Appendix C
ABPP

Avian and Bat Protection Plan for the Buckeye Wind Power Project

Champaign County, Ohio

Prepared for:

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1.0 INTRODUCTION

Buckeye Wind LLC, a wholly owned subsidiary of EverPower Wind Holdings, Inc., (EverPower; hereafter referred to as Buckeye Wind) has proposed development of a wind-powered electric generation facility located in Champaign County in west central Ohio (Figure 1-1). The Buckeye Wind Project (the Project) would consist of up to 100 wind turbines, each with a nameplate capacity rating of 1.6 to 2.5 megawatts (MW), resulting in a total generating capacity of up to 250 MW. The locations of 52 turbines are currently known and the additional 48 turbines will be developed at a later time in accordance with all applicable local, state, and federal guidelines. The Project would also include development of access roads, transmission equipment, staging areas, a substation, and an operations and maintenance facility located within portions of Union, Wayne, Urbana, Salem, Rush, and Goshen Townships.

This Avian and Bat Protection Plan (ABPP) has been developed by Buckeye Wind to provide a detailed framework through which adverse impacts to migratory birds and non-federally listed bats[1] will be avoided and minimized during Project planning, siting, construction, operation, and decommissioning. The ABPP has been developed to address potential impacts that could result from the full 100-turbine project. Buckeye Wind began consultation with the Ohio Ecological Services Field Office of the United States Fish and Wildlife Service (USFWS) and the Ohio Department of Natural Resources Division of Wildlife (ODNR DOW) in 2006 to identify and minimize risks to avian and bat resources from the proposed Project. As part of due-diligence, Buckeye Wind conducted numerous pre-construction surveys for the proposed Project including, but not limited to: surveys for birds and bats, surveys of ecological communities and habitats, and surveys for threatened and endangered species. Pre-construction surveys were designed for an area that included portions of Champaign County and extended north into Logan County ("Initial Study Area"; see Figure 1-1). The pre-construction surveys were initiated in fall 2007 and continued throughout 2008. Project planning incorporated the results of pre-construction field surveys for birds and bats, as well as input from ongoing consultation with state and federal wildlife agencies. During pre-construction surveys, the presence of federally endangered Indiana bats (*Myotis sodalis*) in the northern portion of the Initial Study Area was documented. Two reproductive adult female and one non-reproductive adult male Indiana bats were captured as part of the 2008 survey. The Initial Study Area was subsequently reduced to be at least 8 km (5 mi) from the 2008 Indiana bat capture and roost locations and then adjusted to allow for replacement of potential turbine locations eliminated due to the southward shift ("Adjusted Project Area", Figure 1-1).

Mist-netting conducted in Champaign County during the summer of 2009 for an unrelated project resulted in the capture of Indiana bats within the Adjusted Project Area. Buckeye Wind subsequently prepared a Habitat Conservation Plan (HCP) in support of an Incidental Take Permit (ITP) application pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA). The HCP describes the impacts to Indiana bats that are likely to result from the Project and the measures that will be undertaken to minimize and mitigate such impacts. An Environmental Impact Statement (EIS) was also prepared by the USFWS in compliance with the National Environmental Policy Act (NEPA) to evaluate the effects of the potential issuance of an ITP for Indiana bats. The HCP and associated EIS evaluated an area that included the Adjusted Project

[1] This ABPP will focus on non-federally listed species; a Habitat Conservation Plan (HCP) has been developed for federally listed species that may be impacted by the Project (i.e., Indiana bats).

Area, plus additional areas that were defined during the NEPA scoping process ("Action Area"; Figure 1-1). While the HCP and EIS consider the Action Area as a whole, all of the turbines and associated facilities will be located within the Adjusted Project Area

The Action Area comprises an area approximately 32,395 hectares (ha; 80,051 acres [ac]) that includes portions of Union, Wayne, Urbana, Salem, Rush, and Goshen Townships in Champaign County, OH (referred to hereafter as the Action Area) (Figure 1-1). Within the Action Area, the permanent footprint (the area of permanent disturbance) for the entire Project will be no more than 52.2 ha (128.9 ac), or 0.16% of the total Action Area. Development of the Project will include installation of up to 100 wind turbine generators (turbines), each with a nameplate capacity rating of 1.6 MW to 2.5 MW, resulting in a total generating capacity of up to 250 MW. The Project will also include development of service roads, electricity collection lines, staging areas, and an operations and maintenance (O&M) facility.

The design evaluated as the primary option in this ABPP includes approximately 113.5 kilometers (km; 70.5 miles [mi]) of 34.5 kilovolt (kV) interconnect lines that are to be built above ground on rebuilt poles in existing public road right-of ways. The lines would be over-hung on poles used by the local electric utilities to distribute power to local residences and businesses. Buckeye Wind has identified a possible re-design of the Project collection system that would allow a more efficient infrastructure, resulting in greater ease of construction. The potential redesign would move a portion of those lines to an underground system located on private land under easement ("Redesign Option"). This Redesign Option is under consideration and would require various state and local permits and amendments to those permits. As such, it is offered here as an optional Project design that would be implemented at Buckeye Wind's discretion. While the exact design is not known at this time, the Redesign Option would include 95.4 km (59.3 mi) of 34.5 kV interconnect lines. A reasonable estimate of impacts for the 100-turbine Project with the Redesign Option is presented in this document. No turbine locations would be altered except as otherwise required as part of normal project micro-siting (see HCP Section 7.3.2 – Additional Turbines). Throughout this document, impacts associated with the Redesign Option are presented where applicable. Unless indicated otherwise, the impacts and discussion in this ABPP would apply to either collection system design that is contemplated.

It is anticipated that development of the 100-turbine Project will include (also see HCP Section 2.2 - Table 2-1):

- 64.4 km; (40.0 mi) of new service roads that will connect wind turbines to existing access roads;
- 113.5 km (70.5 mi) of 34.5 kV electrical interconnect lines that will connect individual turbines to the substation, of which,
    - 56.7 km (35.2 mi) will be installed underground with the majority (approximately 84%) installed parallel to Project access roads, requiring no additional clearing or soil impacts beyond those required for access road construction, and
    - 56.8 km (35.3 mi) will be installed overhead in public road right-of-ways (mostly co-located with existing electric distribution facilities);
- Under the Redesign Option, there would be 95.4 km (59.3 mi) of 34.5 kV electrical interconnect lines that will connect individual turbines to the substation, of which;
    - 86.5 km (53.7 mi) will be installed underground with about 32% installed parallel to Project access roads.
    - 9.0 km (5.6 mi) will be installed overhead;
- Temporary crane paths totaling approximately 22.7 km (14.1 mi);
- Up to 4 temporary construction staging areas, occupying a cumulative area of approximately 9.2 ha (22.9 ac);

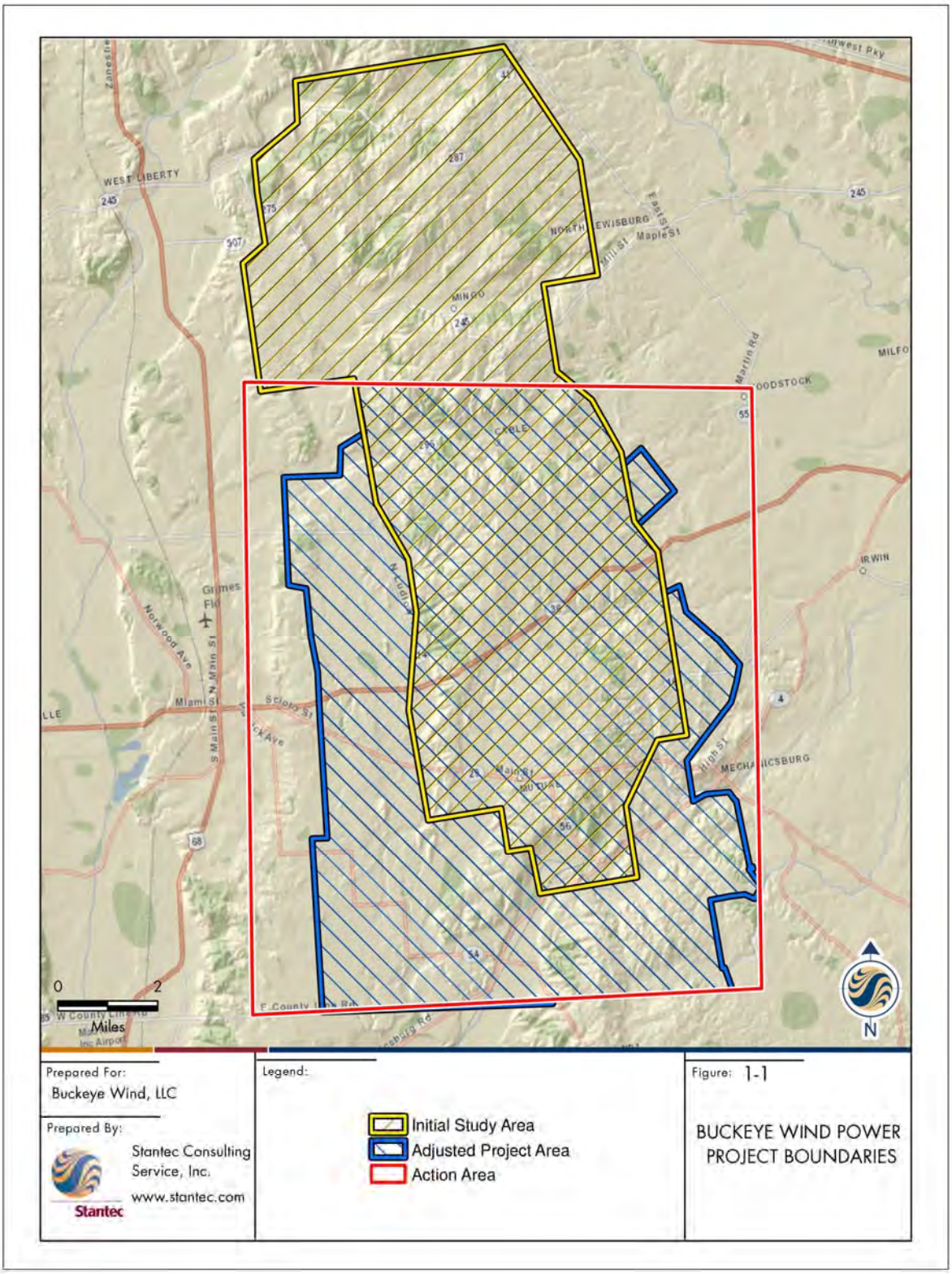
- 1 substation that will allow connection with the existing transmission line, occupying area of approximately 2.0 ha (5.0 ac);
- 1 O&M facility and associated storage yard (likely to be refurbishment of existing facility); and
- Up to 2 concrete batch plants occupying a cumulative area of 2.4 ha (6.0 ac).

Areas where trees will be temporarily or permanently removed are anticipated to comprise approximately 6.5 ha (16.1 ac) for the 100-turbine Project, or 0.2% of the 2,744 ha (6,779 ac) of forested habitat available in the Action Area (6.8 ha [16.8 ac] for the Redesign Option)[2].

Avoidance and minimization measures that Buckeye Wind will implement to reduce impacts to Indiana bats are detailed in the HCP. In addition to evaluating impacts to Indiana bats, the EIS also assesses impacts to migratory birds, non-federally listed bats, and other wildlife species from the proposed Project. Avoidance and minimization measures included in the HCP for Indiana bats are expected to also minimize impacts to non-federally listed bat species, as well as birds.

This ABPP is structured around careful Project planning, siting, and construction. Several Project design and construction measures, described in more detail in the following sections, will be implemented to avoid and minimize impacts to birds and bats to the extent practicable. Mortality monitoring for Indiana bats will be conducted for the life of the Project as a condition of the ITP. Mortality monitoring of non-federally listed bat and bird species will be conducted throughout the life of the Project coincident with monitoring for Indiana bats, providing a much more robust monitoring Program for non-federally listed bats and bird species than is typically incorporated for wind projects.

[2] Note that much of this area is along the edge of woodlots or along thin/sparse tree lines separating parcels, resulting in a conservative estimate. Avoidance and minimization measures described in the HCP Section 6.0 – Conservation Program will likely reduce the area of tree removal to less than the estimated 6.5 ha (16.1 ac), or 6.8 ha (16.8 ac) for the Redesign Option, based on construction needs, landowner preference, and quality of habitat.


WEST LIBERTY
NORTH LEWISBURG
MIN PO
Martin Rd
MILFO
OODSTOCK
IRWIN
MECHANICSBURG
Miami St
S Main St
N Main St
Norwood Ave
Maple St
Mill St
High St
0
2
Miles
N
Prepared For:
Buckeye Wind, LLC
Prepared By:
Stantec Consulting Service, Inc.
www.stantec.com
Stantec
Legend:
Initial Study Area
Adjusted Project Area
Action Area
Figure: 1-1
BUCKEYE WIND POWER PROJECT BOUNDARIES

The results of post-construction monitoring may indicate that bird and bat mortality are not within one standard deviation above the current regional average (Mortality Threshold). The Mortality Threshold is suggested by the ODNR DOW's "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio" (ODNR Protocol; ODNR DOW 2009; see ABPP Section 7.1 – Calculation of Threshold Levels). Should mortality of birds or bats exceed this threshold, Buckeye Wind will work with the ODNR DOW and USFWS to determine what additional measures could help bring mortality to within the Mortality Thresholds while maintaining the economic viability of the project. Additional minimization measures may be necessary to bring mortality to within threshold levels and Buckeye Wind may also implement off- or on-site mitigation to offset documented mortality. This adaptive management approach will allow adverse impacts to birds and bats to be addressed as new information becomes available over time.

This ABPP has adopted 4 primary components to avoid, minimize, and mitigate potential impacts to bird and bat species:

1) Pre-Construction Site Assessment and Planning – includes consultation with the USFWS and ODNR DOW regarding site selection; 2 years of pre-construction surveys to assess impacts to birds and bats; and incorporation of study results and agency consultation into Project siting decisions.

2) Project Design and Construction – includes design and construction measures that will be implemented to minimize and avoid impacts to birds and bats and their habitats.

3) Project Operation – includes use of feathering to reduce mortality of Indiana bats and other bats.

4) Monitoring – includes post-construction monitoring to document levels of bat and bird mortality and detect thresholds for adaptive management (see HCP Section 7 – Adaptive Management).

5) Adaptive Management – if post-construction monitoring indicates that estimated annual bird and bat mortality for the Project is greater than the Mortality Threshold (see Section 7.1 – Calculation of Threshold Levels), Buckeye Wind will work with the ODNR DOW and USFWS to determine what additional minimization, avoidance, or mitigation measures are practicable, while maintaining the economic viability of the project.

This ABPP is a good faith effort on behalf of Buckeye Wind to avoid impacts to birds and bats that may result from construction, operation, and decommissioning of the Project. It is recognized that this ABPP does not authorize bird and bat mortality that may result from the Project; rather its purpose is to develop a plan through which such mortality can be avoided and minimized to the extent practicable.

To ensure that development and implementation of this ABPP follows a focused process, input from representatives of the ODNR DOW, USFWS, and technical/legal advisory consultants has been actively pursued. The measures outlined in this document are based on the best available scientific information and were developed in coordination with state and federal agency representatives.

1.1 Impacts to Birds and Bats from Wind Energy

Wind energy provides a renewable source of clean energy that has been identified by state and federal policy makers as an important part of the country's energy future. The construction and operation of wind facilities can result in both direct (immediate) and indirect (separate in time) impacts to birds and bats and these species groups have been identified as being most at risk from wind power development (Arnett et al. 2008, Natural Resource Council [NRC] 2007, National Wind Coordinating Collaborative [NWCC] 2010). The rapid expansion of wind power development has prompted the need for increased scientific understanding of potential impacts and solutions to avoid and minimize those impacts.

There is a growing database of bird and bat impacts from wind facilities, particularly in the United States and Europe. Most post-construction monitoring studies have focused on bird and bat mortality from turbine collisions and there is less information about indirect impacts (i.e. displacement, decreased breeding success, etc.). In order to most accurately assess potential avian and bat impacts, and to outline the most applicable impact avoidance or minimization measures for the Buckeye Wind Project, this ABPP considers available scientific studies and published literature that are most applicable to the Buckeye Wind Project. Studies conducted at sites which are relatively proximal to the Project are given greater emphasis in this ABPP. While landscape settings at other regional projects may differ from the Buckeye Wind Project, generally the species, regional populations, and seasonal weather patterns among these sites are the most similar to the Project.

Direct impacts to birds caused by wind turbines and associated infrastructure (i.e., fatality resulting from collision) have received attention from local, state, and federal agencies, as well as the public. For raptors in particular, newer generation turbines have proven to cause fewer fatalities than older turbine designs (i.e., those at California wind facilities; NRC 2007). The more modern tubular towers, compared with older lattice tower design, and slower spinning blades may be factors associated with decreased mortality; although raptor abundance and behavior among different facilities is likely a compounding factor. Modern turbine towers and blades are increasing in height and blade length, and as turbine heights increase, nocturnally migrating songbirds (i.e., passerines) could be increasingly affected because they tend to migrate at heights above 122 m (400 ft), which overlaps with the rotor swept zone of many modern wind turbines.

Bird mortality at wind facilities is well documented by recent studies, with some facilities resulting in greater impacts to particular species or species groups than others. The majority of avian fatalities at wind turbines have primarily involved nocturnally migrating songbirds, although mortality at wind facilities has been much lower than that caused by other tall man-made structures and other sources of anthropogenic avian mortality (Erickson et al. 2005). In addition to direct impacts, bird species may be indirectly affected by wind facilities as a result of displacement caused by habitat alteration, habitat loss, or human disturbance (Dewitt and Langston 2006).

While Buckeye Wind is committed to reduce potential impacts to birds and bats, it is also important to recognize that wind energy in general is a minor contributor to bird mortality compared to other anthropogenic activities (see Table 1-1). There are a number of sources that make estimates for the total number of bird deaths caused by wind turbines. The National Academy of Science (NAS) estimated that wind energy is responsible for less than 0.003% (3 of every 100,000) bird deaths caused by human (and feline) activities (NAS 2007). Similarly, Erickson et al. (2005) estimated that about 20,000 to 37,000 birds are killed by wind turbines every year out of an estimated "500 million to possibly over 1 billion birds" killed by anthropogenic causes.

Table 1-1. Estimated annual avian mortality from anthropogenic causes in the United States.

Mortality Source	Estimated Annual Mortality*
Collisions with buildings	97-976 million
Collisions with power lines	130-174 million
Depredation by domestic cats	100 million
Automobiles	80 million
Pesticides	67 million
Communication towers	4-50 million
Oil pits	1.5-2 million
Wind turbines	20,000-37,000

Source: various cited in Erickson et al. 2005.

Bat collisions and mortality at wind facilities are well documented in the United States (Johnson et al. 2003, Kunz et al. 2007*a*, Arnett et al. 2008, and Horn et al. 2008), although there are fewer estimates of overall turbine collision mortality, and no estimates of mortality from other anthropogenic sources. Kunz et al. (2007) estimated that approximately 33,000 to 62,000 bats will be killed annually by wind turbines in the year 2020 in the Mid-Atlantic Highlands, based on several assumptions and projections of wind facility build-out.

Among the 11 species documented in post-construction mortality monitoring studies, 3 species of long distance migratory bats have consistently been documented in the largest proportions at wind facilities across the United States and Canada: the foliage-roosting hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*), and the cavity-roosting silver-haired bat (*Lasionycteris noctivagans*) (Kunz et al. 2007*b*, Arnett et al. 2008). Collectively, these species comprised approximately 75% of documented fatalities and hoary bats made up about half of all fatalities in 2008 (Arnett et al. 2008). The greatest number of fatalities among these and other bat species at wind facilities have occurred in late summer and early fall, coinciding with the migratory period (Kunz et al. 2007*b*, Arnett et al. 2008). Some studies have indicated that bats may be attracted to both moving and non-moving wind turbine blades and that many bat kills occur during periods of low wind (Kunz et al. 2007*b*, Arnett et al. 2008, Horne et al. 2008, Arnett et al. 2010).

1.2 Regulatory Framework

1.2.1 *Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (MBTA) of 1918 decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected (16 U.S.C. 703). A migratory bird is any individual species or family of birds that crosses international borders at some point during their annual life cycle to live or reproduce. The MBTA implements four treaties that prohibit take, possession, transportation, and importation of all migratory, native birds (plus their eggs and active nests) occurring in the wild in the United States except for House Sparrow, European Starling, Rock Pigeon, any recently listed unprotected species in the Federal Register and non-migratory upland game birds, except when specifically authorized by the USFWS. In total, more than 1,000 bird species are protected by the Act, 58 of which can be legally hunted with a permit as game birds. The MBTA addresses take of individual birds, not population level impacts. Failure to comply with the MBTA can result in criminal penalties.

Although the MBTA does not include a provision authorizing incidental take of migratory birds, the USFWS recognizes that some level of mortality of migratory birds at wind projects can occur

even if all reasonable measures to avoid mortality are implemented (USFWS 2010a). The USFWS has and continues to provide wind power project developers guidance in making a good-faith effort to comply with the MBTA. The USFWS has indicated that the Department of Justice has exercised discretion in enforcing provisions of the MBTA regarding companies who have made good faith efforts to avoid the take of migratory birds. This ABPP has been developed, in part, as a good faith effort on behalf of Buckeye Wind to comply with the MBTA.

1.2.2 *Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act (BGEPA) affords specific legal protection to bald eagles (*Haliaeetus leucocephalus)* and golden eagles (*Aquila chrysaetos*). Under this Act, it is a violation to "…take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or in any manner, any bald eagle commonly known as the American eagle, or golden eagle, alive or dead, or any part, nest, or egg, thereof…." This Act defines take as pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, and disturbing. "Disturb" is defined in regulation 50 CFR 22.3 as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In fall 2009, USFWS implemented two rules (50 CFR 22.26 and 22.27) authorizing limited legal take of bald and golden eagles "when the take is associated with, but not the purpose of an otherwise lawful activity, and cannot practicably be avoided" (USFWS 2010). Failure to comply with the BGEPA can result in criminal penalties.

On February 8, 2011, the U.S. Fish and Wildlife Service released Draft Eagle Conservation Plan Guidance that was published in the Federal Register and was available for public comment until May 19, 2011. The Draft Eagle Conservation Plan Guidance (ECP Guidance) was developed to provide interpretive guidance to wind developers, USFWS biologists who evaluate potential impacts on eagles from proposed wind energy projects, and others in applying the regulatory permit standards as specified by the Bald and Golden Eagle Protection Act and other federal laws.

Although take permits may be issued under these new rules, Buckeye Wind is not seeking a "non-purposeful eagle take" permit under the BGEPA at this time since the Project is not expected to result in activities that would incidentally take (harm or harass) eagles (see Section 4.1.3.1 - Eagles).

1.2.3 *State Regulations*

The ODNR DOW has legal authority over OH's fish and wildlife, which includes about 56 species of mammals, 200 species of breeding and migratory birds, 84 species and subspecies of amphibians and reptiles, 170 species of fish, 100 species of mollusks, and 20 species of crustaceans. Additionally, there are thousands of species of insects and other invertebrates which fall under the ODNR DOW's jurisdiction. Ohio Revised Code (RC) 1531.25 grants the chief of the ODNR DOW, with the approval of the wildlife council, the authority to adopt rules, modify and repeal rules restricting the taking or possession of native wildlife that is threatened with state-wide extinction. These rules may only provide for the taking of species for zoological, educational and scientific purpose, and for propagation in captivity to preserve the species. In OH, animals and plants listed as threatened or endangered receive regulatory protection under RC § 1518.01–99; 1531.25, 1531.99. At this time, the ODNR DOW does not have the explicit

authority to authorize take for any listed-species, including Indiana bats, for commercial or business purposes such as the construction and operation of the Project.

