a pre-development site evaluation and ranking process to assess potential project impacts, as well as recommendations for conducting post-construction monitoring. The guidance also contains more information on the applicable laws and permitting aspects in Appendices 3 and 5. Service staff welcome the opportunity to work with representatives of your industry.

As discussed in our voluntary interim guidelines, post-construction monitoring is critical for evaluating the effects of the project on migratory birds and bats. Monitoring should use standard methods which include components of bird mortality and avoidance of structures. If species of concern are present, pre-construction bird surveys may also be warranted.

Site-specific Information

Migratory Birds

Habitat for migratory birds within the project boundaries includes stream corridors, several small wetlands (mostly forested) and small upland woodlots (mostly less than 20 acres). Based on a review of maps and aerial photographs the most significant wetlands are forested wetlands along or near the Wildcat Creek stream corridors in the far northeast portion of Phase 4 (70-80 acres of riparian forest). Some of the wetland and upland woodlots are in close proximity to drainageways and/or forested wetlands, while others are isolated. In agricultural landscapes these features often provide the only habitat for many species of migratory birds.

We are not aware of any site-specific bird issues. There are no Important Bird Areas (IBA's) or potential IBA's near the project area based on 2008 information. The closest significant migratory bird habitat is Mississinewa Lake and State Recreation Areas, approximately 6 miles north of the project boundary; the forested Wildcat Creek corridor; and the forested Pipe Creek corridor about 3 miles southeast of the boundary.

Bats

In Indiana several species of bats forage and roost along forested drainageways and within large patches of other habitat types where an insect forage base is present. Early monitoring data from existing wind power projects in Indiana have shown bat mortality from turbine blade collisions, chiefly during migration season, as in virtually all other wind farm wildlife mortality studies. Very little information is available on the migration pathways of bats in Indiana, however it is likely that bat mortality will occur at all projects. Due to the potential species-level impacts of turbine mortality, all wind power projects should take appropriate measures to minimize bat mortality.

Water Resources

Some of the streams within the project boundaries provide aquatic habitat for fish, macroinvertebrates and amphibians. In addition to their wildlife habitat value, wetlands, streams and riparian areas serve to protect water quality in downstream receiving waters. We recommend preservation of all water resources along with riparian buffers. Work within streams or wetlands may require permits from the US Army Corps of Engineers and/or the Indiana Department of Environmental Management. Work within floodways may require a permit from the Indiana Department of Natural Resources.

Endangered Species

Because of the potential for wind power projects to impact endangered birds, bats, or other listed species, they are subject to the Endangered Species Act (16 U.S.C. 1531-1544) section 9 provisions governing "take", similar to any other development project. Take incidental to a lawful activity may be authorized through the initiation of formal consultation, if a Federal agency is involved; or if a Federal agency, Federal funding, or a Federal permit are not involved in the project, an incidental take permit pursuant to section 10 (a)(1)(B) of the ESA may be obtained upon completion of a satisfactory habitat conservation plan for the listed species. However, there is no mechanism for authorizing incidental take "after-the-fact".

The proposed project is within the range of the Federally endangered Indiana bat (*Myotis sodalis)*. Indiana bats hibernate in caves, then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Recent research has shown that they will inhabit fragmented landscapes with adequate forest for roosting and foraging. Young are raised in nursery colony roosts in trees, typically near drainageways in undeveloped areas. Like all other bat species in Indiana, the Indiana bat diet consists exclusively of insects.

An Indiana bat mortality from a wind turbine collision was documented during the fall migration season in 2009. This mortality confirms the concerns of the community of scientists who study bats that Indiana bats, like other species, are susceptible to mortality at wind turbines. Most bat fatalities at turbines occur during late summer and autumn, suggesting that bats may be particularly susceptible during fall migration. While there are insufficient data to assess seasonal patterns of mortality of Indiana bats at wind facilities, based on data from other species we suspect that Indiana bats may also be at highest risk during fall migration, when migrating from summering areas to winter hibernacula. These migrations occur throughout the range of the species. Take of Indiana bats without authorization from the FWS would constitute a violation of Section 9 of the Endangered Species Act (ESA). To avoid liability under the ESA we recommend that the proposed project pursue one of the following alternatives:

1. Obtain an incidental take permit from the FWS, either through a federal agency pursuant to Section 7 of the ESA, or through development of a Habitat Conservation Plan (HCP) pursuant to Section 10 of the ESA.

2. Develop a plan, in coordination with the FWS, to avoid take of Indiana bats by implementing appropriate design and operation measures. Potential measures include, but are not limited to, operation modifications during bat migration season. These avoidance measures would be conducted in conjunction with increased post-construction monitoring to evaluate the success of implemented measures. This monitoring will allow the FWS to compile more information on Indiana bat migration, patterns of collision with turbines, and underlying reasons why bats collide with turbines. Using this information, recommendations for minimizing and avoiding collisions can be refined.

There are no Indiana bat hibernacula known to exist near the project area. There is suitable summer habitat for this species present in and around the study area, mostly limited to the forested stream corridors and adjacent forest. The most significant habitat within the project boundaries is the aforementioned riparian forest in the northeast portion of Phase 4, which connects to additional habitat downstream. However, there is also good summer habitat near the project boundaries in some locations. The closest summer record of Indiana bats is along the upper reach of Wildcat Creek approximately ½ mile upstream from the habitat in Phase 4, but to our knowledge most of the study area has not been surveyed. Due to the possibility of Indiana bat mortality during summer foraging we recommend that one or more of the following measures be implemented in this project.

1. Avoid installing wind turbines within 2 ½ miles of good summer habitat.

2. Conduct a mistnet survey in habitat areas of concern during the spring/summer maternity season, to determine whether Indiana bats are present. Mistnet surveys must be performed by personnel with appropriate state and federal permits.
3. Include potential take of bats from summer habitat within an HCP as discussed above for migration season.

This endangered species information is provided for technical assistance only, and does not fulfill the requirements of Section 7 of the Endangered Species Act.

Thank you for the opportunity to provide preliminary comments on the aforementioned proposed wind power generation project. Please recoordinate with this office as project development proceeds. For further discussion please call Mike Litwin at (812) 334-4261 ext. 205.

Sincerely yours,

Michael S. Litwin
for Scott E. Pruitt
Field Supervisor

cc: Matt Buffington, Indiana Division of Fish and Wildlife, Indianapolis, IN
Jeff Gosse, USFWS, Twin Cities, MN

APPENDIX B

IDNR CORRESPONDENCE

DNR
Indiana Department of Natural Resources

March 2, 2010

Ms. Lynn Gresock
Arcadis U.S., Inc.
2 Executive Drive, Suite 303
Chelmsford, MA 01824

Dear Ms. Gresock:

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from the Wildcat Wind Project, Indiana. The Indiana Natural Heritage Data Center has been checked and enclosed you will find information on the ETR species documented near the project area.

For more information on the animal species mentioned, please contact Christie Stanifer, Environmental Coordinator, Division of Water, 402 W. Washington Room W264, Indianapolis, Indiana 46204, (317)232-4160.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. If you have concerns about potential Endangered Species Act issues you should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal.
For more information, please contact:

Department of Natural Resources
attn: Christie Stanifer
Environmental Coordinator
Division of Water
402 W. Washington Street, Room W264
Indianapolis, IN 46204
(317)232-4160

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 if you have any questions or need additional information.

Sincerely,

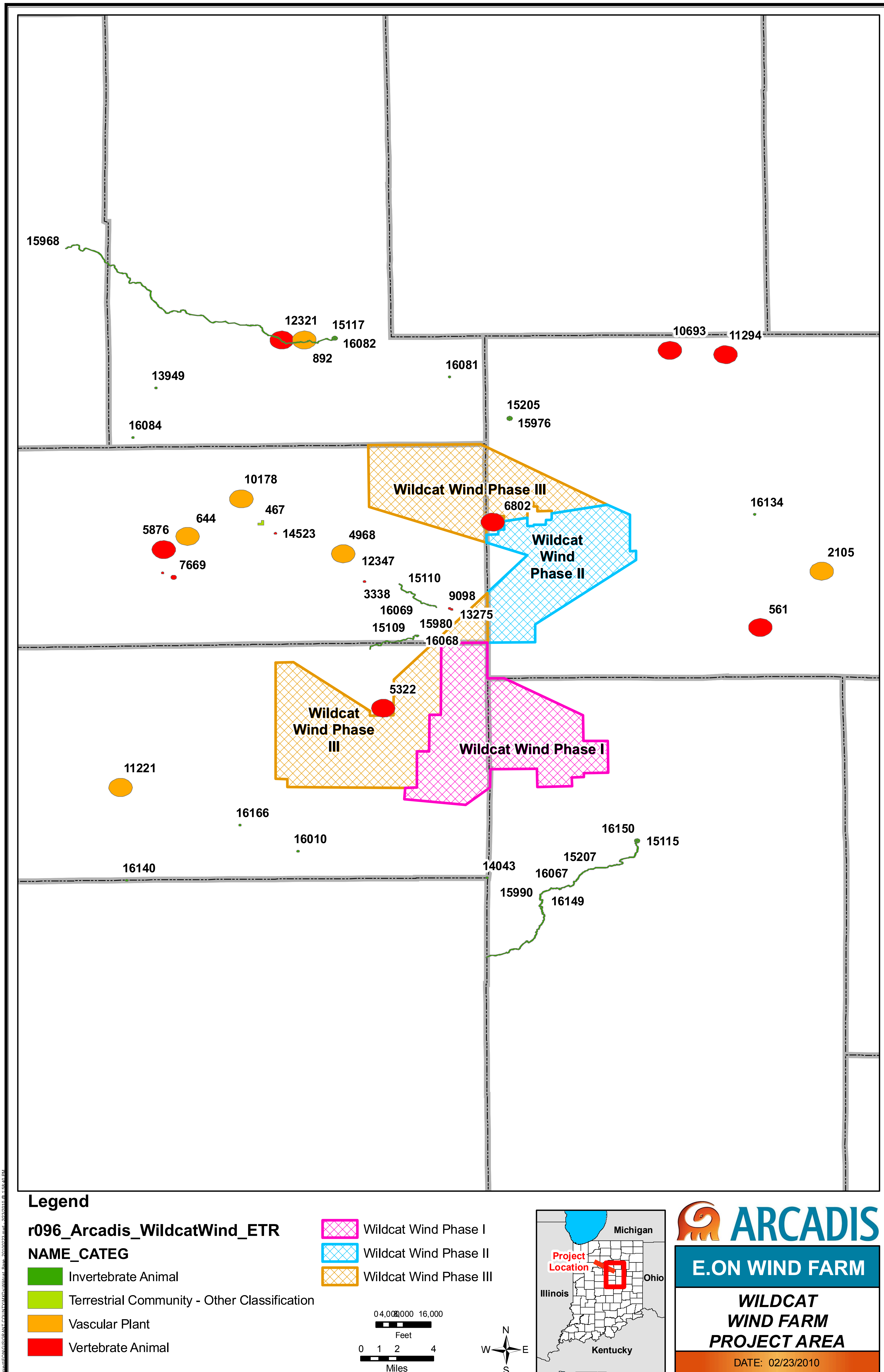
Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

Attachments invoice
Data GIS Shapefile

Wildcat Wind Farm - Phase I
Appendix B - IDNR Correspondance
State-Protected Species Potentially in Project Area

OBJECTID	EO_ID	NAME_CATEG	ELEMENT_GL	ELEMENT_SU	ELCODE	EONUM	SNAME	SCOMNAME	SPROT	LASTOBS	USESA	LONGDEC	LATDEC	OBSERVER	MISCCOMMEN	COUNTY_NAM	QUADNAME	SURVEY_SIT	TRS	TYPE
43	10693.00000000000	Vertebrate Animal	3891	16678	ABPBX05010	36	Mniotilta varia	Black-and-white Warbler	SSC	2002-06-13		-85.71660000000	40.64020000000	BRAD JACKSON		Grant	La Fontaine	METOCINAH CREEK	025N007E 10 NEQ NEQ	Bird
1697	12321.00000000000	Vertebrate Animal	225	13012	ABNGA04010	10	Ardea herodias	Great Blue Heron		1974		-86.02690000000	40.64860000000	S. MILLER	ABANDONED	Miami	Bunker Hill		025N004E 01	Bird
1949	5322.00000000000	Vertebrate Animal	5945	18732	ABNME03040	3	Laterallus jamaicensis	Black Rail	SE	1936-06-10		-85.94580000000	40.35440000000	RUSSELL MUMFORD AND HARMON WEEKS		Tipton	Windfall		022N005E 15	Bird
5686	9098.00000000000	Vertebrate Animal	225	13012	ABNGA04010	80	Ardea herodias	Great Blue Heron		1983		-85.89270000000	40.43410000000	JOE SCHEIDLER IDNR		Howard	Greentown		023N006E 19 NWQ	Bird
12201	7669.00000000000	Vertebrate Animal	2797	15584	ABNKD06070	16	Falco peregrinus	Peregrine Falcon	SE	2003-06-23		-86.11330000000	40.45880000000	John Castrale	Nest site	Howard	Kokomo East	Kokomo Gas and Power	023N004E 6	Bird
11423	467.00000000000	Terrestrial Community - Other Classification	6384	19171	CFORFLACEN	15	Forest - flatwoods central till plair	Central Till Plain Flatwoods	SG	1984-10-31		-86.04220000000	40.50250000000	BRIAN ABRELL, HANK HUFFMAN		Howard	Miami	SCHENK'S WOODS	024N004E 26	High Quality Natural Community
435	11294.00000000000	Vertebrate Animal	1940	14727	AMAJF04010	119	Taxidea taxus	American Badger	SSC	1983		-85.67220000000	40.63690000000	RAYMOND SPEICHER, R2 LAFONTAINE 46940		Grant	La Fontaine		025N008E 07	Mammal
2496	561.00000000000	Vertebrate Animal	3068	15855	AMAJF02020	10	Mustela nivalis	Least Weasel	SSC	1959-06		-85.64440000000	40.41880000000	KIRKPATRICK, R.		Grant	Fairmount		023N008E IN FAIRMOUNT	Mammal
9902	3338.00000000000	Vertebrate Animal	1383	14170	AMAJH03020	123	Lynx rufus	Bobcat	SSC	1991-12-19		-85.96080000000	40.45550000000	JOHN HALL, DIV OF WATER, 317-232-4167	UNCONFIRMED	Howard	Greentown		023N005E 09 NWQ NEQ SEQ	Mammal
11215	13275.00000000000	Vertebrate Animal	424	13211	AMACC01100	68	Myotis sodalis	Indiana Bat or Social Myotis	SE	1991-07-25	LE	-85.89110000000	40.43330000000	V. BRACK & K. TYRELL - 3D ENVIRONMENTAL SERVICES, INC. (513)922-8199		Howard	Greentown	1991 BRACK SURVEY SITE T	023N006E 19 SEQ NEQ NWQ	Mammal
12180	14523.00000000000	Vertebrate Animal	1940	14727	AMAJF04010	307	Taxidea taxus	American Badger	SSC	2003-09-20		-86.03190000000	40.49410000000	Tim Fisher		Howard	Kokomo East		024N004E 25	Mammal
11821	13949.00000000000	Invertebrate Animal	387	13174	IMBIV43030	121	Toxolasma lividus	Purple Lilliput	SSC	2001-11-06		-86.12750000000	40.61020000000	Brant Fisher	WEATHERED DEAD	Miami	Galveston	DEER CREEK	025N003E 13	Mollusk
11858	14043.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	161	Villosa lienosa	Little Spectaclecase	SSC	2002-02-15		-85.86270000000	40.21880000000	Brant Fisher	WEATHERED DEAD	Hamilton	Frankton	DUCK CREEK	020N006E 4	Mollusk
12828	15110.00000000000	Invertebrate Animal	1039	13826	IMBIV21070	202	Lampsilis fasciola	Wavyrayed Lampmussel	SSC	2004-08-03		-85.92080000000	40.44410000000	B.E. FISHER, T.V. BRIGGS	LIVE	Howard	Greentown	NORTH FORK WILDCAT CREEK	023N005E 24	Mollusk
12833	15115.00000000000	Invertebrate Animal	1039	13826	IMBIV21070	207	Lampsilis fasciola	Wavyrayed Lampmussel	SSC	2004-09-13		-85.74270000000	40.24860000000	B.E. FISHER, T.V. BRIGGS	WEATHERED DEAD	Madison	Anderson North	PIPE CREEK	021N007E 21	Mollusk
12837	15117.00000000000	Invertebrate Animal	1039	13826	IMBIV21070	209	Lampsilis fasciola	Wavyrayed Lampmussel	SSC	2004-08-02		-85.98470000000	40.65000000000	B.E. FISHER ,T.V. BRIGGS	FRESH DEAD	Miami	Peoria	PIPE CREEK	026N005E 32	Mollusk
12851	15109.00000000000	Invertebrate Animal	1039	13826	IMBIV21070	201	Lampsilis fasciola	Wavyrayed Lampmussel	SSC	2004-08-03		-85.93690000000	40.40720000000	B.E. FISHER, T.V. BRIGGS	WEATHERED DEAD	Tipton	Greentown	MUD CREEK	023N005E 33	Mollusk
12861	15205.00000000000	Invertebrate Animal	462	13249	IMBIV35060	215	Pleurobema clava	Clubshell	SE	2004-08-02	LE	-85.84470000000	40.58610000000	B.E. FISHER, T.V. BRIGGS	SUBFOSSIL	Grant	Sweetser	PIPE CREEK	025N006E 28	Mollusk
12868	15207.00000000000	Invertebrate Animal	462	13249	IMBIV35060	217	Pleurobema clava	Clubshell	SE	2008-08-18	LE	-85.82020000000	40.20220000000	B.E. FISHER & S.A. BALES	WEATHERED DEAD	Madison	Anderson North	PIPE CREEK	020N006E 1	Mollusk
13559	15990.00000000000	Invertebrate Animal	2211	14998	IMBIV38010	230	Ptychobranchus fasciolaris	Kidneyshell	SSC	2008-08-18		-85.82020000000	40.20520000000	B.E. FISHER AND S.A. BALES	WEATHERED DEAD	Madison	Frankton	PIPE CREEK	020N006E 23	Mollusk
13561	15968.00000000000	Invertebrate Animal	2211	14998	IMBIV38010	208	Ptychobranchus fasciolaris	Kidneyshell	SSC	2005-08-03		-86.13190000000	40.68520000000	B.E. FISHER AND T.V. BRIGGS	FRESH DEAD	Miami	Bunker Hill	PIPE CREEK	026N004E 34	Mollusk
13575	15976.00000000000	Invertebrate Animal	2211	14998	IMBIV38010	216	Ptychobranchus fasciolaris	Kidneyshell	SSC	2004-08-02		-85.84500000000	40.58610000000	B.E. FISHER AND T.V. BRIGGS	SUBFOSSIL	Grant	Sweetser	PIPE CREEK	025N006E 27	Mollusk
13580	15980.00000000000	Invertebrate Animal	2211	14998	IMBIV38010	220	Ptychobranchus fasciolaris	Kidneyshell	SSC	2004-08-03		-85.91860000000	40.41220000000	B.E. FISHER AND T.V. BRIGGS	MUSSEL - WEATHERED DEAD	Howard	Greentown	MUD CREEK	023N005E 25	Mollusk
13590	16010.00000000000	Invertebrate Animal	2211	14998	IMBIV38010	250	Ptychobranchus fasciolaris	Kidneyshell	SSC	2004-06-08		-86.01380000000	40.24000000000	B.E. FISHER AND T.V. BRIGGS	SUBFOSSIL	Tipton	Arcadia	CICERO CREEK	021N004E 25	Mollusk
13614	16081.00000000000	Invertebrate Animal	387	13174	IMBIV43030	177	Toxolasma lividus	Purple Lilliput	SSC	2004-07-14		-85.89270000000	40.61910000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Miami	Amboy	PIPE CREEK	025N006E 18	Mollusk
13617	16082.00000000000	Invertebrate Animal	387	13174	IMBIV43030	178	Toxolasma lividus	Purple Lilliput	SSC	2004-08-02		-85.98440000000	40.65000000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Miami	Peoria	PIPE CREEK	025N005E 5	Mollusk
13621	16084.00000000000	Invertebrate Animal	387	13174	IMBIV43030	180	Toxolasma lividus	Purple Lilliput	SSC	2005-09-06		-86.14580000000	40.57050000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Miami	Galveston	SOUTH FORK DEER CREEK	025N003E 35	Mollusk
13635	16067.00000000000	Invertebrate Animal	387	13174	IMBIV43030	163	Toxolasma lividus	Purple Lilliput	SSC	2008-08-18		-85.82020000000	40.20220000000	BE FISHER AND SA BALES	WEATHERED DEAD	Madison	Anderson North	PIPE CREEK	020N006E 27	Mollusk
13638	16068.00000000000	Invertebrate Animal	387	13174	IMBIV43030	164	Toxolasma lividus	Purple Lilliput	SSC	2004-08-03		-85.91860000000	40.41220000000	B.E. FISHER AND T.V. FISHER	WEATHERED DEAD	Howard	Greentown	MUD CREEK	023N005E 26	Mollusk
13641	16069.00000000000	Invertebrate Animal	387	13174	IMBIV43030	165	Toxolasma lividus	Purple Lilliput	SSC	2004-08-03		-85.92080000000	40.44410000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Howard	Greentown	NORTH FORK WILDCAT CREEK	023N005E 14	Mollusk
13665	16149.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	186	Villosa lienosa	Little Spectaclecase	SSC	2004-09-13		-85.80470000000	40.21000000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Madison	Frankton	PIPE CREEK	020N006E 1	Mollusk
13667	16150.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	187	Villosa lienosa	Little Spectaclecase	SSC	2004-09-13		-85.74330000000	40.24860000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Madison	Anderson North	PIPE CREEK	021N007E 28	Mollusk
13685	16134.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	171	Villosa lienosa	Little Spectaclecase	SSC	2006-08-07		-85.64880000000	40.50910000000	B.E. FISHER	WEATHERED DEAD	Grant	Marion	DEER CREEK	024N008E 20	Mollusk
13699	16140.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	177	Villosa lienosa	Little Spectaclecase	SSC	2004-06-08		-86.15080000000	40.21690000000	B.E. FISHER AND T.V. BRIGGS	FRESH DEAD	Hamilton	Sheridan	PRAIRIE CREEK	021N003E 35	Mollusk
13710	16166.00000000000	Invertebrate Animal	5475	18262	IMBIV47070	203	Villosa lienosa	Little Spectaclecase	SSC	2004-06-08		-86.06020000000	40.26110000000	B.E. FISHER AND T.V. BRIGGS	WEATHERED DEAD	Tipton	Tipton	CICERO CREEK	021N004E 22	Mollusk
951	6802.00000000000	Vertebrate Animal	5524	18311	ARADB06010	36	Clonophis kirtlandii	Kirtland's Snake	SE	1902		-85.85830000000	40.50300000000	1985 RANGEWIDE SURVEY		Grant	Sweetser		024N006E 28	Reptile
2958	5876.00000000000	Vertebrate Animal	3416	16203	ARADB36020	2	Thamnophis butleri	Butler's Garter Snake	SE	1972		-86.12130000000	40.48110000000	SHERMAN MINTON (SAM 1046)		Howard	Kokomo East		023N004E 6	Reptile
384	11221.00000000000	Vascular Plant	2659	15446	PMPOA240K0	1	Panicum leibergii	Leiberg's Witchgrass	ST	1937-06		-86.15580000000	40.29110000000	FRIESNER, R. (10651)		Tipton	Kempton		021N003E 02	Vascular Plant
1034	2105.00000000000	Vascular Plant	537	13324	PDROS0H4X0	1	Crataegus succulenta	Fleshy Hawthorn	SR	1916-05-23		-85.59520000000	40.46380000000	DEAM, C.		Grant	Gas City		023N008E 5 MI NE OF FAIRMOUNT	Vascular Plant
1623	4968.00000000000	Vascular Plant	323	13110	PDROS0H420	3	Crataegus prona	Illinois Hawthorn	SE	1941-07-19		-85.97770000000	40.47770000000	EK, C. (BU)		Howard	Greentown		023N005E 05	Vascular Plant
1720	12347.00000000000	Vascular Plant	537	13324	PDROS0H4X0	4	Crataegus succulenta	Fleshy Hawthorn	SR	1941-07-19		-85.97770000000	40.47770000000	EK, C. (BU)		Howard	Greentown		023N005E 05	Vascular Plant
2186	10178.00000000000	Vascular Plant	1980	14767	PDROS0H3T0	5	Crataegus pedicellata	Scarlet Hawthorn	ST	1941-08-21		-86.05910000000	40.52160000000	EK, C. (BU)		Howard	Miami		024N004E 15	Vascular Plant
2564	644.00000000000	Vascular Plant	2804	15591	PMPOA2Y080	4	Glyceria grandis	American Manna-grass	SX	1946-06		-86.10220000000	40.49160000000	POTZGER, J.		Howard	Kokomo East		024N004E 29	Vascular Plant
2824	892.00000000000	Vascular Plant	537	13324	PDROS0H4X0	5	Crataegus succulenta	Fleshy Hawthorn	SR	1938-07-29		-86.00880000000	40.64860000000	EK, C. (BU)		Miami	Bunker Hill		025N005E N OF MCGRAWSVILLE	Vascular Plant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Project Location
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Ohio
Kentucky
ARCADIS
E.ON WIND FARM
WILDCAT WIND FARM PROJECT AREA
DATE: 02/23/2010