The first list of OH's endangered wildlife was adopted in 1974 and included 71 species. An extensive examination of the list is conducted every 5 years using input from ODNR DOW staff and other wildlife experts across OH. In 2001, as part of their comprehensive management plan, the ODNR DOW initiated a reevaluation of the endangered species list. During this process, the need for an additional state-list category was recognized and was designated as "Special Interest." The name of the previous special interest category has been changed to "Species of Concern," but retains its original definition. The ODNR DOW now uses 6 categories to define the status of wildlife: endangered, threatened, species of concern, special interest, extirpated, and extinct. These categories are defined as follows:

- Endangered – A native species or subspecies threatened with extirpation from the state. The danger may result from 1 or more causes, such as habitat loss, pollution, predation, interspecific competition, or disease. There are currently 125 endangered species in the state.

- Threatened – A species or subspecies whose survival in OH is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered. There are currently 56 threatened species in the state.

- Species of Concern – A species or subspecies which might become threatened in OH under continued or increased stress. Also, a species or subspecies for which there is some concern, but for which information is insufficient to permit an adequate status evaluation. This category may contain species designated as a furbearer or game species, but whose statewide population is dependent on the quality and/or quantity of habitat and is not adversely impacted by regulated harvest. There are currently 101 species of concern in the state.

- Special Interest – A species that occurs periodically and is capable of breeding in OH. It is at the edge of a larger, contiguous range with viable population(s) within the core of its range. These species have no federal endangered or threatened status, are at low breeding densities in the state, and have not been recently released to enhance OH's wildlife diversity. With the exception of efforts to conserve occupied areas, minimal management efforts will be directed for these species because it is unlikely to result in significant increases in their populations within the state. There are currently 42 species of special interest in the state.

- Extirpated – A species or subspecies that occurred in OH at the time of European settlement and that has since disappeared from the state. Thirty-two species have been extirpated in the state.

- Extinct – A species or subspecies that occurred in OH at the time of European settlement and that has since disappeared from its entire range. Nine species have become extinct in the state.

These categories and the species contained within them are revised by the ODNR DOW as their knowledge of the status of OH's wildlife evolves.

1.2.4 *Relevant Federal and State Guidelines and Policies*

1.2.4.1 *USFWS Guidelines for Wind Energy Projects*

The USFWS first addressed wind power and wildlife, specifically migratory birds, by adopting "Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines" in 2003 (USFWS 2003). These Interim guidelines were intended to assist USFWS staff in providing technical assistance to the wind industry to avoid or minimize impacts to wildlife and their habitats through the following measures:

- Proper evaluation of potential wind energy development sites;
- Proper location and design of turbines and associated structures within sites selected for development; and
- Pre- and post-construction research and monitoring to identify and/or assess impacts to wildlife.

The Wind Turbine Federal Advisory Committee (FAC) was established in 2007 by the Secretary of the Interior to provide advice and recommendations on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities. The FAC drafted an initial set of Recommendations in 2009. In April 2010, the FAC provided to the Secretary a revised set of Recommendations (USFWS FAC 2010). The tiered approach set forth in the FAC's Recommendations is a biologically sound risk assessment approach that includes:

- Formulating appropriate questions regarding potential wildlife impacts;
- Collecting data in ever increasing detail to answer those questions;
- Making risk assumptions based on sufficient data prior to construction of wind facilities;
- Using best-management practices during construction, operation, and decommissioning;
- Testing assumptions after construction and during wind facility operations; and
- Adjusting operations and/or mitigation as needed (USFWS FAC 2010).

The USFWS then convened an internal working group to review the FAC's Recommendations. The working group used the recommendations as a basis to develop Draft Voluntary Land-Based Wind Energy Guidelines, which were released for public review and comment in February, 2011. These Draft Guidelines were available for public comment until May 19, 2011. Two subsequent Revised Draft Voluntary Land based Wind Energy Guidelines were released in July and September, 2011. Final Guidelines were published in March 2012.

The USFWS's July 2010 White Paper on Considerations for Avian and Bat Protection Plans suggests that wind power developers devise and implement an Avian Protection Plan (APP) or ABPP for their projects to demonstrate consideration of and attempts to comply with the MBTA. The intent is that the document should result in an understanding between the project proponent and the USFWS as a "good faith" effort to conserve birds and bats while still allowing for the environmentally friendly development of renewable energy projects.

It should be noted that the 2010 FAC Recommendations were developed after Buckeye Wind was well into the Project siting and permitting; therefore, while siting and environmental review processes were not based on the 2010 Recommendations, this ABPP outlines how processes utilized by Buckeye Wind were nonetheless consistent with the FAC Recommendations. The siting and review processes, pre-construction surveys, and post-construction monitoring protocols for the Buckeye Wind Project were developed in coordination with the USFWS and ODNR DOW.

1.2.4.2 *ODNR DOW Cooperative Agreement*

The ODNR DOW has established the ODNR Protocol for on-shore wind facilities. The standardized procedures will allow the ODNR DOW to make comparisons in order to minimize wind and wildlife interactions in OH. The standardized procedures are made part of an ODNR DOW Terrestrial Wind Energy Voluntary Cooperative Agreement (WEVCA; ODNR DOW 2009) that is intended to establish a framework in which the ODNR DOW and the Cooperator would work collaboratively to ensure that wind-energy projects are developed in an environmentally conscientious manner.

It should be noted that the WEVCA and associated ODNR Protocol were developed after the project had completed a significant portion of pre-construction surveys. It should also be noted that Buckeye Wind – consistent with its corporate policy – nonetheless worked closely with the ODNR DOW to design appropriate pre-construction surveys informed by industry standards and responsible development. Buckeye will continue to work with the ODNR DOW to appropriately address any wildlife concerns.

1.3 Corporate Policy and Commitment to Environmental Protection

EverPower and its subsidiaries are dedicated to making environmental compliance and conservation an integral part of the company's operations. EverPower is a fully integrated energy company that develops, constructs, owns, and operates wind power projects across North America. EverPower is dedicated to developing clean energy resources with environmental benefits and delivering the highest values for their partners and the communities where they work, while exhibiting a strong commitment to promoting environmental stewardship and corporate responsibility. Sustainability is an integral part of EverPower's mission statement and minimizing the adverse environmental effects from project development is a key goal for the company. EverPower recognizes that development of its wind projects may have direct and indirect impacts on wildlife and their habitats. Therefore, it is EverPower's policy that project design, construction, and operation programs shall take into consideration measures to avoid and minimize impacts. This ABPP supports practices and processes intended to avoid and minimize impacts to birds and bats from the Project.

EverPower has a proven track record of operating its wind facilities in an environmentally sustainable manner, working cooperatively with state and federal agencies, using best management practices, and following state and federal guidelines to comply with environmental regulations. EverPower is committed to building environmentally responsible renewable energy projects and will continue to work closely with regulatory agencies to develop appropriate measures to minimize and avoid impacts to wildlife.

2.0 SITE SELECTION PROCESS

EverPower has a methodology for wind power project site selection that follows a specific process for screening, evaluating, and selecting potential sites. A site selection process was initiated in 2006 in Champaign and Logan Counties. Buckeye Wind relied on input and guidance from the USFWS and ODNR DOW, among other inputs, to inform their site selection process for the Buckeye Project. Though the initial FAC Recommendations (USFWS FAC 2009) were not available when the siting and environmental review process for the Project was initiated, the site evaluation and screening methodology for the Project is very similar to the FAC Recommendations for Tier One site selection (USFWS FAC 2010). The following sections describe how the process Buckeye Wind followed in selecting the Buckeye Project relates to the 5 tier framework set out in the FAC Recommendations.

2.1 Tier One – Preliminary Evaluation or Screening of Sites

The first tier in the FAC Recommendations includes a broad-level review of publicly-available information to evaluate potential development sites within a specific landscape area. In 2006, Buckeye Wind began evaluating land in west central OH for potential for wind energy development. Landscape-level screening identified several areas as having potentially suitable wind resources and land lease potential. The evaluation included screening for known and potential occurrence of state and federally listed species, presence of designated Critical Habitat, the location of Important Bird Areas, wildlife management areas, Conservation Reserve Areas, and general ecological context of the potential locations, including the degree of fragmentation, land ownership and land use.

This initial screening eliminated areas that were either adjacent to or part of large blocks of contiguous forested habitat and protected areas. Instead, areas in which prior agricultural practices had created a highly fragmented landscape where wind development would presumably pose less risk to potential species of concern were prioritized for further consideration. This Tier One evaluation identified several land parcels within Champaign and Logan Counties that potentially had adequate wind resources, transmission available within a reasonable distance, and where existing information indicated that risks to bird and bat breeding or migratory areas, important habitat areas, and federally and state listed species would be low.

2.2 Tier Two – Site Characterization

In Tier Two, available site-specific information is gathered to further characterize sites identified as potentially suitable in the Tier One evaluation. Site-specific information was obtained from public sources to identify the likelihood of occurrence of wildlife species of concern. Based on areas identified in the Tier One evaluation, the evaluation was further focused to identify areas that could present particular risk to particular species or species groups, such as known or suspected bat hibernacula, area of known raptor or eagle migratory corridors or nesting sites, or records of special status bird or bat species. Ecological resources in the vicinity of the Initial Study Area were also identified through analysis of existing data sources. Data were obtained from the ODNR DOW Ohio Biodiversity Database (OBD; formally the Natural Heritage Database); Ohio Breeding Bird Atlas II; the Ohio Aquatic Gap Analysis Program; the Ohio Frog and Toad Calling Survey; the Ohio Salamander Monitoring Program; and standard biological literature for the region. Additional information was obtained from personal communications with biologists familiar with the natural resources in the area from the Ohio Ecological Services Field Office of

the USFWS and the ODNR DOW. These various sources of information were synthesized in order to establish a complete picture of potential species at the Initial Study Area.

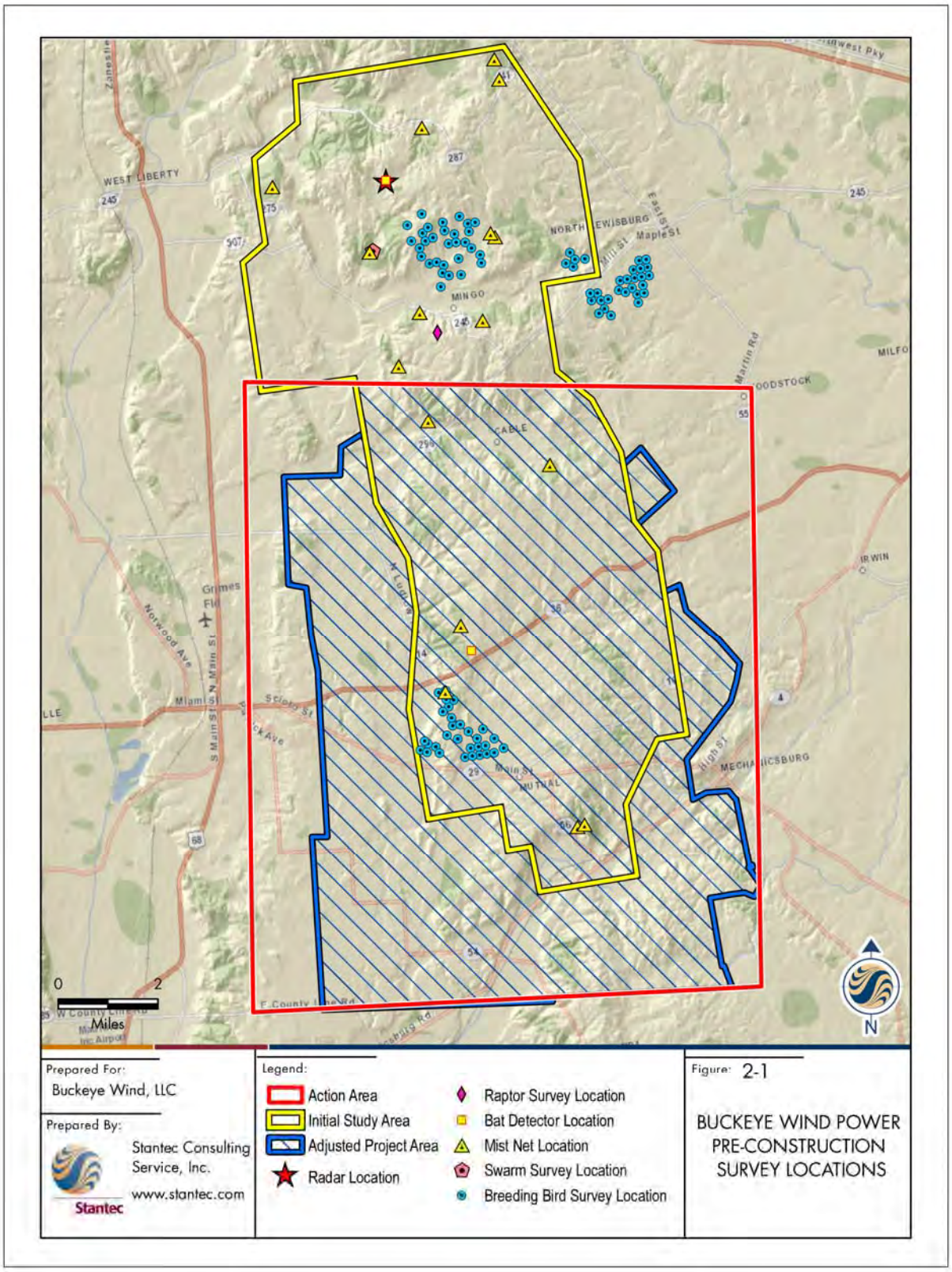
As a result of these evaluations, the Initial Study Area was found to have no known critical areas where wildlife congregate, was highly fragmented from previous and ongoing agricultural activities, and did not appear to contain any federal or state listed species. The area was also found to be sufficiently distant from any known Indiana bat hibernacula (the closest known hibernacula is the Lewisburg Limestone Mine in Preble County, OH, approximately 100 km [62.5 mi] southwest of the Initial Study Area) and did not have any known Indiana bat summer records (Indiana bat summer records in western OH were only known from Greene, Montgomery, and Miami Counties in OH prior to 2008). Thus, the Initial Study Area was considered suitable for further evaluation and in-depth studies to fully characterize the natural resources potentially at risk from development of the Project.

2.3 Tier Three – Field Studies to Document Site Wildlife Conditions and Predict Project Impacts

In Tier Three, the FAC Recommendations call for quantitative and scientifically rigorous studies to be conducted to assess the potential risk of a wind project to species and/or habitats of concern. A series of studies were designed based on work plans developed in consultation with the USFWS and ODNR DOW to evaluate bird and bat resources in the Initial Study Area (see Figure 2-1). Study work plans were discussed and shared with the USFWS and ODNR DOW beginning in fall 2007. Several meetings were held in 2007 and 2008 to receive and discuss agency comments, several field visits were conducted with agency representatives, and members of both the ODNR DOW and the USFWS participated in several of the field studies. Agency comments and feedback were subsequently incorporated into final study protocols.

The following baseline Tier Three studies were conducted, which are included as appendices to the EIS:

- Radar studies to document nocturnally migrating birds and bats in fall 2007;
- Bat acoustic surveys using 6 detectors at 2 meteorological (MET) towers in fall 2007, and spring through fall 2008;
- Diurnal raptor migration surveys in fall 2007, and spring and fall 2008;
- Breeding bird surveys in spring and summer 2008;
- Bat mist netting surveys in summer 2008;
- Sandhill crane (*Grus canadensis*) migration surveys in fall 2008;
- Bat swarming surveys at 2 caves openings in fall 2008;
- Surveys to detect potential hibernacula at 14 known/suspected karst areas in 2008; and
- General habitat and surface water mapping in 2009.


WEST LIBERTY
MINGO
NORTH LEWISBURG
CABLE
IRWIN
MECHANICSBURG
Grimes Fld
Miami St
Scioto St
Main St
High St
Martin Rd
Maple St
0
2
Miles
N
Prepared For:
Buckeye Wind, LLC
Prepared By:
Stantec Consulting Service, Inc.
www.stantec.com
Stantec
Legend:
Action Area
Initial Study Area
Adjusted Project Area
Radar Location
Raptor Survey Location
Bat Detector Location
Mist Net Location
Swarm Survey Location
Breeding Bird Survey Location
Figure: 2-1
BUCKEYE WIND POWER
PRE-CONSTRUCTION
SURVEY LOCATIONS

These baseline studies were completed to characterize the distribution, relative abundance, behavior, and site use of species of concern identified in Tier One and Tier Two evaluations. As part of the Tier Three evaluations these baseline studies were used to identify to what extent, if any, the development of the Project would expose these species to risk and what additional studies or modeling were needed to assess those risks. Based on the identification of a new summer colony record for Indiana bats in Logan County, the Initial Project Area was adjusted southward to avoid this newly documented colony and adjusted to allow for replacement of potential turbine locations eliminated due to the southward shift (Adjusted Project Area). As a result of this southward shift, the Project will also avoid 2 hibernacula (not Indiana bat hibernacula) documented during pre-construction studies that were within the Initial Project Area. While the original Project designs did not propose to directly impact the hibernacula, the southward shift resulted in a 6.3 km (3.9 mi) buffer from the 2 hibernacula, where collectively 884 non-federally listed bats were captured during 5 swarming surveys in fall 2008 (see Section 3.2.3.2 – Swarming Survey at Hibernacula). The other studies collectively indicated a relatively low risk to breeding and migrating birds and non-federally listed bats (results of these studies are summarized in Section 3.2 – Tier Three Planning Studies).

Upon completion of the 2008 field season, Buckeye Wind, in consultation with the USFWS and ODNR DOW, made a Tier Three decision to proceed with the Project in its adjusted location based on wind resource, transmission availability, constructability, and because site specific baseline studies indicated that the Project site could be developed resulting in mortality rates consistent with other wind facilities within the Midwest region. Buckeye Wind then proceeded to develop an application for a Certificate of Environmental Compatibility and Public Need (CECPN) for approval through the Ohio Power Siting Board (OPSB).

Despite thorough pre-planning, due diligence, and ongoing consultation with state and federal agencies, Indiana bats were unexpectedly discovered in the Action Area in summer 2009 during mist netting surveys conducted as part of an unrelated project. As a result, Buckeye Wind, in coordination with the USFWS, decided to develop a HCP in compliance with Section 10 of the ESA and apply for an ITP, to be able to continue with development and operation of the Project. This decision was made because Buckeye Wind believes that specific avoidance and minimization methodologies are effective in reducing direct and indirect impacts to Indiana bats. The HCP and EIS will be available for public review and comment and this ABPP has been prepared consistent with these documents.

The CECPN for the known 52 turbine location and associated facilities was conditionally approved by the OPSB on 22 March 2010. One of the conditions included in the CECPN is that the Project secure an ITP for the Indiana bat before construction.

2.4 Tier Four – Post-Construction Fatality Studies

Post-construction mortality monitoring is recommended in the FAC Recommendations for multiple years for some wind projects, based on the outcome of the Tier Three studies. Tier Four studies for the Project will include post-construction mortality monitoring and potentially other post-construction studies, depending upon the results of initial monitoring. The focus of monitoring will be to document the number and species composition of bird and bat carcasses found beneath turbines. The post-construction mortality monitoring methods will specify the location and size of search areas, duration and frequency of searches, search protocol, staff training, and examples of field survey bias and error assessments that could be used. Mortality monitoring protocols will be developed in consultation with the ODNR DOW and USFWS.

2.5 Tier Five – Additional Post-Construction Studies

The FAC Recommendations do not provide specific study protocol recommendations for Tier Five studies because such studies need to be specific to individual sites and issues. With respect to non-federally listed bats and birds, the need for additional minimization, mitigation, or studies will be evaluated based on the results of the first 1 to 2 years of post-construction monitoring data. However, as previously stated, non-federally listed bat and bird mortality will continue to be monitored over the life of the Project, coincident with Indiana bat mortality monitoring that will be conducted as a condition of the ITP. If at any point during other monitoring years, mortality of non-federally listed bats or birds exceeds the Mortality Thresholds, Buckeye Wind will work with the ODNR DOW to determine if any additional mitigation measures are appropriate (see Section 7.0 – Adaptive Management).

3.0 ENVIRONMENTAL SETTING

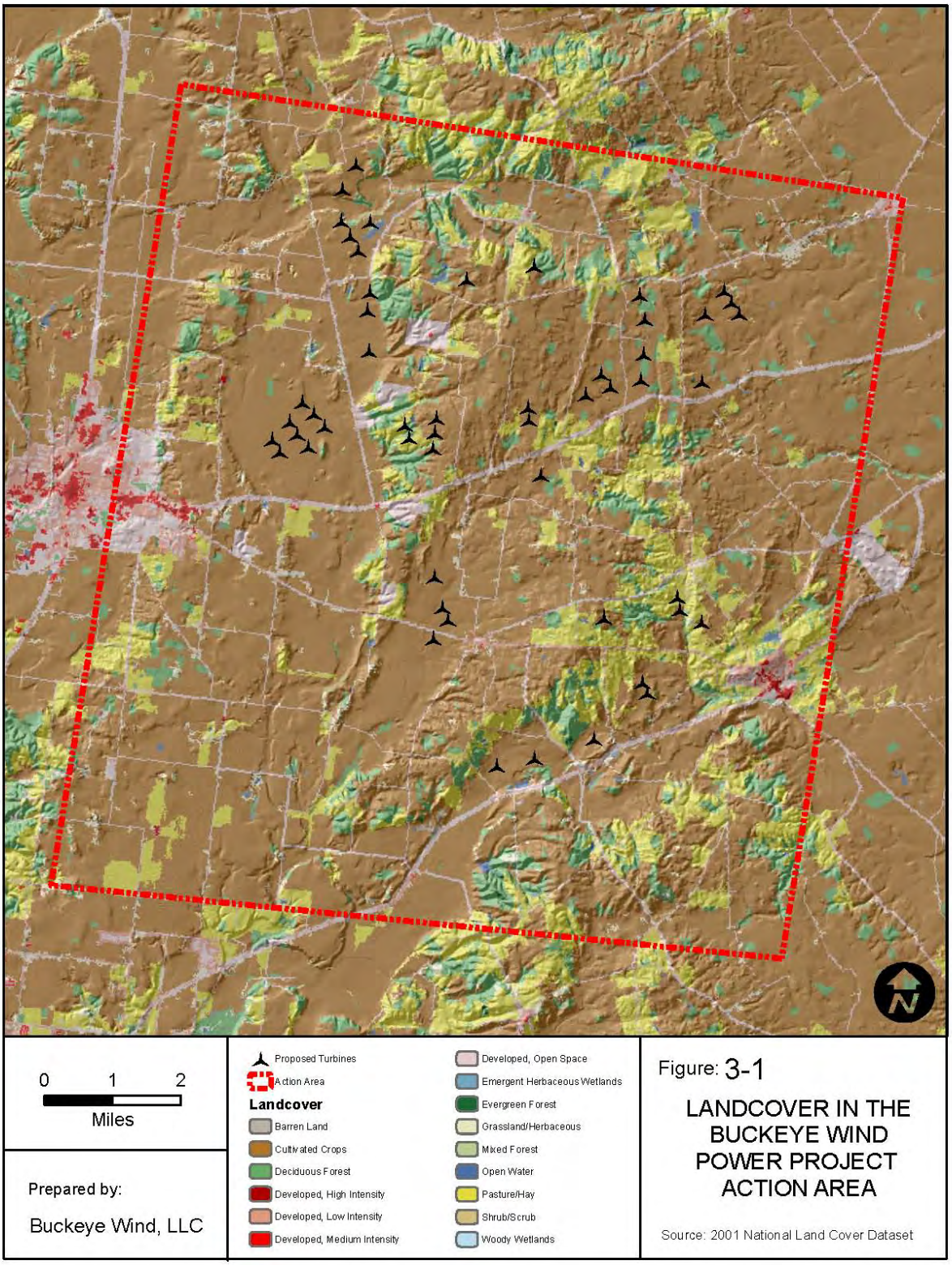
3.1 Project Setting

The proposed Project is located in the glaciated Till Plains Section of the Central Lowland Physiographic Province. The topography of the region is characterized by gently rolling hills and moderate slopes with elevations ranging from 396 m to 548 m (1,300 ft to 1,800 ft) above mean sea level. While all Project facilities will be located within the Adjusted Project Area, the Action Area was developed as part of the HCP and EIS process. The Action Area is characterized by a flat and rolling landscape (Figure 3-1). Agriculture (mainly corn and soybean crops) is the predominant land use. The Action Area also contains hayfields and pastureland, some of which are enrolled in the Conservation Reserve Program (CRP; the CRP program and its implications for wildlife habitat will be discussed further in Section 4.1.2 – Breeding Birds). The Action Area also contains scattered stands of mixed hardwood forest that range in size from (3.6 ha to 107 ha (0.2 ac to 263 ac), primarily bordered by agricultural fields, and dominated by oaks (*Quercus* spp.), maples (*Acer* spp.), hickories (*Carya* spp.), and ash (*Fraxinus* spp.). Table 3-1 contains the relative land cover composition within the Action Area.

Table 3-1. National Land Cover Database landcover types and size (ha and ac) identified in the Buckeye Project Action Area, Champaign County, OH.

Landcover type	Hectares	Acres	Percent of action area
Cultivated crops	22,408	55,372	69%
Hay/pasture	4,163	10,287	13%
Deciduous forest	2,744	6,779	9%
Developed, open space	1,962	4,849	6%
Grassland/herbaceous	445	1,099	1%
Developed, low intensity	422	1,042	1%
Open water	84	208	0%
Developed, medium intensity	55	135	0%
Emergent herbaceous wetlands	40	100	0%
Evergreen forest	31	76	0%
Developed, high intensity	26	65	0%
Barren land (rock/sand/clay)	13	33	<0.1%
Mixed forest	2	6	<0.1%
Totals	32,395	80,051	100%

Source: Homer et al. 2004



In terms of the amount of wooded area that would be cleared for the Project, 6.5 ha (16.1 ac; 6.8 ha [16.8 ac] for the Redesign Option) of tree clearing is planned for the 100-turbine Project.

This represents approximately 0.2% of the 2,744 ha (6,779.4 ac) of wooded habitat available in the Action Area[3]. These estimates are based on the known 52 turbine layout plus a reasonable estimate for the additional 48 turbines (see Table 3-2 and Table 3-3). Additionally, tree clearing is expected to be spread throughout the Action Area and is not expected to be extensive in any single area.

Table 3-2. Worst-case scenario impacts[a] to NLCD 2001 land cover types[b] for the 100-turbine Buckeye Wind Project, Champaign County, OH.

	Area of disturbance						
	Total			Temporary		Permanent	
Land cover type	Hectares	Acres	Percent of total	Hectares	Acres	Hectares	Acres
Cultivated crops	199.1	492.0	90.1%	157.1	388.2	42.0	103.8
Hay/pasture and herbaceous grassland	0.6	1.5	0.3%	0.2	0.5	0.4	1.0
CRP (included in hay/pasture, grassland above)	11.3	27.9	5.1%	9.0	22.2	2.3	5.7
Developed, open space	3.2	7.9	1.4%	2.3	5.7	0.9	2.2
Deciduous forest[c]	6.4	15.8	2.9%	0.0	0.0	6.4	15.8
Emergent herbaceous wetlands	0.0	0.0	0.0%	0.0	0.0	0.0	0.0
Developed, low intensity	0.2	0.4	0.1%	0.1	0.2	0.1	0.2
Evergreen forest	0.1	0.3	0.1%	0.0	0.1	0.1	0.2
Open water	0	0.0	0%	0	0.0	0	0.0
Barren land	0	0.0	0%	0	0.0	0	0.0
Developed, medium intensity	0	0.0	0%	0	0.0	0	0.0
Mixed forest	0	0.0	0%	0	0.0	0	0.0
Developed, high intensity	0	0.0	0%	0	0.0	0	0.0
Total	220.9	545.8	100%	168.8	416.9	52.2	128.9

Source: Homer et al. 2004

[a] Impacts are estimated from actual impacts calculations of the known 52 turbines and associated facilities and a reasonable estimate of impacts from the additional 48 turbines based on characteristics of the Action Area and the avoidance and minimization measures described in Sections 6.1 – Avoidance Measures and 6.2 – Minimization Measures.

[b] Numbers based on the NLCD and adjusted for impacts to wooded areas as determined with the 2010 NAIP and specific avoidance measures such as avoidance of wetlands.

[c] Include in the mitigation acres calculation as an offset for cleared wooded areas

[3] Note that much of this area is along the edge of woodlots or along thin/sparse tree lines separating parcels, resulting in a conservative estimate. Avoidance and minimization measures described in Section 5.2.1.1 will reduce the area of tree removal based on construction needs, landowner preference, and quality of habitat.

Table 3-3. The Redesign Option worst-case scenario impacts[a] to NLCD 2001 land cover types[b] for the 100-turbine Buckeye Wind Project, Champaign County, OH based on the collection system redesign.

	Area of disturbance						
	Total			Temporary		Permanent	
Land cover type	Hectares	Acres	Percent of total	Hectares	Acres	Hectares	Acres
Cultivated crops	196.8	486.4	89.5%	154.8	382.6	42.0	103.8
Hay/pasture and herbaceous grassland	0.7	1.8	0.3%	0.3	0.8	0.4	1.0
CRP (included in hay/pasture, grassland above)	12.4	30.7	5.6%	10.1	25.0	2.3	5.7
Developed, open space	3.0	7.5	1.4%	2.1	5.2	0.9	2.3
Deciduous forest[c]	6.7	16.5	3.0%	0.0	0.0	6.7	16.5
Emergent herbaceous wetlands	0.0	0.0	0.0%	0.0	0.0	0.0	0.0
Developed, low intensity	0.2	0.4	0.1%	0.1	0.2	0.1	0.2
Evergreen forest	0.1	0.3	0.1%	0.0	0.1	0.1	0.2
Open water	0	0.0	0%	0	0.0	0	0.0
Barren land	0	0.0	0%	0	0.0	0	0.0
Developed, medium intensity	0	0.0	0%	0	0.0	0	0.0
Mixed forest	0	0.0	0%	0	0.0	0	0.0
Developed, high intensity	0	0.0	0%	0	0.0	0	0.0
Total	219.9	543.6	100%	167.4	413.9	52.5	129.8

Source: Homer et al. 2004

[a] Impacts are estimated from actual impacts calculations of the known 52 turbines and associated facilities and a reasonable estimate of impacts from the additional 48 turbines based on characteristics of the Action Area and the avoidance and minimization measures described in Sections 6.1 – Avoidance Measures and 6.2 – Minimization Measures.

[b] Numbers based on the NLCD and adjusted for impacts to wooded areas as determined with the NAIP and specific avoidance measures such as avoidance of wetlands.

[c] Include in the mitigation acres calculation as an offset for cleared wooded areas

3.2 Tier Three Planning Studies

In order to establish baseline information about wildlife use of the Project area and to evaluate the potential impacts from construction and operation of the Project, a number of wildlife studies were conducted which will be summarized in the following sections. The studies were designed to assess species use within the Initial Study Area. A summary of the results of pre-construction bird and bat studies can be found in Appendix A Tables 1 to 10 and detailed descriptions of survey methods, results, and discussion can be found in the respective seasonal reports (Stantec 2008*a*, Stantec 2008*b*, Stantec 2009*a*, Hull 2009). Additional information

regarding the biology of each species group has also been summarized in the EIS and impacts to Indiana bats have been analyzed and described in depth in the HCP.

3.2.1 *Habitat and Wetlands Mapping*

An assessment of ecological communities within a 0.4 km (0.25 mi) distance from known 52 turbines and related infrastructure was conducted in 2008 (Hull and Associates, Inc. [Hull] 2009[4]). This evaluation involved mapping and describing plant communities and compiling lists of animals likely to utilize each habitat. Hull (2009) identified and mapped 6 major plant community types: old field, scrub-shrub, young woods, upland ridge, upland woods, and riparian woods. In addition, the locations of the turbine and related infrastructure were screened for major species of biota, including those of commercial or recreational value, and those designated as state or federally threatened or endangered.

A surface water evaluation was performed at all proposed construction areas. Surveys for wetlands and other surface waters were conducted in the immediate vicinity of Project components, including the 52 known turbine locations, access roads, buried and above-ground electrical interconnect lines, and the substation (Hull 2009). Similar evaluations of surface water features will be completed when the 48 additional turbine locations are determined.

Wetlands and other surface waters were identified in accordance with the USACE Wetlands Delineation Manual (Environmental Laboratory 1987), subsequent regulatory guidance issued by the USACE (USACE 2010), and the OEPA guidance on evaluation of streams and wetlands (OEPA 2009).

No wetlands will be impacted by the 100-turbine Project. Limited impacts to streams are anticipated and appropriate state and federal permits will be secured by Buckeye Wind prior to any construction activities that will impact streams. A detailed description of the stream crossings and impacts are included in the EIS.

3.2.2 *Bird Studies*

Buckeye Wind worked proactively with the USFWS and ODNR DOW to conduct thorough pre-construction surveys to document spring and fall bird migration patterns through the Initial Study Area and Adjusted Project Area, and to document distribution and species composition of breeding birds within the Initial Study Area and Adjusted Project Area (see Figure 2-1). Buckeye Wind also conducted sandhill crane surveys, and habitat assessments for threatened and endangered species. Buckeye Wind first contacted USFWS and ODNR DOW in 2006 and 2007 when Tier I and Tier II site characterization was underway in order to gather information from these agencies to supplement information from online databases. Surveys analogous to Tier III surveys were developed in coordination with ODNR DOW and USFWS and conducted primarily during 2008 (prior to the ODNR Protocol). Experts from USFWS and ODNR DOW were actively involved in the survey design and execution. Appendix A Tables 3 through 6 include the breeding bird, raptor, and waterfowl and waterbird species detected within or in the vicinity of the Buckeye Wind Project during pre-construction field surveys. All pre-construction avian survey reports are included as Appendices to the EIS.

3.2.2.1 *Breeding Bird Surveys*

Breeding bird surveys were conducted at 90 point count locations within and in the vicinity of the Initial Study Area and Adjusted Project Area (up to a distance of 5.2 km [3.2 mi]; Stantec

[4] The Hull 2009 study covers the known 52 turbine locations and associated infrastructure. Similar studies will be conducted for the remaining 48 and will be made part of the associated OPSB application.

2009*a*) and were sampled 4 times from 3 May 2008 to 29 July 2008. A total of 97 bird species were documented during surveys conducted in forested, agricultural, and hay/pasture habitat (Appendix A Table 3). The most commonly observed species were red-winged blackbird (Agelaius phoeniceus), horned lark (Eremophilia alpestris), American robin (Turdus migratorius), song sparrow (Melospiza melodia), American crow (Corvus brachyrhynchos), and European starling (Sturnus vulgaris).

No federally endangered or threatened species were detected during 2008 breeding bird surveys. One northern harrier (*Circus cyaneus*), listed as state endangered, and one least flycatcher (*Empidonax minimus*), listed as state threatened, were detected. Two state species of concern were detected: bobolink (*Dolichonyx oryzivorus*) (16) and northern bobwhite (*Colinus virginianus*) (2). Two state species of special interest were detected: magnolia warbler (*Setophaga magnolia*) (4) and blackburnian warbler (*Setophaga fusca*) (4). There were 11 species listed as federal species of conservation concern by the USFWS (2008): Acadian flycatcher (*Empidonax virescens*) (1), blue-winged warbler (*Vermivora cyanoptera*) (3), field sparrow (*Spizella pusilla*) (162), willow flycatcher (*Empidonax traillii*) (27), yellow-billed cuckoo (*Coccyzus americanus*) (15), grasshopper sparrow (*Ammodramus savannarum*) (10), horned lark (*Eremophila alpestris strigata*) (427), northern flicker (*Colaptes auratus*) (17), prairie warbler (*Setophaga discolor*) (1), red-headed woodpecker (*Melanerpes erythrocephalus*) (9), and wood thrush (*Hylocichla mustelina*) (39).

As per the ODNR Protocol, a similar breeding bird survey will be conducted for one year post-construction. This post construction survey will not be used for adaptive management purposes because the amount of data will be very low and it is not reasonable that an understanding of avoidance patterns will be deduced from one study. Rather, this study will be used in conjunction with other surveys from other projects and, over an extended time period, avoidance patterns may be able to be appropriately studied.

3.2.2.2 *Raptor Migration Surveys*

Raptor migration surveys were conducted over 11 days from 30 August 2007 to 11 October 2007 (66 hr) from an observation point located within the Initial Study Area and 1.6 km (1.0 mi) north of the Adjusted Project Area (Stantec 2008*a*). After consultation with ODNR DOW, it was determined that additional raptor migration surveys were needed and were subsequently conducted over 32 days from 1 March 2008 to 15 May 2008 (216 hr) and over 24 days from 1 September 2008 to 15 November 2008 (167 hr). Surveys for sandhill cranes were conducted over 12 days from 16 November to 15 December 2008 (84 hr) (Stantec 2009a). All of the above referenced migration surveys were conducted from an observation point located 4.5 km (2.8 mi) north of the Adjusted Project Area. The raptor survey locations were within the Initial Study Area; however, when the Project boundary was shifted to the south to avoid impacts to Indiana bats documented in Logan County in the 2008 mist-netting surveys, the survey locations were outside the Adjusted Project Area boundary. However, as confirmed through consultation with the ODNR DOW, the raptor migration activity observed in the 2007 and 2008 surveys is believed to be representative of raptor migration activity in the Adjusted Project Area because the habitat and landscape features that occurred in the area surrounding the raptor survey locations that might influence raptor use of the area are very similar as those found throughout the Initial Study Area, which included the majority of the Adjusted Project Area.

The most common raptor species observed in all raptor migration surveys was turkey vulture (*Cathartes aura*), accounting for 90% of observations, and red-tailed hawk (*Buteo jamaicensis*) which accounted for 6% of observations (Appendix A Table 4). Fourteen other raptor species were observed in low numbers. There were 3 state listed raptor species observed during the fall 2007 raptor surveys: northern harrier (state endangered) (2), black vulture (*Coragyps atratus;*

state species of concern) (3) and sharp-shinned hawk (*Accipiter striatus; state* species of concern) (4). There were also 4 state listed raptor species observed during the spring 2008 surveys: sharp-shinned hawk (2), northern harrier (5), peregrine falcon (*Falco peregrines;* state threatened; also listed as a federal species of concern) (1) and bald eagle (state threatened, federal species of concern and protected under BGEPA and MBTA) (1); also observed during the 2008 spring raptor survey were 4 sandhill cranes (state endangered). During the fall 2008 raptor migration surveys, there were 3 state listed raptor species observed, bald eagle (1), northern harrier (4) and sharp-shinned hawk (4). One golden eagle, protected under BGEPA and MBTA, was observed in each of the spring and fall 2008 monitoring seasons.

3.2.2.3 *Nocturnally Migrating Bird Surveys*

A fall 2007 radar survey was conducted from 1 September 2007 to 15 October 2007 which included 30 nights of sampling to detect night migrating birds (Stantec 2008*a*). Radar surveys were not required by the ODNR DOW, but were conducted by Buckeye Wind to proactively collect as much information about birds in the Initial Study Area as possible. Surveys were conducted from sunset to sunrise using X-band radar on nights when weather conditions permitted radar operation to adequately document bird movements. The radar was positioned approximately 6.4 km (4.0 mi) north of the Adjusted Project Area near the Champaign-Logan County line. It should be noted that the radar survey location was within the Initial Study Area; however, as the Project boundary was revised, the location was outside the Adjusted Project Area. However, due to proximity to the Adjusted Project Area and similar landscape features between the survey location and the Adjusted Project Area, the results from the radar survey location are believed to be representative of Adjusted Project Area. Moreover, nocturnally migrating passerines have consistently been documented in radar studies to migrate across a broad front, covering hundreds of miles each night, so the location of the survey point generally reflects the use pattern of the surrounding area.

The overall passage rate for the entire survey period was (mean ± standard error): 74 ± 15 targets per km per hr (t/km/hr). Nocturnal passage rates were highly variable among nights, ranging from 0 t/km/hr to 404 t/km/hr. The mean flight direction through the survey area was 194° ± 144° (i.e., slightly southwest). The mean flight altitude of all targets observed on the radar was 393 m ± 12 m (1290 ft ± 39 ft) above ground level (agl). The average nightly flight altitude ranged from 252 m ± 43 m (828 ft ± 140 ft) agl to 506 m ± 27 m (1661 ft ± 88 ft) agl. The percentage of targets observed flying below 150 m (492 ft) agl (maximum turbine height) varied by night from 2% to 38%; however, only 4 out of the 30 nights of sampling did targets flying below 150 m (492 ft) agl exceeded 10%. Passage rates on these four nights ranged from 0 t/km/hr[5] to 97 t/km/hr, with three of the nights having passage rates considerably below the seasonal mean level. The overall average for targets flying below 150 m (492 ft) during the entire survey period was 5% (Stantec 2008a). Radar surveys took place on 30 nights, which spanned the anticipated peak in fall nocturnal migration and sampled nights with a variety of weather conditions, wind speeds, and wind directions. Birds migrating at lower altitudes at night would be at higher risk of coming into contact with wind turbines than those birds flying at heights well above the height of wind turbines, however, no correlation between radar passage rates and risks to avian species has been established. Comparison of passage rates among sites must be done with caution, as differences in passage rates could be due to differences in radar view between sites. This limiting factor makes site-to-site comparisons difficult, and in turn limits ability to ascertain risk based on radar results. Comparison of flight altitudes between survey sites as measured by radar is generally less influenced by site characteristics, as the main portion of the radar beam is

[5] A passage rate of 0 t/km/hr indicates that no targets were observed while the radar was operating in horizontal mode. However, a small number of targets were observed in vertical mode, allowing calculation of the percentage of targets below 150 m.

directed skyward and the potential effects of surrounding vegetation on the radar's view can be more easily controlled. The emerging body of studies characterizing nocturnal migration shows a relatively consistent pattern in flight altitude, with most targets appearing to fly at altitudes of several hundred meters (m)or more above the level of the radar unit (see Stantec 2008a Table 2-1). Since turbines for this Project will be about 150 m tall, this would suggest that risk of collision with migrating birds is low.

3.2.2.4 *Sandhill Crane Surveys*

Sandhill cranes are listed as state endangered. Surveys for sandhill cranes were conducted during 12 days (84 hr) from 16 November 2008 to 15 December 2008. No sandhill cranes were detected during surveys. Four sandhill cranes were observed during the spring 2008 raptor survey (Appendix A Table 6).

In general, few waterfowl or waterbird species were observed during avian field surveys, with the exception of several killdeer (*Charadrius vociferus*) observed during breeding bird surveys in 2008 and Canada geese (*Branta canadensis*) were occasionally detected flying overhead (Appendix A Table 6). Other waterbirds detected include mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), and great blue heron (*Ardea herodias*) (Appendix A Table 6). Canada goose is the only waterbird species commonly detected on the Breeding Bird Survey route within the Adjusted Project Area. All of these species are expected to occur as transients within the Adjusted Project Area while en route to preferred habitats.

3.2.3 *Bat Studies*

Buckeye Wind worked proactively with the USFWS and ODNR DOW to conduct thorough pre-construction surveys to document activity patterns of bats with acoustic surveys, bat mist-netting surveys, and swarm surveys at bat hibernacula, as well as habitat assessments for threatened and endangered species. All pre-construction bat survey reports are available as Appendices to the EIS. Buckeye Wind first contacted USFWS and ODNR DOW in 2007 when Tier II-analogous site characterization was underway in order to gather information from these agencies to supplement information from online databases. Tier III-analogous surveys were developed in coordination with ODNR DOW and USFWS, and experts from those agencies were actively involved in the survey design and execution

3.2.3.1 *Mist Netting Surveys*

A total of 298 bats were captured during mist-netting surveys that were conducted on 75 net-nights between 17 June 2008 and 25 July 2008 (Stantec 2008b). Mist-net sampling effort was conducted in portions of both the current Adjusted Project Area and the Initial Study Area to the north. While the Initial Study Area to the north was originally assessed, it was later excluded from the Action Area when the presence of Indiana bats was detected in 2008 as described in Section 1 of this ABPP.

The average capture rate was 4.0 bats per net per night (b/n/n). A total of 7 bat species were captured, with big brown bats consisting of 66% of all captures, followed by northern bats (13%), eastern red bats (12%), little brown bats (6%), hoary bats (1%), tri-colored bats (1%), and Indiana bats (1%) (Table 3-4). All of these bats are state species of concern with the exception of the Indiana bat, which is state (and federal) endangered. Reproduction of all 7 species was documented through the capture of reproductive females. Two reproductive adult female Indiana bats and 1 non-reproductive adult male Indiana bat were captured and radio-tagged north of the Action Area, with the closest capture location approximately 7.8 km (4.8 mi) north, in Logan County.

Table 3-4. Bat species captured during summer 2008 mist-netting in the Buckeye Wind Power Project Action Area and Initial Study Area, Champaign and Logan Counties, OH (values in parentheses represent juvenile bats; values not in parentheses represent adults).

Species	Males	Females	Unknown	Total (% of total)
Big brown bat	51 (39)	87 (19)	1	197 (66%)
Northern	21	16 (1)	0	38 (13%)
Eastern red bat	8 (4)	12 (8)	4	36 (12%)
Little brown bat	12 (2)	4	0	18 (6%)
Hoary bat	0	1 (2)	0	3 (1%)
Tri-colored bat	1	2	0	3 (1%)
Indiana bat	1	2	0	3 (1%)
All Species	94 (45)	124 (30)	5	298

3.2.3.2 *Swarming Surveys at Hibernacula*

Bat swarming surveys were conducted in fall 2008 at 2 cave openings (Sanborn's Cave and a nearby, unnamed cave) located approximately 6.3 km (3.9 mi) north of (outside) the Action Area and within the Initial Study Area (Stantec 2009a). At total of 884 bats were captured during 5 capture events from 15 September 2008 to 27 October 2008 using harp traps placed at cave openings and a mist-net across a nearby stream during 1 capture event. Northern bats were the most common species captured during swarming surveys (74%), with males representing 58% of all northern bats captured. The second most frequently captured species was the little brown bat, representing 23% of all bats captured (Table 3-5). Males represented the majority (82%) of all little brown bats captured. The least frequently captured bats were tri-colored bats (2%) and big brown bats (1%). No Indiana bats were captured during the fall 2008 swarming surveys. A survey of 14 areas with known or suspected karst geologic features was also conducted in the vicinity of the Action Area during 2008; no features capable of hosting bats were documented at any of the areas surveyed.

Table 3-5. Bat species captured during fall 2008 swarming surveys at Sanborn's Cave and a nearby, unnamed cave located in Logan County, OH, approximately 6.3 km (3.9 mi) north of the Buckeye Wind Power Project Action Area.

Species	Males	Females	Unknown	Total (% of total)
Northern	380	250	23	653 (74%)
Little brown bat	164	37	0	201 (23%)
Tri-colored bat	9	9	0	18 (2%)
Big brown bat	10	2	0	12 (1%)
All Species	563	298	23	884

3.2.3.3 *Acoustic Surveys*

Acoustic bat call sequences were recorded using 6 Anabat SD1 detectors (Titley Electronics Pty Ltd.) at 2 MET towers from 28 August 2007 to 29 October 2007 (Stantec 2008a) and 29 March 2008 to 3 September 2008 (Stantec 2009a). One MET tower was located in the central portion of the Action Area, and another was located within the Initial Study Area, but 6.2 km (3.8 mi) north of the Action Area. Three acoustic bat detectors were placed at each of the "North" and "South" MET towers (Table 3-6) at heights of 2 m (7 ft; "Tree"), 20 m (66 ft "Low"), and 40 m (131 ft "High") agl.