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State of Indiana
DEPARTMENT OF NATURAL RESOURCES
Division of Water

Early Coordination/Environmental Assessment

DNR #:	ER-14779	**Request Received:**	March 9, 2010

Requestor: Arcadis G and M Incorporated
Barbara Mohrman
326 First Street
Suite 200
Annapolis, MD 21403

Project: Wildcat wind project

County/Site info: Grant - Howard - Madison - Tipton

The Indiana Department of Natural Resources has reviewed the above referenced project per your request. Our agency offers the following comments for your information and in accordance with the National Environmental Policy Act of 1969.

Regulatory Assessment: This proposal may require the formal approval of our agency pursuant to the Flood Control Act (IC 14-28-1) for any proposal to construct, excavate, or fill in or on the floodway of a stream or other flowing waterbody which has a drainage area greater than one square mile. Please submit more detailed plans to the Division of Water's Technical Services Section if you are unsure whether or not a permit will be required.

Natural Heritage Database: The Natural Heritage Program's data have been checked.
Attached is a Heritage Data map showing the project boundary. The only existing record of a state listed species in the area is of the Kirtland's snake in 1902 west of Swayzee.

Fish & Wildlife Comments: The Indiana Department of Natural Resources supports wind energy projects as a source of alternative energy, but only when all the impacts, both positive and negative, are fully evaluated and the project is sited such that negative impacts to fish, wildlife, and botanical resources are reduced to the greatest extent possible and unavoidable impacts are properly mitigated.

Avoid areas of concern to fish, wildlife, and botanical resources to the greatest extent possible. Be prepared to demonstrate avoidance, minimization, and mitigation of impacted resources. The following are recommendations for potential impacts identified in the proposed project area:

We recommend consulting the United States Fish and Wildlife Service (USFWS) Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines: http://www.fws.gov/habitatconservation/wind.pdf.

1. Pre-construction
A. The DNR recommends standardized bird and bat surveys of at least one to two years pre-construction within the effected zone (horizontal and vertical). Surveys should occur across all seasons and be modified as needed to obtain results that accurately portray the bird and bat use of the area during breeding, wintering, and migration. Point counts, transects, raptor nest surveys, radar, and Anabat surveys are among typical surveys employed. If needed, contact the DNR Environmental Supervisor for assistance in developing monitoring protocols.
B. Submit survey results to the Department of Natural Resources, Division of Fish and Wildlife.

2. Turbine and Access Siting
A. The juxtaposition of the proposed wind power project near Ouabache State Park is problematic. To the greatest extent possible, shift development away from Ouabache State Park. Placing wind turbines in close proximity to such an area has the potential to

Attachments: A - General Information

result in significant environmental harm to fish, wildlife, and botanical resources in the area. This includes direct mortality of birds and bats with turbines and towers and the removal of a large block of otherwise suitable habitat for many species.
B. Avoid large, intact areas of native vegetation. Sites where native vegetation is scarce or absent, especially forests, should have substantially fewer biological resource concerns. Note that some turbines located in highly agricultural areas still experience bat mortality and a thorough pre-construction survey of bat usage in the area is recommended to help guide siting decisions, though such surveys may not provide an accurate prediction of the level of bat mortality observed once turbines are erected. When feasible, obtain mortality survey results from other wind power projects (locally and throughout Indiana) to determine potential areas to avoid during turbine siting.
C. Avoid development in areas that contain high densities of breeding or wintering birds, in high wildlife use areas, migratory staging areas, woodlots, riparian corridors, Audubon Important Bird Areas, and DNR Nature Preserves, State and National Parks, State Forests, Fish & Wildlife Areas, and other publicly owned properties. If possible, offset any turbines by at least 500 meters to one mile from publicly owned property. The locations of most of the DNR properties (nature preserves, state parks, state forests, and fish and wildlife areas) can be found at www.in.gov/dnr or call the Customer Service Center at (317) 232-4200.
D. Use pre- and post-construction survey results to determine wind turbine placement and operation away from areas most used by wildlife
E. Use cluster and/or string designs to reduce gaps.
F. Maximize the use of flat land and gentle slopes.
G. Avoid ridges, steep slopes, valleys, stream banks, wetlands, shorelines, and forested areas as they are usually areas of concentrated wildlife, particularly birds and bats.
H. When ridges, steep slopes, valleys, stream banks, and shorelines are within the project vicinity, offset the turbines at least 100 meters from the features, if possible.
I. Please note that the cumulative effects of wind facilities are not fully understood and the presence of one wind facility may have different effects upon natural resources when compared to multiple facilities within the same general area.
J. To reduce habitat fragmentation, minimize the number of new roads constructed. Maximize use of existing corridors, roads, disturbed or developed areas, and agricultural lands.
K. Close and revegetate any temporary and unnecessary roads after completion of the project. Avoid roads and rights-of-way that provide access to critical wildlife habitat, and near known migration routes (especially terrestrial and semi-aquatic wildlife routes), stopover sites, Indiana bat hibernacula, and large blocks of habitat.
L. As much as possible, avoid construction of new waterway crossings or modification of existing crossings. New crossings should provide for passage of fish and wildlife and not reduce the efficiency of a structure to allow them passage. Construction related to bridges may require a Construction in a Floodway permit (IC 14-28-1) from the DNR, Division of Water.
M. Restore habitat in construction zones, staging areas, etc. once construction is complete.

3. Power Transmission
A. Use underground power lines when possible.
B. Use raptor protective devices on above-ground wires.
C. Minimize the amount of lighting around substations and other power collection areas. Direct lighting toward the ground as much as possible, not skyward.

4. Tower Design
A. Unless site-specific requirements suggest differently, use tubular towers with lower blade reaches higher than 100 feet and upper blade reaches less than 400 feet tall.

B. For turbine towers, use tubular designs, avoid the use of guy wires, and use bird flight diverters when guy wires are necessary. For meteorological towers, lattice towers are acceptable but avoid the use of guy wires and use bird flight diverters when guy wires are necessary.
C. Utilize the minimum blade rpm. Consider reducing the blade rpm during spring and fall bird and bat migrations, especially at night and during inclement weather.
D. Minimize the use of lights on towers, in accordance with federal, state, and local requirements, wherever possible because they may attract flying wildlife to the vicinity of the turbines, especially during inclement weather. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes, with no more than 24 pulses/minute and a longer "off" phase between the flash phases of the light pulses) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract night-migrating birds at a much higher rate than white strobe lights. Red strobe lights have not yet been studied. See the USFWS lighting guidelines at: http://migratorybirds.fws.gov/issues/towers/comtow.html.

5. Construction
A. Ensure that all necessary local, state, and federal permits have been acquired prior to beginning construction. For example, a construction in a floodway permit may be required from the DNR. See www.in.gov/water for more information regarding DNR, Division of Water permits.
B. Due to the possibility of wetlands on site, we recommend contacting and coordinating with the Indiana Department of Environmental Management (IDEM) 401 program and also the United States Army Corps of Engineers (USACOE) 404 program.
C. All efforts should be made to minimize habitat alterations and impacts to vegetative communities. Staging areas and construction sites should be located in previously disturbed areas and revegetated with native species that approximate pre-disturbance plant community composition.
D. When disturbed areas are not available, high quality habitat* should be avoided and any altered areas should be returned to the original grade and revegetated to natural conditions following construction.
E. Coordinate project activities and construction throughout the year to minimize disturbance to breeding birds. Breeding seasons vary greatly among bird species in Indiana. Develop a construction plan to avoid disturbance during nesting seasons (late January through July for Bald Eagles and Great-horned Owls, May through July for most other species).
F. Do not remove trees, live or dead, with a diameter-at-breast height of 3" or greater, that have loose hanging bark, from April 1 through September 30, as these sites are commonly used as maternity roosts for federally endangered Indiana bats.
G. Should any construction occur within natural or low-disturbance areas, provide notice to DNR to conduct plant salvage efforts.
H. Appropriately designed measures for controlling erosion and sediment should be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized.
I. Do not excavate or place fill in any riparian wetland.
J. Seed and protect all disturbed streambanks and slopes that are 3:1 or steeper with erosion control blankets (follow manufacturer's recommendations for selection and installation) or use an appropriate structural armament; seed and apply mulch on all other disturbed areas.

* High quality and disturbed habitats are described as follows: Professional biologists can typically provide a basic assessment of the quality of a site based on one or more site visits. Private consultants can also evaluate habitat quality through a standardized assessment tool, the Floristic Quality Assessment (FQA). This assessment will provide a quantitative assessment score. The FQA rates sites on a scale from 0 to 10, 10 being the highest quality. Disturbed habitats generally contain non-native, invasive species; extremely low plant diversity; are under regular maintenance; and are small and surrounded by unsuitable habitat. High quality habitats contain much the opposite: high plant diversity; low numbers of non-native, invasive plants; are left in a natural state; and have high quality plants or ones that are very valuable to wildlife.

6. Post-construction
A. The DNR recommends a survey of at least one to two years of post construction mortality surveys to assess the level of impacts to wildlife (local and migrating populations). These surveys should be standardized and conducted at various times of the year to assess breeding, wintering, and migrating wildlife use (raptors, bats, songbirds, etc.). Survey results shall be submitted to the Department of Natural Resources, Division of Fish and Wildlife, Environmental Supervisor.
B. In order to properly conduct mortality surveys, a Special Purpose Salvage permit (312 IAC 9-10-13.5) is required from the Division of Fish and Wildlife prior to salvaging dead vertebrates. Visit our website at www.in.gov/dnr/fishwild for an application or call (317) 232-4102.
C. For the development of surveys, contact DNR. Also, the State of Ohio has guidelines on conducting surveys at:
http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/ResearchandSurveys/WildlifeWind/tabid/21467/Default.aspx
D. Allow access to turbine areas by outside parties, such as DNR, USFWS, and local universities, in order to conduct additional post-construction monitoring. Larger data sets provide a better understanding of the effects of wind turbines on wildlife.
E. Make attempts to control noxious weeds using approved herbicides, where allowed.
F. Where possible, implement new and innovative designs and features with regard to all facets of the project, including siting, construction, and deterrents, as new technologies are developed and a better understanding of how wildlife relate to turbines is gained.
G. Should other wind developments occur within the area, provide survey results and other background information to other developers to allow a thorough evaluation of future projects and to aid in avoiding certain areas.

7. Turbine Operation
A. Adjust turbine operation as needed to avoid direct impacts to birds and bats. This includes reduced operation during peak migration periods, low wind, and heavy fog. Further operation adjustments should be made as monitoring data are reviewed and management of the facility is adapted to local and changing conditions.
B. Mitigation for mortality may include adjusting locations of specific turbines, altering hours of operation to avoid bird and/or bat activity, and possibly shutting down during migratory peaks for specific species such as Indiana bats.

8. Other
A. Coordinate this project with the US Fish and Wildlife Service in order to address issues related to migratory birds and Indiana bat. The USFWS office in Indiana can be reached at 812-334-4261.
B. Impacts less than 1 acre to non-wetland forest should be mitigated at a minimum 1:1 ratio. Impacts of 1 acre or more to non-wetland forest should be mitigated as a minimum 2:1 ratio. Impacts to wetlands should be mitigated at the appropriate ratio (see the state wetlands and habitat mitigation guidelines at

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http://www.in.gov/legislative/register/20061213-IR-312060562NRA.xml.pdf).

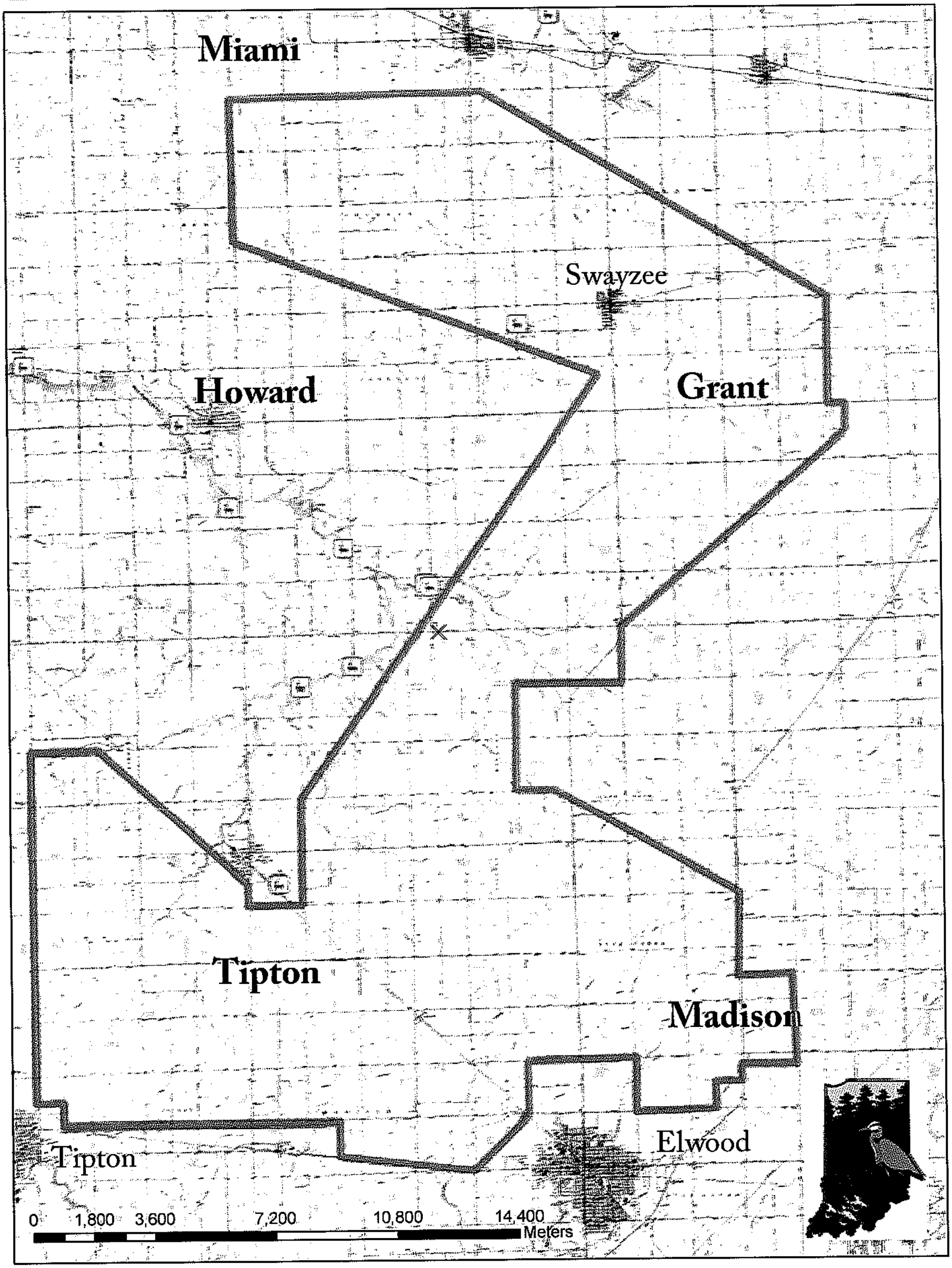
Contact Staff: Christie L. Stanifer, Environ. Coordinator, Fish & Wildlife
Our agency appreciates this opportunity to be of service. Please do not hesitate to contact the above staff member at (317) 232-4160 or 1-877-928-3755 (toll free) if we can be of further assistance.

J. Matthew Buffington
Environmental Supervisor
Division of Fish and Wildlife

Date: July 30, 2010

CTS-ER-14779: Wildcat Wind Project

Project Boundaries   County Line



APPENDIX C

SITE PHOTOGRAPHS

Photo 1. Agricultural land use at the Wildcat Wind Farm. The field to the left of the photo is a wetland with grassland buffer habitat. Tilled soy fields can be seen to the left side of the photograph.

Photo 2. Active agricultural field is to the right of the photo while a small area of hot weather grasses was planted in the center of the photo and the drainage canal is to the left of the photo.

Photo 3. Untilled corn field, and a wetland with grassland buffer is in the distance. This is the area where the golden plovers were observed on site.

Photo 4. Untilled corn field on left, tilled soy field in the distance on right along with forested area in the distance.

Photo 5. Active agriculture field of corn with wetland and grassland buffer habitat to left.

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Wildcat Wind Farm Phase I, LLC

DRAFT Pre-Construction Avian Use Study Report

Wildcat Wind Farm – Phase I

July 2011

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DRAFT Pre-Construction Avian Use Study Report

Wildcat Wind Farm – Phase I

Prepared for:

Wildcat Wind Farm Phase I, LLC

Prepared by:

ARCADIS
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Suite 303
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Massachusetts 01824
Tel 978.937.9999
Fax 978.937.7555

Our Ref.:

CO001397.0003

Date:

July 2011

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1. Introduction

Wildcat Wind Farm Phase I, LLC (WWF) is considering a site for a wind farm project (Wildcat Wind Farm) within private lands northeast of Indianapolis, Indiana. The Wildcat Wind Farm-Phase I project is a wind energy facility proposed within approximately 13,000 acres of agricultural properties located in Madison and Tipton Counties, Indiana (Project Area). The Project Area is identified in Figure 1.