A total of 1,522 bat call sequences were recorded over 226 detector-nights during fall 2007, for a mean nightly detection rate of 6.7 call sequences per detector per night (s/d/n) (Stantec 2008*a*; Table 3-2). The majority of recorded bat call sequences (48%) were identified to the unknown (UNKN) guild, followed by those identified to the big brown bat /silver-haired bat /hoary bat (BBSHHB) guild (34%), the eastern red bat /tri-colored bat (RBTB) guild (18%), and the *Myotis* (MYSP) guild (<1%). Twenty-six percent of call sequences across all guilds, and only 1 MYSP call sequence, were recorded at detectors at the 40 m (131 ft) height.

Table 3-6. Distribution of bat acoustic detections by guild at 2 60-m MET towers at the Buckeye Wind Power Project, Champaign County, OH and Initial Study Area, 28 August 2007 to 29 October 2007.

Detector	Guild				
	Big brown silver-haired hoary bat (BBSHHB)	Red bat tri-colored bat (RBTB)	Myotis (MYSP)	Unknown (UNKN)	Total
North High: 40 m (131 ft)	101	5	1	69	176
North Low: 20 m (66 ft)	134	13	3	125	275
North Tree: 2 m (6.5 ft)	1	3	1	83	88
South High: 40 m (131 ft)	119	3	0	100	222
South Low: 20 m (66 ft)	45	2	1	32	80
South Tree: 2 m (6.5 ft)	110	253	0	318	681
Total	510	279	6	727	1,522
Guild Composition	34%	18%	<1%	48%	NA

A total of 18,715 bat call sequences were recorded over 774 detector-nights during spring through fall 2008, for a mean nightly detection rate of 23.7 s/d/n (Stantec 2009a; Table 3-7). The majority of calls recorded across all detectors (60%) were identified to the big brown/silver-haired bat (BBSH) guild (separated from the BBSHHB guild in 2008), followed by the UNKN (32%), RBTB (4%), MYSP (3%), and hoary bat (HB; 1%) guilds. Four percent of call sequences across all guilds, and 1% of MYSP call sequences were recorded at detectors placed at 40 m (131 ft) agl. Mean nightly detection rate was variable across seasons, with the highest rates recorded during the fall sampling period.

Table 3-7. Distribution of bat acoustic detections by guild at 2 60-m MET towers at the Buckeye Wind Power Project, Champaign County, OH and surrounding vicinity, 29 March 2008 to 3 September 2008.

	Guild							
					Unknown			
Detector	Big brown silver-haired (BBSH)	Hoary (HB)	Red bat tri-colored bat (RBTB)	Myotis (MYSP)	High frequency (HFUN)	Low frequency (LFUN)	Unknown (UNKN)	Total
North High: 40 m (131 ft)	91	9	20	4	35	112	1	272
North Low: 20 m (66 ft)	495	17	173	21	249	318	32	1,305
North Tree: 2 m (6.5 ft)	7,891	44	333	546	1,586	1,312	200	11,912
South High: 40 m (131 ft)	120	29	25	4	44	161	1	384
South Low: 20 m (66 ft)	343	24	70	4	102	304	3	850
South Tree: 2 m (6.5 ft)	2,298	25	96	24	423	1,046	80	3,992
Total	11,238	148	717	603	2,439	3,253	317	18,715
Guild Composition	60%	1%	4%	3%	13%	17%	2%	

When comparing 2008 detection rates for Buckeye Wind to other wind project sites in the eastern United States for which data are publicly available (Tables 2-4 and 2-5 in Stantec 2008*a*), the average detection rate at the 4 MET detectors in fall (12.4 s/d/n) was within the range of those observed at other sites in recent years. The fall detection rate at the south tree detector (13.1 s/d/n) was also comparable to rates observed at other sites in the fall; however, the fall detection rate at the north tree detector (256.5 s/d/n) was higher than rates observed in other surveys.

Calls at the north tree detector were comprised mostly of call sequences identified to the BBSH guild (74%; n=3,228); 14% of these calls were identified as big brown bat. The majority of the remaining calls which were not able to be identified to species were likely also big brown bat calls, given that they were recorded at 2 m (7 ft) agl, below the typical flight height of silver-haired bats.

It is important to note that acoustic surveys cannot be used to predict risk of collision mortality at wind facilities. Numbers of recorded bat call sequences are not necessarily correlated with numbers of bats in an area because acoustic detectors do not allow for differentiation between a single bat making multiple passes, and multiple bats each recorded individually (Hayes 2000). Additionally, differences in methodology, sampling duration, annual variation, habitat, detector placement, and physiographic conditions among surveys limit our ability to make meaningful comparisons among studies. Further limiting the applicability of acoustic survey results to

predicting risk at wind facilities is the fact that no studies to date have linked pre-construction acoustic activity rates with post-construction fatality rates.

Peak bat activity at almost all detectors was documented during the fall migratory period. When looking at detections of long-distance migratory species at high and low MET detectors from mid-August to early September in 2008, only eastern red bats displayed an obvious peak in activity, based on call files identified to this species (Because only 1% of the bats in this guild were positively identified as tri-colored, it is likely most are eastern red bats). Conversely, hoary and silver-haired bats did not display peak activity in the fall (based on hoary and silver-haired bat call files positively identified to species), but had high detection rates earlier in the survey, during the spring migratory or summer breeding season. Because eastern red bats were the only long-distance migratory species to show a peak in activity at MET detectors during the fall migratory period when bat fatalities have been found to be most numerous, it is possible that bat mortalities at the Project could be greatest in August and early September, and that these mortalities would consist mostly of eastern red bats because of the observed species composition of that guild.

4.0 AVIAN AND BAT CONCERNS

As discussed previously, the most likely direct (or immediate) effects to birds and bats from the proposed Project is turbine-associated collision mortality and/or barotrauma for bats (tissue damage to air-containing organs due to rapid-air pressure reduction at moving turbine blades). Other direct effects to birds and bats may also result from noise, increased human presence, and other disturbances associated with Project construction activities, or displacement effects from the operating wind facility. Because potential impacts and actions to manage those impacts will differ between species groups, bird and bat species are divided among the following groups:

- Birds
  - nocturnally migrating birds;
  - cranes, waterfowl and other water birds;
  - resident breeding birds; and
  - migrating raptors.
- Bats:
  - long-distance migratory bats; and
  - cave-hibernating bats (including Indiana bats).

For each species group, the potential impacts from the proposed Project will be described based on the results of Tier III-analogous pre-construction field surveys, as well as information from other studies and published literature. The specific Project design and construction measures, avoidance and minimization measures, and potential mitigation options to address impacts will be discussed in Sections 5.0 and 7.0.

4.1 Birds

Collision with various man-made structures is a significant source of bird mortality (Trapp 1998, Kerlinger 2000, Shire et al. 2000, and many others). Large, episodic mortality events, sometimes involving hundreds of birds at 1 location in 1 night, have been documented at tall structures such as guyed communication towers, lighted buildings, and lighthouses (Shire et al. 2000, Gehring et al. 2009, Avery 1979). Nationally, wind turbines are estimated to be responsible for 0.01% to 0.02% of all avian fatalities resulting from collision with anthropogenic structures (Erickson et al. 2005). Table 1-1 summarizes estimated annual avian mortality from anthropogenic causes, including wind turbines.

A recent publication from the USFWS estimates that 440,000 birds are killed by wind turbines annually (Manville 2009). However, that estimate implies a mortality rate of about 16 birds per MW (given an installed capacity of 25,000 MW in 2008), which is significantly higher than mortality rates actually reported from various projects throughout the Midwest.

More current information with most, if not all, studies accounting for searcher efficiency or carcass persistence, is available from eastern and Midwestern sites. The average avian mortality rate reported at wind facilities in the east and Midwest is approximately 3.93 b/t/y (Osborn et al. 2000; Johnson et al. 2000, 2002; Howe 2002; Kerns and Kerlinger 2004; Arnett 2005; Koford et al. 2004, 2005; Piorkowski 2006; Derby et al. 2007; Fiedler et al. 2007; Jain et al. 2007, 2008; Miller 2008; Stantec 2008*c;* Vlietstra 2008, 2009*abcd;* Arnett et al. 2009; Gruver 2009; NJ Audubon Society 2009; Stantec 2009*bc*; Tidhar 2009; Young et al. 2009; Stantec 2010*ab*; Drake et al. 2010). The highest reported avian mortality among these studies (11.8 b/t/y) was documented at the Blue

Sky Green Field Project in WI (Gruver et al. 2009). Bird fatality estimates for wind-energy facilities in the west and upper Midwest range from 0.4 to 11.8 b/t/y (multiple studies as cited in Poulton 2010). The correlation between habitat type and avian mortality remains unclear due to other confounding factors such as bird density and behavior.

Although avian collision mortality can occur during both the breeding and migration seasons, patterns in avian mortality at tall towers, buildings, wind turbines, and other man-made structures suggest that the majority of fatalities occur during the spring and fall migration periods (NRC 2007, NWCC 2010). Overall, no particular species has been identified as incurring greater numbers of fatalities at wind energy facilities. However, it has been documented that night-migrating passerines experience the highest frequency of fatalities (Lilley and Firestone 2008). In general though, and likely due to differences in abundance, use of habitat, and behavior, bird groups have experienced varied impacts from wind turbines. Table 4-1 provided below is the general distribution of fatalities across bird groups, as reported by 24 publicly available post-construction mortality studies conducted at 19 different locations and habitat types (e.g., agricultural, upland, forested ridgeline, coastal, and grassland) in the eastern and Midwestern United States. A total of 868 avian fatalities, comprised of at least 7 bird groups, were documented either during standard searches or as incidental observations. Songbirds account for the highest number of wind-related fatalities in the eastern and Midwestern United States (Table 4-1) and across the nation (NWCC 2010).

Although bird mortality rates have been found to be variable among facilities and regions (NWCC 2010), the number of avian fatalities at wind energy facilities has generally been low when compared to the total number of birds passing through these sites (Erickson et al. 2002, comparing results of radar surveys concurrent with mortality monitoring).

Table 4-1. Documented avian fatalities at wind energy facilities between 1994 and 2009 in the eastern and Midwestern United States. (Note: Data represent individuals found and are not estimates of annual fatality; fatality data were not corrected for biases related to searcher efficiency or carcass persistence.)

Bird group	# individuals	% of total fatalities
Passerine	628	72.4%
Unknown species	108	12.4%
Raptor	46	5.3%
Waterfowl	21	2.4%
Gamebird	41	4.7%
Shorebird	14	1.6%
Seabird	6	0.7%
Owl	4	0.5%
Total	868	100.0%

Sources: Osborn et al. 2000; Johnson et al. 2000, 2002; Howe et al. 2002; Kerns and Kerlinger 2004; Koford et al. 2005; Arnett 2005; Piorkowski 2006; Derby et al. 2007; Fiedler et al. 2007; Jain et al. 2007, 2008, 2009*abcd;* Miller 2008; Stantec 2008*c*, 2009*bc*, 2010*b;* Vlietstra 2008; Arnett et al. 2009; Gruver et al. 2009; NJ Audubon Society 2009; Tidhar 2009; Young et al. 2009; and Drake et al. 2010.

4.1.1 *Nocturnally Migrating Songbirds*

Indirect effects (separated in time) to nocturnally migrating birds during Project siting and construction may include habitat loss or modification that occurs while the birds are not in the

breeding season, though these indirect effects are minimal because the Action Area is not located in a major migratory pathway and the habitat disturbance due to the Project is minor (0.15% of the entire Action Area will be disturbed). Direct (immediate) effects could include collision with turbine blades, towers, or MET towers.

As previously stated, the majority of avian mortality at tall man-made structures, including wind turbines, has primarily involved nocturnally migrating songbirds (NWCC 2010). At existing wind facilities in the east and Midwest, approximately 72% of documented avian fatalities have consisted of songbirds (Table 4-1). Nocturnal migrant songbird fatalities most frequently documented at existing wind facilities in the east and Midwest are regionally common and abundant species, such as golden-crowned kinglet (*Regulus satrapa*) and red-eyed vireo (*Vireo olivaceus*) (Sauer et al. 2005). Among the eastern and Midwestern mortality monitoring studies referenced in Section 4.1 – Birds, there were 79 and 61 documented golden-crowned kinglet and red-eyed vireo fatalities, respectively, at all sites combined (note that these numbers include observed mortality and were not corrected for searcher efficiency or carcass persistence). The estimated North American population is 34 million and 140 million for golden-crowned kinglet and red-eyed vireo, respectively (Sauer et al. 2005).

Abundance alone may not necessarily result in increased collision risk. For example, at the Cohocton and Dutch Hill wind farms (agricultural and wooded habitat) in Stueben County, NY, horned lark were frequently observed in the project areas during pre- and post-construction surveys (Woodlot 2006*ab*, Stantec 2010*a*); however, there were no documented horned lark fatalities during 2 years of post-construction monitoring (Stantec 2010*a*, Stantec 2011). Trends observed for certain species in the western United States are not necessarily observed in the east. For example, while horned lark are among species most commonly reported during fatality studies at western wind facilities (WEST Inc. 2010, Poulton 2010), there have been relatively few horned lark fatalities at eastern and Midwestern sites (Poulton 2010). Among all eastern and Midwestern mortality monitoring studies referenced in Section 4.1 – Birds, there have been 16 horned lark fatalities (observed fatalities only and uncorrected for searcher efficiency and carcass persistence).

Although nocturnally migrating songbirds are expected to pass above the Action Area during spring and fall migration periods, most of these individuals are flying at consistently high altitudes above the height of the turbines, as has been documented in the vast majority of recent radar surveys conducted at proposed wind facilities in the northeast (Appendix B Table 1). The results of the radar study in the Initial Study Area indicate that passage rates were low when compared to other sites in the United States with publicly available data. Additionally, the mean flight altitude of targets (assumed to primarily consist of night-migrating passerines, but could also include bats) indicates that the majority of nocturnal migration in the area occurred well above the maximum height of the wind turbines. The average flight altitude was 393 m (1,289 ft) and only 5% of the targets flew below the maximum turbine height (150 m; Stantec 2008*a*). These findings indicate that the Project does not have a high potential for impacts to nocturnal migrants in comparison to other sites.

It is anticipated that certain Project design and management actions can reduce risk to nocturnal migrants. The measures that Buckeye Wind will be implementing are described in greater detail in Section 5.0 – Avoidance and Minimization Measures. Additionally, nighttime operational adjustments that will be implemented to reduce impacts to Indiana bats as a condition of the HCP are also expected to reduce risk of collision for nocturnally migrating birds, although the effectiveness of feathering for reducing bird mortality has not been tested.

Buckeye Wind anticipates generally low levels of seasonal songbird collision mortality during migration, which is consistent with documented avian fatalities at existing wind facilities. While it is clear that impacts to nocturnally migrating songbirds occur at wind energy facilities, the number of impacted birds is small relative to their total populations and to other anthropogenic sources (see Table 1-1). According to the NWCC (2010), a consensus-based collaborative comprised of representatives from state and federal government, the utility, wind industry, and environmental sectors (among others), wind turbine related mortality is unlikely to affect songbird population trends.

4.1.2 *Breeding Birds*

Indirect effects to breeding birds during Project siting and construction may include habitat loss or modification that occurs while the birds are not in the breeding season. Direct (immediate) effects include disturbances associated with increased human presence and noise associated with construction activities that may result in displacement. In addition, direct effects from construction include collision with construction and maintenance vehicles.

Although there will be some degree of loss of habitat and/or habitat alteration, over 90% of the total disturbed area during construction of the Project will occur in areas classified as cultivated crop land cover types. Agricultural land is generally thought to provide marginal quality habitat for wildlife because it is fragmented and subject to periodic disturbance from mowing, plowing, and harvesting. However, some habitat generalist and grassland breeding birds will use agricultural fields, hay fields, and pastures, particularly if they are not mowed until after June. If pastures contain seasonal sources of water, they can provide breeding habitat for some species of ducks and shorebirds.

Agricultural lands enrolled in the CRP program may also provide higher quality habitat for grassland and upland nesting species. The CRP program is a cost-share and rental payment program administered by the United States Department of Agriculture (USDA) Farm Service Agency (FSA) that encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to natural vegetative cover by planting native and non-native grasses and trees. The quality of habitat on CRP land for wildlife will depend on how long the land has been enrolled in the program and taken out of crop rotation and what type of habitat improvements have been made. For the 100-turbine Project, it is anticipated that not more than 6 turbines will be located in CRP land. Permanent impacts include 2.3 ha (5.7 ac), which represents 0.2% of CRP land in the Action Area (approximately 1250 ha [3,088 ac]). An additional 9.0 ha (22.2 ac) will be temporarily disturbed. For the Redesign Option, 2.3 ha (5.7 ac) of permanent disturbance and 10.1 ha (25.0 ac) of temporary disturbance will occur.

Project components sited in CRP land will result in temporary and permanent loss of grassland habitat that provide higher quality habitat for breeding grassland and upland bird species than active agricultural land. However, CRP designations are temporary in nature and dependent on landowner participation; contracts are issued for 10 or 15 years, but can be broken, subject to penalties. Landowner participation is strongly influenced by commodity prices (i.e., the price of corn, soybeans, and derived products, such as biofuels), which affect the relative financial benefits of participation in the program. As the price of commodities increase, there is a disincentive for farmers to keep their lands in CRP because the price of rental payments will decrease relative to economic rewards of active crop production. Therefore, the amount of land in CRP changes significantly over a relatively short period of time. The 11.3 ha (27.9 ac; 12.4 ha [30.7 ac] redesign) of total CRP land in the Action Area that will be temporarily and permanently removed as a result of Project development will not drastically change the landscape of the Action Area. Furthermore, CRP that is temporarily disturbed will be re-planted consistent with the CRP program established on the respective property. Additionally, this

amount is small compared to variation of CRP participating land that would occur from normal land management practices in the Action Area over time (i.e., potential conversion of CRP land back to active crop). To further avoid and minimize potential effects to grassland birds, CRP land will be cleared only during the non-breeding season for grassland birds (before 1 Mar and after 15 Jul).

Potential impacts to forest-associated breeding birds are anticipated to be minimal because there will be a small amount of tree clearing during Project construction compared to forested habitat available in the Action Area. Construction impacts anticipated for the 100-turbine Project will affect up to 6.5 ha (16.1 ac) of forested habitat (National Land Cover Database [NLCD] and National Agriculture Imagery Program [NAIP]), which represents 0.2% of 2,743.5 ha (6,779.4 ac) of forested habitat in the Action Area (6.8 ha [16.8 ac] for the Redesign Option)[6]. Forest removal will be spread throughout the Adjusted Project Area and is not expected to be extensive in any single area. In order to avoid potential direct effects to Indiana bats, tree clearing activities will be conducted between 1 November and 31 March, which should also minimize impacts to forest-associated bird species which would not be breeding at this time. The largest forest area planned for removal is (1.1 ha [(2.7 ac]). In general, tree removal will occur at the edges of larger forest stands.

Impacts to breeding birds could occur as a result of increased human presence and noise associated with construction activities. The significance of these types of impacts will likely vary by species. Because most construction activities will occur in agricultural land and early successional habitat, species utilizing those habitats (such as grassland bird species) are most likely to be disturbed/displaced by construction activities. Disturbances associated with construction activities will be temporary, as the 52 and 48 turbine phases are expected to be commissioned 12 months to 18 months after initiation of construction. While the rate of displacement, if any, and the rate of re-colonization of displaced species and the impact of temporary or permanent displacement is not known, given the small area of disturbed habitat there is not expected to be significant adverse impacts to affected species.

Risk of collision with vehicles during construction of the Project is expected to be somewhat higher for birds than bats, as construction activity will occur mostly during the day when the majority of breeding birds are active. However, risk of collision for both birds and bats is expected to be low since construction vehicles are expected to be large, slow-moving trucks. Once the proposed Project is operational, maintenance associated with the Project will not significantly contribute to traffic on local roads. Additionally, given that increased vehicular traffic resulting from Project construction will occur over a limited time period, estimated to span less than 2 years, vehicle collision events are expected to be minimal and not result in significant impacts to bird species.

Available post-construction studies have indicated some level of displacement of breeding birds in locations in close proximity (50 m to 200 m [164 ft to 656 ft]) to operational turbines at projects in similar landscape settings; however, results have been mixed (Poulton 2010). Studies conducted at the Buffalo Ridge Wind Power Plant (Buffalo Ridge) in southwestern MN reported that birds in general avoided flying in areas with turbines and reported fewer individuals and species in survey plots with turbines, as compared to reference survey plots (Osborn et al. 1998).

[6] Note that much of this area is along the edge of woodlots or along thin/sparse tree lines separating parcels, resulting in a conservative estimate. Avoidance and minimization measures described in Section 6.0 will likely reduce the area of tree removal to less than the estimated 6.5 ha (16.1 ac), or 6.8 ha (16.8 ac) for the Redesign Option, based on construction needs, landowner preference, and quality of habitat.

Although the majority of grassland breeding birds decreased their use adjacent to turbines at Buffalo Ridge, waterfowl were observed to continue use of the area (Osborn et al. 1998). Also at Buffalo Ridge, male songbird densities were 4 times greater in reference CRP grasslands, as compared to CRP grasslands located within 180 m (591 ft) of turbines (Leddy et al. 1999). Johnson et al. (2002) reported 65% of bird groups were not displaced within 100 m (328 ft) of turbines at Buffalo Ridge; however, certain bird groups and species were displaced.

At the Maple Ridge Wind Power Project in northeastern NY, bobolink density was lower in hayfields within 75 m (246 ft) of turbines compared to hayfields without turbines, but no difference in bobolink density was detected in hayfields within 100 m to 400 m (328 ft to 1,312 ft) of turbines compared to hayfields without turbines (Kerlinger and Dowdell 2008). In a study at the Stateline Wind Project in OR and WA, grasshopper sparrows (*Ammodramus savannarum*) and western meadowlarks (St*urnella neglecta*) showed a significant decrease in use within the first 50 m (164 ft) of the turbines (WEST and Northwest 2004).

Based on these studies, some degree of displacement of certain species of grassland birds in the vicinity of turbines is possible, with most impacts occurring within 50 - 200 m (164 - 656 ft) of the turbines. Assuming displacement within 50 - 200 m of Project turbines, birds could be displaced from approximately 110 ha (280 ac) – 1,300 ha (3,100 ac) for a 100-turbine project, which comprises 0.3% – 4.0% of the total Action Area size. However, given that clearing will be limited to non-breeding seasons and over 90% of the Action Area is agricultural land, the amount of any potential displacement is expected to be limited. Thus, displacement is not expected to significantly affect local breeding bird populations.

There is collision risk for breeding birds with turbine structures during the lifespan of the Project. While the majority of avian collisions at existing wind projects occurs during spring and fall migration and appears to be primarily nocturnally migrating songbirds, collisions are also known to occur during the breeding season. Post-construction monitoring will assess turbine collision impacts for breeding birds. Due to the siting of turbines largely in agricultural habitat and other avoidance and minimization measures described in Section 5.0 – Avoidance and Minimization Measures, impacts are not expected to adversely impact local populations of breeding birds. Should mortality of birds or bats exceed Mortality Thresholds (see Section 7.1 – Calculation of Threshold Levels, Buckeye Wind will work with the ODNR DOW and USFWS to determine what additional measures could help bring mortality to within the Mortality Thresholds while maintaining the economic viability of the Project (see Section 7.1 – Calculation of Threshold Levels).

4.1.3 *Migrating Raptors*

Potential impacts to migratory raptors include risk of collision during operation of the Project. Migratory raptors were observed in the Action Area but occurred in relatively low numbers compared to raptors observed at regional Hawk Migration Association of North America (HMANA) sites. During fall 2008, observation rates at regional HMANA sites ranged from 5.2 birds/hr to 3,082.8 birds/hr (Stantec 2009*a*). The most active site was Detroit River Hawk Watch (DRHW), Pointe Mouillee, MI, and is the HMANA site most near to the Action Area (approximately 217 km [135 mi] north from the center of the Action Area). At DRHW, 323,691 raptors were counted during 105 survey hours (3,082.8 birds/hr) during fall 2008. This was likely due to the close proximity of DRHW to Lake Erie, which is known to concentrate large numbers of raptors.

When compared to 14 other publicly available wind project spring pre-construction raptor surveys conducted from 1999 to 2006, the passage rate observed for the Project in spring 2008 (6.8 birds/hr) was similar to that of many projects in agricultural settings. The average passage rate for these sites was 5.2 birds/hr (rate range 0.9 birds/hr to 25.6 birds/hr) (see Appendix B,

Table 2). When compared to passage rates for 17 other wind project fall pre-construction surveys conducted from 1996 to 2007, the passage rate for the Project in fall 2008 (3.5 birds/hr) is among the lowest (see Appendix B, Table 3)[7]. Passage rates for other fall surveys averaged 4.4 birds/hr (rate range 3.0 birds/hr to 12.7 birds/hr). Geographical location and topography can affect the magnitude of raptor migration at a particular site. The lower passage rate at the Project is likely due to a lack of landscape features with dramatic relief or steep topography which may create updrafts that concentrate raptor migration, and lack of large bodies of water that may funnel some migrating raptors along shorelines.

Based on data collected in eastern and Midwestern avian mortality monitoring studies (Table 4-1), raptors have been found to represent approximately 5.3% of documented avian fatalities. Studies at wind energy facilities document increases in raptor mortality as levels of raptor use in the area increase (NWCC 2010). Table 4-2 shows the species most commonly found during fatality searches in the east and Midwest; red-tailed hawks and turkey vultures have comprised the majority of documented fatalities. These species forage in open country and are regionally common and abundant. For example, the North American population of red-tailed hawks and turkey vultures is estimated to be 1 million and over 3 million, respectively (Wheeler 2003). Note that numbers presented in Table 4-2 are reported individual fatalities and have not been corrected for searcher efficiency or carcass persistence, which presumably would result in higher numbers of raptor fatalities. Despite this, these data provide useful information on the relative rates of mortality for different raptor species.

Table 4-2. Species composition of documented raptor fatalities at wind facilities in the eastern and Midwestern United States (Note: Data represent observed mortality and have not been corrected for searcher efficiency or carcass persistence biases).

Species	Number of fatalities
Red-tailed hawk	16
Turkey vulture	16
Sharp-shinned hawk	5
American kestrel	4
Broad-winged hawk	2
Osprey	2
Cooper's hawk	1

Sources: Osborn et al. 2000; Johnson et al. 2000, 2002; Howe 2002; Kerns and Kerlinger 2004; Koford et al. 2004, 2005; Arnett 2005; Piorkowski 2006; Derby et al. 2007; Fiedler et al. 2007; Jain et al. 2007, 2008, 2009*abc;* Miller 2008; Stantec 2008*c*, 2009*bc*, 2010*a;* Vlietstra 2008; Arnett et al. 2009; Gruver 2009; NJ Audubon Society 2009; Tidhar 2009; Young et al. 2009; and Drake et al. 2010.

Estimated species-specific raptor mortality, based on the results of post-construction mortality monitoring at operational facilities within landscapes similar to the Project is presented in Table 4-4. These data, combined with the results of pre-construction surveys, indicate a low collision risk for raptors in the Action Area. The level of raptor mortality for the Project and the species

[7] While methodologies may differ among these surveys as it relates to level of effort (number of days surveys are conducted, number of points surveyed, number of hours surveyed, etc.), these data are reported in terms of birds/hr, providing sufficiently standardized data points and allowing for a reasonable comparison across the survey results.

involved in collisions are expected to be similar to those documented at operational facilities within similar landscapes in the eastern and Midwestern United States (i.e., generally less than 2 raptors per monitoring year [Poulton 2010, NWCC 2010], involving mostly red-tailed hawks and turkey vultures).

Table 4-4. Raptor mortality estimates per species at New York facilities in agricultural plateau/wooded landscapes.

Project name	Survey year	Species	Search interval	Estimate/turbine/study period	Citation
Maple Ridge	2006	American kestrel	weekly	0.07	Jain et al. 2007
Maple Ridge	2007	red-tailed hawk	weekly	0.41	Jain et al. 2008
Maple Ridge	2007	sharp-shinned hawk	weekly	0.00	Jain et al. 2008
Maple Ridge	2008	American kestrel	weekly	0.02	Jain et al. 2009a
Maple Ridge	2008	Cooper's hawk	weekly	0.02	Jain et al. 2009a
Maple Ridge	2008	sharp-shinned hawk	weekly	0.02	Jain et al. 2009a
Clinton	2008	broad-winged hawk	3-day	0.43	Jain et al. 2009b
Ellenburg	2008	broad-winged hawk	daily	0.48	Jain et al. 2009c
Bliss	2008	red-tailed hawk	daily	0.18	Jain et al. 2009d
Bliss	2008	sharp-shinned hawk	3-day	0.28	Jain et al. 2009d

4.1.3.1 *Eagles*

In November 2011, the USFWS provided results of a risk assessment for potential impacts to eagles from the Project. The USFWS considered the following sources of information in making its assessment:

- Buckeye Wind Fall 2007 Bird and Bat Migratory Survey Report - Visual, Radar, and Acoustic Bat Surveys for the Buckeye Wind Power Project in Champaign and Logan Counties, OH
- Spring, Summer, and Fall 2008 Bird and Bat Survey Report for the Buckeye Wind Power Project in Champaign and Logan Counties, OH
- Avian Studies for the Champaign Wind Farm Champaign County, Ohio Final Report September 4, 2008 – January 28, 2010 (study completed for an unrelated wind farm that was entirely within the Action Area)
- Site specific investigations by Service biologists during the summer and fall of 2011

The remainder of this section is a re-production of the USFWS's assessment (USFWS 2011):

"Surveys conducted for the Project collectively observed one bald eagle and one golden eagle during the fall migration period, and one bald eagle and one golden eagle during the spring migration period. The golden eagle in the spring and bald eagle in the fall were flying within the rotor-swept zone of the turbines (defined as below 150 m). The golden eagle in the fall and the bald eagle in the spring were flying above the rotor-swept zone of the turbines. Additionally breeding bird surveys were conducted in May, June, and July 2008 and no bald or golden eagles were observed."

"Similar surveys were conducted for another project within the current Buckeye Wind Action Area, also following recommendations provided by the Service and ODNR. For that project, passerine migration surveys were conducted at four point-count stations in the proposed Action Area. Surveys were conducted once per week from September 16 through November 14, 2008, April 2 through May 26, 2009, and August 21 through September 15, 2009. A total of 120 breeding bird surveys were conducted during summer of 2009 at 40 survey points established across the study area relative to the proportion of individual habitat types. Diurnal bird/raptor migration surveys were conducted three times per week during the fall 2008 (September 4 – October 31) and spring 2009 (March 18 – May 2) at four point-count stations for a total of 170 survey events within the Action Area. The four survey points were selected to maximize viewsheds in roughly 360° around the point. Sandhill crane migration surveys were an extension of weekly diurnal bird/raptor migration protocol. Surveys were conducted approximately three days per week from November 3 through December 14, 2009. Throughout all of these surveys, ten bald eagles were documented during the fall migration period. Two of these observations were of birds within the rotor swept zone (defined as between 20-120 m). A search for nesting raptors was conducted on March 24, 2009 encompassing approximately half of the current Buckeye Wind Action Area. No bald eagle nests were observed."

"USFWS biologists received incidental observations from local landowners that reported juvenile bald eagles within the action area during the summer and fall of 2011. USFWS biologists met with landowners to discuss and verify their observations. One sighting was verified with an audio/video recording[8]. The other sightings were unverified. An additional sighting of an adult bald eagle in November 2009 was verified with a photograph from the local newspaper. Although this information is noteworthy in our risk assessment and is mentioned below to support the notion that eagles occasionally use the habitat within and around the project area, it is not appropriate to include incidental observations in the predictive model with the formal pre-construction monitoring survey data outlined below. It is also noteworthy that, in an effort to verify these sightings and update the area nest survey data, USFWS biologists canvassed the western portions of the action area on October 25, 2011, searching for eagle nests in the area where residents had reported eagle observations. No eagle nests were observed."

Breeding Season

"As described above, raptor nest searching was conducted in March 2009 and October 2011, and ODNR's bald eagle monitor was contacted to determine if bald eagle nests exist within proximity to the Buckeye Wind project. No eagle nests were identified within

[8] After the risk assessment was provided by the USFWS, an additional photo-verified siting of an adult bald eagle on 23 Nov 2011 was received from a local resident. Additionally, there was a report in February 2012 of a bald eagle nest greater than 6.5 mi from the Action Area boundary although the exact location is not known. Given this distance, USFWS concluded that it does not think that this pair would be likely to forage or roost within the Action Area.

the Action Area. An analysis of the proposed site and surrounding area using 2011 nesting data provided by ODNR has located one known active bald eagle nest (an eagle use area) approximately 9 miles north of the Action Area. Although the movements of breeding eagles may vary drastically among adults and among territories, at this distance there is likely no overlap between the Action Area and the established territory of this pair. Non-breeding eagles (juveniles, sub-adults, or adult "floaters") have been reported by local landowners within the Action Area during the summer, and one report of a sub-adult eagle was verified with an audio/video recording. While some non-breeding eagle use was reported by residents, the formal surveys that were conducted within the action area most recently in 2009 did not detect any eagle use during the breeding season. Overall, based on this initial assessment, it appears that risk to eagles during the breeding season may be relatively low at this site. However, to our knowledge there are limited to no data during the courtship/nest building period (mid-Jan to Feb). Because of this, there is uncertainty in our eagle risk assessment during this time of the year."

Winter Season

"There is not substantial information on winter eagle concentration areas and winter eagle movements in Ohio. According to the Avian Knowledge Network (Munson et al. 2011), which compiles bird data from various sources made publically available, the data for Champaign, Logan and Clark Counties do not indicate any records for wintering bald eagles in these Counties from 1991-2011. Madison and Union Counties, which border the Action Area to the east, each have 0-2 wintering eagle observations total since 1991. Further the Sandhill crane surveys conducted within the Action Area from November 3 through December 14, 2009 did not detect any eagles. No large water bodies such as reservoirs or major river corridors exist within the Action Area that could serve as feeding areas during the winter for bald eagles. From the details above, it appears that risk to eagles during the winter may be relatively low at this site. However, there are no data available on eagle use from mid-December until the start of the breeding season (mid-January) and the November-December data that is available was collected over approximately one-half of the Action Area. Because of this, there is uncertainty in our eagle risk assessment during this time of year."

Migration Season

"Migration surveys were conducted during fall 2007, spring and fall 2008, and spring and early fall 2009, as described in detail above. During all of these survey events one bald eagle and one golden eagle were observed during spring migration, and 11 bald eagles and one golden eagle were observed during fall migration. Three of the bald eagles during the fall migration period were flying within the rotor-swept zone. One golden eagle in spring was flying within the rotor-swept zone."

"As mentioned previously, these surveys were conducted prior to the release of the ECP Guidelines (see Section 1.2.2 – Bald and Golden Eagle Protection Act) and are not optimally designed to document eagle use of the Action Area and rotor-swept zone. It is apparent that both bald and golden eagles are present within the Action Area during the migratory period. The migration survey data was used as described below to assess potential risk to eagles during the migratory period."

The USFWS also used a predictive model that is it developing in collaboration with modeling experts from outside and within the USFWS. The model predicts the following risks to eagles (USFWS 2011):

- A fatality estimate of 0.059 bald eagles per year, with a 95% confidence interval between 0 eagles and 0.127 eagles per year.
- A fatality estimate of 0.019 golden eagles per year, with a 95% confidence interval between 0 eagles and 0.059 eagles per year.

The risk summary concludes that, "there are no "important eagle use areas" (including "eagle nests, foraging areas, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles") (Service 2009b) or migration corridors within the Action Area. We have determined that there is low risk to eagles during the breeding and winter seasons" (USFWS 2011).

While the USFWS concludes that the risk to eagles is low, they acknowledge that there is uncertainty in the predicted model results, and the assessment includes the following recommendations (USFWS 2011):

1. A commitment to monitor for and report eagle mortality for the life of the project.
2. An operational plan to minimize, where appropriate, the likelihood that eagles will use the project site (e,g., carcass management, maintain vegetation heights around turbines to reduce prey availability and raptor foraging).
3. A plan to periodically update the predicted risk of the project to eagles utilizing the best available sources of information such as updated nest location information, post-construction fatality monitoring data, migration data, incidental observations, and other sources of information. This may also include new research, monitoring, and surveys if the above information is not available.
4. Adaptive management plans that initiate action (i.e., minimization or mitigation) if risk to eagles is found to increase to moderate or high levels in the future. Specifically, the management plan should identify methodologies and quantitative risk assessment methods that will be used to identify changing risk and describe criteria that will trigger adaptive management. Thresholds for applying for a take permit under the Eagle Act in the future should also be outlined, along with any "advanced conservation practices" (see ECP Guidance) that may be employed to avoid take should risk to eagles increase.
5. A commitment to consider and incorporate, where appropriate, the latest research findings and minimization measures concerning eagle mortality at wind power projects.
6. Ground wires and any guy wires (e.g., on met towers) used in the project should be marked with deflectors.
7. Follow APLIC guidelines for overhead utilities.

Buckeye Wind intends to follow the USFWS recommendations:

1. Mortality monitoring for eagles will occur for the life of the Project, coincident with Indiana bat mortality monitoring as described in the HCP.
2. The minimization measures described in Section 5.2 – Construction and Maintenance will constitute an operation plan that will reduce the likelihood that eagles or other birds will use the Action Area. The majority of the Action Area is in agricultural use, which does not promote raptor use. However, areas that are pasture land or CRP will be left in the desired land use of the landowner.
3. Buckeye Wind will work with USFWS and ODNR to develop a plan to periodically update the predicted risk of the Project. In order to have an appropriate basis for the plan, it will be developed once the ECP Guidance is finalized and will incorporate portions of the ECP Guidance as appropriate for the level of risk and for a Project that is in the advanced stages of development or has completed the development process.

4. Buckeye Wind is committed to implementing any practicable advanced conservation practices. Buckeye will consider adaptive management plans and advanced conservation practices once the ECP Guidance is final. Any application of the final ECP Guidance will consider Project risk and Project economics and any specific treatment for already operating wind projects contained in the final ECP Guidance.
5. Buckeye Wind will consider and incorporate any new research findings and minimization measures concerning eagle mortality at wind power projects where appropriate and as practicable considering costs to the Project.
6. Any guy wires used for MET towers will be marked with deflectors or other acceptable bird/raptor diverters.
7. While Buckeye Wind would own the wires carry electricity from the turbines, the above ground collection lines, including distribution poles, will be owned and maintained by DPL and subject to DPL construction guidelines. While it is likely that DPL will utilize APLIC guidelines, or similar, and Buckeye Wind will encourage the use of APLIC guidelines, it is not possible for Buckeye to commit to such measures. In the Redesign Option, above ground collection lines will not be used, except for in very limited circumstances.

4.1.4 *Sandhill Cranes, Waterfowl, and other Waterbirds*

Waterbird (i.e., shorebirds, seabirds, waterfowl) mortality at wind facilities has been found to be relatively low (Osborn et al. 2000; Johnson et al. 2000, 2002; Howe 2002; Kerns and Kerlinger 2004; Koford et al. 2004, 2005; Arnett 2005; Piorkowski 2006; Derby et al. 2007; Fiedler et al. 2007; Jain et al. 2007, 2008, 2009*abcd;* Miller 2008; Stantec 2008*c*, 2009*bc*, 2010*a;* Vlietstra 2008; Arnett et al. 2009; Gruver 2009; NJ Audubon Society 2009; Tidhar 2009; Young et al. 2009; and Drake et al. 2010). Based on post-construction mortality data collected at eastern and midwestern wind facilities (Table 4-2), waterbirds have been found to represent approximately 4.7% of documented avian fatalities.

Agricultural fields and pastures may be used by breeding and migrating shorebirds, waterfowl, and other waterbirds, particularly during periods with seasonal sources of water. However, due to the limited amount of wetlands, streams, and open water habitats in the Action Area, the lack of significant breeding or stop-over habitat in the vicinity of the Project, and results of pre-construction field surveys (see Section 3.2.2 – Bird Surveys), waterbird activity in the Action Area is expected to be low (Stantec 2009a).

Sandhill cranes may occur in the Action Area during spring and fall migration but they are not expected to occur in the Adjusted Project Area during breeding season. Sandhill crane migration movements typically begin 1.5 hr to 0.5 hr after sunrise and cease from 2 hr before to 15 min after sunset. They will occasionally migrate at night (Tacha et al. 1992) and the majority of migration movement occurs, or is initiated, during clear to partly cloudy conditions. Sandhill cranes will often roost overnight in fields and wetlands during migration. Most documented sandhill crane migratory flight heights are less than 1,600 m (5,249 ft), with 75% of documented flights between 150 m and 760 m (492 ft and 2,493 ft).

There is a risk of collision mortality for sandhill cranes during migration seasons. As opposed to some passerines, sandhill cranes are diurnal migrants, so their collision risk may be lessened because collision risk has been found to be greatest for nocturnal migrants traveling during inclement weather (NRC 2007). Adverse impacts to sandhill crane are not anticipated to result from the Project, based on lack of suitable habitat within the Action Area, low numbers of sandhill crane observations during pre-construction studies, and the majority of sandhill crane migratory movements occurs during good visibility and at heights above the proposed rotor swept zone.

4.1.5 *Other Bird Species*

As detailed in the previous sections (see Section 3.2.2 – Bird Studies), during breeding bird, raptor migration, and sandhill crane surveys, the following quantities of state-listed birds were observed: 4 endangered, 7 threatened, 6 federal species of concern, and 13 species of special interest. Additionally, there were 13 avian species of conservation concern observed during pre-construction surveys conducted for the Project. Post-construction monitoring (as described in Section 6.0 – Tier Four Post-Construction Mortality Monitoring) will document fatalities of species of conservation concern. However, as described in the previous sections, the likelihood of substantial adverse impacts to state listed species is low. In the event that mortality of a state endangered or threatened species is documented, ODNR DOW will be notified and appropriate next steps will be discussed.

4.2 Bats

4.2.1 *Long-Distance Migratory Bat Species*

Long-distance migratory bat species are thought to be the most vulnerable to collision mortality at wind projects based on results of mortality surveys at operational projects (Kunz et al. 2007*b*, Arnett et al. 2008). Three species of long distance migratory bats have consistently comprised the largest proportions of fatalities at wind facilities to date: the foliage-roosting hoary bat and eastern red bat, and the cavity-roosting silver-haired bat (Kunz et al. 2007*b*, Arnett et al. 2008). All these bat species are listed as state species of concern. Collectively, these species comprised approximately 75% of documented fatalities and hoary bats made up about half of all fatalities in 2008 (Arnett et al. 2008). Silver-haired bats have been recorded more frequently at sites in western Canada, IA, WI, and the Pacific Northwest relative to the eastern United States (Arnett et al. 2008, Gruver et al. 2009). Eastern red bats have most commonly been found at wind facilities located in forested landscapes in the eastern United States, as well as in the Midwestern United States (Arnett et al. 2008). See HCP Section 4.5.5.2.1 – Species Distribution for more information.

Long-distance migratory bats captured during mist-netting surveys and/or detected during bat acoustic surveys in the Initial Project Area include all 3 species that occur in the region: silver-haired bat (<1%), hoary bat (1.0%), and eastern red bat (12.1%) (Appendix A Tables 6 through 9). However, it should be cautioned that no studies have effectively linked pre-construction acoustic activity rates with post-construction fatality rates. As there will be minimal impacts to forested habitats associated with Project construction, impacts to long-distance migratory bats would mainly consist of collision mortality and barotrauma, particularly during fall migration and periods of low wind.

Long-distance migratory bat mortality during the spring migration period has consistently been lower than mortality documented during the fall. One noted species-specific exception to this that has been documented is silver-haired bats. At Buffalo Mountain, TN, 15 of 18 silver-haired bats (83%) were found between mid-April and early-June 2005 (Fiedler et al. 2007), although this pattern was not observed in studies conducted from 2000 to 2003 at the same site. Spring mortality of silver-haired bats was also documented, though in lesser numbers, at Summerview, Alberta; 16 of 272 (6%) silver-haired bat fatalities were found in May and June. These studies suggest that spring migration may be a period of risk particularly for silver-haired bats (and not the other species of long-distance migrants [i.e., hoary bats, eastern red bats, and western red bats]) at some wind facilities.

Prior to implementing feathering and cut-in speeds, levels of mortality of long-distance migrants associated with the Project would be expected to be similar to those observed at existing facilities in similar landscape settings in the region (see HCP Section 4.5.5 – Collision Mortality at Wind Facilities for a detailed discussion on mortality of bats at wind projects). However, feathering and cut-in speeds will be used, so mortality of long-distance migrants should be substantially less (68% less based on an average of 3 curtailment studies). Based on patterns of bat activity documented during the 2008 acoustic survey, eastern red bats may experience the highest levels of mortality among the 3 species of long-distance migrants. Risk of collision or barotrauma mortality is expected to be greatest in the fall and during periods of low wind.

Other potential impacts posed by the Project to long distance migrants may include habitat loss or alteration, disturbance due to construction activities, and mortality resulting from vehicle collision. Impacts from habitat loss are expected to be minimal, as 96% of the area impacted by construction will occur in active agricultural areas, or hay/pasture habitats. During the summer reproductive period, long-distant migrant bat species in the region are closely associated with forested areas, which provide roosts, foraging opportunities, and cover from predators. A very small amount of forested area (6.5 ha (16.1 ac) or 6.8 ha [16.8 ac] for the Redesign Option) will be impacted by construction of the Project. Construction impacts anticipated for the 100-turbine Project will affect approximately 0.2% of forested habitat in the Action Area. This habitat will be cleared during the winter, when bats are not present or using these areas to avoid mortality from construction activities. Therefore, impacts to long-distance migratory bats from habitat loss associated with construction activities are expected to be minimal and temporary.

Impacts from vehicle collisions are also considered unlikely because of the timing and duration of construction activities. Construction will be temporary, as the 52 and 48 turbines phases are expected to be commissioned 12 months to 18 months after initiation of construction and will occur almost exclusively during daytime hours when bats are not active. In addition, speed limits for construction and other personnel will be posted, further reducing possible impacts. Similar characteristics will be applicable during decommissioning and vehicular traffic during operation will discountable.

4.2.2 *Cave-hibernating Bat Species*

Within the region, cave-hibernating bat species include Indiana, little brown, evening (*Nyctisceius humeralis)* northern long-eared, big brown, tri-colored, Rafinesque's big-eared (*Corynorhinus rafinesquii*), and eastern small-footed (*Myotis leibii*) bats. All of these bats are listed as state species of concern (while the Indiana bat is a federally and state listed endangered species). All cave-hibernating bat species in the region were detected during pre-construction bat surveys, except for eastern-small footed and Rafinesque's big-eared bats. Rafinesque's big-eared bat is known to occur in 1 county in southern OH and is not known to occur in west-central OH where the Project is located. The range of the eastern small-footed bat extends into southern OH, but is not known to occur in west-central OH. Therefore, these 2 species of concern are not expected to be impacted by the Project.