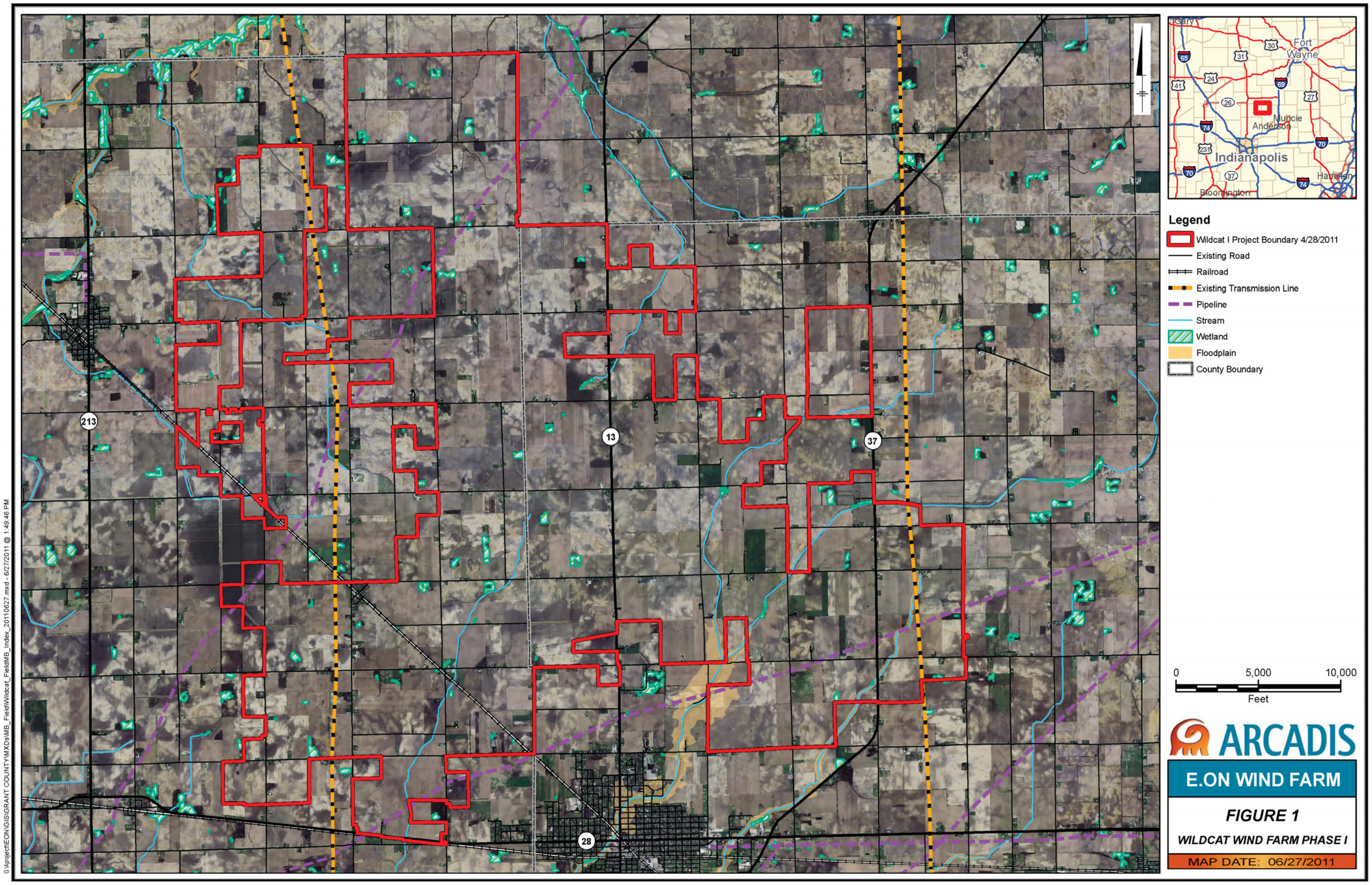
A Pre-construction Avian Use Study was completed during the spring 2011 migration season. This report contains a summary of results from the Spring 2011 Pre-construction Avian Use Study (April and May, 2011), which included point-count surveys and raptor migration surveys. This report also discusses the potential risks to birds from the construction, operation, and maintenance of the Wildcat Wind Farm-Phase I.

1.1 Purpose

This report was prepared to quantitatively describe avian resource use of the Project Area and understand the potential impacts of the Wildcat Wind Farm on these avian resources. Documenting avian use within the Project Area during the pre-construction phase is an action that is consistent with the suggestions outlined in the U.S. Fish and Wildlife Service (USFWS) Draft Land-based Wind Energy Guidelines (USFWS 2011). These voluntary guidelines provide for a scientifically based, tiered approach to assist wind farm developers in reducing potential impacts to wildlife and their habitats.

Several federal laws exist that afford protection to avian species. The Endangered Species Act (ESA) and the Bald and Golden Eagle Protection Act (BGEPA) each address specifically identified species. The Migratory Bird Treaty Act (MBTA) is a federal statute rendering it unlawful to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird.

Figure 1 Wildcat Wind Farm-Phase I Site Location Map



The majority of birds in the United States are legally protected under the MBTA, with the exception of non-native species such as the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and rock pigeon (*Columba livia*). In addition, the BGEPA specifically prohibits the take of eagles and the ESA provides protection for avian species that are federally listed as endangered or threatened.

State-listed species are protected by the Indiana Department of Natural Resources (IDNR) and specifically the Wildlife Diversity Section (WDS) is responsible for the conservation and management of over 750 species of nongame, endangered, and threatened wildlife in Indiana. The IDNR also protects any nongame species deemed to require conservation measures (Species of Concern) in an attempt to preclude species from becoming state and/or federally listed as threatened or endangered.

1.2 Project Area Description

Topography within the Project Area is relatively flat and consists mainly of actively managed agricultural fields for production of corn (*Zea mays*), soy beans (*Glycine max*), alfalfa (*Medicago sativa*) and winter wheat (*Triticum aestivum*). In addition, residential areas and agricultural buildings and structures are scattered throughout the Project Area. Riparian-type vegetation is present along several drainage tributaries within the Project Area and is also established along Mud Creek approximately 2.5 km to the north and Big Duck Creek in the southeastern most portion of the Project Area (Figure 1). In general, trees are limited to these riparian areas, around residential areas, and in concentrated areas of 2-20 acre deciduous woodlots scattered throughout the Project Area. There are a number of National Wetland Inventory mapped wetlands within the Project Area, most of which are limited to small woodlot areas, active agricultural lands, and along low-relief drainage features of agricultural lands. No significant landscape differences between the Project Area and surrounding areas are apparent.

1.3 Avian Overview

Based upon literature reviews and prior studies conducted for this project, there are a variety of avian species that are known to or have potential to occur within the Project Area (Sibley 2000, Sibley 2001, IDNR 2002, ARCADIS 2011). For the purposes of this report, these species have been categorized into 11 separate avian groups: passerines, doves, swifts, woodpeckers, corvids (crows and jays), raptors, falcons, water birds (herons), waterfowl (ducks and geese), shorebirds, and special status species (species listed as endangered, threatened, or special concern). Each avian group is described further in the following sections.

1.3.1 Passerines

Passerines include species in the taxonomic order Passeriformes. Passerines form the most diverse group of avian species that are known to or that have the potential to occur within the Project Area. Actively managed agricultural lands make up a large portion of the Project Area and as such, passerine species that prefer these habitat types are expected to occur most commonly within the Project Area (e.g., horned lark [*Eremphila alpestris*], brown-headed cowbird [*Molothrus ater*], barn swallow [*Hirundo rustica*], common grackle [*Quiscalus quiscula*], etc.). To a lesser extent, passerines that prefer vegetated drainage ditches dominated by either herbaceous or woody vegetation, wetlands/riparian areas, developed areas and small woodlots (e.g., red-winged blackbird [*Agelaius phoeniceus*], song sparrow [*Melospiza melodia*] and American robin [*Turdus migratorius*]) also occur in the Project Area.

Passerines are typically known to migrate through the Project Area during the spring and fall migration periods (April to June and August to November) and potentially nest within the Project Area from early April to late August. Some species are also known to be present within the Project Area year-round. Passerines also utilize the Project Area for foraging, as a number of different food sources are present within the Project Area during different times of the year (Sibley 2000, Sibley 2001).

1.3.2 Doves

Doves include species in the taxonomic order Columbiformes. Dove species that are known to occur within the Project Area include: mourning dove (*Zenaida macroura*) and rock pigeon (*Columba livia*). Mourning doves typically migrate through the Project Area during the spring and fall migration periods (April to June and August to November) and potentially nest within the Project Area from early April to late August. In addition, mourning doves and rock pigeons are known to be present year-round in Indiana. Mourning doves and rock pigeons likely utilize agricultural fields for foraging as a number of different food sources are present within the Project Area during different times of the year (e.g., residual grain) (Sibley 2000, Sibley 2001).

1.3.3 Swifts

Swifts include species in the taxonomic order Apodiformes. Chimney swifts are known to occur within the Project Area (ARCADIS 2011). Chimney swifts typically migrate through the Project Area during the spring and fall migration periods (April to June and August to November) and nest within the Project Area from early April to late August. Chimney swifts were once known to nest exclusively in the hollows of trees but have since adapted to human presence and now most commonly nest inside the walls of chimneys. Chimney swifts have the potential to utilize the Project Area for foraging in flight for insects during the spring and summer months (Sibley 2000, Sibley 2001).

1.3.4 Woodpeckers

Woodpeckers include species in the taxonomic order Piciformes. Woodpeckers that are known to or that have the potential to occur within the vicinity of the Project Area include: downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*), pileated woodpecker (*Dryocopus pileatus*), red-headed woodpecker (*Melanerpes erythrocephalus*), red-bellied woodpecker (*Melanerpes carolinus*), and yellow-bellied sapsucker (*Sphyrapicus varius*). Woodpeckers typically migrate through the Project Area during the spring and fall migration periods (April to June and August to November) and nest within the vicinity of the Project Area from early April to late August, although some woodpeckers are known to be present year-round in Indiana (Sibley 2000, Sibley 2011).

1.3.5 Corvids

Corvids include species in the taxonomic order Passeriformes and family Corvidae. Corvids that are known to occur within the Project Area include: American crow (*Corvus brachyrhynchos*) and blue jay (*Cyanocitta cristata*). Corvids typically migrate through the vicinity of the Project Area during the spring and fall migration periods (April to June and August to November) and nest within the Project Area from early April to late August. Corvids are also known to be present year-round and could utilize the project area for foraging as a number of different food sources are present within the Project Area during different times of the year (e.g., residual grain) (Sibley 2000, Sibley 2001).

1.3.6 Raptors

Raptors include species in the taxonomic order Accipitriformes. Raptor species that have been documented within the Project Area or have the potential to occur in the Project Area include: northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), turkey vulture (*Cathartes aura*), and bald eagle (*Haliaeetus leucocephalus*). Similar to passerines, raptors could use the Project Area during migration and for foraging and nesting. Raptors typically migrate through the Project Area during the spring and fall migration periods (April to June and August to October) and have the potential to nest within the Project Area from April to late July. In addition, some raptor species (e.g., Cooper's hawk, red-tailed hawk) are known to be present year-round in Indiana (Sibley 2000, Sibley 2001).

Raptors are protected under the MBTA and golden eagles (*Aquila chrysaetos*) and bald eagles are protected under the BGEPA. A single adult bald eagle was observed flying over the Project Area. While bald eagles have the potential to occur within the Project Area, only individuals observed would most likely be flying through the area as there is little, if any, suitable foraging and nesting habitat available for eagles in the Project Area.

1.3.7 Falcons

Falcons include species in the taxonomic order Falconiformes. Falcon species that have been documented within the Project Area or have potential to occur in the Project Area include: American kestrel (*Falco sparverius*) and peregrine falcon (*Falco peregrines*). Similar to raptors, falcons could use the Project Area during migration and for foraging and nesting. Falcons typically migrate through the Project Area during the spring and fall migration periods (April to June and August to October) and have the potential to nest within the Project Area from April to late July. In addition, American kestrels are known to be present year-round in Indiana (Sibley 2000, Sibley 2001).

1.3.8 Water Birds

Water birds include birds in the taxonomic order Ciconiformes. Great blue herons (*Ardea herodias*) have the potential to occur within the Project Area or in the vicinity of the Project Area. Water birds also could potentially utilize the Project Area during migration and for nesting and foraging. However, great blue herons are unique in that aspects of their life history make them dependent on wetlands/riparian areas (Sibley 2000, Sibley 2001).

1.3.9 Waterfowl

Waterfowl include birds in the taxonomic order Anseriformes. Waterfowl that have been documented within the Project Area include: Canada geese (*Branta canadensis*), mallard (*Anas platyrhynchos*), and wood duck (*Aix sponsa*). Waterfowl also could potentially utilize the Project Area during migration and for nesting and foraging, especially within and adjacent to agricultural fields as a number of different food sources and nesting habitats are present within the Project Area during different times of the year (e.g., residual grain). Waterfowl typically migrate through the Project Area during the spring and fall migration periods (approximately March to May and August to December, although waterfowl migration is highly variable depending on the species and weather conditions). Waterfowl also have been observed utilizing riparian areas/wetlands within the vicinity of the Project Area for foraging (Sibley 2000, Sibley 2001).

1.3.10 Shorebirds

Shorebirds include birds in the taxonomic order Charadriiformes. Shorebirds species that are known to occur within the Project Area include the killdeer (*Charadrius vociferous*), American golden-plover (*Pluvialis dominica*), pectoral sandpiper (*Calidris melanotos*), and lesser yellowlegs (*Tringa flavipes*). Shorebirds typically utilize the Project Area as a stopover area during migration in order to fuel up before continuing their flight to their breeding grounds. The American golden-plover is known to utilize the Project Area as a stopover location during its spring migration from northeastern South America to the Arctic coastal plain (fall migration is along a different route). The peak of American golden-plover occurrence is during the month of April. With the exception of the killdeer, shorebirds typically do not nest within the Project Area. The nesting season for killdeer within the Project Area is from approximately late March until early August (Sibley 2000, Sibley 2001).

1.3.11 Special Status Species

For the purpose of this report, special status species include bird species that are listed as endangered, threatened, or species of concern by the USFWS and IDNR. According to the USFWS, there are no known federally listed threatened or endangered species of birds present.

Based on reviews and consultation with IDNR, the black-and-white warbler (*Mniotilta varia*) is a state species of special concern and both the black rail (*Laterallus jamaicensis*) and the peregrine falcon are state endangered species that have potential to occur in or migrate through the Project Area.

2. Methods

The following sections describe in detail the specific methods that were implemented for avian point-count surveys and raptor migration surveys as part of this study.

2.1 Survey Locations

Forty point-count survey locations were randomly selected from a pool of 128 preliminary turbine locations on March 29, 2011 using ArcGIS 9.3.1 (ESRI 2009) in order to achieve even coverage of the Project Area (one location approximately every square mile (Figure 2). To the extent possible and depending on weather and field conditions, each point count location was surveyed twice during each survey period (April and May). Each point-count location was a 150 meter (m) radius circle centered on a proposed turbine location. The habitat types present at each point-count location are listed in Table 1.

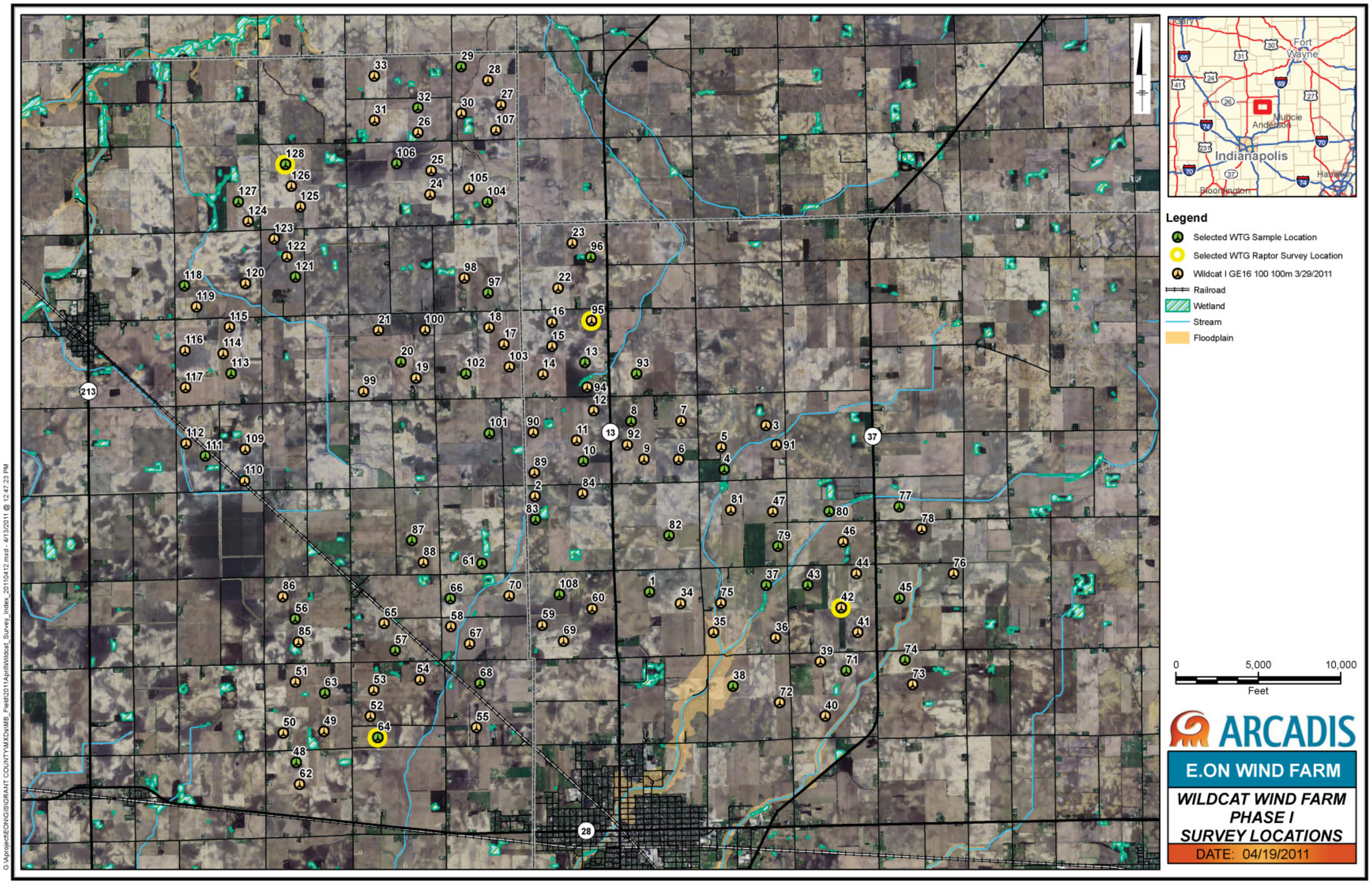
Table 1 Habitat Types Present at Each Point-Count Location During Spring Point-Count Surveys at Wildcat Wind Farm-Phase I, April-May 2011

Point-count Location*	Habitat Types Present
1	Agricultural
4	Agricultural, Herbaceous Drainage Ditch, Woodlot, Woody Drainage Ditch
8	Agricultural
10	Agricultural
13	Agricultural
20	Agricultural
29	Agricultural
32	Agricultural
37	Agricultural, Herbaceous, Woody Drainage Ditch
43	Agricultural, Herbaceous Fencerow
48	Agricultrual
56	Agricultural, Herbaceous Drainage Ditch

Point-count Location*	Habitat Types Present
57	Agricultural
61	Agricultural
63	Agricultural, Herbaceous Drainage Ditch, Herbaceous Fencerow
64	Agricultural
66	Agricultural, Herbaceous Drainage Ditch, Woody Drainage Ditch
68	Agricultural
71	Agricultural
74	Agricultural
77	Agricultural
79	Agricultural
80	Agricultural, Woody Drainage Ditch
82	Agricultural, Herbaceous Drainage Ditch
83	Agricultural, Herbaceous Drainage Ditch, Woodlot
88	Agricultural
93	Agricultural
96	Agricultural, Woodlot
97	Agricultural
101	Agricultural
102	Agricultural, Pasture/Trees
104	Agricultural, Woody Fencerow
106	Agricultural, Woody Fencerow
108	Agricultural
111	Agricultural, Woody Fencerow
113	Agricultural, Herbaceous Drainage Ditch, Herbaceous Fencerow
118	Agricultural
121	Agricultural
127	Agricultural, Herbaceous Drainage Ditch
128	Agricultural, Herbaceous Drainage Ditch

*Numbers reflect preliminary turbine location numbering; layout has subsequently been revised but is generally similar to the basis used to select survey locations.

Figure 2 Avian Point-Count Survey Locations and Raptor Migration Survey Locations at Wildcat Wind Farm-Phase I, April-May, 2011



2.2 Avian Point-count Surveys

Survey methods were identical for the April and May point-count surveys. Point-count surveys were conducted from April 26-29, 2011 and again from May 24-27, 2011. These survey weeks corresponded with the expected timing for the spring migration period. Surveys were conducted daily between the hours of 0730 and 1400 depending on weather conditions (e.g., high winds, rain events). Surveys consisted of walking to each point-count location and waiting for a 2-minute period to allow birds to adjust to observer presence. Each point was then surveyed for a 10-minute period. All birds

observed within a 150-m radius during the point-count survey were recorded. Observations beyond the 150-m radius were also recorded, but were excluded from statistical analyses.

The date, starting, and ending time of the survey period, and weather information (e.g., temperature, wind speed using the Beaufort scale, wind direction, % cloud cover) were recorded prior to beginning each survey. Species identification, number of individuals, initial time of detection (0-10 minutes), distance (m) to initial detection, flight height (m) above ground, behavior (flying, foraging, singing, calling, perched, nesting), and habitat type were recorded for each observation. The behavior of each bird observed and the habitat type in which it was detected in were recorded based on when each bird was initially detected. Biologists recorded avian detections within a fixed, 150-m radius of each point-count location. Birds detected as part of a pair or flocks were recorded as a single detection to avoid complications with statistical independence, although the number of individuals was recorded. For birds observed in flight during the detection period, biologists estimated the height of flight (m), which allowed biologists to determine whether or not birds would be flying within the potential rotor-swept area of a wind turbine. Though the type of wind turbine had not been selected for this project at the time of the survey, based on previous project experience, bird flight heights were conservatively placed in the following theoretical altitude bands: below rotor-swept zone (0-35 m), within rotor-swept zone (35-150 m), and above rotor-swept zone (above 150 m).

Data were entered on a data form, and after the 10-minute survey period, surveyors confirmed that the data form was complete before proceeding to the next point-count location. Birds that were identified by call but were not observed (audibles) and birds that were observed flying overhead (flyovers) were also noted, but assigning these observations to a specific habitat type was not always possible.

2.2.1 Point-count Data Analysis

Data were analyzed in order to describe avian use at each point-count location and within each habitat type. Species richness, relative abundance, mean use and percent composition were calculated for the point-count surveys. In addition, approximate flight height and spatial patterns of use were analyzed. Species richness is defined as the total number of species within a given area and was calculated as the mean number of species observed per point-count location per survey period. Species richness was then compared among point-count locations. Estimates of relative abundance were defined as the mean number of individuals per point-count location and the mean number of detections per point-count location (where flocks and/or pairs flying together were recorded as a single detection). This metric is also known as the detection rate. Means were reported as the mean ± standard error.

To evaluate the use of habitats in the vertical plane, avian flight heights were analyzed for each habitat type. The results of this analysis were used to evaluate the turbine collision potential for various species. A higher potential for collision with a wind turbine resulted in habitats having average observed avian flight heights within the proposed rotor-swept zone (35-150 m).

2.2.2 Quality Assurance and Quality Control

Quality assurance and quality control measures were implemented during all stages of this study, including study design, field data collection, data entry and analysis, and documentation. Once surveys were completed for the day, field technicians were responsible for inspecting the data forms for accuracy, completeness, and legibility. Irregular or inaccurate codes or data suspected to be questionable were discussed with the observer. Errors, omissions, or issues identified during data analysis were traced back to the original raw data forms, and appropriate changes were made.

2.3 Raptor Migration Surveys

The objective of the raptor migration surveys was to estimate the spring use of the Wildcat Wind Farm-Phase I Project Area by diurnal raptors, specifically any large migratory flyovers within the Project Area. Raptor migration surveys were conducted during the April survey period immediately after the point-count surveys were completed each day. Due to the small number of raptors observed within the Project Area and given that peak migration for raptors through the Project Area is approximately late March to late April, raptor surveys were not conducted during the May survey period (May 24-27, 2011).

2.3.1 Survey Locations

Four raptor migration survey location points were selected from the 138 proposed turbine locations in order to achieve even coverage of the Project Area (Figure 2). This was accomplished by selecting one survey location in each of the four quadrants of the Project Area (northeast, northwest, southeast, southwest). Each raptor survey location was surveyed twice. Each raptor survey location was approximately a 1,000 m radius circle centered on a proposed turbine location, although all raptors observed during migration surveys were recorded.

2.3.2 Survey Methods

Surveys consisted of walking to each raptor survey location and waiting for a 2-minute period to allow birds to adjust to the observer. Each location was then surveyed for a 30-minute period. All raptors observed during the survey were recorded. Observations outside of the 30-minute period were recorded but were excluded from statistical analyses.

Raptor surveys were conducted from April 26-29, 2011 after point-count surveys were competed each day. Surveys were conducted daily between the hours of 1200 and 1600 depending on weather conditions and the ending time of point-count surveys.

The dates, starting, and ending time of the survey period, and weather information (e.g., temperature, wind speed using the Beaufort scale, wind direction, percent cloud cover) were recorded prior to beginning each survey. Species identification, number of individuals, initial time of detection (0-30 minutes), height (m) above ground, behavior, and habitat type, were recorded for each observation. The behavior of each bird observed and the habitat type in which it was detected were recorded based on when each bird was initially detected. Height above the ground measurements were recorded based on three height classes: below rotor-swept zone (0-35 m), within rotor-swept zone (35-150 m), and above rotor-swept zone (above 150 m).

2.3.3 Raptor Migration Survey Data Analysis

Raptor migration survey data were analyzed to estimate species richness, relative abundance, and flight height trends. In addition, flight behavior (perched, direct flight or indirect flight) was analyzed in an attempt to determine if observed raptors were migrating through the Project Area or possibly nesting/foraging within the vicinity of the Project Area. These data helped determine whether or not large numbers of raptors and raptor species are utilizing the Project Area during the migration period or if most observations were likely resident birds. In addition, flight height data helped determine if a large number of raptors are currently flying within the height of the rotor-swept zone of proposed wind turbines.

3. Spring 2011 Pre-construction Avian Use Study Results

Results from the spring 2011 pre-construction avian use study are reported in the sections below.

3.1 Spring 2011 Avian Point-Count Survey Results

Pre-construction avian point-count surveys were conducted at 40 locations at the Wildcat Wind Farm-Phase I from April 26-29, 2011 and from May 24-27, 2011. In total, 1,047 avian detections, 2,291 individuals, and 52 unique bird species were identified during the spring 2011 avian point-count surveys at Wildcat Wind Farm-Phase I Project (Appendix A). An additional 12 species were opportunistically observed within the Project Area. A complete avian species list, including opportunistic observations, is presented in Appendix B.

3.1.1 Percent Composition and Relative Abundance by Avian Group and Species

Passerines accounted for approximately 62 percent of all birds detected during the spring 2011 avian point-count surveys. Shorebirds totaled 32 percent (mostly American golden-plovers) of all birds detected. In contrast, corvids, waterfowl, swifts, doves, woodpeckers, raptors, and falcons each accounted for less than 2 percent of all birds detected during the spring 2011 point-count surveys.

The 10 most abundant species detected during the spring 2011 avian point-count surveys included American golden-plover, red-winged blackbird, horned lark, brown-headed cowbird, common grackle, killdeer, American robin, European starling, pectoral sandpiper, and barn swallow. These species were observed during both the April and May survey periods, except for the American golden-plover and the pectoral sandpiper that were only observed during the April survey period (April 26-29, 2011). Figure 3 displays the mean percentage of individuals for each of the 10 most abundant species detected during the spring 2011 avian point-count surveys. Figure 4 displays the mean percentage of individuals within each of the 10 species groups detected during the spring 2011 avian point-count surveys.

Figure 3 **Ten Most Abundant Species Detected During the Avian Point-Count Surveys on Wildcat Wind Farm-Phase I from April-May, 2011**

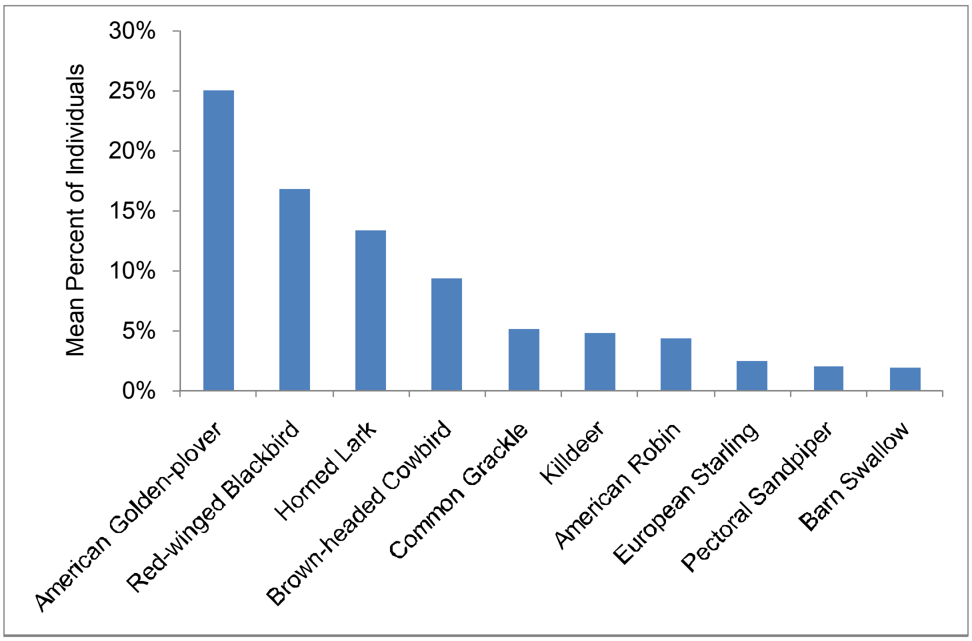


Figure 4 Mean Percent of Individuals by Species Type Observed During Point-Count Surveys at Wildcat Wind Farm-Phase I from April-May, 2011

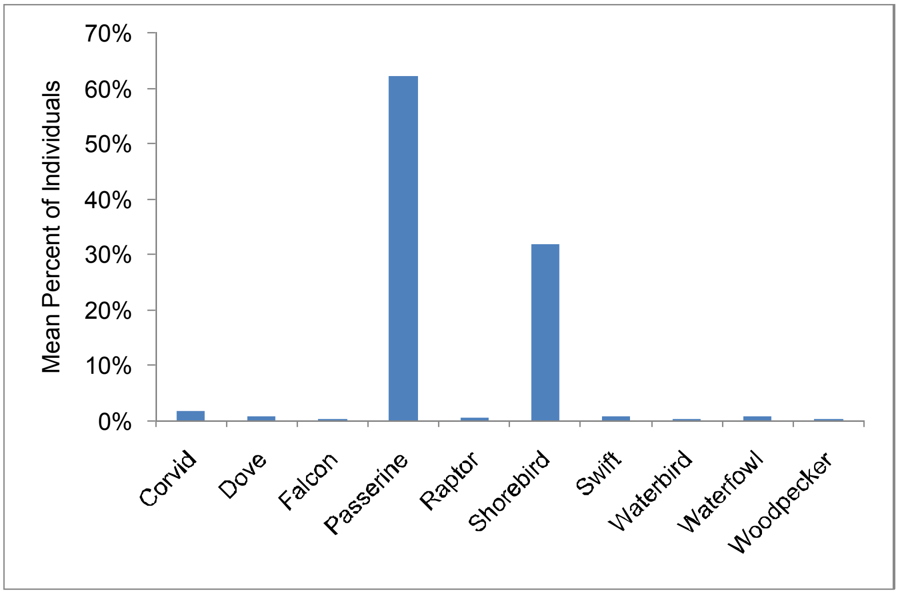
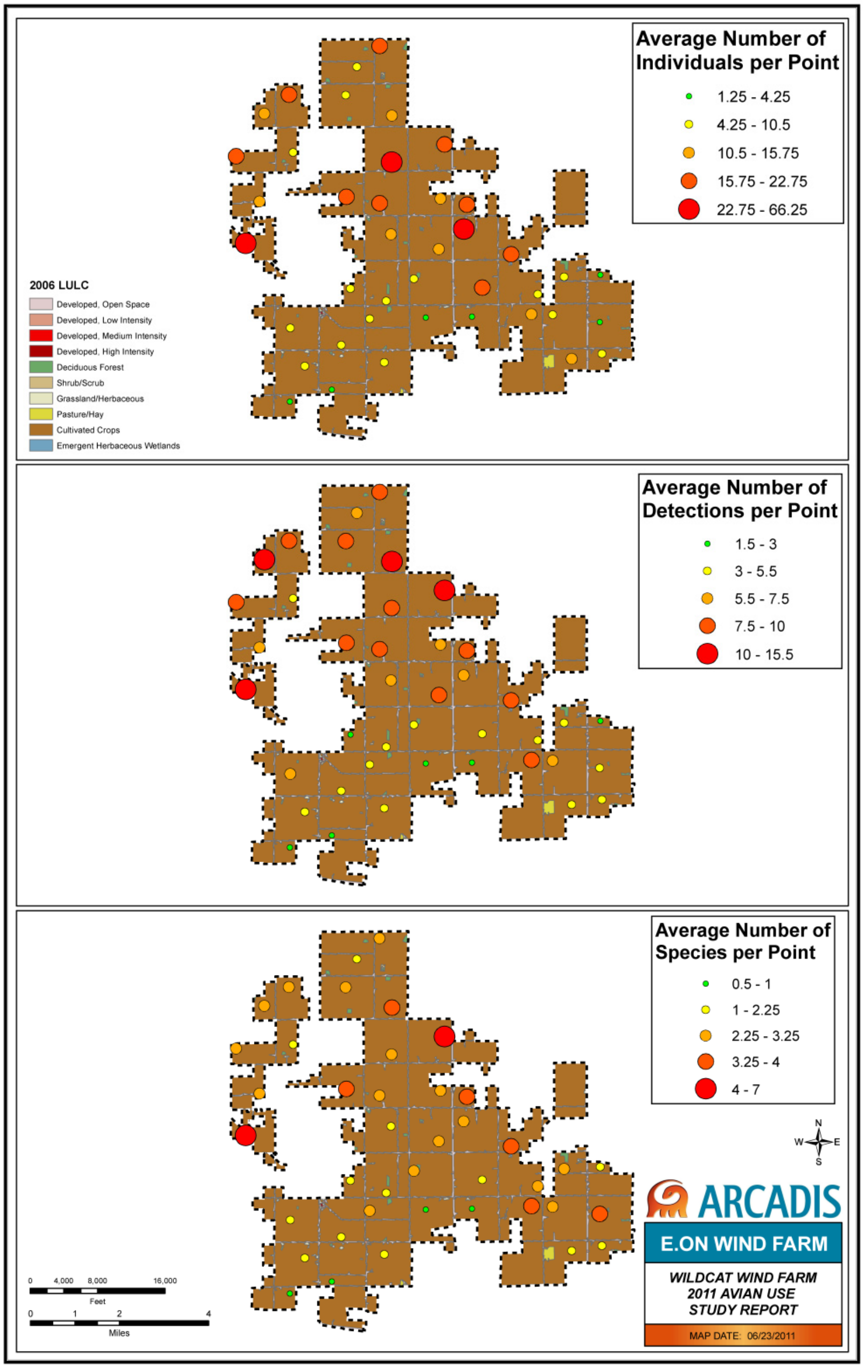


Figure 5 shows the average number of individuals, detections, and species observed at each point-count location during the spring 2011 survey periods. This figure displays various sized circles around each point-count location. The size of the circle corresponds to the average number of detections, individuals, or species observed at each point-count location. For example, a larger circle around a point-count location translates to a larger average number of birds observed at that point-count location. This visually depicts where the highest numbers of observations were observed within the Project Area and in which habitat type.

Point-count location number 97 (Figure 2), located in the middle of an actively managed agricultural field, averaged the highest number of individuals (66.25 birds) in the Project Area (Appendix A). This was due to several large flocks of American golden-plovers either flying over or foraging within the survey plot. In addition, common agricultural species including the horned lark, brown-headed cowbird, and vesper sparrow, were observed in fairly large numbers within these actively managed agricultural fields. Point-count location number 111 (Figure 2), located in an actively managed agricultural field and in between a 10-acre woodlot and a heavily vegetated 40-m wide abandoned railway corridor, averaged the highest number of detections and species (15.5 and 7.0, respectively) in the Project Area (Appendix A). Biologists also observed a variety of bird species utilizing similar habitats throughout the Project Area.

Figure 5 Relative Abundance Maps



In contrast, point-count location number 48 (Figure 2), located in the middle of an actively managed agricultural field (soy bean and corn rotation), averaged the fewest number of individuals, detections, and species per point-count location (2.0, 1.5 and 0.5, respectively) in the Project Area (Appendix A). This could be due to the fact that the field had been recently planted, in addition to being surveyed by biologists late in the day following weather delays.

The average number of individuals detected per point-count location in the Project Area during the spring 2011 study is comparable to those reported in similar pre-construction use studies at other wind farm sites throughout the U.S. during the spring migration period. The total number of species observed during the spring 2011 avian use study is also similar to the total number of species recorded during similar spring studies at other wind farm sites in the U.S. The study conducted at the Buffalo Ridge Wind Farm in Minnesota may be the most relevant due to the similarities in habitat types and migration routes compared to this Project Area because both study areas are within the Midwest (Johnson et al. 2000). However, the Buffalo Ridge study conducted point-counts for only 5 minutes at each station, yet the total number of species detected was almost 3 times higher than at Wildcat Wind Farm-Phase I. Table 2 compares the results of the spring 2011 avian point-count surveys within the Wildcat Wind Farm-Phase I with pre-construction avian surveys conducted at other wind farm sites with similar habitat types.

Table 2 Comparison of Wildcat Wind Farm-Phase I Avian Point-Count Survey Results to Other Wind Farm Sites in the U.S.

Wind Farm Project	Timing of Survey	Length of Point-Count (minutes)	Total Number of Species Detected	Average Number of Individuals per Station
Sturgis Windfarm Project, Meade County, South Dakota[1]	April 19-June 25	10	36	13.11
Kit Carson Windpower Project, Colorado[2]	May 19-June 25	10	29	15.08
Buffalo Ridge Wind Farm, Minnesota[3]	March 15-May 31	5	142	6.59

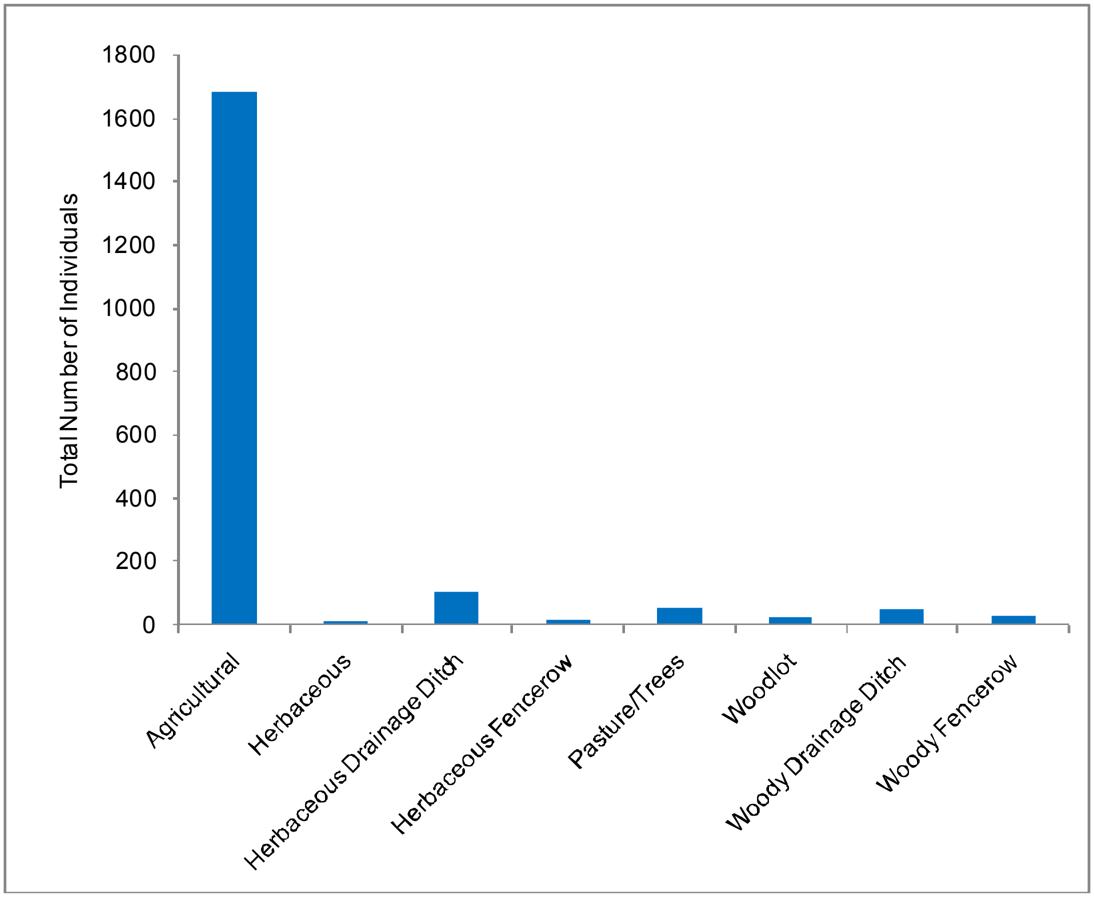
Wind Farm Project	Timing of Survey	Length of Point-Count (minutes)	Total Number of Species Detected	Average Number of Individuals per Station
Wildcat Wind Farm, Indiana, 2010	April 22 - May 27	10	56	8.41
Wildcat Wind Farm, Indiana, 2011	April 25-May 27	10	52	14.46

[1]ARCADIS 2009a
[2]ARCADIS 2009b
[3]Johnson et al. 2000

3.1.2 Spatial and Temporal Patterns of Avian Use by Habitat Type

The Project Area is comprised of four main habitat types: agricultural (e.g., soy beans, corn, alfalfa, and winter wheat), herbaceous drainage ditches, woody drainage ditches, and small woodlots/wetlands (~2-20 acres). The spring 2011 avian point-count survey locations coincided with proposed wind turbine locations. The preliminary turbine locations chosen for the avian point-count surveys were in or near each of these representative habitat types. Actively managed agricultural fields are the most common habitat type in the Project Area, comprising approximately 85-90 percent of the Project Area. Therefore, based strictly on proportions, relative abundance, as would be expected, was highest in this habitat type and lower in the less common habitat types such as herbaceous, pasture/trees and woodlots/wetlands (Figure 6). In addition, six of the 40 point-count locations contained linear habitat features, such as fencerows and drainage ditches that were dominated by either herbaceous or woody vegetation. These linear habitats combined had the second highest number of avian detections, most likely due to being dominated by herbaceous and woody vegetation that can be good cover and quality nesting habitat for a diverse suite of bird species.

Figure 6 Total Number of Individuals Detected per Habitat Type During Avian Point-Count Surveys on Wildcat Wind Farm-Phase I, April-May 2011



As Figure 7 illustrates, of the ten most abundant species recorded, the majority of individuals were also observed within agricultural fields. As Figure 8 illustrates, of all birds recorded, the majority of individuals observed were in the passerine and shorebird species groups. In addition, of these two species groups, the majority of the detections were recorded within agricultural fields, which would be expected given that actively managed agricultural fields are the dominant habitat type within the Project Area.