Suitable summer roosting and foraging habitat for cave-hibernating species that occur in the region exists in the Adjusted Project Area. Cave-hibernating species may also travel through the Adjusted Project Area during spring or fall migration. As discussed in Section 3.2.3.2 – Swarming Surveys at Hibernacula, swarming surveys at 2 caves located approximately 6.3 km (3.9 mi) north of the Adjusted Project Area resulted in the capture of 653 northern long-eared, 201 little brown, 18 tri-colored, and 12 big brown bats during 5 capture events. The Lewisburg Limestone Mine is another hibernaculum within migrating distance of the Adjusted Project Area (approximately 100 km [62.5 mi] to the southwest) where substantial numbers of cave-hibernating bats have been documented (i.e., 24,931 bats, including 9,007 Indiana bats in 2009). In 2012, it was

reported that 9,243 Indiana bats used the Lewisburg Limestone Mine for hibernaculum, though the 2012 survey did not include a census of all bat species (M. Seymour, USFWS, personal communication).

Potential impacts posed by the Project to cave-hibernating species may include habitat loss or alteration, disturbance due to construction activities, and mortality resulting from vehicle collision, turbine collision and barotrauma. Impacts from habitat loss are expected to be minimal, as 96% of the area impacted by construction will occur in active agricultural areas, or hay/pasture habitats. During the summer reproductive period, cave-hibernating bat species in the region are closely associated with forested areas, which provide roosts, foraging opportunities, and cover from predators. A very small amount of forested area (6.5 ha (16.1 ac) or 6.8 ha [16.8 ac] for the Redesign Option) will be impacted by construction of the Project. Construction impacts anticipated for the 100-turbine Project will affect approximately 0.2% of forested habitat in the Action Area. This habitat will be cleared during the winter, when bats are not present or using these areas to avoid mortality from construction activities. Additionally, there are no hibernacula within the Adjusted Project Area and therefore, no hibernaculum will be impacted by the Project. Therefore, impacts to cave-hibernating bats from habitat loss associated with construction activities are expected to be minimal and temporary.

Impacts from vehicle collisions are also considered unlikely because of the timing and duration of construction activities. Construction will be temporary, as the 52 and 48 turbines phases are expected to be commissioned 12 months to 18 months after initiation of construction and will occur almost exclusively during daytime hours when bats are not active. In addition, speed limits for construction and other personnel will be posted, further reducing possible impacts. Similar characteristics will be applicable during decommissioning and vehicular traffic during operation will discountable.

Data from post-construction studies compiled by the USFWS provide mortality rates for certain cave-hibernating species within the range of the Indiana bat (Jennifer Szymansky and Megan Seymour, USFWS, personal communication). Of 3,433 fatalities from 26 studies, only 587 (17%) were cave-hibernating species. Little brown bats accounted for 225 (38%) of the cave-hibernating fatalities. Within the Midwest, 145 (7%) of 2,046 fatalities were cave-hibernating of which 37% were little brown bats. Thus, it is expected that mortality from turbine collision and barotrauma will be significantly less for cave-hibernating species than migratory species. Furthermore, implementing the feathering and cut-in speed regime outlined in the HCP should further reduce mortality of these species.

While the majority of the documented fatalities at existing wind facilities have involved long-distance migratory bat species (Arnett et al. 2007), the relative significance of impacts to cave-hibernating species could increase over time if populations of these species are substantially reduced due to white-nose syndrome (WNS), described in the following section. For additional information of potential future listing of cave-hibernating bats see the HCP Section 7.2.1.1.

4.2.2.1 *White-Nose Syndrome*

WNS is a condition that is responsible for millions of bat fatalities in the eastern United States from 2006 to 2010 (United States Geological Survey [USGS] 2010). An estimated 5.7 million to 6.7 million bat fatalities have occurred since WNS was first recorded in 2007 (USFWS 2012). Recent studies have discovered that WNS is associated with a newly-described psychrophilic (cold-loving) fungus (*Geomyces destructans*) that grows on exposed tissues (i.e., noses, faces, ears, and/or wing membranes) of the majority of affected bats. The skin infection caused by *G. destructans* is thought to act as a chronic disturbance during hibernation. Infected bats exhibit premature arousals, aberrant behavior, and premature loss of critical fat reserves (Frick et al. 2010).

Although it is not certain whether *G. destructans* is the primary cause of death or a secondary infection (Blehert et al. 2009), the fungus is directly associated with bat mortality (Puechmaille et al. 2010) and is widely considered to be the causal agent of WNS (USGS 2010).

WNS was first documented in bats in Schoharie County, NY, and mortality was confirmed at 4 sites in eastern NY in winter 2006-2007. WNS continued to spread and by the end of winter 2008-2009, all known WNS-affected hibernacula were in states located within USFWS Region 5 (R5; the Northeast Region). However, by March 2010, the presence of *G. destructans* had been confirmed or suspected within the following 15 states in USFWS Regions R2 (Southwest), R3 (Midwest), R4 (Southeast), and R5: CT, DE, MA, MD, MO, NH, NJ, NY, OK, PA, RI, TN, VA, VT, and WV. WNS was confirmed in one hibernaculum in southern OH, as well as sites in IN, KY, NC and ME during winter 2010-2011. Winter 2011-2012 hibernacula surveys resulted in six counties in OH that tested positive for WNS (Preble, Lawrence, Cuyahoga, Portage, Summit, and Geauga). The origin of WNS remains uncertain, although anthropogenic introduction of the disease, via commerce or travel from Europe, is a plausible hypothesis (Frick et al. 2010).

In Canada, WNS was documented in southern Ontario and Quebec in 2010 (Ontario Ministry of Natural Resources [OMNR] 2010). In Europe, WNS has been detected in southwestern France (Puechmaille et al. 2010), Switzerland, Hungary, and Germany (Wibbelt et al. 2010). However, no mass casualties have been detected among infected bats in Europe (Puechmaille et al. 2010, Wibbelt et al. 2010). Wibbelt et al. (2010) hypothesize *G. destructans* is present throughout Europe and European bats may be more immunologically or behaviorally resistant to *G. destructans* than their North American congeners because they potentially coevolved with the fungus.

WNS is causing unprecedented mortality among at least 6 cave-hibernating species in North America (Frick et al. 2010): Indiana bat, eastern small-footed bat, little brown bat, northern long-eared bat, tricolored bat, and big brown bat (USGS 2010). Other affected species include the cave Myotis (*Myotis velifer*) and gray bat (*Myotis grisescens)*. The 25 bats species of North American that rely on winter hibernacula may potentially be affected by WNS (USGS 2010). Infected hibernacula are experiencing annual population decreases ranging from 30% to 99%, with a mean of 73% throughout eastern North America (Frick et al. 2010). Total mortality averaged 95% at closely monitored WNS hibernaculum that had multiple years of infection in NY, MA, and VT in 2009 (A. Hicks, New York State Department of Environmental Conservation, personal communication, as cited by Turner and Reeder 2009).

While it had been estimated that WNS is spreading at a rate of 24.1 km (15 mi) to 32.2 km (20 mi) per year (Turner and Reeder 2009), the recent documentation of WNS across large and disjunctive geographic areas indicates that the spread is more rapid and far-reaching than originally thought. The mechanisms for persistence and transmission of the fungus during summer and fall months are currently unknown, but the spread of the fungus to new geographic regions and between species may result from social and spatial mixing of individuals across space and time, particularly at winter hibernacula (Frick et al. 2010). Laboratory experiments have observed bat-to-bat transmission of *G. destructans*. Additionally, the fungus has been collected from soils of affected hibernacula, indicating that environmental factors may play a role in WNS transmission (BCI 2010b).

Avoidance and minimization measures implemented to reduce impacts to Indiana bats, as described in the HCP, are expected to also substantially reduce mortality of cave-hibernating species. Mitigation and conservation measures, as outlined in HCP Chapter 6.0 – Conservation Program, that will be implemented as part of the HCP are also expected to offset potential take and enhance the reproductive potential and survival of species that share hibernacula, summer

foraging, and roosting areas with the Indiana bat, including the northern long-eared and little brown bat. Additionally, conservation measures implemented under the HCP, including research on bat-wind interactions or deterrent techniques, may increase the effectiveness of avoidance and minimization measures and decrease risk to long-distance migrant and cave-hibernating bat species over time.

4.2.3 Potential Listing of New Species Under the ESA

Although not yet quantified, other bat species are experiencing similar mortality from WNS and may also be at risk of population collapse, most notably northern long-eared bats, eastern small-footed bats, and Indiana bats (USGS 2010). The Center for Biological Diversity (CBD) recently petitioned the United States Secretary of the Interior to list the eastern small-footed bat and northern long-eared bat as threatened or endangered species under the ESA and to designate critical habitat for these species concurrent with listing (CBD 2010; filed 21 January 2010). On 29 June 2011, the USFWS announced that the eastern small-footed and northern long-eared bats may warrant Federal protection as threatened or endangered under the ESA pursuant to 16 U.S.C. § 1533(b)(3)(B) (76 Fed. Reg. 38095-38106). The USFWS has thus initiated a more thorough status review of these species. Further, a status assessment of the little brown bat (*M. lucifugus*) is being completed to determine if threats to the species warrant listing. The USFWS is also collecting information on additional species susceptible to WNS (USFWS 2011b).

The CBD petition states that the eastern small-footed bat and the northern long-eared bat are threatened by 4 of 5 factors identified by the ESA to warrant listing: the loss and curtailment of their habitat or range; disease (i.e., WNS); numerous natural and anthropogenic factors (e.g., environmental contaminants, climate change, wind energy development); and inadequacy of existing regulatory mechanisms. Although many bat species in the eastern United States are experiencing threats discussed above, the CBD petition (2010) argues that the life histories, habitat associations, and current population statuses of the eastern small-footed bat and northern long-eared bat make these species especially vulnerable to severe population declines and local extinctions. These 2 species were added to the USFWS Region 3 federal list of Species of Concern, an informal term indicating species that Region 3 feels might be in need of conservation activities and are listed as Species of Concern by ODNR DOW.

The range of the eastern small-footed bat does overlap the Action Area, however no suitable habitat exists within the Action Area and therefore potential future declines of this species would not have direct relevance to ongoing management of the Project. However, northern long-eared bats occur in the Adjusted Project Area and were captured during pre-construction mist-netting surveys (38 bats or 13% of all species captured) and during swarming surveys (653 bats or 74% of all species captured). During the swarming surveys bats were marked with a temporary white paint on their wings to identify bats that were captured in traps or nets more than once (recaptures). Twenty-four bats (3%) were recaptures from previous surveys or from an earlier time during the same survey night. Northern long-eared bat fatalities have been recorded at wind energy facilities, but generally constitute a small fraction of overall bat fatalities; from 1996 to 2006, 8 northern long-eared bat fatalities were reported nationwide (Arnett et al. 2008). However, this number represents observed fatality only and does not include bias correction estimates for searcher efficiency and carcass persistence.

Due to WNS or other factors, the conservation status of non-federally listed cave-hibernating bat species may change over the life of the Project. In the event that the USFWS determines that the listing of the northern long-eared bat, little brown bat and/or other bat or bird species is warranted under 16 U.S.C § 1533(b)(3)(B)(ii) or (5)(A)(i), Buckeye Wind, in coordination with the USFWS, will evaluate the potential for the Project to result in incidental take of those species. The

same coordination will occur for any other species for which the Service determines listing is warranted under 16 U.S.C § 1533(b)(3)(B)(ii) or (5)(A)(i), either through a petition action or through a status assessment absent a petition action, that is expected to occur within the Action Area. The evaluation will consider the known occurrence of the species and habitat within the Action Area and results of post-construction mortality monitoring in the Action Area and at other wind facilities. As previously stated, the avoidance, minimization, mitigation, and conservation measures that will be implemented for the Indiana bat as part of this HCP will result in similar minimization of impacts and benefits to the other bats that share similar life history characteristics, roosting and foraging behavior, and habitat with the Indiana bat. If incidental take is deemed to be likely, the ITP will be amended or other avenues for take coverage will be explored. In the case that the northern long-eared bat or little brown bat is listed before an amendment is obtained, Buckeye Wind will take the appropriate actions pursuant to the ESA to avoid take.

5.0 AVOIDANCE AND MINIMIZATION MEASURES

Buckeye Wind will implement measures to avoid and minimize impacts to birds and bats in the design, construction, operation, and decommissioning phases of the Project, presented in the following sections.

5.1 Project Siting and Design

The Tier III surveys support the initial assessment that the Project presents a relatively low risk for most species, except for the detection of the federally and state endangered Indiana bat (which was not documented in the Adjusted Project Area during Tier III studies conducted for the Project, but was documented in conjunction with a different proposed development project that overlapped the Adjusted Project Area). The impacts of bat mortality at wind projects throughout the eastern and Midwestern United States is still being assessed. The Project is not expected to have a greater impact to bats than other projects in the Midwest, and the minimization measures implemented as part of this ABPP and the HCP are expected to significantly decrease bat mortality. Prudent avoidance and minimization measures have been incorporated into this ABPP and will be incorporated into actual Project siting and design in order to minimize risk to bird and bat species. The following general conclusions can be made regarding risk to avian and bat species and their habitat, as documented during Tier III studies:

- Land in the Action Area is highly fragmented due to previous and ongoing agricultural practices and agricultural land comprises over 90% of the Action Area. In general, agricultural land provides marginal quality and highly fragmented habitat for most bird and bat species.
- Pre-construction studies and results of other post-construction mortality surveys indicate the Project, in general, is not expected to result in substantial risks to bird species, their breeding or migratory areas, or other important habitats.
- Pre-construction studies and results of other post-construction mortality surveys indicate that the Project, in general and prior to implementing feathering to protect Indiana bats, would be expected to result in mortality rates to bird and bat species similar to those observed for other similarly situated wind projects. Because of the minimal clearing of wooded areas, impacts to bat breeding or foraging habitat, or other important habitats, will be minimal.

As such, the conversion of land proposed for wind turbine development will not result in substantial impacts to bird and bat habitat, and those impacts that may occur will be minimized to the greatest extent practical. In order to minimize impacts to wildlife, Buckeye Wind has incorporated the following avoidance and minimization measures into siting decisions for the 52 turbines and associated infrastructure currently known and planned for construction. In addition, Buckeye Wind will incorporate the following measures and any newly available monitoring information into siting and design decisions for the additional 48 turbines and associated infrastructure.

1. Project siting will avoid and/or minimize impacts to habitat used by forest-dwelling birds and bats to the maximum extent practicable;
    a. Over 90% of total disturbed area will occur in previously disturbed areas, mainly consisting of cultivated crop;
    b. 0.2% of the 2,743.5 ha (6,779.4 ac) of forested habitat available in the Action Area will be cleared for construction; no more than 6.4 ha (15.8 ac) of deciduous

forest habitat will be cleared for the 100-turbine facility (6.7 ha [16.5 ac] for the Redesign Option).

c. Project siting will avoid development in large contiguous tracts of deciduous forested habitat; tree removal will occur at the edges of relatively small forest blocks, hedgerows, or woodlots; minimizing fragmentation and reduction of forest patch size.
d. Project siting will avoid forested stream crossings to the maximum extent practicable.
e. Project siting will avoid wetland habitats.
f. Turbines and components for the entire 100-turbine Project will be contained within a portion of the Action Area that further excludes potential impacts to wooded areas and other resources (the Adjusted Project Area; see Section1.0 – Introduction)

2. Project siting will minimize impacts to habitat used by grassland birds to the maximum extent practicable;
    a. Siting turbines largely in agricultural fields is likely to minimize impacts to grassland bird species.
    b. For the full 100-turbine layout, a maximum of 11.3 ha (27.9 ac) of CRP land (12.4 ha [30.4 ac] in the Redesign Option) will be permanently or temporarily disturbed, or 0.9% of the 1,252.9 ha (3,096.1 ac) of land currently in CRP in the 6 townships included in the Action Area.

3. Creation of new roads will be minimized to the maximum extent practicable;
    a. Existing roads or farm lanes will be utilized to the extent practical.
    b. No more than 64.4 km (40.0 mi) of new service roads will be created to connect wind turbines (for the 100-turbine facility) to existing access roads.
    c. The permanent footprint of new access roads will be kept to a minimum width (6.1 m [20 ft]) in an effort to minimize disturbance to surrounding cropland or other vegetation.

4. Tower design will minimize opportunities for bird perching;
    a. Tubular tower supports rather than lattice supports are incorporated into the Project design to minimize bird perching and nesting opportunities.
    b. Internal ladders and platforms on tubular towers are part of the Project design to minimize perching and nesting of birds.

5. Underground transmission lines have been incorporated into the Project design to the extent practical, minimizing potential for avian and bat collisions and electrocutions;
    a. 56.8 km (35.3 mi) of the 34.5 kV interconnects will be above ground (on rebuilt distribution poles in public road right-of-ways) and 56.7 km (35.2 mi) buried underground for the 100-turbine facility.
        - In the Redesign Option, 86.5 km (53.7 mi) of interconnection lines will be built underground, with 9.0 km (5.6 mi) installed overhead.
    b. Power lines, if not underground, will be equipped with insulated and shielded wire to avoid electrocution of birds and bats.
    c. Placement of transmission lines will avoid impacts to wetlands.
    d. APLIC (2006) guidelines will be followed for the siting of above ground lines, where possible and as dictated by DPL construction guidelines[9].

[9] While Buckeye Wind would own the wires carry electricity from the turbines, the above ground collection lines, including distribution poles, will be owned and maintained by DPL and subject to

e. New distribution poles will be fitted with bird perch deterrents, where possible and as dictated by DPL construction guidelines.

6. Operational lighting will be minimized to the maximum extent practicable;
   a. Unnecessary lighting on the operations and maintenance building and substation at night will be eliminated to reduce attraction of birds and bats.
   b. No steady burning lights will be left on at the facility buildings or turbines unless necessary for safety or security; in such cases, the lights will be shielded downward and utilize motion detectors, infrared light sensors or "auto-off" switches that will automatically be extinguished after 2 hours to avoid continuous lighting.

7. Federal Aviation Administration (FAA) lighting will be minimized to the maximum extent practicable;
   a. Attached to the top of some of the nacelles, per specifications of the FAA, will be a single, medium intensity aviation warning light.
   b. The minimum amount of pilot warning and obstruction avoidance lighting specified by the FAA will be used (FAA 2007); approximately 1 in every 5 turbines will be lit, and all lights within the facility will illuminate synchronously.
   c. FAA lights are anticipated to be flashing red strobes (L-864) that operate only at night. Buckeye Wind will use the lowest intensity lighting as allowed by FAA.
   d. To the extent possible, USFWS recommended lighting schemes will be used on the nacelles, including reduced intensity lighting and lights with short flash durations that emit no light during the "off phase".
   e. MET towers will also utilize the minimum lighting as required by the FAA.

8. MET tower design will minimize opportunities for avian collision;
   a. Guy lines on new MET towers will be equipped with recommended bird deterrent devices in accordance with the APLIC (2006) guidelines.
   b. Permanent MET towers will be non-guyed.

5.2 Construction and Maintenance

The following construction phase measures have been incorporated into the ABPP to avoid construction activities in the vicinity of sensitive habitats during critical periods in bird and bat life cycles, and to minimize impacts to wildlife habitat and resources.

1. Tree clearing activities will minimize impacts to bats and birds;
   a. Tree clearing will be conducted between 1 November and 31 March during the non-active period for bats and the non-breeding season for many species of migratory birds.
      i. Timing of tree removal will avoid mortality of roosting bats and their young in the event that maternity roost trees are felled.
      ii. Timing of tree removal will avoid mortality of breeding birds and their young that nest in trees.
   b. Any potential Indiana bat roost trees, including bat maternity roost trees, which are observed within the clearing zone will be flagged prior to clearing and during

DPL construction guidelines. While it is likely that DPL will utilize APLIC guidelines, or similar, and Buckeye Wind will encourage the use of APLIC guidelines, it is not possible for Buckeye to commit to such measures. In the Redesign Option, above ground collection lines will not be used, except for in very limited circumstances.

construction, and all practical efforts will be made to avoid impacts to potential roost trees.

c. Prior to any tree removal, the limits of proposed clearing will be clearly demarcated with orange construction fencing, flags or similar markers to prevent inadvertent over-clearing of the site.
d. A natural resource specialist, approved by ODNR DOW and USFWS, who is familiar with bird and bats habitat requirements, will be present when construction is being performed in or near sensitive wildlife areas to help ensure the appropriate resources are protected.

2. Clearing and construction practices will reduce soil disturbance and allow for the reestablishment of natural vegetation;
    a. Where possible, vegetation will be cleared without grubbing or removal of stumps or tree roots.
    b. All construction equipment will be restricted to designated travel areas to minimize ground disturbance.
    c. Construction clearings, storage yards, staging areas, or temporary roads not needed for long-term operation of the Project will be allowed to revegetate after commissioning of the Project.
    d. If turbines require substantial maintenance involving large cranes or other heavy equipment, the same measures used during construction to limit clearing of vegetation and disturbance of soil will be used.
    e. Initial clearing of CRP land will be conducted before 1 March and after 15 July to avoid disturbance during nesting periods.
    f. Areas where mowing will be conducted for post-construction monitoring will be cleared and mowed prior to 1 March, if needed. Regular mowing will occur to prevent establishment of habitat suitable for nesting activities throughout the breeding season.

3. Best management practices will be used to avoid the introduction and spread of invasive species;
    a. Construction vehicles and equipment that arrive from other areas will be regularly cleaned.
    b. Non-agricultural areas will be re-seeded and stabilized using native seed, to the extent possible pending seed availability and landowner preferences, following construction in an effort to preserve natural habitat to the extent possible. Re-seeding will be consistent with state permit requirements to avoid the introduction of invasive plant species.

4. Best Management Practices for construction activities will minimize degradation of water quality from storm water runoff and sediment from construction;
    a. A plan note will be incorporated into the construction contract requiring that contractors adhere to all provisions of National Pollutant Discharge Elimination System permits and the Storm Water Pollution and Prevention Plan.
    b. Federal and state measures will be adhered to for handling toxic substances to minimize danger to water and wildlife resources from spills.
    a. The Project was designed to avoid stream crossings whenever possible. Due to the nature of this type of project, there is some flexibility in selecting turbine locations and, more so, access road and electric collection line locations. As such, great care was taken to design Project facilities to avoid tree clearing and in-water work associated with stream crossings to the maximum extent practicable. See HCP Section 5.2.1.2 – Impacts to Aquatic Habitats).

b. Horizontal directional boring for collection lines will be used to avoid impacts to all perennial streams.
c. Only streams that are not designated Coldwater Habitat or Exceptional Warmwater Habitat[10] will be impacted. A Nationwide permit will be secured for each stream crossing involving in-water work.

5. Maintenance activities will help to avoid the creation of foraging opportunities for raptors and/or scavengers, or availability of materials that could be harmful to birds;
    a. Rock and brush piles that could create habitat for raptor prey will be removed from turbine areas.
    b. Any observed road-kill or other dead animals that may attract scavenging raptors such as vultures or eagles will be cleared from within turbine areas, and access roads;
        i. To avoid disruption of the post-construction monitoring, no dead animals will be removed from within the monitoring transects that overlap turbine areas and access roads.
    c. Food waste littering by construction/maintenance staff will be prohibited;
    d. Garbage containers for disposal of packing material during construction will have covers, as such debris (i.e., Styrofoam) is prone to wind blowing and can be harmful to birds.

6. Maintenance of overhead utilities will minimize impacts to birds;
    a. Buckeye Wind will follow APLIC (2006) guidelines for overhead utilities maintenance, where possible and as dictated by DPL construction guidelines[11].