Figure 7 **Total Number of Individuals of the Ten Most Abundant Species by Habitat Type Recorded During Avian Point-Count Surveys Within Wildcat Wind Farm-Phase I, April-May 2011**

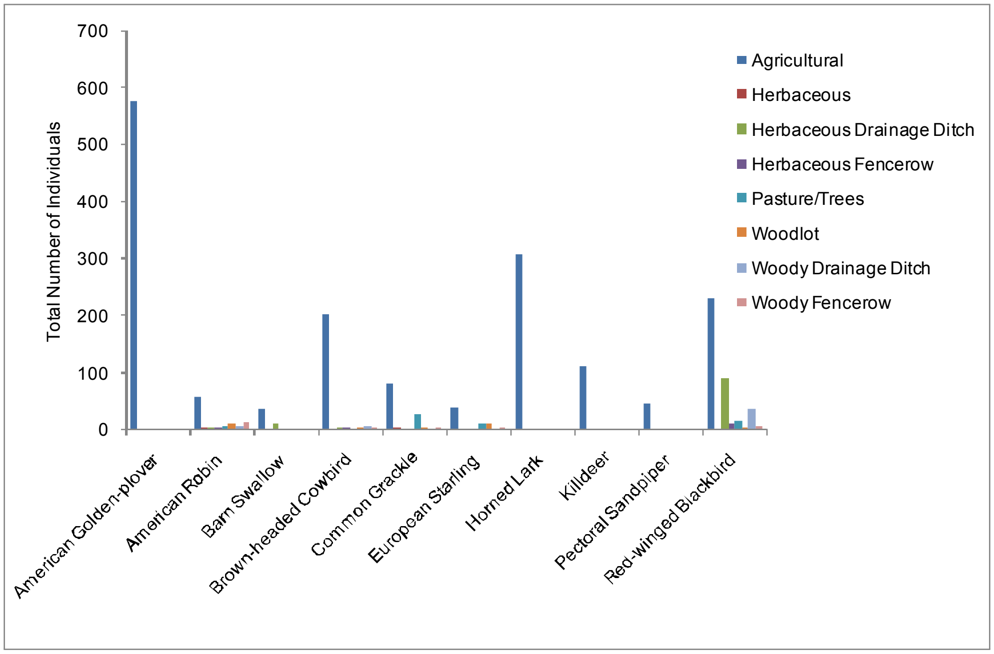
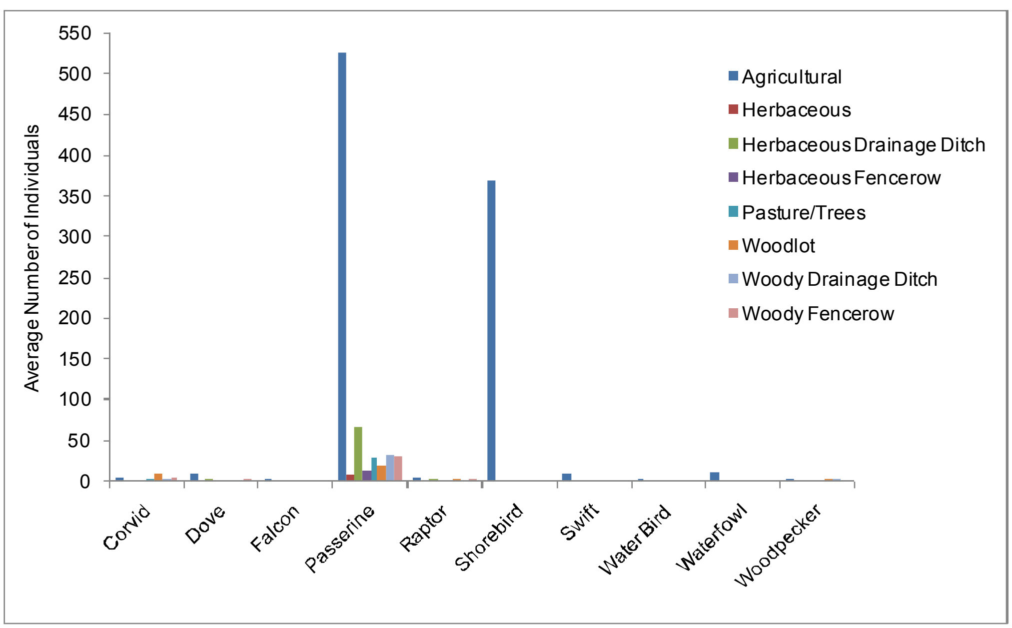


Figure 8 **Average Number of Observations per Species Type by Habitat Type During Avian Point-Count Surveys Within Wildcat Wind Farm-Phase I, April-May 2011**



Utilization of habitat types by all bird groups is shown in Table 3. Agricultural land was the most dominant land use within the Project Area and provided the most abundant habitat for birds to utilize. The utilization rate was second highest at 11.66 birds per survey. The habitat with the highest utilization rate was pasture/trees habitat with 19.33 birds per survey. This rate is most likely biased high due to this habitat type being present at only one point-count location and this point-count location was only surveyed 3 times (instead of 4) total during both survey periods (April and May, 2011). Woody fencerow habitat was the third most utilized habitat, with 6.17 birds observed per survey.

Table 3 Utilization of Habitats at Wildcat Wind Farm-Phase I During Spring Avian Point-Count Surveys, April and May, 2011

Habitat Type	Species Type	Total Number Observed	Total Surveys	Utilization Rate	Total Percent Habitat Utilization by Species Type
Agricultural	Corvid	9	160	0.06	0.5%
	Dove	16	160	0.10	0.9%
	Falcon	2	160	0.01	0.1%
	Passerine	1045	160	6.53	56.0%
	Raptor	11	160	0.07	0.6%
	Shorebird	736	160	4.60	39.4%
	Swift	19	160	0.12	1.0%
	Water Bird	1	160	0.01	0.1%
	Waterfowl	22	160	0.14	1.2%
	Woodpecker	4	160	0.03	0.2%
	Total	**1865**		**11.66**	
Herbaceous	Passerine	6	4	1.50	100%
	Total	**6**		**1.50**	
Herbaceous Drainage Ditch	Dove	2	36	0.06	1.5%
	Passerine	131	36	3.64	97.8%
	Raptor	1	36	0.03	0.7%
	Total	**134**		**3.72**	
Herbaceous Fencerow	Passerine	26	36	0.72	100%
	Total	**26**		**0.72**	
Pasture/Trees	Corvid	1	3	0.33	1.7%
	Passerine	57	3	19.00	98.3%
	Total	**58**		**19.33**	

Habitat Type	Species Type	Total Number Observed	Total Surveys	Utilization Rate	Total Percent Habitat Utilization by Species Type
Woodlot	Corvid	19	12	1.58	31.7%
	Passerine	36	12	3.00	60.0%
	Raptor	2	12	0.17	3.3%
	Woodpecker	3	12	0.25	5.0%
	Total	**60**		**5.00**	
Woody Drainage Ditch	Corvid	2	16	0.13	2.9%
	Passerine	64	16	4.00	94.1%
	Woodpecker	2	16	0.13	2.9%
	Total	**68**		**4.25**	
Woody Fencerow	Corvid	9	12	0.75	12.2%
	Dove	1	12	0.08	1.4%
	Passerine	63	12	5.25	85.1%
	Raptor	1	12	0.08	1.4%
	Total	**74**		**6.17**	

3.1.4 Flight Height Patterns

The type of wind turbine to be used for the project had not yet been determined at the time of this survey; however, for the purposes of analyzing avian use in the vertical plane, the rotor-swept zone could fall anywhere between 35 and 150 m. Overall, only a few avian species observed averaged flight heights within the potential rotor-swept zone. These species included the American golden-plover, turkey vulture and the red-winged blackbird. American golden-plovers were observed flying over the Project Area in small- (< 30 individuals) to medium- (30-100 individuals) sized flocks at nine of the 40 point-count locations (22.5% of the survey locations) and throughout the Project Area during non-survey periods. Six of the eight turkey vultures, two of the five red-tailed hawks, and one of the two American kestrels observed at various point-count locations were soaring at heights approximately within the potential rotor-swept zone, while 90 of the 386 red-winged blackbirds were observed at heights approximately within the potential rotor-swept zone (Appendix C). Individual American goldfinches, American robins, brown-headed cowbirds, Canada geese, horned larks, mourning doves, and tree swallows were also observed sporadically at heights that potentially could be within the rotor-swept zone, but generally averaged flight heights well below the potential rotor-swept zone. Figure 9 shows the total number of individuals within each of the three flight height zones observed for the ten most abundant species detected during the spring 2011 avian point-count surveys. As illustrated, 5 of the 10 most abundant species detected during the spring 2011 avian point-count surveys were at some point observed flying within the height of the rotor-swept zone (35-150 m). The majority of the 360 American golden-plover detections recorded to be flying within the height of the proposed rotor-swept zone were the result of several flocks of birds moving around the Project Area. Figure 10 shows the total number of individuals within each of the three flight height zones by habitat type during the spring 2011 avian point-count surveys. As Figure 10 illustrates, nearly all of the observations within the height of the proposed rotor-swept zone were detected within agricultural fields. This is primarily the result of a number of flocks of American golden-plovers observed flying in and around agricultural fields where they are known to forage during their migration stopover from northeastern South America.

Figure 9 Total Number of Individuals Recorded Within Each of the Three Flight Height Zones (Below, Within, and Above Proposed Rotor-Swept Zone) For the Ten Most Abundant Species Observed During Spring Avian Point-Count Surveys at Wildcat Wind Farm-Phase I, April-May 2011

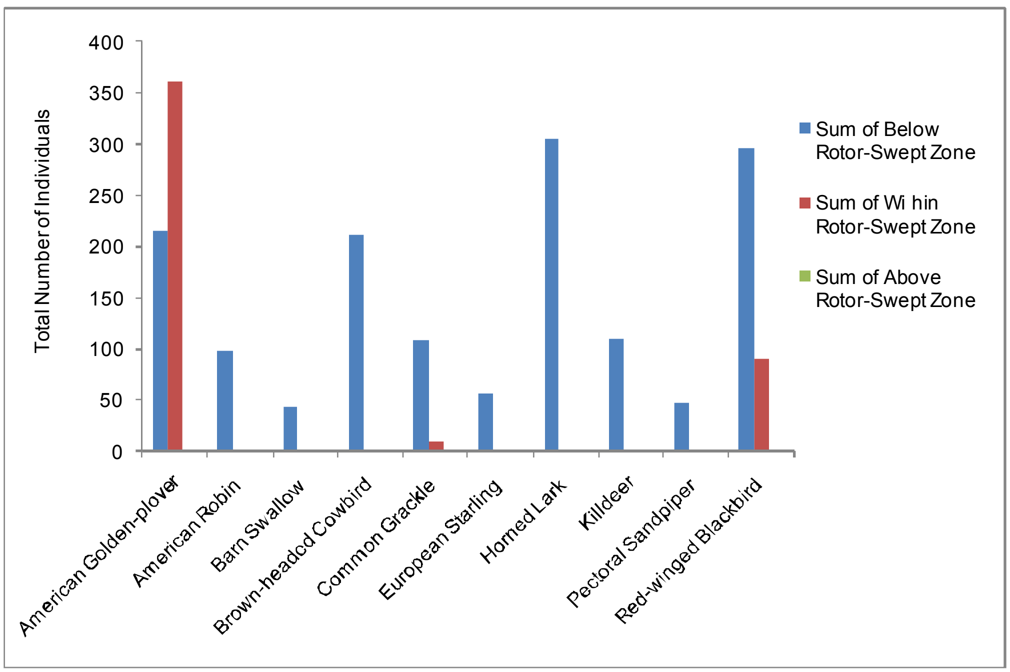
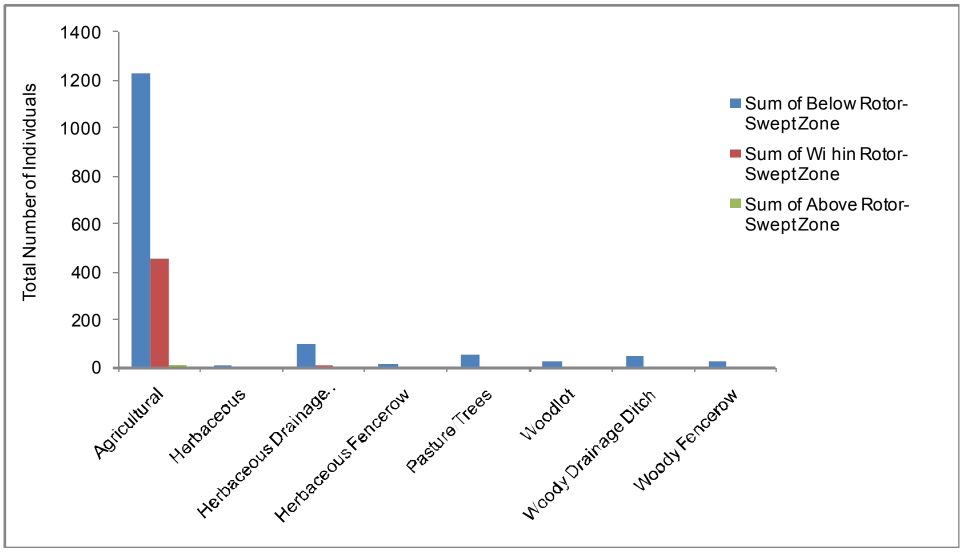


Figure 10 **Total Number of Individuals Observed Within the Three Flight Height Zones (Below, Within, and Above the Proposed Rotor-Swept Zone) by Habitat Type During Spring Avian Point-Count Surveys at Wildcat Wind Farm-Phase I, April-May 2011**



3.2 Raptor Migration Survey Results

Pre-construction raptor migration surveys were conducted at four survey stations on April 26, 27, 28, and 29, 2011. Weather during the raptor migration surveys consisted of light to strong winds (5-25 miles per hour) predominately out of the southeast. Temperatures were between 48 and 66 degrees Fahrenheit. In total, nine individuals were observed during the spring 2011 raptor migration surveys. A total of three raptor species were recorded: red-tailed hawk, American kestrel, and turkey vulture. In addition, 17 individual raptors, including one additional raptor species (Cooper's hawk), were recorded during the spring 2011 avian point-count surveys, although it is possible that some of the nine observations during the raptor migration surveys were also detected during the avian point-count surveys and vice versa.

Table 4 lists the three raptor species observed during the spring raptor migration surveys and also summarizes whether each species showed signs of direct (flight patterns associated with migrating birds) or indirect flight (flight patterns associated with hunting, foraging, etc.) or were seen perched in trees or on other structures. All raptors mentioned below are protected by the MBTA.

Table 4 **Species Observed During the Spring 2011 Raptor Migration Surveys and Their Associated Flight Behavior When First Detected at Wildcat Wind Farm-Phase I, April 26-29, 2011**

Species	Total Individuals	Flight Behavior		
		Direct	Indirect	Perched
American kestrel	1	0	0	1
Turkey vulture	3	3	0	0
Red-tailed hawk	5	3	2	0
Total	**9**	**6**	**2**	**1**

Of all the raptor individuals recorded during the spring raptor migration surveys, 56 percent were red-tailed hawks, 33 percent were turkey vultures and 11 percent were American kestrels. Twenty-two percent of all raptors observed exhibited indirect flight behaviors. Sixty-seven percent of all raptors observed exhibited direct flight behaviors. In addition, one American kestrel was observed perched on an electrical wire during a single survey period. In general, no distinct migration corridors were identified; instead it appeared that a few of the raptors observed flying through the Project Area were using thermals from the land surface of the Project Area to gain altitude. In addition, no distinct migration pattern was observed during the spring 2011 raptor migration surveys.

There were a total of four hours of raptor migration surveys completed between the four raptor migration stations (one hour at each station). At the migration stations located in the eastern portion of the Project Area (locations 42 and 95, Figure 1) only two raptors were observed during the spring raptor migration surveys. At the migration stations located in the western portion of the Project Area (locations 64 and 128) a total of seven raptors were observed during the spring raptor migration surveys.

Of those observed, a total of five red-tailed hawks were observed during the spring 2011 raptor migration surveys and all were observed flying at heights that were approximately within the height of the proposed rotor-swept zone. One turkey vulture was observed above the height of the proposed rotor-swept zone while the remaining three raptors were observed flying below the height of the proposed rotor-swept zone. The number of individuals per raptor species that were observed flying below, within, and above the height of the proposed rotor-swept zone during the spring 2011 raptor migration surveys is summarized in Table 5.

Table 5 Total Number of Individuals per Species Flying Below, Within, and Above the Height of the Proposed Rotor-Swept Zone at Wildcat Wind Farm-Phase I During Spring Raptor Migration Surveys, April 26-29, 2011

Species	Total Individuals	Flight Height		
		0-35m (below rotor-swept area)	35-150m (within rotor-swept area)	>150m (above rotor-swept area)
American kestrel	1	1	0	0
Turkey vulture	3	2	0	1
Red-tailed hawk	5	0	5	0
Total	**9**	**3**	**5**	**1**

3.3 Spring 2011 Raptor Nest Search Results

Pre-construction raptor nest searches were conducted throughout the Project Area during the weeks of April 26 and May 23, 2011. Overall, no active raptor nests were found during the spring 2011 raptor nest searches. Only one possible active raptor nest was located in the southwestern border of the Project Area. The nest was a medium-sized stick nest and was monitored several times during the April survey period. No raptor activity was observed at the nest site location during the monitoring. In general, biologists observed little raptor activity (nesting and foraging) during the spring 2011 study.

3.4 Opportunistic Observations during Non-Survey Periods

During the first week of surveys (week of April 25, 2011) an adult bald eagle was opportunistically observed flying through the Project Area heading north. As mentioned earlier, the bald eagle is protected under the MBTA and the BGEPA. No other bald eagles were observed during the survey periods.

A total of 1,134 American golden-plovers, 96 pectoral sandpipers, and two lesser yellowlegs were opportunistically observed either foraging in agricultural fields or flying in and around the Project Area during the first week of surveys (week of April 25, 2011). In addition, a number of other migratory bird species were opportunistically observed within the Project Area during non-survey periods during both survey weeks (April and May, 2011). Some of these migrants included alder flycatcher (*Empidonax alnorum*), bank swallow (*Riparia riparia*), common snipe (*Gallinago gallinago*), rose-breasted grosbeak (*Pheucticus ludovicianus*), summer tanager (*Piranga rubra*), wood thrush (*Hylocichla mustelina*), and yellow warbler (*Dendroic petechia*). In addition, several great blue herons were opportunistically observed either foraging in wetland/riparian areas or flying in the Project Area within the potential rotor-swept zone.

4. Avian Use Assessment for the Spring Migration Season

Activities associated with the construction, operation, and maintenance of a wind farm can directly and indirectly impact birds. Using the results from this study, biologists independently evaluated the potential risk that the proposed project may pose to the groups of birds that occur in the Project Area, including: passerines, doves, swifts, woodpeckers, corvids (crows and jays), raptors, falcons, water birds (herons), waterfowl (ducks and geese), shorebirds, and special status species (species listed as endangered, threatened, or special concern). Risks to birds may include habitat loss, habitat fragmentation, or disturbance/displacement due to construction and operation activities and/or collision risks. These potential impacts are described in the sections below.

4.1 Passerines

Based on data gathered during the Spring 2011 Pre-Construction Avian Use Study, passerines account for the majority of birds that occur in the Project Area during the spring migration and nesting seasons. Passerines are also the most diverse bird group (in terms of total number of species) that occurs within the Project Area. A total of 34 species within the passerine group were observed during spring avian point-count surveys, which represents 65 percent of all species and 62 percent of all individuals detected during the spring point-count surveys.

In general, passerines are expected to utilize the Project Area during spring and fall migration and for nesting and foraging. Some passerines will over-winter within the Project Area; however, the combination of cold temperatures, strong winds, and low food abundance will most likely make the Project Area relatively inhospitable to many passerines during the winter months, especially within the actively managed agricultural fields. As such, winter use by not only passerines, but all bird groups discussed below, is expected to be relatively low in the Project Area.

Passerines have the potential to be indirectly impacted as a result of habitat loss and fragmentation. Therefore, limiting wind farm development to large, actively managed agricultural fields would be least harmful to migrating passerines. In addition, potential impacts to passerines that nest within the Project Area could result from ground disturbing activities associated with the construction of the wind farm. Most nesting passerines were observed in grasslands, drainage ditch buffer areas (herbaceous and woody vegetation), and small woodlots during this study. Therefore, the risk of mortality to nesting birds would be greatest in these habitats during the wind farm construction phase. The project layout is anticipated to avoid such areas, locating turbines only within active agricultural fields. Should construction work associated with ancillary features occur in habitat suitable for nesting birds, measures to avoid impact to nesting can be undertaken (e.g., work outside of the peak nesting season (April to late July), remove potential nesting habitat prior to the nesting season, such as mowing any grassland buffer areas that could be directly impacted by wind farm construction, conduct pre-construction surveys for nest avoidance).

For passerines that forage in the Project Area, potential risk could result from displacement due to the loss of foraging habitat. Passerines are a relatively diverse group of birds in the Project Area, and were observed foraging in many different habitat types. However, the greatest numbers of foraging passerines (mostly horned larks and brown-headed cowbirds) were observed foraging in actively managed agricultural fields, where most of the proposed wind turbines would be placed. Given the size of these actively managed agricultural fields (>100 acres) and the proposed wind farm layout, the impacts from wind farm construction to foraging passerines would most likely be very low.

Collision with wind turbines and other wind farm related infrastructure (e.g., transmission lines, meteorological towers, substations, etc.) is a potential direct impact to be considered for wind farm construction. Migrating passerines are at the greatest risk when flying at altitudes within the rotor-swept zone of wind turbines. Migrating and foraging passerines may be at a relatively higher risk of collision during take-off and landing (especially at dusk) as well as during poor weather conditions. Poor weather conditions, such as low cloud cover and heavy rain events can influence bird behavior, causing them to fly at lower altitudes (Winkelman 1995, Gill et al. 1996, Erickson et al. 2001, Howe et al. 2002, Johnson et al. 2002, Kerlinger and Keins 2003). However, during this survey period, only 7.5 percent (Table 6) of the observed passerines were found flying within the height of the rotor-swept zone. Published literature has documented that under normal weather conditions, passerines migrate at altitudes well above the height of modern wind turbines and other wind farm related infrastructure (Kerlinger and Moore 1989, Kerlinger 1995). Our results are consistent with these findings; therefore, passerines are expected to be at a relatively low risk of collision while migrating or foraging through the Project Area.

Table 6 Total Number of Individuals by Species Type Observed Flying Below, Within, or Above the Proposed Rotor-Swept Zone at Wildcat Wind Farm-Phase I During Spring Avian Point-Count Surveys, April and May, 2011

Species Type	Below Rotor-Swept Zone	Within Rotor-Swept Zone	Above Rotor-Swept Zone	Total	Percent Within Rotor-Swept Zone
Corvid	40			40	0.0%
Dove	17	2		19	10.5%
Falcon	1	1		2	50.0%
Passerine	1,320	107	1	1,428	7.5%
Raptor	7	8		15	53.3%
Shorebird	376	360		736	48.9%
Swift	14	5		19	26.3%
Waterbird			1	1	0.0%
Waterfowl	14	8		22	36.4%
Woodpecker	9			9	0.0%

4.2 Raptors and Falcons

Similar to passerines, raptors and falcons can migrate through, nest in, and forage in the Project Area. Raptors and falcons are subject to the same types of impacts discussed for passerines. The potential risks to raptors and falcons from wind farm construction, operation, and maintenance are discussed below. Because they have similar behavior and risk factors, the discussion regarding raptors reflects a combined discussion for both groups (raptors and falcons)

Raptors were observed rather infrequently during the Spring 2011 Pre-Construction Avian Use Study. The few raptors (26) that were observed within the Project Area did not appear to be migrating through the Project Area, although a single adult bald eagle was observed flying through the Project Area. Nesting raptors are uncommon in the Project Area, as no confirmed active raptor nests were found within or near the Project Area during this study. However, this does not preclude the potential for raptors to nest in or around the Project Area in subsequent nesting seasons. Because the project turbines will all be located within active agricultural fields, proximity to raptor nests is not anticipated.

Forested habitat at the Project Area is limited to 2-20 acre deciduous woodlots scattered throughout the Project Area; therefore, raptors that depend on forested habitat for perching, nesting, etc., are not as common and these species tend not to have a high risk of displacement. However, during this study, biologists opportunistically observed several raptors searching for prey from perch sites in the Project Area, and the perch sites used (typically by American kestrels) were often poles and above-ground transmission lines. Without proper mitigation measures, raptors could be at risk from electrocution if they perch on above-ground transmission lines. For example, at the proposed Sturgis Wind Farm Project in South Dakota risk to raptors from electrocution was realized when the remains of an electrocuted juvenile golden eagle carcass was located under the Black Hills Power transmission line at the site (ARCADIS 2009a). At the Wildcat Wind project, all electrical interconnections will be underground, significantly reducing the potential for avian impact. An overhead transmission interconnection will extend from the project substation to the existing transmission line. Design recommendations to reduce risk to raptors associated with overhead transmission are provided in Suggested Practices for Avian Protection on Power Lines – The State of the Art in 2006 (APLIC 2006) and Avian Protection Plan Guidelines 2005 (USFWS 2005), including such measures as minimum distances between conductors or installation of perch guards.

A total of 54% of all raptors (1 falcon and 13 raptors) were observed soaring within the height of the rotor-swept zone, searching for prey, moving between different habitats, or possibly searching for suitable nesting habitat (Table 5 and 6). Therefore, collision with turbines may be a potential risk for raptors that fly within the Project Area. Poor weather conditions (e.g., low cloud cover, rain events) could potentially influence raptors causing them to fly at lower altitudes which could result in a relatively greater risk of turbine collision. Raptors could also be at a relatively greater risk from collision when landing into or taking off from the Project Area; however, no raptors were observed doing this during the spring 2011 study. Because raptors search for food throughout all habitat types in the Project Area, it would be difficult to site wind turbines outside of potential hunting habitat. As such, it is recommended that wind turbines be placed in actively managed agricultural field areas that are not in immediate proximity to woodlots, grassland areas, or riparian corridors. Doing so would help minimize potential direct impacts associated with turbine collision.

Most studies show that raptor mortality as a result of collision is low compared to other species (Johnson et al. 2000, Erickson et al. 2001, Strickland et al. 2003). Although this study observed 53 percent flying within the height of the rotor-swept zone, due to the low number of raptors observed compared to other species (i.e., less than 2 percent), risk to this species group is still considered to be minimal.

In general, since so few raptors were observed and no nesting activity was observed, the risk of habitat loss and fragmentation, electrocution, disturbance/displacement and collision as a result of the wind farm construction for this Project Area is expected to be low.

4.3 Waterfowl and Water Birds

Waterfowl and water birds together only accounted for about 1 percent of all birds observed during the spring 2011 avian point-count surveys and 36.4 percent (8 birds total) were observed flying within the rotor swept zone (Table 6). Waterfowl and water birds are unique in that they spend most of their time within wetlands/riparian areas and most often nest near, feed in, and land in/take off from these habitats during spring migration. Waterfowl and water birds are subject to the same types of habitat loss and fragmentation impacts discussed for passerines and raptors; however, waterfowl and water birds are generally at risk if turbines were located in proximity to or result in the net loss of wetlands/riparian areas. Because the project will avoid and minimize potential impact to such areas, siting wind turbines only in active agricultural fields, potential impacts to waterfowl and water birds will be minimal.

Waterfowl (i.e., Canada geese, mallards) are known to and have been observed foraging within actively managed agricultural fields during this study. These species may be at a greater risk to wind turbine collision while landing in/taking off from these agricultural fields. However, because so few birds were observed compared to other species types within the Project Area (i.e., 1 percent) this risk is considered low for the Project Area.

4.4 Shorebirds

Based on data gathered during the Spring 2011 Pre-Construction Avian Use Study, shorebirds are the second most abundant group of birds (second to passerines) that occurred within the Project Area during the 2011 spring migration season. The most abundant of shorebird species observed was the American golden-plover, with 575 individuals detected during avian point-count surveys and an additional 1,134 observed during non-survey periods (refer to Section 3.4, Opportunistic Observations during Non-Survey Periods). The majority of the shorebirds were observed in small to medium sized flocks foraging in actively managed agricultural fields or flying in and around the Project Area during the first week of surveys (April 26-29, 2011). Several medium sized flocks (~50-100 birds) were observed flying within the height of the proposed rotor-swept zone during avian point-count surveys (48.9 percent overall, Table 6). To this extent, shorebirds may be at a greater risk of collision with wind turbines during early April when American golden-plovers and other shorebird species (e.g., pectoral sandpipers) utilize the Project Area as stopover foraging habitat during their migration to northern latitudes (e.g., high arctic tundra of Alaska and Canada). Migration for these birds is along a different route during fall migration (Haverschmidt 1969, Johnson and Connors 1996, Johnson 2003).

In general, because of the short migration period of the American golden-plovers within the Project Area and the few numbers of additional shorebirds observed, the impacts on shorebirds are expected to be low.

4.5 Corvids, Doves, Swifts and Woodpeckers

Corvids consist of two species that occur in the Project Area: American crow and blue jay. Corvids made up only 1.7 percent of all birds detected during the Spring 2011 Pre-Construction Avian Use Study. In general, corvids utilize the Project Area during migration, for nesting, and for foraging. Corvids were generally observed in or around small woodlots and riparian areas within the Project Area during avian point-count surveys and none were observed flying within the height of the proposed rotor-swept zone. To this extent, impact to corvids within the Project Area would most likely be minimal during the spring migration period.

Doves consist of two species that occur in the Project Area: rock pigeon and mourning dove. The rock pigeon is a non-native species that is not protected under the MBTA. The mourning dove is protected under the MBTA, although it is also considered a game species in Indiana. Mourning doves could potentially be at risk from wind farm construction, operation, and maintenance during migration, nesting, and foraging activities, although mourning doves accounted for less than 1 percent of all birds observed during the spring avian point-count surveys and only 11 percent were observed flying within the height of the proposed rotor-swept zone (Table 6); thus, impacts would most likely be minimal during the spring migration period. In addition, mourning doves generally migrate during the day, in flocks, and at relatively low altitudes (Kaufman 1996).

Chimney swifts were observed using (foraging in flight mainly) the Project Area during spring avian point-count surveys. Like doves, chimney swifts accounted for less than 1 percent of all birds observed during spring avian point-count surveys. Although the majority of the chimney swifts observed were flying below the height of the proposed rotor-swept zone, about 26 percent were observed flying within the height of the proposed rotor-swept zone (Table 6). Chimney swifts most frequently nest inside of chimney structures, usually located on houses and other buildings. Because no turbines will be located closer than 300 meters from a residential structure, potential impact to chimney swifts is expected to be minimal

Woodpeckers consist of three species that were observed within the Project Area: northern flicker, red-bellied woodpecker, and red-headed woodpecker. Woodpeckers made up less than 0.4 percent of all birds detected during spring avian point-count surveys. In general, woodpeckers utilize the Project Area during migration for nesting and foraging. Woodpeckers were generally observed in or around small woodlots and riparian areas within the Project Area during spring surveys and none were observed flying within the height of the proposed rotor-swept zone. To this extent, impact to woodpeckers within the Project Area would most likely be minimal during the spring migration period.

4.6 Special Status Species

No federally or state-listed threatened or endangered species or state-listed species of concern were observed during spring avian point-count surveys, although a single bald eagle was opportunistically observed flying through the Project Area during the first week of surveys (April, 2011). In general, habitat within the Project Area is not suitable for these species (i.e., the black rail, bald eagle, and peregrine falcon) or the Project Area is outside of the major migration pathway of these species. Based on this information, the risk of direct and indirect impacts from construction, operation and maintenance of the Wildcat Wind Farm-Phase I to federally or state-listed threatened and endangered species or state-listed species of concern is expected to be extremely low.

5. Summary

- Pre-construction avian point count surveys were conducted at 40 locations and 1,047 avian detections, 2,291 individuals, and 52 unique bird species were identified;
- Passerines accounted for 62% of all species observed and shorebirds (mainly the American golden-plover) accounted for 32%;
- There was an average of 6.60 avian detections, 14.46 individuals and 2.68 species observed per point-count survey location;
- Actively managed agricultural fields are the most common habitat type in the Project Area (85 to 90 percent); therefore, based on proportions, relative abundance of birds was highest in this habitat type;

- Overall, only a few species observed average flight heights within the proposed rotor-swept zone (i.e. American golden-plover, turkey vulture, and red-winged blackbird);
- Overall, 13 of 23 raptors, one of three falcons and 360 (American golden-plovers) of 731 shorebirds were observed flying within the height of the proposed rotor-swept zone and were the top three species observed flying within the height of the proposed rotor-swept zone;
- Nine individual raptors of three species were observed during raptor migration surveys; and
- No active raptor nests were observed during the raptor nest surveys.

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Appendix A

Raw Data from Avian Point-Count Surveys, April and May, 2011

Point #	Species	Total #	Mean # Detections	Mean # individuals	Mean # Species	Behavior	Distance	Height Zone	Habitat	Survey Effort	Type of Species
1	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
1	MODO	1				FLYOVER	2	1	AGRICULTURAL	1	DOVE
1	AMRO	1				FLYOVER	2	2	AGRICULTURAL	2	PASSERINE
1	AMGO	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
1	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
1	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
1	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
1	HOLA	1	2	2.25	1	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
4	AMGP	10				FORAGING	1	1	AGRICULTURAL	1	SHOREBIRD
4	RWBL	2				PERCHED	1	1	WOODY DRAINAGE DITCH	1	PASSERINE
4	CAGO	3				AUDIBLE	3	1	AGRICULTURAL	1	WATERFOWL
4	CHSP	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
4	BLJA	1				AUDIBLE	3	1	WOODLOT	1	CORVID
4	RWBL	1				PERCHED	1	1	AGRICULTURAL	1	PASSERINE
4	AMGO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
4	KILL	1				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
4	RWBL	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
4	RWBL	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
4	RWBL	4				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
4	NOFL	1				AUDIBLE	3	1	WOODLOT	2	WOODPECKER
4	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
4	CAGO	4				FORAGING	2	1	AGRICULTURAL	2	WATERFOWL
4	AMRO	2				AUDIBLE	3	1	WOODLOT	2	PASSERINE
4	BHCO	4				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
4	CHSP	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
4	SOSP	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
4	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
4	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
4	BARS	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
4	RWBL	3				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
4	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
4	AMRO	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
4	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
4	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
4	RWBL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	PASSERINE
4	RWBL	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
4	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE

4	AMRO	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
4	BHCO	2				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
4	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
4	RWBL	2				FLYOVER	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
4	KILL	1				AUDIBLE	2	1	AGRICULTURAL	2	SHOREBIRD
4	SOSP	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
4	AMRO	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
4	HOLA	3				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
4	CHSW	2				FLYOVER	1	2	AGRICULTURAL	2	SWIFT
4	BANS	1				FLYOVER	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
4	BARS	1	10	18	4	FLYOVER	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
8	GBHE	1				FLYOVER	3	1	AGRICULTURAL	1	WATERBIRD
8	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
8	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
8	CAGO	2				FLYOVER	3	1	AGRICULTURAL	1	WATERFOWL
8	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
8	RWBL	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
8	BARS	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
8	AMGP	3				FORAGING	3	1	AGRICULTURAL	1	SHOREBIRD
8	AMGP	75				FLYOVER	3	2	AGRICULTURAL	1	SHOREBIRD
8	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
8	AMGP	80				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
8	PESA	5				FORAGING	1	1	AGRICULTURAL	2	SHOREBIRD
8	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
8	RWBL	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
8	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
8	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
8	KILL	1				FLYOVER	3	1	AGRICULTURAL	1	SHOREBIRD
8	KILL	2				FORAGING	1	1	AGRICULTURAL	2	SHOREBIRD
8	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
8	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
8	COGR	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
8	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
8	BHCO	5				FORAGING	3	1	AGRICULTURAL	2	PASSERINE
8	BHCO	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
8	AMRO	1	6.25	47.75	3	FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
10	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
10	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
10	COHA	1				FLYOVER	1	1	AGRICULTURAL	1	RAPTOR

10	CHSW	1				FLYOVER	1	1	AGRICULTURAL	1	SWIFT
10	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
10	VESP	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
10	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
10	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
10	RWBL	2				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
10	AMGO	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
10	RWBL	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
10	AMRO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
10	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
10	AMRO	1				FLYOVER	1	2	AGRICULTURAL	2	PASSERINE
10	BHCO	1				FLYOVER	2	2	AGRICULTURAL	2	PASSERINE
10	RWBL	2				FLYOVER	1	2	AGRICULTURAL	2	PASSERINE
10	COGR	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
10	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
10	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
10	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
10	COGR	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
10	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
10	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
10	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
10	BHCO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
10	COGR	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
10	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
10	COGR	3				FLYOVER	3	2	AGRICULTURAL	1	PASSERINE
10	BHCO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
10	RWBL	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
10	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
10	RWBL	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
10	KILL	1				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
10	BHCO	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
10	BHCO	1				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
10	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
10	COGR	2				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
10	BHCO	1	9.5	11.75	2.5	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
13	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
13	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
13	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
13	HOLA	2				FLY-IN/LANDED	2	1	AGRICULTURAL	1	PASSERINE

13	KILL	1				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
13	AMGP	20				FORAGING	1	1	AGRICULTURAL	2	SHOREBIRD
13	KILL	2				FLY-IN/LANDED	1	1	AGRICULTURAL	2	SHOREBIRD
13	HOLA	2				FORAGING	2	1	AGRICULTURAL	2	PASSERINE
13	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
13	SAVS	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
13	AMRO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
13	KILL	2				FLY-IN/LANDED	3	1	AGRICULTURAL	1	SHOREBIRD
13	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
13	AMRO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
13	MODO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	DOVE
13	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	SAVS	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
13	RWBL	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
13	EUST	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
13	KILL	1				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
13	KILL	1	6.25	12.5	2.75	FLY-IN/LANDED	3	1	AGRICULTURAL	2	SHOREBIRD
20	HOLA	5				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
20	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	VESP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
20	HOLA	4				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
20	HOLA	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
20	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	PESA	6				FLYOVER	3	1	AGRICULTURAL	2	SHOREBIRD
20	HOLA	4				FORAGING	1	1	AGRICULTURAL	2	PASSERINE
20	BHCO	7				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
20	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
20	AMGP	25				FLYOVER	3	2	AGRICULTURAL	2	SHOREBIRD
20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	BHCO	6				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	KILL	1				FLYOVER	2	1	AGRICULTURAL	1	SHOREBIRD
20	TRES	2				FLYOVER	1	2	AGRICULTURAL	1	PASSERINE
20	KILL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	SHOREBIRD

20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
20	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
20	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
20	RWBL	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
20	HOSP	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
20	MODO	2				FLY-IN/LANDED	1	1	AGRICULTURAL	2	DOVE
20	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
20	EUST	4				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
20	BHCO	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
20	BARS	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
20	COGR	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
20	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
20	BHCO	1	8.25	22.75	3.5	FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
29	MODO	1				FLYOVER	1	1	AGRICULTURAL	1	DOVE
29	EUST	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
29	AMGO	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
29	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
29	MODO	1				FLYOVER	3	1	AGRICULTURAL	1	DOVE
29	MODO	2				FLYOVER	3	1	AGRICULTURAL	1	DOVE
29	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
29	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
29	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
29	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
29	EUST	4				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
29	BLJA	1				PERCHED	2	1	AGRICULTURAL	2	CORVID
29	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
29	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
29	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
29	AMGO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
29	AMRO	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
29	RBWO	1				FLYOVER	1	1	AGRICULTURAL	2	WOODPECKER
29	BHCO	50				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
29	EAKI	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
29	EUST	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
29	BARS	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
29	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
29	COGR	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE

29	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
29	EUST	1				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
29	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
29	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
29	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
29	AMRO	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
29	COGR	1				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
29	AMGO	1	8	21.5	3.25	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
32	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
32	AMKE	1				PERCHED	3	1	AGRICULTURAL	1	FALCON
32	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
32	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
32	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
32	HOLA	2				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
32	AMCR	2				FLYOVER	3	1	AGRICULTURAL	1	CORVID
32	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
32	KILL	1				FLYOVER	3	1	AGRICULTURAL	1	SHOREBIRD
32	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
32	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
32	KILL	2				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
32	HOLA	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
32	BARS	3				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
32	COGR	3				FORAGING	2	1	AGRICULTURAL	2	PASSERINE
32	RWBL	4				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
32	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
32	COGR	2				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
32	HOLA	2				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
32	HOLA	1	6.25	9.5	2.25	FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
37	RWBL	4				PERCHED	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	RHWO	1				PERCHED	2	1	WOODY DRAINAGE DITCH	1	WOODPECKER
37	BHCO	4				AUDIBLE	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	RWBL	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
37	AMRO	2				AUDIBLE	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	AMRO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE

37	KILL	2				AUDIBLE	1	1	AGRICULTURAL	1	SHOREBIRD
37	SOSP	2				PERCHED	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	MALL	1				FLYOVER	1	1	AGRICULTURAL	1	WATERFOWL
37	BHCO	3				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
37	AMRO	1				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
37	KILL	2				FORAGING	1	1	AGRICULTURAL	2	SHOREBIRD
37	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
37	AMRO	1				AUDIBLE	3	1	HERBACEOUS	2	PASSERINE
37	SOSP	1				AUDIBLE	3	1	HERBACEOUS	2	PASSERINE
37	COGR	4				FLY-IN/LANDED	2	1	HERBACEOUS	2	PASSERINE
37	BLJA	1				FLYOVER	2	1	AGRICULTURAL	2	CORVID
37	RWBL	4				PERCHED	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	NOCA	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	KILL	2				PERCHED	1	1	AGRICULTURAL	1	SHOREBIRD
37	KILL	2				PERCHED	1	1	AGRICULTURAL	1	SHOREBIRD
37	RWBL	1				FLYOVER	1	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	SOSP	1				PERCHED	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	COYE	1				AUDIBLE	2	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	AMRO	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	RWBL	3				PERCHED	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
37	COYE	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	AMRO	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	SOSP	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	BHCO	2				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	TRES	1				FLYOVER	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	KILL	6				PERCHED	2	1	AGRICULTURAL	2	SHOREBIRD
37	RWBL	1				FLY-IN/LANDED	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
37	NOFL	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	WOODPECKER
37	INBU	1	8.75	15.75	3.75	AUDIBLE	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
43	KILL	1				AUDIBLE	1	1	AGRICULTURAL	1	SHOREBIRD
43	AMPI	2				FORAGING	1	1	AGRICULTURAL	1	PASSERINE
43	SAVS	1				PERCHED	1	1	HERBACEOUS FENCEROW	1	PASSERINE
43	AMRO	1				PERCHED	1	1	HERBACEOUS FENCEROW	1	PASSERINE
43	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
43	BHCO	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
43	RWBL	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
43	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
43	RWBL	5				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
43	GRSP	1				PERCHED	3	1	HERBACEOUS FENCEROW	2	PASSERINE

43	RWBL	3				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
43	AMRO	1				PERCHED	2	1	HERBACEOUS FENCEROW	1	PASSERINE
43	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
43	RWBL	1				PERCHED	2	1	HERBACEOUS FENCEROW	1	PASSERINE
43	RWBL	1				FLYOVER	1	1	HERBACEOUS FENCEROW	1	PASSERINE
43	BHCO	2				PERCHED	3	1	HERBACEOUS FENCEROW	1	PASSERINE
43	SAVS	1				AUDIBLE	2	1	HERBACEOUS FENCEROW	1	PASSERINE
43	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
43	EUST	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
43	RWBL	1				AUDIBLE	2	1	HERBACEOUS FENCEROW	2	PASSERINE
43	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
43	SAVS	1				AUDIBLE	1	1	HERBACEOUS FENCEROW	2	PASSERINE
43	HOSP	4				FLY-IN/LANDED	1	1	HERBACEOUS FENCEROW	2	PASSERINE
43	AMRO	1				AUDIBLE	2	1	HERBACEOUS FENCEROW	2	PASSERINE
43	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
43	SOSP	1				AUDIBLE	2	1	HERBACEOUS FENCEROW	2	PASSERINE
43	RWBL	2	6.75	10.25	3	FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
48	HOLA	2				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
48	SAVS	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
48	HOLA	2				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
48	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
48	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
48	HOLA	1	1.5	2	0.5	AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
56	RWBL	1				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
56	KILL	2				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD
56	HOLA	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
56	COHA	1				FLYOVER	1	1	AGRICULTURAL	1	RAPTOR
56	RWBL	4				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
56	RWBL	1				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
56	SOSP	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
56	RWBL	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
56	RWBL	1				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
56	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
56	KILL	2				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
56	BHCO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
56	AMRO	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
56	BARS	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
56	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
56	KILL	3				FLY-IN/LANDED	1	1	AGRICULTURAL	2	SHOREBIRD