7. Fire potential will be minimized;
    a. Spark arrestors will be used on all electrical equipment;
    b. Smoking will be restricted to designated areas on site.

[10] According to Ohio Revised Code, Exceptional Warmwater Habitat streams are capable of maintaining an exceptional or unusual community of warmwater aquatic organisms with the general characteristics of being highly intolerant of adverse water quality conditions and/or being rare, threatened, endangered or species of special status. This is the most protective use designation assigned to warmwater rivers and streams in OH. A Coldwater Habitat stream is capable of supporting populations of coldwater aquatic organisms on an annual basis and/or put-and-take salmonid fishing. These water bodies are not necessarily capable of supporting the successful reproduction of salmonids and may be periodically stocked with these species. Both are afforded special protections under OH's CWA provisions.

[11] While Buckeye Wind would own the wires carry electricity from the turbines, the above ground collection lines, including distribution poles, will be owned and maintained by DPL and subject to DPL construction guidelines. While it is likely that DPL will utilize APLIC guidelines, or similar, and Buckeye Wind will encourage the use of APLIC guidelines, it is not possible for Buckeye to commit to such measures. In the Redesign Option, above ground collection lines will not be used, except for in very limited circumstances (see Section 1.1 – Overview and Purpose of the HCP).

5.3 Operation

As described in Section 4.0 – Avian and Bat Concerns, significant effects to non-federally listed bats and birds due to forested habitat removal, disturbance from construction activities, noise from operating turbines are unlikely. No disturbance to lands, streams, and wetlands beyond that which is necessary for Project construction will occur. Many areas impacted by construction will be restored after construction. The following actions will be taken to minimize adverse effects to non-federally listed bats and birds from operations activities for the 100-turbine Project:

a. Minimal FAA lighting will be utilized.
b. Any ground-based lighting at the turbines or substation necessary for safety or security will be controlled by motion detectors or infrared sensors.
c. Any scheduled tree trimming for maintenance and safety will be conducted between 31 October and 31 March. Only trees that are either live or fallen will be cleared or trimmed during the active period.
d. Access roads built for the Project will be posted with a 25 mile per hour speed limit to minimize risk of collision with Indiana bats and other wildlife.

Operational restrictions described in the Project HCP will be employed to minimize the impacts to Indiana bats. These operational restrictions will also avoid and minimize potential impacts to non-federally listed bats and bird.

Operational restrictions will dictate that turbines are feathered (i.e., not spinning) until a designated cut-in speed is reached. This cut-in speed is generally higher than the wind speed at which the turbine is technically able to begin spinning and producing power. A number of studies have now shown that increased cut-in speeds can be expected to reduce mortality of bats (see Table 5-1). It is expected that the overall reduction in mortalities from feathering that has been observed at other sites will be realized at the Project.

Three studies that evaluated the effects of increasing turbine cut-in speed on bat fatalities (PA [Arnett et al. 2010], Alberta [Baerwald et al. 2009], and IN [Good et al. 2011]) found that reductions between 38% and 93% (median of 68.3% across all studies) were achieved by curtailing or feathering turbine operations at wind speeds of 5.0 m/s and 6.5 m/s (Table 5-1). Although site-specific factors such as turbine model, local weather patterns, and bat populations may affect the relative effectiveness of operational adjustments at different wind facilities, the finding that similar reductions in bat mortality were achieved in areas as geographically diverse as PA, Alberta, and IN holds promising support for broad application of curtailing or feathering as a minimization technique.

Results from post-construction mortality monitoring suggest non-operating turbines pose little to no risk to bats; of 44 wind turbines studied at the Mountaineer facility, the only turbine with no reported fatalities was non-operational during the study period (Kerns et al. 2005). Although no studies to date have empirically tested the effectiveness of feathering for birds, Manville (2009) suggested that turbine feathering can benefit both birds and bats when risk of collision is high[12].

[12] As discussed in Section 4.1 – Birds, the risk of bird collisions at the Project are not high.

Table 5-1. Observed range in reductions in bat fatalities and median values for 4 operational effectiveness studies. Turbines were feathered at Casselman and in Southwest Alberta, and curtailed at Fowler Ridge.

Study	Observed fatality reduction[a]			Source
	Min	Max	Average	
Casselman 2008[b]	52.0%	93.0%	82.0%	Arnett et al. 2010
Casselman 2009[b]	44.0%	86.0%	72.0%	Arnett et al. 2010
Fowler Ridge 2010[c]	38.0%	85.0%	64.5%[d]	Good et al. 2011
Southwest Alberta[e]	NA	NA	60.0%	Baerwald et al. 2009
Median fatality reduction	44.0%	86.0%	68.3%	

[a]All studies used a combination of cut-in speeds of 5.0 m/s to 6.5 m/s except Baerwald et al. 2009, which used 5.5 m/s
[b]Based on a 95% confidence interval
[c]Based on a 90% confidence interval
[d]Based on the median of the reported average reductions from each treatment (5.0 m/s = 50%; 6.5 m/s = 79%)
[e]Study did not provide confidence intervals for appropriate min and max comparison to other studies

Turbine feathering during the active season for Indiana bats (1 Apr through 31 Oct) will be implemented as a condition of the Buckeye HCP to minimize take of Indiana bats to the maximum extent practicable; feathering will also minimize collision-related mortality for non-listed bat and possibly bird species (although minimization affects for bird species has not been established). Feathering will be applied to all turbines as detailed in the HCP Section 6.2.3 – Feathering Plan Phases, with the highest cut-in speed applied to turbines located in areas expected to present the greatest risk; those located in areas with high quality Indiana bat foraging and roosting habitat; and during seasons of high or uncertain risk, such as fall and summer, respectively. Adaptive management will be used to implement changes to cut-in speeds over time, as appropriate, and as new information on impacts to Indiana bats and other bats and birds becomes available through ongoing mortality monitoring and from other studies or sources (see Section 7.0 – Adaptive Management and HCP Section 6.5.3 – Adaptive Management for Minimization).

5.4 Decommissioning

Once the Project has reached the end of its operational life, and if the appropriate permits and permissions for repower are not secured, decommissioning will target restoration of the baseline ecosystem to the extent practicable and will be completed in coordination with appropriate regulatory agencies. Buckeye Wind will comply with the recommendations and conditions from the FAC Recommendations and/or the OPSB CECPN, as required:

1. Decommissioning activities will avoid additional site disturbances and removal of native vegetation to the extent possible.
2. Foundations will be removed to a depth of 91 cm (3 ft) below the surrounding grade and covered with soil to allow for reestablishment of native plants or crops and to prevent subsurface structures from substantially disrupting ground water movements.
3. If topsoil is removed during decommissioning, it will be stockpiled and used as topsoil for replanting. Once decommissioning activities are complete, topsoil will be restored, reseeded, and stabilized. Re-seeding with native species will be consistent with state permit requirements to avoid the introduction and spread of invasive plant species.

4. Surface water flows will be restored to baseline conditions, including removal of stream crossings, roads, and turbine pads, consistent with storm water management objectives and requirements.
5. Overhead pole lines that are no longer needed will be removed.
6. Erosion control measures will be implemented in all disturbance areas where potential for erosion exists, consistent with storm water management objectives and requirements.
7. Any fencing erected for the Project will be removed unless in use by the landowner.
8. Petroleum or chemical soil contamination will be remediated prior to completion of decommissioning.

6.0 TIER FOUR POST-CONSTRUCTION MORTALITY MONITORING

Post-construction mortality monitoring will be conducted to meet the requirements of the HCP and will follow the ODNR Standardized Protocol or as agreed with the ODNR DOW to accommodate project-specific characteristics. The goals of post-construction monitoring specific to the Indiana bat are described in the HCP. As described in the WEVCA, the goals of post-construction monitoring include:

- Determine if project operations are causing an unacceptable level of impact so that additional minimization or mitigation can be employed if needed; and
- Assess predictive value of pre-construction monitoring, minimization, and avoidance measures by comparing those results with post-construction mortality.

Monitoring will be conducted to detect mortality of Indiana bats for the ITP term (i.e., 30 years); these monitoring efforts for Indiana bats will also document annual bird and other non-federally listed bat mortality and provide substantial information that will help the ODNR DOW, the USFWS, and the wind industry in general to better understand wind and wildlife interaction. Post-construction monitoring methods, analysis, and reporting are summarized below.

Buckeye Wind will enlist the services an independent consultant to conduct mortality monitoring. Buckeye Wind will select the consultant based on qualifications, experience and costs and will receive a scope of work proposal from the selected consultant that provides detailed information on consultant's qualifications. The scope will include detail on adequate implementation of the monitoring methods described in this Section 6.0 – Tier Four Post-Construction Mortality Monitoring. A qualified project manager (PCM Manager) and field technicians will be assigned to oversee the day-to-day monitoring efforts. Before awarding a contract, Buckeye Wind will provide the proposal to the FWS and ODNR DOW for approval.

If Buckeye Wind decides to change the consultant at any point during the Project life, the same process for selection and FWS and ODNR DOW approval will be followed.

6.1 Monitoring Phases

Post-construction mortality monitoring for Indiana bat mortality will be conducted within 3 phases: the Evaluation Phase, Implementation Phase, and Re-evaluation Phase. Monitoring will be most intensive during the first years of Project operation, during the Evaluation Phase. It is expected that the Evaluation Phase will provide sufficient information to meet the specific goals of the ODNR Protocol and of the HCP. The Evaluation Phase will last for a minimum of 2 years.

The Evaluation Phase will help demonstrate that impacts to non-federally listed bats or birds do not exceed Mortality Thresholds (see Section 7.1 – Calculation of Threshold Levels). If at any point during other monitoring phases, mortality of non-federally listed bats or birds exceeds the Mortality Thresholds, Buckeye Wind will work with the ODNR DOW to determine if any additional measures are appropriate.

6.2 Survey Period

Initial monitoring efforts will involve mortality searches conducted for approximately 32 consecutive weeks within 3 seasonal periods that correspond to unique seasonal behaviors of Indiana bats: spring (1 Apr to 31 May), summer (1 Jun to 31 Jul), and fall (1 Aug to 15 Nov). After

two years of study, if no Indiana bat mortality is documented at the site after 31 October, and if equal to or less than 5% of all documented *Myotis* mortality occurs after 31 October, the monitoring period will be shortened to end on October 31. If operation begins after 1 April, monitoring will proceed at the beginning of operation and continue for the remainder of the active period.

6.3 Sample Size and Search Frequency

Searches will be conducting using a 3-day search interval for every turbine. Under a 3-day search interval, mortality searches will occur every day of the week throughout the survey period, with approximately one third of the turbines searched every day (i.e., turbines searched on Monday would have 3 nights of potential mortality and would then be searched again on Thursday). By using a 3-day search frequency and searching every turbine, there is a positive probability of detecting an Indiana bat fatality if it occurs; whereas, if only a subset of turbines is searched, the probability of detecting an Indiana bat at the non-searched turbines is necessarily zero. The former method is therefore preferable when the goal of monitoring is to detect a rare event, such as an Indiana bat fatality (M. Huso, Oregon State University, personal communication).

In order to balance the objective of assessing Indiana bat mortality at all turbines while also providing the ODNR DOW with annual data that is more closely compatible with current ODNR Protocol (ODNR 2009), during the first 1 to 2 years of monitoring, a portion of the turbines will be searched using a 1-day search interval.

The first 1 – 2 years of monitoring will involve searches at 20% of the turbines with a 1-day search interval and the remaining 80% of turbines on a 3-day search interval. In total, 46.7% of the turbines will be searched on any given day (or a 3 day cycle of 46, 47 and 47 turbines searched each day if 100 turbines are in operation). This combination of search intervals is designed to meet the data needs of the ODNR DOW while also meeting the objectives of the HCP. ODNR DOW will re-evaluate the combined search intervals after the first year of monitoring and determine what percent of the turbines, if any, would still need to be searched using a 1-day search interval.

Mortality searches will also be conducted at all MET towers in the Action Area during the first year of Project operation, as recommended in the ODNR Protocol. Depending on the results of the first year of monitoring, Buckeye Wind and ODNR DOW will determine if monitoring at MET towers during the optional second year of post-construction monitoring may be waived, reduced or continued. Since MET towers are not expected to pose risks to Indiana bats (See HCP Section 4.5.5.6 – Bat Collisions with Other Structure), monitoring will not continue past the first or second year after erection.

Searches will be initiated at sunrise and end by 1:00 PM in an effort to recover carcasses before removal by diurnal scavengers, as well as to increase the chances of recovering live Indiana bats (coincidentally, chances of recovering live birds and non-federally listed bats will also be increased).

6.4 Search Area

Plot size will include an area that extends 2.0 times the blade length from the base of the turbine (i.e., radius of 100 m (328 ft) for a 50 m [164 ft] blade). After 2 years of study, the search area will be adjusted to the distance within which 90% of the total bat carcasses and 100% of Indiana bat carcasses were found, not to exceed the size of the original search area. In this way, any reduction in search area will include the maximum distance that any Indiana bat carcass was

found from a turbine. If the search area is reduced during Evaluation Phase monitoring, the reduced area will be utilized for any Re-evaluation Phase monitoring that may occur.

Search transects will be positioned north-to-south and will be spaced 5 m (16 ft) apart across search plots. In an attempt to standardize time spent searching each turbine, carcasses will be marked in the field when they are found, and will be processed after the turbine search is complete.

The entire plot size will be searched, subject to a measurable probability of finding carcasses and worker safety. In many cases, the full plot size at each turbine cannot be completely searched because of factors that make areas within the plot too difficult or too dangerous to search (Strickland et al. 2011, USFWS 2011c). Areas will be considered too difficult to search if there is little to no bare ground cover and more than 25% of the ground cover is over 12 inches in height. The PCM Manager will determine what areas and conditions present environments too dangerous to search.

Wind facilities located largely in agricultural settings, such as the Project, can present difficult searching conditions (e.g., 3 m [10 ft] tall corn). Pesticide use in agricultural settings can make conditions unsafe for workers for short periods of time after pesticide application. ODNR Protocol (2009) states that transects should not venture into hazardous areas such as steep slopes or water. Further, vegetative conditions such as tall corn can make searching difficult. In conditions of tall corn, the probability of finding a carcass along the transect line itself will be similar to the probability found in other vegetative cover; however, the probability of finding a carcass off the transect line will be close to 0. Searcher efficiency trials (see Section 6.7.1 – Searcher Efficiency Trials) are designed to adjust observed mortality by the probability that a searcher will find a carcass, given it is present. However, these trials are conducted under the assumption that a searcher is walking a transect line and searching several meters off each side of the line, which cannot be done in extremely low visibility such as tall corn. If the probability of detecting a carcass is un-measureable or extremely low given current searcher efficiency methods, searching these areas will likely bias mortality estimates.

ODNR Protocol (2009) requires that an estimate of searchable area be provided for each searched turbine. Most post-construction mortality monitoring uses an area correction factor to adjust mortality estimates by the amount of area searched beneath turbines (for example, see Kerns et al. 2005, Arnett et al. 2009, and Strickland et al. 2011). A simple adjustment by the proportion of areas searched below turbines cannot be used, as density of carcasses is known to decrease as distance from turbine increases (Kerns et al. 2005) – unsearched areas tend to be farthest from turbines in areas of low carcass density, so a simple adjustment based on proportion of area searched would over-estimate mortality (Arnett et al. 2009). Therefore, a function is used to relate density of observed carcasses with distance from the turbine. Within each standardized search plot, searches will therefore be focused within areas where probability of detection is measurable and search areas will be delineated by the area around each turbine that is clear of dense crops, shrubs, forested habitat, open water, large rock or rubble, or conditions that otherwise prohibit effective or safe searching conditions. For these reasons, searchable area may vary by turbine and month

6.4.1 *Vegetation Management and Mapping*

Because vegetation influences carcass detectability, 25% of turbines' search plots (i.e., 13 for the 52-turbine Project and 25 for the 100-turbine Project) will be regularly mowed or chemically treated to remove vegetation. The 20% of turbines that will be searched on a 1- day search interval will be included within the 25% of turbine search plots that will be mowed. For those turbines where mowing will be utilized, vegetation will be maintained at a height of 4 inches or

less, with less than 2% of interspersed vegetation no higher than 12 inches. Should mowing be used, Buckeye Wind will ensure scheduled mowing occurs during the day in which the turbine was searched, and after the search is completed, to avoid carcasses being destroyed by mowing. Should other acceptable means to maintain searcher efficiency become available during the ITP Term, Buckeye Wind may change its methods (See HCP Section 7.2.1.9 – Use of New Methods, Information, or Technological Advances).

Vegetation in all search plots will be monitored on a weekly basis by a Buckeye Wind employee or contractor hired by Buckeye Wind; the aerial extent of each ground cover type and respective vegetation heights will be recorded. Any significant changes in ground cover type will be noted (e.g., plowing, mowing, harvesting). Once during each of the seasonal periods in which searches are conducted, the aerial extent of each cover type within search plots will be mapped using a global positioning system (GPS) unit. Vegetation height and percent cover will be recorded at 10 m (33 ft) distances along each transect of the search plot. Additional GPS points will be taken at points of abrupt ground cover transition and to document conditions that cause the searchable area to be reduced (e.g., forest edge). All records and documentation will be kept on file and/or in electronic format and may be provided to USFWS on request. See Section 6.7.1 – Searcher Efficiency Trials and Section 6.7.2 – Carcass Persistence Trials for information on how ground cover will be used as a factor to estimate unobserved mortality.

6.5 Weather Monitoring

On nights preceding mortality searches, general weather conditions in the vicinity of the Project (i.e., precipitation, cloud type, cloud height, percent cloud cover, and moon phase) and notable weather events (e.g., storm or passage of a front) will be recorded on standardized datasheets. Additional weather data (i.e., wind speed, wind direction, temperature, and barometric pressure) will be downloaded from an on-site met tower and/or a turbine nacelle for the entire survey period. At the beginning of each turbine search effort, the surveyor will record weather conditions including estimated wind speed, wind direction, temperature, sky conditions, precipitation events, and visibility. In addition, the surveyor will record his/her name, date, and time searches are initiated and completed.

6.6 Carcass Information

During searches, surveyors will walk slowly looking for carcasses on either side of the search transect. All intact bird and bat carcasses or remnants of scavenged carcasses (e.g., a cluster of feathers representing more than a molt, or a patch of skin and bone) will be photographed (before the carcass is moved), collected, and documented as fatalities. To the extent possible, turbine-related fatalities will be distinguished from those that occurred as a result of collisions with met towers, electrical collection lines, vehicles, or other sources of mortality.

All carcasses should be collected in individual re-sealable plastic bags, and the carcass identification number written in pencil on a piece of write-in-the-rain paper enclosed with the carcass. All information on ODNR's Fatality Reporting Form should be recorded, including:

- Date, time, and surveyor identification;
- Search type during which carcass was found (i.e., turbine search, met tower search, or incidentally);
- Distance (determined with a laser range finder) and compass direction of carcass from tower;
- GPS location of carcass;
- Ground cover type, height, and condition (e.g., wet, dry) where carcass was found;

- Carcass species identification, age (juvenile or adult), sex, and reproductive condition (to the extent possible);
- Carcass condition (estimate of number of days decomposed and/or scavenging activity);
- If applicable, notes will be recorded to indicate why a carcass was not believed to be a turbine-related fatality; and
- Evidence of scavenger activity (e.g., tracks or scat) in the vicinity of the carcass.

Mortalities encountered outside the bounds of an official search should be collected, and the above information recorded, but "Incidental" should be written into the notes area. These will not be used in the calculation of site mortality rates, but may (depending on species) be used in searcher efficiency or carcass removal trials.

Prior to initiation of fatality searches, Buckeye Wind and its contractors will obtain the appropriate state and federal permits necessary for the collection and possession of Indiana bats (and other bats and birds). Any individual that handles live bats will maintain an up-to-date rabies vaccination. If injured animals are encountered, the closest licensed wildlife rehabilitator able to take that species will be notified. A list of local, licensed wildlife rehabilitators capable of accepting regional bird and bat species will be developed and provided to searchers. Every attempt will be made for timely transportation of injured animals to a rehabilitation center to ensure that the animal has the best chance of survival. If successful rehabilitation is not likely, then the individual will be humanely euthanized through cervical dislocation. Buckeye Wind will bear the costs of any rehabilitation or euthanasia. If the species in question is a state or federally threatened or endangered species, the individual will not be euthanized and will be taken to a rehabilitation center and the appropriate agency will be contacted.

The ODNR DOW and USFWS OH field office supervisor and project biologist will be notified within 24 hours via email if a suspected or confirmed Indiana bat carcass or other federally listed species carcass is found. All *Myotis* bats that are not suspected or confirmed to be an Indiana bat will be collected and provided to ODNR DOW for inspection and identification verification. These carcasses should be frozen and given to the ODNR DOW at a prearranged date (at least annually). Bats within the *Myotis* genus are difficult to differentiate, and will not be used for scavenging rate or searcher efficiency trials unless negative identification is achieved and approved by ODNR DOW and USFWS. Identification of *Myotis* carcasses will be verified by the USFWS and ODNR DOW through agreed upon means, which may include, but not be limited to, DNA testing by an appropriate lab (as determined in coordination with the USFWS), examination by recognized expert or some other mutually agreeable method. Genetic testing may be performed if the species of a bat is unclear and it is necessary to confirm the carcass identification.

Any other federally or state threatened or endangered species found will be reported to the USFWS an ODNR DOW within 48 hours of discovery and arrangements will be made to submit the carcass(es) to the appropriate agency personnel. Per the ODNR Protocol, agency contact will also be made within 48 hours if a "significant mortality event" occurs, defined as greater than 5 birds or bats found at any 1 turbine, or if greater than 20 birds or bats are found at all searched turbines combined.

6.7 Estimating Annual Mortality

6.7.1 *Searcher Efficiency Trials*

Searcher efficiency rates are variable among studies at wind facilities in the United States and are largely dependent on ground cover conditions. Searcher recovery rates have ranged from

25% to 56% for small carcasses and as high as 100% for large carcasses (Arnett 2005, Erickson et al. 2003a, Jain et al. 2007). Therefore, trials will be conducted by the PCM Manager in each year that mortality monitoring is performed to estimate searcher efficiency and carcass removal rates. Both searcher efficiency and carcass removal trial methods will remain the same during the Evaluation, Implementation, and Re-evaluation phases.

Trials will involve the placement of a minimum of 200 carcasses over the course of the monitoring year (where 1 carcass equals 1 trial) per ODNR Protocol. The same individual trial carcasses will be re-used in multiple trials over the course of the study period, and up to 20 trial carcasses may be used on a single trial day. "Over-seeding" may occur if too many trial carcasses are placed in a small area (which may increase scavenger activity). Therefore, no more than 2 trial carcasses will be placed at any time at a single turbine (Strickland et al. 2011, USFWS 2011c). On trial days, carcasses will be placed at multiple turbines scheduled to be searched that day and will be placed at random distances from turbine towers and in a variety of cover types.

Multiple trials (at least 200) will be conducted throughout the survey period to account for changes in ground cover conditions. Recommended placement procedures range from distributing carcasses equally across ground cover types (USFWS 2011c) to having higher sample sizes in low visibility ground cover in order to obtain more precise estimates of searcher efficiency in areas contributing to higher uncertainty in overall fatality estimates (Strickland et al. 2011). No studies to date have suggested a preferred method for stratifying trial carcass placement (Strickland et al. 2011). As ground cover conditions will be highly variable throughout the survey period and from year to year, and trial schedule will be dependent upon carcass availability, the PCM Manager will attempt to distribute trials evenly across ground cover types to his or her best ability.