56	RWBL	2				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
56	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
56	SOSP	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
56	RWBL	2				FLY-IN/LANDED	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
56	HOLA	1				FLYOVER	2	3	AGRICULTURAL	2	PASSERINE
56	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
56	AMRO	1	5.75	8.25	2	PERCHED	3	1	AGRICULTURAL	2	PASSERINE
57	BHCO	5				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
57	MODO	1				FLYOVER	3	1	AGRICULTURAL	1	DOVE
57	BHCO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
57	RWBL	4				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
57	RWBL	1				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
57	RWBL	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
57	COGR	2				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
57	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
57	RWBL	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
57	AMRO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
57	COGR	2				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
57	RWBL	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
57	KILL	1				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
57	MODO	2				FLYOVER	3	1	AGRICULTURAL	2	DOVE
57	RWBL	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
57	AMKE	1				FLYOVER	2	2	AGRICULTURAL	2	FALCON
57	RWBL	5	4.25	8	1.75	FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
61	HOLA	1				PERCHED	1	1	AGRICULTURAL	1	PASSERINE
61	TUVU	1				FLYOVER	2	1	AGRICULTURAL	1	RAPTOR
61	HOLA	1				PERCHED	1	1	AGRICULTURAL	1	PASSERINE
61	BHCO	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
61	SOSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
61	VESP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
61	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
61	HOLA	3				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
61	HOLA	2				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
61	TUVU	2				FLYOVER	1	2	AGRICULTURAL	2	RAPTOR
61	EUST	2				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
61	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
61	SAVS	1				PERCHED	1	1	AGRICULTURAL	1	PASSERINE
61	BHCO	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
61	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE

61	SAVS	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
61	AMGO	2				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
61	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
61	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
61	BHCO	2	5	7	2.25	FLY-IN/LANDED	1	1	AGRICULTURAL	2	PASSERINE
63	RWBL	4				FLYOVER	3	1	HERBACEOUS FENCEROW	1	PASSERINE
63	RWBL	1				FLYOVER	2	1	HERBACEOUS FENCEROW	1	PASSERINE
63	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
63	KILL	2				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
63	BHCO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
63	COGR	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
63	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
63	EUST	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
63	COGR	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
63	BHCO	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
63	MODO	1				FLYOVER	1	1	AGRICULTURAL	2	DOVE
63	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
63	BHCO	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
63	RWBL	2				FLYOVER	3	2	AGRICULTURAL	2	PASSERINE
63	EAME	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
63	RWBL	2	4	5.75	2	PERCHED	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
64	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
64	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
64	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
64	KILL	1				FLYOVER	3	1	AGRICULTURAL	2	SHOREBIRD
64	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
64	BHCO	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
64	COGR	3				FLYOVER	1	2	AGRICULTURAL	2	PASSERINE
64	BHCO	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
64	HOLA	2				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
64	HOLA	1	2.5	3.5	1	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
66	BHCO	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
66	RWBL	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
66	SOSP	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
66	CHSW	1				FLYOVER	2	1	AGRICULTURAL	1	SWIFT
66	RWBL	2				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
66	COSN	5				PERCHED	1	1	AGRICULTURAL	2	SHOREBIRD
66	RWBL	6				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
66	EUST	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE

66	SOSP	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
66	SOSP	1				PERCHED	1	1	WOODY DRAINAGE DITCH	1	PASSERINE
66	RWBL	5				FLY-IN/LANDED	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
66	RWBL	1				PERCHED	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
66	COYE	1				AUDIBLE	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
66	EUST	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
66	SOSP	1				AUDIBLE	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	RWBL	1				PERCHED	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	AMGO	2				PERCHED	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	RWBL	2				PERCHED	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	AMRO	1				PERCHED	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	RWBL	1				PERCHED	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
66	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
66	BARS	1	5.5	9.5	2.75	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
68	KILL	1				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD
68	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
68	AMGO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
68	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
68	MODO	1				FLYOVER	1	1	AGRICULTURAL	1	DOVE
68	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
68	KILL	1				FLYOVER	3	1	AGRICULTURAL	2	SHOREBIRD
68	KILL	2				PERCHED	1	1	AGRICULTURAL	1	SHOREBIRD
68	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
68	RWBL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	PASSERINE
68	AMRO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
68	HOLA	1				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
68	RWBL	1				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
68	RWBL	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
68	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
68	TUVU	1				FLYOVER	3	2	AGRICULTURAL	2	RAPTOR
68	KILL	2				FLY-IN/LANDED	3	1	AGRICULTURAL	2	SHOREBIRD
68	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
68	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
68	BHCO	2	5	6.75	2	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
71	PESA	25				FLYOVER	3	1	AGRICULTURAL	1	SHOREBIRD
71	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
71	RWBL	2				FLYOVER	1	2	AGRICULTURAL	1	PASSERINE
71	BARS	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
71	HOLA	1				PERCHED	1	1	AGRICULTURAL	1	PASSERINE

71	RWBL	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
71	RWBL	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
71	KILL	2				PERCHED	3	1	AGRICULTURAL	1	SHOREBIRD
71	HOLA	1				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
71	HOLA	3				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
71	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
71	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
71	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
71	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
71	BHCO	6				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
71	HOLA	1	4	12.75	1.5	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
74	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
74	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
74	RWBL	5				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
74	AMRO	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
74	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
74	AMCR	1				FLYOVER	3	1	AGRICULTURAL	2	CORVID
74	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
74	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
74	AMRO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
74	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
74	MODO	2				FLYOVER	3	2	AGRICULTURAL	1	DOVE
74	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
74	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
74	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
74	BHCO	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
74	RWBL	2				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
74	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
74	AMGO	1	4.5	6.5	1.75	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
77	PESA	10				PERCHED	1	1	AGRICULTURAL	1	SHOREBIRD
77	HOLA	2				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
77	KILL	1				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD
77	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
77	RWBL	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
77	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
77	COGR	1	1.75	4.25	1.5	FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
79	AMGP	10				PERCHED	3	1	AGRICULTURAL	1	SHOREBIRD
79	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
79	KILL	1				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD

79	EUST	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
79	AMRO	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
79	EAKI	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
79	BARS	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
79	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
79	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
79	BARS	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
79	EAME	1				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
79	AMGO	1				FLYOVER	1	2	AGRICULTURAL	1	PASSERINE
79	BHCO	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
79	KILL	1				PERCHED	2	1	AGRICULTURAL	1	SHOREBIRD
79	HOLA	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
79	COGR	3				FLYOVER	3	2	AGRICULTURAL	2	PASSERINE
79	KILL	1				FLY-IN/LANDED	3	1	AGRICULTURAL	2	SHOREBIRD
79	HOLA	1	4.5	8.25	2.75	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
80	RWBL	8				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
80	EAME	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
80	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
80	VESP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
80	BHCO	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
80	HOLA	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
80	AMRO	1				FLYOVER	1	1	WOODY DRAINAGE DITCH	1	PASSERINE
80	SOSP	1				AUDIBLE	1	1	WOODY DRAINAGE DITCH	1	PASSERINE
80	BLJA	2				AUDIBLE	2	1	WOODY DRAINAGE DITCH	2	CORVID
80	RWBL	1				PERCHED	1	1	WOODY DRAINAGE DITCH	2	PASSERINE
80	SOSP	1				AUDIBLE	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
80	RWBL	4				PERCHED	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
80	RWBL	3				PERCHED	3	1	WOODY DRAINAGE DITCH	1	PASSERINE
80	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
80	SOSP	1				AUDIBLE	1	1	WOODY DRAINAGE DITCH	2	PASSERINE
80	RWBL	1				PERCHED	2	1	WOODY DRAINAGE DITCH	2	PASSERINE
80	KILL	2				FLY-IN/LANDED	1	1	AGRICULTURAL	2	SHOREBIRD
80	EUST	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
80	AMRO	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
80	RWBL	1	5	9	2.5	PERCHED	3	1	WOODY DRAINAGE DITCH	2	PASSERINE
82	AMGP	45				FORAGING	2	1	AGRICULTURAL	1	SHOREBIRD
82	AMRO	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
82	RWBL	8				FLYOVER	1	2	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
82	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE

82	CHSW	2				FLYOVER	1	1	AGRICULTURAL	1	SWIFT
82	RTHA	1				FLY-IN/LANDED	1	1	HERBACEOUS DRAINAGE DITCH	1	RAPTOR
82	EUST	5				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
82	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
82	RWBL	3				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
82	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
82	HOLA	1				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
82	KILL	2				PERCHED	1	1	AGRICULTURAL	1	SHOREBIRD
82	HOLA	1				FLY-IN/LANDED	1	1	AGRICULTURAL	1	PASSERINE
82	BHCO	5				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
82	AMRO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
82	BHCO	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
82	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
82	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
82	BHCO	2				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
82	AMRO	1	5	21.25	2.25	FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
83	CHSW	1				FLYOVER	1	1	AGRICULTURAL	1	SWIFT
83	RWBL	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
83	BARS	3				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
83	AMRO	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
83	RWBL	1				FLY-IN/LANDED	3	1	WOODLOT	1	PASSERINE
83	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
83	KILL	1				AUDIBLE	1	1	AGRICULTURAL	1	SHOREBIRD
83	TRES	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
83	EUST	4				FLYOVER	3	1	WOODLOT	1	PASSERINE
83	RWBL	2				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
83	SOSP	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
83	AMRO	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
83	BLJA	1				FLYOVER	2	1	AGRICULTURAL	2	CORVID
83	KILL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	2	SHOREBIRD
83	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
83	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
83	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
83	HOLA	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
83	BARS	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
83	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
83	HOLA	1	5.25	6.75	2.75	AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
87	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
87	AMRO	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE

87	KILL	2				FLY-IN/LANDED	2	1	AGRICULTURAL	1	SHOREBIRD
87	AMGO	4				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
87	BHCO	1				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
87	CHSW	4				FLYOVER	3	1	AGRICULTURAL	1	SWIFT
87	KILL	2				FLY-IN/LANDED	2	1	AGRICULTURAL	2	SHOREBIRD
87	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
87	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
87	KILL	1				PERCHED	2	1	AGRICULTURAL	2	SHOREBIRD
87	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
87	EUST	2	3	5.25	1.75	FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
93	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
93	AMRO	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
93	EUST	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
93	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	BLJA	1				AUDIBLE	3	1	AGRICULTURAL	1	CORVID
93	SOSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	RWBL	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
93	BHCO	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
93	CHSP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
93	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	CHSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	RWBL	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
93	AMGP	40				FLYOVER	3	2	AGRICULTURAL	2	SHOREBIRD
93	BAOR	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
93	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
93	HOLA	2				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
93	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
93	VESP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
93	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
93	BHCO	2				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
93	CHSW	1				FLYOVER	3	1	AGRICULTURAL	1	SWIFT
93	BARS	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
93	CAGO	2				FLYOVER	1	2	AGRICULTURAL	2	WATERFOWL
93	BHCO	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
93	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
93	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
93	RWBL	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
93	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE

93	AMRO	1				PERCHED	3	1	AGRICULTURAL	2	PASSERINE
93	BHCO	2				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
93	VESP	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
93	HOLA	1	8.25	20	3.75	FLYOVER	1	2	AGRICULTURAL	2	PASSERINE
96	KILL	3				FLY-IN/LANDED	1	1	AGRICULTURAL	1	SHOREBIRD
96	BLJA	3				AUDIBLE	3	1	WOODLOT	1	CORVID
96	CHSW	3				FLYOVER	3	2	AGRICULTURAL	1	SWIFT
96	COGR	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
96	RTHA	1				FLYOVER	2	2	WOODLOT	1	RAPTOR
96	BLJA	12				FLYOVER	3	1	WOODLOT	1	CORVID
96	BRTH	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	RWBL	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
96	NOCA	1				PERCHED	3	1	WOODLOT	1	PASSERINE
96	EUST	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
96	CHSP	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	NOCA	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	RTHA	1				FLYOVER	3	1	WOODLOT	2	RAPTOR
96	KILL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	2	SHOREBIRD
96	AMRO	4				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	HOLA	3				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
96	TRES	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
96	NOCA	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	BHCO	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
96	COGR	1				AUDIBLE	2	1	WOODLOT	2	PASSERINE
96	EAME	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
96	AMGO	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	BLJA	1				AUDIBLE	3	1	WOODLOT	2	CORVID
96	HOWR	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	KILL	1				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
96	REVI	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	BLJA	1				AUDIBLE	3	1	WOODLOT	1	CORVID
96	AMRO	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
96	EAWP	1				AUDIBLE	3	1	WOODLOT	1	PASSERINE
96	RWBL	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
96	HOLA	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
96	RBWO	1				AUDIBLE	3	1	WOODLOT	1	WOODPECKER
96	EUST	1				FLY-IN/LANDED	3	1	WOODLOT	1	PASSERINE
96	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
96	BHCO	1				FLY-IN/LANDED	3	1	WOODLOT	2	PASSERINE

96	RWBL	1				FLY-IN/LANDED	3	1	WOODLOT	2	PASSERINE
96	SOSP	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	RBWO	1				AUDIBLE	3	1	WOODLOT	2	WOODPECKER
96	EAWP	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	BLJA	1				AUDIBLE	3	1	WOODLOT	2	CORVID
96	INBU	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	AMRO	1				AUDIBLE	3	1	WOODLOT	2	PASSERINE
96	RHWO	1				FLYOVER	1	1	AGRICULTURAL	2	WOODPECKER
96	EAKI	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
96	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
96	UNPA	1				FLYOVER W/ FOO	2	1	AGRICULTURAL	2	PASSERINE
96	EUST	4				PERCHED	3	1	WOODLOT	2	PASSERINE
96	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
96	SAVS	1	12.25	19.5	6.5	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	AMGP	9				FLYOVER	2	1	AGRICULTURAL	1	SHOREBIRD
97	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	SOSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	AMGP	100				FLYOVER	2	2	AGRICULTURAL	1	SHOREBIRD
97	EUST	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
97	KILL	1				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD
97	KILL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	SHOREBIRD
97	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
97	SOSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	HOLA	3				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
97	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	RWBL	2				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
97	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
97	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
97	AMGP	75				FLYOVER	3	2	AGRICULTURAL	2	SHOREBIRD
97	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
97	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
97	AMGP	13				FLY-IN/LANDED	2	1	AGRICULTURAL	2	SHOREBIRD
97	AMGP	25				FLYOVER	2	2	AGRICULTURAL	2	SHOREBIRD
97	AMGP	5				FORAGING	2	1	AGRICULTURAL	2	SHOREBIRD
97	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
97	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE

97	AMRO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
97	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	AMRO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
97	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
97	BHCO	1				FLYOVER	1	2	AGRICULTURAL	1	PASSERINE
97	SAVS	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
97	AMRO	1				PERCHED	2	1	AGRICULTURAL	2	PASSERINE
97	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
97	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
97	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
97	BARS	1	9.75	66.25	3.25	FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
101	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
101	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
101	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
101	KILL	1				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
101	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
101	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
101	AMGP	20				FLYOVER	3	2	AGRICULTURAL	2	SHOREBIRD
101	HOLA	2				FLY-IN/LANDED	1	1	AGRICULTURAL	2	PASSERINE
101	RWBL	1				FLYOVER	1	2	AGRICULTURAL	2	PASSERINE
101	BHCO	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
101	BARS	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
101	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
101	HOLA	2				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
101	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
101	VESP	1				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
101	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
101	BHCO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
101	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
101	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
101	RWBL	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
101	KILL	1				FLYOVER	3	1	AGRICULTURAL	1	SHOREBIRD
101	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
101	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
101	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
101	BHCO	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE

101	RWBL	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
101	COGR	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
101	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
101	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
101	VESP	1	7.5	13.75	2	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
102	RWBL	6				FLY-IN/LANDED	1	1	PASTURE	1	PASSERINE
102	KILL	2				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
102	COGR	2				FLYOVER	1	1	PASTURE	1	PASSERINE
102	EUST	3				PERCHED	1	1	PASTURE	1	PASSERINE
102	HOLA	4				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
102	COGR	8				FLYOVER	1	1	PASTURE	1	PASSERINE
102	COGR	10				FLYOVER	1	1	PASTURE	1	PASSERINE
102	AMRO	1				PERCHED	3	1	PASTURE	1	PASSERINE
102	COGR	4				FLY-IN/LANDED	1	1	PASTURE	2	PASSERINE
102	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
102	AMRO	2				PERCHED	1	1	PASTURE	2	PASSERINE
102	RWBL	3				FLY-IN/LANDED	1	1	PASTURE	2	PASSERINE
102	KILL	1				AUDIBLE	2	1	AGRICULTURAL	2	SHOREBIRD
102	COGR	2				FLYOVER	1	1	PASTURE	2	PASSERINE
102	RWBL	3				PERCHED	1	1	PASTURE/TREES	1	PASSERINE
102	EUST	3				FLYOVER	1	1	PASTURE/TREES	1	PASSERINE
102	AMRO	1				FORAGING	2	1	AGRICULTURAL	1	PASSERINE
102	AMRO	1				AUDIBLE	1	1	PASTURE/TREES	1	PASSERINE
102	SOSP	1				PERCHED	1	1	PASTURE/TREES	1	PASSERINE
102	EUST	2				FLY-IN/LANDED	1	1	PASTURE/TREES	1	PASSERINE
102	COGR	1				AUDIBLE	1	1	PASTURE/TREES	1	PASSERINE
102	SAVS	1				PERCHED	1	1	PASTURE/TREES	1	PASSERINE
102	COGR	1				FLY-IN/LANDED	3	1	PASTURE/TREES	1	PASSERINE
102	RWBL	1				AUDIBLE	3	1	PASTURE/TREES	1	PASSERINE
102	BLJA	1				FLY-IN/LANDED	1	1	PASTURE/TREES	1	CORVID
102	AMRO	2	8.67	22.22	3	FLY-IN/LANDED	1	1	PASTURE/TREES	1	PASSERINE
104	AMRO	1				PERCHED	1	1	WOODY FENCEROW	1	PASSERINE
104	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
104	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
104	NOMO	1				AUDIBLE	1	1	WOODY FENCEROW	1	PASSERINE
104	BARS	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
104	DICK	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
104	BLJA	1				AUDIBLE	2	1	AGRICULTURAL	1	CORVID
104	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE

104	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
104	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
104	SOSP	1				AUDIBLE	1	1	WOODY FENCEROW	1	PASSERINE
104	AMRO	1				AUDIBLE	1	1	WOODY FENCEROW	1	PASSERINE
104	NOFL	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	WOODPECKER
104	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
104	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
104	CHSP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
104	AMRO	1				AUDIBLE	1	1	WOODY FENCEROW	2	PASSERINE
104	SOSP	1				AUDIBLE	1	1	WOODY FENCEROW	2	PASSERINE
104	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
104	KILL	3				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
104	COGR	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
104	VESP	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
104	AMRO	2				FLYOVER	1	1	WOODY FENCEROW	2	PASSERINE
104	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
104	SOSP	1				PERCHED	1	1	WOODY FENCEROW	2	PASSERINE
104	INBU	1				AUDIBLE	1	1	WOODY FENCEROW	1	PASSERINE
104	AMRO	1				FLY-IN/LANDED	3	1	WOODY FENCEROW	1	PASSERINE
104	KILL	1				FLY-IN/LANDED	3	1	AGRICULTURAL	1	SHOREBIRD
104	VESP	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	PASSERINE
104	EUST	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
104	HOLA	1				FLY-IN/LANDED	2	1	AGRICULTURAL	1	PASSERINE
104	EUST	1				FLY-IN/LANDED	3	1	WOODY FENCEROW	1	PASSERINE
104	INBU	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
104	HOLA	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
104	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
104	RWBL	1				AUDIBLE	1	1	WOODY FENCEROW	2	PASSERINE
104	AMRO	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
104	INBU	1				AUDIBLE	1	1	WOODY FENCEROW	2	PASSERINE
104	AMGO	2				FLY-IN/LANDED	1	1	WOODY FENCEROW	2	PASSERINE
104	SOSP	1				AUDIBLE	2	1	WOODY FENCEROW	2	PASSERINE
104	BARS	2				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
104	AMRO	2				FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE
104	SOSP	1				AUDIBLE	2	1	WOODY FENCEROW	2	PASSERINE
104	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
104	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
104	RWBL	1	11.5	13.5	4	FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
106	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE

106	RTHA	1				PERCHED	3	1	WOODY FENCEROW	1	RAPTOR
106	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
106	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
106	EAME	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
106	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
106	BHCO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
106	COGR	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
106	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
106	KILL	1				AUDIBLE	2	1	AGRICULTURAL	2	SHOREBIRD
106	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
106	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
106	COGR	3				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
106	HOLA	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
106	EUST	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
106	COGR	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
106	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
106	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
106	RWBL	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
106	SOSP	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
106	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
106	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
106	AMRO	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
106	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
106	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
106	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
106	HOLA	2				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
106	EUST	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
106	KILL	1				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
106	KILL	1				FLYOVER	2	1	AGRICULTURAL	2	SHOREBIRD
106	COGR	3				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
106	BARS	4	8	10.5	2.75	FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
108	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
108	RWBL	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
108	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
108	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
108	HOLA	1				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
108	RWBL	3				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
108	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
108	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE

108	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
108	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
108	BHCO	1	2.75	3.25	0.75	FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
111	NOCA	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	BLJA	1				AUDIBLE	2	1	WOODY FENCEROW	1	CORVID
111	RWBL	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	FISP	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	AMRO	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
111	RWBL	75				FLYOVER	3	2	AGRICULTURAL	1	PASSERINE
111	BLJA	4				AUDIBLE	2	1	WOODY FENCEROW	1	CORVID
111	CHSW	3				FLYOVER	1	1	AGRICULTURAL	1	SWIFT
111	PAWA	4				FORAGING	2	1	WOODY FENCEROW	1	PASSERINE
111	RWBL	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	SOSP	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	AMGO	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
111	RWBL	3				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	NOCA	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	FISP	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	BARS	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
111	RCKI	1				AUDIBLE	2	1	WOODY FENCEROW	1	PASSERINE
111	VESP	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
111	TUVU	1				FLYOVER	3	1	AGRICULTURAL	2	RAPTOR
111	MALL	2				FLYOVER	3	1	AGRICULTURAL	2	WATERFOWL
111	AMRO	1				AUDIBLE	2	1	WOODY FENCEROW	2	PASSERINE
111	RWBL	1				AUDIBLE	1	1	WOODY FENCEROW	2	PASSERINE
111	BLJA	1				AUDIBLE	2	1	WOODY FENCEROW	2	CORVID
111	MALL	4				FLYOVER	3	2	AGRICULTURAL	2	WATERFOWL
111	BHCO	8				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
111	TUVU	1				FLYOVER	1	2	AGRICULTURAL	2	RAPTOR
111	COGR	4				PERCHED	2	1	WOODY FENCEROW	2	PASSERINE
111	FISP	1				AUDIBLE	2	1	WOODY FENCEROW	2	PASSERINE
111	BRTH	1				FLYOVER	2	1	WOODY FENCEROW	2	PASSERINE
111	TUVU	1				FLYOVER	1	2	AGRICULTURAL	1	RAPTOR
111	NOCA	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	BAOR	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	AMRO	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	AMRO	1				PERCHED	3	1	WOODY FENCEROW	1	PASSERINE
111	INBU	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	INBU	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE

111	HOWR	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	TRES	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
111	AMGO	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
111	NOCA	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	GRCA	1				AUDIBLE	3	1	WOODY FENCEROW	1	PASSERINE
111	BLJA	1				AUDIBLE	3	1	WOODY FENCEROW	1	CORVID
111	VESP	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
111	KILL	1				FLYOVER	1	1	AGRICULTURAL	1	SHOREBIRD
111	COGR	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
111	INBU	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	EAWP	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	EATO	1				PERCHED	3	1	WOODY FENCEROW	2	PASSERINE
111	HOWR	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	BHCO	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	BLJA	1				FLY-IN/LANDED	3	1	WOODY FENCEROW	2	CORVID
111	AMCR	1				FLYOVER	1	1	AGRICULTURAL	2	CORVID
111	NOCA	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
111	AMGO	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	AMRO	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	COYE	1				AUDIBLE	3	1	WOODY FENCEROW	2	PASSERINE
111	BLJA	1				AUDIBLE	3	1	WOODY FENCEROW	2	CORVID
111	BHCO	1				PERCHED	3	1	WOODY FENCEROW	2	PASSERINE
111	BHCO	3				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
111	TRES	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
111	MODO	1	15.5	41	7	AUDIBLE	3	1	WOODY FENCEROW	2	DOVE
113	RWBL	3				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
113	EAME	1				AUDIBLE	3	1	HERBACEOUS FENCEROW	1	PASSERINE
113	SOSP	1				AUDIBLE	3	1	HERBACEOUS FENCEROW	1	PASSERINE
113	TUVU	1				FLYOVER	1	2	AGRICULTURAL	1	RAPTOR
113	HOLA	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
113	RWBL	3				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
113	BHCO	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
113	AMRO	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
113	RWBL	4				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
113	RWBL	4				PERCHED	2	1	AGRICULTURAL	1	PASSERINE
113	KILL	1				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
113	HOLA	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
113	HOLA	3				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE

113	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
113	BARS	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
113	RWBL	2				PERCHED	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
113	RWBL	1				FLYOVER	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
113	BHCO	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
113	AMRO	1				AUDIBLE	3	1	HERBACEOUS FENCEROW	2	PASSERINE
113	RWBL	1				AUDIBLE	3	1	HERBACEOUS FENCEROW	2	PASSERINE
113	KILL	1				FLYOVER	2	1	AGRICULTURAL	1	SHOREBIRD
113	RWBL	2				PERCHED	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
113	SOSP	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
113	RWBL	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
113	BRTH	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
113	RWBL	5				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
113	KILL	1				FLYOVER	3	1	AGRICULTURAL	2	SHOREBIRD
113	SAVS	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
113	HOLA	1	7.25	12	2.75	AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
118	CHSP	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
118	COGR	1				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
118	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
118	MALL	1				FLYOVER	3	1	AGRICULTURAL	1	WATERFOWL
118	CHSW	1				FLYOVER	1	1	AGRICULTURAL	1	SWIFT
118	BHCO	5				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
118	KILL	1				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
118	AMGP	12				FLY-IN/LANDED	3	1	AGRICULTURAL	1	SHOREBIRD
118	HOLA	2				FLY-IN/LANDED	3	1	AGRICULTURAL	1	PASSERINE
118	CAGO	1				FLYOVER	3	1	AGRICULTURAL	1	WATERFOWL
118	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	HOLA	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	AMGP	8				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
118	HOLA	1				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
118	HOLA	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
118	EUST	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
118	BHCO	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	VESP	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
118	RWBL	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	RWBL	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
118	HOLA	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
118	BHCO	2				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE

118	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
118	AMRO	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
118	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
118	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
118	KILL	1				FLYOVER	1	1	AGRICULTURAL	2	SHOREBIRD
118	COGR	6				FORAGING	1	1	AGRICULTURAL	2	PASSERINE
118	RWBL	3				FORAGING	1	1	AGRICULTURAL	2	PASSERINE
118	VESP	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
118	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
118	BHCO	2				FORAGING	3	1	AGRICULTURAL	2	PASSERINE
118	HOLA	3				FLY-IN/LANDED	1	1	AGRICULTURAL	2	PASSERINE
118	BHCO	1	8.75	17.75	3.25	PERCHED	3	1	AGRICULTURAL	2	PASSERINE
121	HOLA	3				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
121	HOLA	1				FORAGING	1	1	AGRICULTURAL	1	PASSERINE
121	KILL	1				AUDIBLE	3	1	AGRICULTURAL	1	SHOREBIRD
121	RWBL	3				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
121	RWBL	2				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
121	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
121	HOLA	1				FLY-IN/LANDED	1	1	AGRICULTURAL	1	PASSERINE
121	HOLA	3				AUDIBLE	1	1	AGRICULTURAL	2	PASSERINE
121	BHCO	1				PERCHED	1	1	AGRICULTURAL	2	PASSERINE
121	BARS	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
121	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
121	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
121	HOLA	2				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
121	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
121	AMRO	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
121	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
121	HOLA	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
121	COGR	3				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
121	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
121	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	2	PASSERINE
121	HOLA	1	5.25	8.25	1.75	FLY-IN/LANDED	1	1	AGRICULTURAL	2	PASSERINE
127	RWBL	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	HOLA	2				AUDIBLE	1	1	AGRICULTURAL	1	PASSERINE
127	RWBL	2				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
127	VESP	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
127	SOSP	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	BARS	4				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE

127	EAME	1				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	SAVS	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	BARS	1				FLYOVER	1	1	AGRICULTURAL	1	PASSERINE
127	RHWO	1				FLYOVER	1	1	AGRICULTURAL	1	WOODPECKER
127	BHCO	2				FORAGING	2	1	AGRICULTURAL	1	PASSERINE
127	SOSP	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	RWBL	2				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	BHCO	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
127	RWBL	1				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	AMRO	2				FORAGING	1	1	AGRICULTURAL	2	PASSERINE
127	RWBL	2				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	SOSP	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	RWBL	1				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	SAVS	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	BHCO	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
127	COGR	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
127	BHCO	4				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
127	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
127	SAVS	1				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	KILL	1				AUDIBLE	3	1	AGRICULTURAL	2	SHOREBIRD
127	RWBL	4				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
127	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
127	RWBL	1				FORAGING	3	1	AGRICULTURAL	1	PASSERINE
127	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
127	SOSP	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	RTHA	1				FLYOVER	1	2	AGRICULTURAL	1	RAPTOR
127	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
127	BARS	2				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
127	RWBL	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
127	RWBL	2				PERCHED	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	AMRO	1				FLYOVER	2	1	AGRICULTURAL	2	PASSERINE
127	AMRO	1				FLYOVER W/ FOO	3	1	AGRICULTURAL	2	PASSERINE
127	SOSP	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	COGR	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
127	COGR	1				FLYOVER	3	1	AGRICULTURAL	2	PASSERINE
127	BARS	1				FLYOVER	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
127	AMRO	1	11	15.75	3.25	FORAGING	2	1	AGRICULTURAL	2	PASSERINE
128	RWBL	3				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE

128	AMRO	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	EAME	2				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	HOLA	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
128	BARS	1				FLYOVER	2	1	AGRICULTURAL	1	PASSERINE
128	RWBL	3				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	RWBL	4				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	KILL	1				AUDIBLE	2	1	AGRICULTURAL	1	SHOREBIRD
128	HOLA	2				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
128	AMRO	1				FLY-IN/LANDED	2	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	MALL	2				FLYOVER	3	2	AGRICULTURAL	1	WATERFOWL
128	HOLA	2				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
128	SOSP	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	SAVS	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
128	SAVS	1				AUDIBLE	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	RWBL	8				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	BHCO	1				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
128	RWBL	2				FLY-IN/LANDED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	AMRO	1				AUDIBLE	3	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	EAME	1				AUDIBLE	2	1	AGRICULTURAL	2	PASSERINE
128	SOSP	1				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	SAVS	1				AUDIBLE	2	1	AGRICULTURAL	1	PASSERINE
128	KILL	2				FLYOVER	2	1	AGRICULTURAL	1	SHOREBIRD
128	RWBL	3				PERCHED	3	1	AGRICULTURAL	1	PASSERINE
128	RWBL	5				FLY-IN/LANDED	1	1	HERBACEOUS DRAINAGE DITCH	1	PASSERINE
128	HOLA	1				AUDIBLE	3	1	AGRICULTURAL	1	PASSERINE
128	COGR	1				FLYOVER	3	1	AGRICULTURAL	1	PASSERINE
128	RWBL	4				PERCHED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	SAVS	1				AUDIBLE	2	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	MODO	1				FLYOVER	3	1	AGRICULTURAL	2	DOVE
128	COGR	2				FLYOVER	1	1	AGRICULTURAL	2	PASSERINE
128	AMRO	1				FLY-IN/LANDED	3	1	AGRICULTURAL	2	PASSERINE
128	RWBL	1				FLY-IN/LANDED	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	MODO	2				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	2	DOVE
128	BARS	1				FLYOVER	1	1	HERBACEOUS DRAINAGE DITCH	2	PASSERINE
128	HOLA	5	9	17.75	3	FLY-IN/LANDED	2	1	AGRICULTURAL	2	PASSERINE

Appendix B

Avian Species List for Wildcat Wind Farm-Phase I

Common Name	Genus / Species	Species Type	Observed During April Survey Period?	Observed During May Survey Period?
Alder flycatcher	*Empidonax alnorum*	Passerine		Y
American crow	*Corvus brachyrhynchos*	Corvid	Y	Y
American golden-plover	*Pluvialis dominica*	Shorebird	Y	
American goldfinch	*Carduelis tristis*	Passerine	Y	Y
American kestrel	*Falco sparverius*	Falcon	Y	Y
American pipit	*Anthus rubescens*	Passerine	Y	
American robin	*Turdus migratorius*	Passerine	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	Raptor	Y	
Bank swallow	*Riparia riparia*	Passerine		Y
Baltimore oriole	*Icterus galbula*	Passerine	Y	Y
Barn swallow	*Hirundo rustica*	Passerine	Y	Y
Blue jay	*Cyanocitta cristata*	Corvid	Y	Y
Brown-headed cowbird	*Molothrus ater*	Passerine	Y	Y
Brown thrasher	*Toxostoma rufum*	Passerine	Y	Y
Canada goose	*Branta canadensis*	Waterfowl	Y	Y
Chimney swift	*Chaetura pelagic*	Swift	Y	Y
Chipping sparrow	*Spizella passerina*	Passerine	Y	Y
Common snipe	*Gallinago gallinago*	Shorebird	Y	
Common grackle	*Quiscalus quiscula*	Passerine	Y	Y
Common yellowthroat	*Geothlypis trichas*	Passerine		Y
Cooper's hawk	*Accipiter cooperii*	Raptor	Y	
Dickcissel	*Spiza americana*	Passerine	Y	
Eastern kingbird	*Tyrannus tyrannus*	Passerine	Y	Y
Eastern meadowlark	*Sturnella magna*	Passerine	Y	Y
Eastern towhee	*Pipilo erythrophthalmus*	Passerine		Y
Eastern wood-pewee	*Contopus virens*	Passerine		Y
European starling	*Sturnus vulgaris*	Passerine	Y	Y
Field sparrow	*Spizella pusilla*	Passerine	Y	Y

Common Name	Genus / Species	Species Type	Observed During April Survey Period?	Observed During May Survey Period?
Gray catbird	*Dumetella carolinensis*	Passerine		Y
Grasshopper sparrow	*Ammodramus savannarum*	Passerine	Y	
Great blue heron	*Ardea herodias*	Waterbird	Y	Y
Horned lark	*Eremophila alpestris*	Passerine	Y	Y
House sparrow	*Passer domesticus*	Passerine	Y	Y
House wren	*Troglodytes aedon*	Passerine		Y
Indigo bunting	*Passerina cyanea*	Passerine		Y
Killdeer	*Charadrius vociferus*	Shorebird	Y	Y
Lesser yellowlegs	*Tringa flavipes*	Shorebird	Y	
Mallard	*Anas platyrhynchos*	Waterfowl	Y	Y
Mourning dove	*Zenaida macroura*	Dove	Y	Y
Northern cardinal	*Cardinalis cardinalis*	Passerine	Y	Y
Northern flicker	*Colaptes auratus*	Woodpecker	Y	Y
Northern mockingbird	*Mimus gundlachii*	Passerine	Y	
Palm warbler	*Dendroica palmarum*	Passerine	Y	
Pectoral sandpiper	*Caladris melanotos*	Shorebird	Y	
Red-bellied woodpecker	*Melanerpes caronlinus*	Woodpecker	Y	Y
Red-eyed vireo	*Vireo olivaceus*	Passerine		Y
Red-headed woodpecker	*Melanerpes erythrocephalus*	Woodpecker	Y	Y
Red-tailed hawk	*Buteo jamaicensis*	Raptor	Y	Y
Red-winged blackbird	*Agelaius phoeniceus*	Passerine	Y	Y
Rock pigeon	*Columba livia*	Dove	Y	
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Passerine		Y
Ruby-crowned kinglet	*Regulus calendula*	Passerine	Y	
Savannah sparrow	*Passerculus sandwichensis*	Passerine	Y	Y
Song sparrow	*Melospiza melodia*	Passerine	Y	Y
Summer tanager	*Piranga rubra*	Passerine		Y
Tree swallow	*Tachycineta bicolor*	Passerine	Y	Y

Common Name	Genus / Species	Species Type	Observed During April Survey Period?	Observed During May Survey Period?
Tufted titmouse	*Baeolophus bicolor*	Passerine	Y	
Turkey vulture	*Cathartes aura*	Raptor	Y	Y
Unid passerine		Passerine	Y	Y
Vesper sparrow	*Pooecetes gramineus*	Passerine	Y	Y
Warbling vireo	*Vireo gilvus*	Passerine		Y
Willow flycatcher	*Empidonax traillii*	Passerine		Y
Wood duck	*Aix sponsa*	Waterfowl	Y	
Wood thrush	*Hylocichla mustelina*	Passerine		Y
Yellow warbler	*Dendroic petechia*	Passerine	Y	Y

ARCADIS

Appendix C

Total Number of Individuals per Species Observed Flying Below, Within, or Above the Proposed Rotor-Swept Zone at Wildcat Wind Farm-Phase I during Spring Avian Point-Count Surveys, April and May, 2011

Appendix C

Total Number of Individuals per Species Observed Flying Below, Within, or Above the Proposed Rotor-Swept Zone at Wildcat Wind Farm-Phase I during Spring Avian Point-Count Surveys, April and May, 2011

Species	Below	Within	Above	Grand Total	Percent Within
American crow	4			4	0.0%
American goldfinch	25	1		26	3.8%
American golden-plover	215	360		575	62.6%
American kestrel	1	1		2	50.0%
American pipit	2			2	0.0%
American robin	98	2		100	2.0%
Baltimore oriole	2			2	0.0%
Bank swallow	1			1	0.0%
Barn swallow	44			44	0.0%
Brown-headed cowbird	212	2		214	0.9%
Blue jay	36			36	0.0%
Brown thrasher	3			3	0.0%
Canada goose	10	2		12	16.7%
Chipping sparrow	7			7	0.0%
Chimney swift	14	5		19	26.3%
Common grackle	106	9		115	7.7%
Common snipe	5			5	0.0%
Common yellowthroat	4			4	0.0%
Cooper's hawk	2			2	0.0%
Dickcissel	1			1	0.0%
Eastern kingbird	4			4	0.0%
Eastern meadowlark	16			16	0.0%
Eastern towhee	1			1	0.0%
Eastern wood-pewee	3			3	0.0%
European starling	56			56	0.0%
Field sparrow	3			3	0.0%
Great blue heron			1	1	0.0%
Gray catbird	1			1	0.0%
Grasshopper sparrow	1			1	0.0%
Horned lark	304	1	1	306	0.3%
House sparrow	5			5	0.0%
House wren	3			3	0.0%
Indigo bunting	8			8	0.0%

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Appendix C

Total Number of Individuals per Species Observed Flying Below, Within, or Above the Proposed Rotor-Swept Zone at Wildcat Wind Farm-Phase I during Spring Avian Point-Count Surveys, April and May, 2011

Species	Below	Within	Above	Grand Total	Percent Within
Killdeer	110			110	0.0%
Mallard	4	6		10	60.0%
Mourning dove	17	2		19	10.5%
Northern cardinal	9			9	0.0%
Northern flicker	3			3	0.0%
Northern mockingbird	1			1	0.0%
Palm warbler	4			4	0.0%
Pectoral sandpiper	46			46	0.0%
Ruby-crowned kinglet	1			1	0.0%
Red-bellied woodpecker	3			3	0.0%
Red-eyed vireo	1			1	0.0%
Red-headed woodpecker	3			3	0.0%
Red-tailed hawk	3	2		5	40.0%
Red-winged blackbird	295	90		385	23.3%
Savannah sparrow	19			19	0.0%
Song sparrow	40			40	0.0%
Tree swallow	5	2		7	28.6%
Turkey vulture	2	6		8	75.0%
Unidentified passerine	1			1	0.0%
Vesper sparrow	34			34	0.0%
Grand Total	1799	491	1	2291	
Percent Total	78.5%	21.4%	0.1%	100.0%	

APPENDIX C: Table C-1

Appendix C Table C-1. Comparison of bird fatality rates at existing wind farms in Midwestern U.S.

Wind project	Habitat type (no. turbines)	Dates surveyed	No. turbines searched and interval	No. birds found during surveys (no. found incidentally)	Estimated bird mortality per turbine per year (total fatalities per year)	Reference
Buffalo Ridge, Minnesota (Phase I)	agricultural grassland (73)	Apr 1994 - Dec 1995	30-73 turbines weekly and biweekly	7 (1)	0.33-0.66 (36)	Osborn et al. (2000)
Buffalo Ridge, Minnesota (Phase I)	agricultural, grassland (73)	Mar 15 - Nov 15, 1996- 1999	21 turbines every 14 days	13	4-year avg. 0.98 (72)	Johnson et al. (2002)
Buffalo Ridge, Minnesota (Phase I)	agricultural, grassland (143)	Mar 15 - Nov 15, 1998- 1999	40 turbines every 14 days	20	2-year avg. 2.27 (324)	Johnson et al. (2002)
Buffalo Ridge, Minnesota (Phase III)	agricultural, grassland (138)	Mar 15 - Nov 15, 1999	30 turbines every 14 days	20	4.45 (613)	Johnson et al. (2002)
Kewaunee County, Wisconsin	agricultural (31)	Jul 1999 – Sep 2001	not provided	25	1.29 (31)	Howe et al. (2002)
Top of Iowa, Iowa	agricultural (89)	Apr 15, 2003 - Dec 15, 2003	26 turbines every 2-3 days	2	0.44 (39)	Koford et al. (2004)
Top of Iowa, Iowa	agricultural (89)	Mar 24 - Dec 10, 2004	26 turbines every 3-days	5	0.90 (80)	Koford et al. (2005)
Blue Sky Green Field, Wisconsin	agricultural (88)	Jul 21 - Oct 31, 2008 Mar 17 - Jun 6, 2009	30 turbines 10 daily 20 every 4-6 days	40 (3)	11.83 (1,041)	Gruver et al. (2009)
Cedar Ridge, Wisconsin	agricultural (41)	Spring/Fall 2009	20 turbines every 1-4 days	31 (11)	10.82 (444)	BHE (2010)
Crescent Ridge, Illinois	agricultural (33)	Sep - Nov 2005 Mar - May 2006 Aug 2006	33 turbines every 5 days	10	Fall: 0.49 (16) Spring 0.47 (16) Combined 0.96	Poulton (2010)
Fowler Ridge Phase I, Indiana	agricultural (162)	Apr 6 - Oct 30, 2009.	25 turbines weekly and biweekly searches	24(4)	5.26 (852)	Johnson et al. (2010)
Forward Energy Center, Wisconsin	agriculture (86)	Jul 15 – Nov 15, 2008 Apr 15– May 31, 2009 Jul 15 – Oct 15, 2009 Apr 15- May 31, 2010	29 turbines 11 daily 9 every 3 days 9 every 5 days	20	2-year avg. 3.27 (281)	Grodsky and Drake (2011)

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