Bat trial carcasses in varying stages of decomposition will be marked by the PCM Manager so that trial carcasses may be distinguished from actual fatalities without the surveyor's knowledge. Non-bat surrogates (for example, mice or birds) will not be used to estimate searcher efficiency for bats. If a sufficient number of trial carcasses cannot be obtained from on-site mortality, then Buckeye Wind will attempt to obtain carcasses from outside sources. Buckeye Wind will first consult with the USFWS and ODNR DOW to identify whether either agency has a source of additional carcasses. If not, then Buckeye Wind will attempt to find a source of additional carcasses from other sources, such as academia, the Ohio Department of Health, or other wind facilities, as long as precautions can be followed to avoid spreading WNS. These precautions will follow USFWS and ODNR Protocol. To the extent that it is feasible (i.e., carcasses are in good condition and do not show signs of WNS), carcasses from Project fatalities or carcasses from elsewhere that are of species expected to be encountered during the searches will be used in trials. If nothing else is available, non-bat surrogates may be used if necessary in coordination with USFWS and ODNR DOW.

A *Myotis* carcass will not be used in a trial unless its identification has been verified. Negative identification of the carcass will be verified by the USFWS and ODNR DOW through agreed upon means, which may include, but not be limited to, DNA testing by an appropriate lab (as determined in coordination with the USFWS), examination by recognized expert or some other mutually agreeable method.

Surveyors being tested will be unaware of trial dates and locations. The PCM Manager will leave carcasses out before sunrise at search turbines and will make every effort to leave no evidence of trial set-up (e.g., vehicle or foot prints in wet grass or mud). The PCM Manager will record the following information for each carcass placed and will use the Searcher Efficiency Form as provided in the ODNR Protocol:

- Date, time of set-up, PCM Manager, and surveyor being tested;
- Turbine number;
- Carcass identification;
- Carcass distance and direction from tower;
- Ground cover type and vegetation height where carcass was placed; and
- GPS location.

After searches are completed on trial days, the PCM Manager will determine how many trial carcasses were recovered. Trial carcasses that were not found the first day will be left in place for possible detection on subsequent days. The presence of the carcass (i.e., availability for detection) will be determined by the PCM Manager each day immediately after the completion of each searcher efficiency trial day.

Searcher efficiency rate will be expressed as the proportion of trial carcasses found by searchers (the number of trial carcasses found by searchers divided by the total number of trial carcasses placed during searcher efficiency trials (i.e., searcher efficiency = number found/total number placed). Searcher efficiency will be calculated separately by season and by vegetation cover type (such as cleared versus uncleared plots) as trial carcasses are available and as sample sizes allow. Each trial carcass collected during mortality surveys will be associated with a searcher efficiency value specific to the season, trial carcass type, and cover type in which it was found. If alternative formulas are developed over time, the formula determined to be most applicable to the Project and most accurate at the time of analysis will be chosen in coordination with the USFWS and ODNR DOW (see HCP Section 6.5.2.7 – Estimating Unobserved Mortality). Separate searcher efficiency rates will be developed for all bats and *Myotis* bats, as trial carcasses are available and as sample sizes allow.

6.7.2 *Carcass Removal Trials*

Trials will be conducted to estimate the carcass persistence rate or the average length of time carcasses remain in the area prior to removal by scavengers. Per ODNR Protocol (2009), a minimum of 50 trial carcasses will be placed at random distances and directions from turbines over the course of each monitoring year (subject to carcass availability). Several trial carcasses will be placed per month during the course of the survey year in order to account for seasonal changes of scavenger activity, per ODNR protocol (2009). Carcasses in fresh condition will be used in trials and will be marked to differentiate them from actual fatalities. Non-bat surrogates (for example, mice or birds) will not be used to estimate carcass persistence rates for bats, unless nothing else is available. If nothing else is available, non-bat surrogates may be used in coordination with USFWS and ODNR DOW. Preferably, carcasses used for trials will be those collected from the site (ODNR 2009).

Trial carcasses will be randomly placed and stratified across various habitat types in proportion to their occurrence (for example, if 90% of the area under turbines is agricultural, then 90% of trial carcasses will be randomly placed in agricultural settings). Carcasses will be placed at cleared and uncleared search plots. Trial carcasses will be randomly placed at multiple turbines throughout the monitoring area and will be checked daily for the first 7 days, then every 2 days until the trial carcass is removed or completely decomposed, per ODNR (2009) protocol. On each day the trial carcass is checked, surveyors will indicate whether the trial carcass is present (intact or partially scavenged but readily detectable) or absent (completely removed or with so few feathers or tissue that they are not readily detectable). The following additional information will be recorded on standardized datasheets for each trial carcass:

- Date, time of set-up, PCM Manager;

- Turbine number;
- Carcass identification;
- Carcass distance and direction from tower;
- Ground cover type and vegetation height where carcass was placed; and
- Detailed notes describing any scavenging and evidence of scavenger identification.
- GPS location

There are several formulas currently available to estimate carcass persistence rate, and new methods are continuously being developed. In coordination with the USFWS, the formula determined to be most applicable to the Project and most accurate at the time of analysis will be used. Using an example estimator employed by Erickson et al. (2004) and Tidhar (2009), the average number of days a carcass remained at a site before it was removed by scavengers (*t*) was expressed as:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

- Where *s* is the number of test carcasses used in the search trials;
- s_c is the number of test carcasses remaining in the study area at the end of the trial; and
- t_i is the number of days carcass *i* remained in the study area.

If all trial carcasses are removed before the end of the 14 day trial, then s_c is equal to 0, and *t* is equal to the arithmetic average number of days each carcass remained in the study area.

Other methods currently in use calculate the number of trial carcasses remaining after the average time between impact and discovery (Jain et al 2009a) or calculate the probability that a trial carcass was not removed in the interval between searches (Arnett et al. 2010). The formula determined to be the most applicable to the Project and the most accurate at the time of analysis will be used, pending USFWS approval (USFWS 2011c). Separate carcass persistence rates will be developed for all bats and *Myotis* bats, as trial carcasses are available and as sample sizes allow. Carcass persistence will also be calculated separately by season and by vegetation cover type (such as cleared versus uncleared plots) as trial carcasses are available and as sample sizes allow. Each carcass collected during mortality surveys will be associated with a carcass persistence value specific to the season, carcass size, and cover type in which it was found.

It is expected that, as recommended by the USFWS draft guidance document (2011c), the most contemporary and most accurate equations for estimating fatality available at the time of analysis will be used. In the case that other formulas will be more appropriate, Buckeye Wind would propose to utilize those formulas for estimating unobserved mortality. The utilization of any new formulas will be made in coordination with and with the approval of the USFWS and will be based on site-specific information.

6.7.3 *Searchable Area*

Searchable area around each turbine may vary by turbine and month, and therefore vegetation mapping will be conducted on a weekly basis to record the aerial extent of each ground cover type and respective vegetation heights. There are several methods currently available to adjust estimated mortality by searchable area, and new methods are continuously

being developed (see Section 6.5.2.7 – Estimating Unobserved Mortality). In coordination with the USFWS and ODNR DOW, the method and formula determined to be most applicable to the Project and most accurate at the time of analysis will be used.

One method is to adjust mortality estimates to account for area searched and distribution of carcasses around turbines following Young et al. (2009a). Density of carcasses decreases as distance from turbines increases (Kerns et al. 2005). Therefore, an area adjustment calculates the density of carcasses within distance bands, centered on the turbine. The adjustment relates the density of carcasses within each distance band with the proportion of area searched in the same band, resulting in a factor by which estimated mortality is adjusted to account for unsearched areas.

With this example method, a multiplier, *A*, is calculated based on the percentage of area searched within circular bands of fixed radius surrounding each turbine, searcher efficiency, and numbers of carcasses found within each band. An estimate of *A* is then calculated according to the following formula:

$$A = \frac{\sum_{k'=1}^{7} \frac{c_{k'}}{p_{k'} s_{k'}}}{\sum_{k'=1}^{7} \frac{c_{k'}}{p_{k'}}}$$

- Where c_k = the number of carcasses within the kth distance band;
- p_k = searcher efficiency; and
- s_k = the proportion of area searched within the kth distance band across turbines.

Estimates of *A* are calculated separately for season and carcass type. Estimated mortality is derived by multiplying total observed mortality "*m*" (see Section 6.5.2.8.2 – Data Analysis) by *A*.

6.8 Reporting and Consultation

Buckeye Wind will implement post-construction monitoring in accordance with the final HCP post-construction monitoring plan and in accordance with OPSB Certificate conditions, with possible increased rigor during the first 1 – 2 years to accommodate ODNR's monitoring protocol at the time of implementation. Work plans that describe the field, analysis, and reporting methods used during monitoring will be developed in consultation with the ODNR DOW and USFWS and will be approved by these agencies prior to initiation of monitoring studies. An annual report describing the methods and results of mortality monitoring will be submitted to the ODNR DOW and USFWS by 31 December of each calendar year that monitoring is actively conducted.

Concurrent with reporting as required under the HCP, annual reports will including the following:
Intermittent Construction Reports will include:

- A written notification of the turbine number, location and date placed in commercial operation for each turbine(s). This notification will be submitted at least 30 days prior to the turbine(s) being placed in commercial operation.

Seasonal Reports will include:

- Quantity and species composition of observed bat and bird mortality, including Indiana bat mortality during reporting period;
- Review of adaptive management measures implemented, if any, in response to observed mortality.

Annual Reports will include:

- Quantity and species composition of observed bat and bird mortality, including Indiana bat mortality during reporting period;
- Estimates of total mortality of all bats, all birds, Myotis species, and Indiana bats using searcher efficiency trials, carcass persistence trials, and searchable area adjustments. All estimates will include 95% confidence intervals;
- Report on weather conditions monitored during nights preceding mortality searches and weather conditions during searches;
- Review of adaptive management measures implemented in response to observed and/or estimated mortality;
- Annual operating parameters (cut-in speeds at each turbine during each season) and compilation of mortality data as it relates to those parameters;
- Raw carcass data of bat fatalities in Excel spreadsheet format (raw date for bird fatalities will also be provided);
- Fatality Reporting Forms;
- A calendar reflecting dates, times, and locations of searches;
- Injured bat and bird reporting forms and rehabilitator reports;
- A description of the subsequent year's monitoring efforts based on the monitoring phase and any adaptive management measures that will be implemented; and
- A cost estimate of the subsequent year's monitoring;

Meetings will be held with the USFWS and ODNR DOW in January of each calendar year to review the results of the previous year's monitoring. Additional meetings may be called by either the USFWS or Buckeye Wind to discuss new information or research that may be relevant to ongoing monitoring.

7.0 ADAPTIVE MANAGEMENT

Based on the best scientific information available, Buckeye Wind expects that the proposed Project will not pose significant risk to bird and bat populations. However, if fatality estimates are greater than the Mortality Thresholds defined below, adaptive management will be used to develop additional avoidance and minimization measures to reduce the number of fatalities. These adaptive management measures will be implemented in addition to, and consistent with, any adaptive management measures required in the HCP for the Indiana bat. Such measures, pending the specific circumstances resulting in increased collision risk, might include:

1. Project structures, such as stairways leading up to tower doors, may be modified if being used for perching or nesting by birds.

2. Lighting may be modified if it contributes to bird mortality events.
3. Additional feathering may be implemented to reduce mortality of birds or bats; specific methods will be dependent on species being impacted and will be determined based on results of scientifically driven reports that have demonstrated effectiveness of feathering for reducing impacts to birds or bats and will allow for the continued economically viable operation of the Project. Any further operational adjustments will be implemented in consultation with ODNR DOW and USFWS.
    a. Additional modification of feathering will be based on the following criteria:
        - It will be limited to periods of higher risk (seasonal and time of day/night) as established through examination of previous years' monitoring results and other applicable data from other projects.
        - It will be limited to certain weather considerations (wind speed, temperature, barometric pressure, humidity) as established through examination of previous years' monitoring results and other applicable data from other projects.
        - It will limited to just those turbines that have demonstrated higher levels of impact.
        - Additional adjustments will be made commensurate with the degree to which the Mortality Thresholds are exceeded.

4. Technology proven to decrease bird/bat mortality without affecting the financial viability of the Project may be applied.

The specific management actions to be taken will be developed in coordination with USFWS and ODNR DOW. The second year of post-construction searches will be used to assess the effectiveness of additional avoidance and minimization measures. If such measures decrease the number of fatalities to below Mortality Threshold levels, the use of these measures will continue through the life of the Project or until Buckeye Wind offers additional information or minimization measures that reduce mortality rates below Mortality Threshold levels. As there will be long-term monitoring for Indiana bat fatalities, the opportunity will exist to monitor the need for and effectiveness of management actions for other species of bats and birds as well. If at any point during other monitoring years, mortality of non-federally listed bats or birds exceeds the Mortality Thresholds, Buckeye Wind will work with the ODNR DOW to determine if any additional mitigation measures are appropriate. It making this determination, consideration will be given for the fact that other projects in OH are not providing mortality data beyond 1 or 2 years.

If avoidance and minimization measures are found to be ineffective at reducing impacts and mortality continues to exceed the Mortality Threshold, Buckeye Wind will consider mitigation options including, but not limited to, the following actions to offset impacts to birds and bats:

1. Contribute to funding for protection, enhancement or restoration of habitat which is of particular importance to the impacted species.

2. Contribute to funding of on-site or off-site research, such as bird displacement studies or acoustic bat studies to better understand the specific Project design, environmental, or behavioral factors contributing to mortality.

3. Contribute to funding of off-site research that would contribute to knowledge of survival or breeding success of the impacted species.

4. Contribute to funding for retrofitting of communication towers with bird flight diverters on guy lines, and/or retrofitting communication towers with lighting schemes that are less of an attraction to nocturnal migrants.

5. Contribute to funding for the installation of off-site nesting platforms or nest boxes to increase breeding success of the impacted species.

6. Other, unknown mitigation measures, determined in coordination with ODNR DOW and USFWS, which may satisfy a recently discovered (previously unforeseen) need in the area.

The specific measures to be taken would be developed in cooperation with ODNR DOW and the USFWS, would consider the best available science, and would occur in Ohio. The amount of funding available would be commensurate with the level of mortality relative to the thresholds and will not exceed $100,000 for the life of the Project. It should be recognized that there are adaptive management and mitigation measures outlined in the HCP that are geared toward mitigating impacts to Indiana bats, such as conservation and restoration of forested habitat and turbine feathering, that will coincidentally benefit other species of bats and birds. Any measures employed through the HCP will also be considered as mitigation measures in this ABPP to the extent that the Indiana bat mitigation also provided benefits to the affected species.

7.1 Calculation of Threshold Levels

The results of post-construction monitoring may indicate that bird and bat mortality are not below the Mortality Thresholds. Should mortality of birds or bats exceed this Mortality Threshold, Buckeye Wind will work with the ODNR DOW and USFWS to determine what additional measures could help bring mortality to within the Mortality Threshold while maintaining the economic viability of the project. This adaptive management approach will allow adverse impacts to birds and bats to be addressed as new information becomes available over time.

In order to most accurately assess potential avian and bat impacts, and to outline the most applicable avoidance or minimization measures for the Project, calculation of this threshold should consider available scientific studies and published literature that are most applicable to the Project. Data from different geographic regions that had markedly different species assemblages and habitats, different seasonal bird and bat behavioral patterns, different seasonal weather patterns, and, in some cases, markedly different turbine models, such as the Altamont Pass Wind Resource Area, CA, other western wind facilities, and wind facilities in Europe, should not be used. Rather, only studies conducted at sites in the Midwestern United

States should be included. While landscape settings at other regional projects may differ from the Project, generally the species, regional populations, and seasonal weather patterns among these sites are the most similar to the Project. Threshold levels for birds and bats will be calculated as the mean estimated number of fatalities per turbine per year plus one standard deviation. The calculation for mean is as follows:

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where n is the sample size and x_i.denotes the *i*th observation. Standard deviation is calculated as follows:

$$sd = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}}$$

Where n is the sample size, x_i.denotes the *i*th observation, and $\overline{x}$ is the mean.

7.1.1 *Threshold levels for bats*

Data compiled in Table 7-1 was used to calculate a regional average of 9.6 bats per turbine per year and a standard deviation of 14.5. Given the current set of monitoring results, Adaptive Management will be considered if Project related bat mortality is greater than 24.1 bats per turbine per year.

Table 7-1. Estimated bat mortality rates reported at Midwestern wind-energy facilities in the United States.

Project Location	Year	No. of turbines at site	Estimated no. bats per turbine/yr	90% confidence interval (per no. b/t/yr)	Study period	Source
Blue Sky Green Field, WI	2008	88	35.6	30.98-51.16 [a]	21 Jul - 31Oct 2008; 15 Mar - 31 May 2009	Gruver et al. 2009
Buffalo Ridge, MN (Phase I)	1999	73	0.26	0.06-0.46	15 Mar - 15 Nov 1999	Johnston et al. 2003a
Buffalo Ridge, MN (Phase II)	1998	143	1.62	1.21-2.03	15 Mar - 15 Nov 1998	Johnston et al. 2003a
Buffalo Ridge, MN (Phase II)	1999	143	1.94	1.53-2.35	15 Mar - 15 Nov 1999	Johnston et al. 2003a
Buffalo Ridge, MN (Phase III)	1999	138	2.04	1.46-2.62	15 Mar - 15 Nov 1999	Johnston et al. 2003a
Buffalo Ridge, MN (Phase II)	2001	143	3.26	2.25-4.48	15 Jun - 15 Sep 2001	Johnston et al. 2004
Buffalo Ridge, MN (Phase III)	2001	138	2.78	1.96-3.71	15 Jun - 15 Sep 2001	Johnston et al. 2004
Buffalo Ridge, MN (Phase II)	2002	143	1.36	0.82-2.00	15 Jun - 15 Sep 2002	Johnston et al. 2004
Buffalo Ridge, MN (Phase III)	2002	138	1.3	0.89-1.77	15 Jun - 15 Sep 2002	Johnston et al. 2004
Cedar Ridge, WI	2009	41	50.5 [c]	NR	Mar-May 2009; July-Nov 2009	BHE 2010

Crescent Ridge, IL	2005/2006	33	0.18-2.67	4.36-5.46	Sep-Nov 2005; Mar-May 2006; Aug 2006	Kerlinger et al. 2007
Fowler Ridge, IN	2010	355	22.2	19.32-29.17	13 Apr - 5 May 2010; 1 Aug - 15 Oct 2010	Good et al. 2011
Forward Energy Center, WI	2008-2009	86	NR	NR	15 Jul 2008 - 15 Oct 2009	Drake et al. 2010
Kewaunee County, WI	1999-2001	31	4.26	NR	Jul 1999 - Jul 2001	Howe et al. 2002
NPPD Ainsworth, NE	2006	36	1.91 [b]	0.91-3.37	13 Mar - 4 Nov 2006	Derby et al. 2007
Top of Iowa, IA	2003	89	3.74-8.08[b]	NR	15 Apr - 15 Dec 2003	Jain 2005
Top of Iowa, IA	2004	89	7.19-13.14[b]	NR	15 Apr - 15 Dec 2004	Jain 2005
AVERAGE		112.2	9.6			

[a] estimation includes incidental fatalities

[b] estimation based on study period, not bats per turbine/yr

7.1.2 *Threshold levels for birds*

ODNR DOW data compiled in Table 7-2 was used to calculate a regional average of 2.5 birds per turbine per year and a standard deviation of 3.0. (Note these results only represent data from 6 distinct wind farms.) Given the current set of monitoring results, Adaptive Management will be considered if Project-related bird mortality is greater than 5.5 birds per turbine per year.

Table 7-2. Estimated bird mortality rates reported at wind-energy facilities in the Midwestern United States.

Project Location	Year	No. of turbines at site	Estimated no. birds per turbine/yr	90% confidence interval (per no. b/t/yr)	Study period	Source
Buffalo Ridge, MN (Phase I)	1995	73	0.33 - 0.66	n/a	Jan - Dec 1995	Osborn et al 2000
Buffalo Ridge, MN (Phase I)	1996	73	1.45	0.33-2.57	15 March -15 Nov 1996	Johnson et al. 2002
Buffalo Ridge, MN (Phase I)	1997	73	0.88	0.09-1.67	15 March - 15 Nov 1997	Johnson et al. 2002
Buffalo Ridge, MN (Phase I)	1998	73	1.1	0.21-1.99	15 March - 15 Nov 1998	Johnson et al. 2002

Buffalo Ridge, MN (Phase I)	1999	73	0.5	0.05-1.2	15 March - 15 Nov 1999	Johnson et al. 2002
Buffalo Ridge, MN (Phase I)	1996-1999	73	0.98	0.42-1.54	15 March - 15 Nov (overall)	Johnson et al. 2002
Buffalo Ridge, MN (Phase II)	1998	143	1.85	0.55-3.20	15 March - 15 Nov	Johnson et al. 2002
Buffalo Ridge, MN (Phase II)	1999	143	2.68	0.63-4.73	15 March - 15 Nov	Johnson et al. 2002
Buffalo Ridge, MN (Phase II)	1998-1999	143	2.27	1.67-2.86	15 March - 15 Nov (overall)	Johnson et al. 2002
Buffalo Ridge, MN (Phase III)	1999	138	4.45	0.11-8.78	15 March - 15 Nov	Johnson et al. 2002
Blue Sky Green Field, WI	2008-2009	88	11.83	9.08-16.43	21 Jul - 31Oct 2008; 15 Mar – 31 May 2009	Gruver et al. 2009
Cedar Ridge, WI	2009	41	10.8 [a]	NR	15 Mar - 31 May; 15 July - 15 Nov 2009	BHE 2010
Forward Energy Center, WI	2008-2009	86	NR	NR	15 Jul 2008 - 15 Oct 2009	Drake et al. 2010
NPPD Ainsworth, NE	2006	36	2.68	1.48-4.43	13 Mar - 4 Nov 2006	Derby et al. 2007
Kewaunee County, WI	1999-2001	31	1.29	NR	Jul 1999 - Jul 2001	Howe et al. 2002
Top of Iowa, IA	2003	89	39.47 [a]	34.87 - 44.07	15 Apr - 15 Dec 2003	Jain 2005
Top of Iowa, IA	2004	89	85.38 [a]	77.6-93.16	15 Apr - 15 Dec 2004	Jain 2005
AVERAGE		86.2	2.5			

[a] estimation of total fatalities per study period, not per turbine/yr

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Appendix A

Appendix A Table 1. Federal- and State-listed Threatened and Endangered Wildlife Species with Potential to Occur in the Vicinity of the Action Area

Species[a]	Listing Status	General Habitat Description[a]	Occurrence in Action Area Vicinity
Indiana bat *Myotis sodalis*	FE SE	Winter hibernacula are in caves and abandoned mines and summer roosts are in trees and tree hollows.	Maternity colonies documented in Logan County and in Champaign County.[c] Captured during 2009 mist net surveys in Action Area.[e]
Northern harrier *Circus cyaneus*	SE	Large contiguous grasslands, marshes, low intensity agriculture.	Not observed on BBS survey route in Action Area during 15 years of survey (1992-2007) [b]. Observed in Action Area during migration.[e] Marginal habitat for this species exists within the Action Area. **Not expected to regularly occur or breed in Action Area – transient use only.**
Sandhill crane *Grus Canadensis*	SE	Large contiguous wetlands, shallow/standing water, agricultural land.	Observed in the Action Area during migration.[e] Marginal habitat for this species exists within the Action Area. **Not expected to regularly occur or breed in Action Area – transient use only.**
Loggerhead shrike *Lanius ludovicianua*	SE	Large, relatively contiguous grasslands and open areas with scattered trees.	One breeding record since 1980 in 5-county area.[b] Not observed on BBS survey route in Action Area during 15 years of survey (1992-2007) [b]. Marginal habitat for this species exists within the Action Area. **Not expected to regularly occur or breed in Action Area – transient use only.**
Upland sandpiper *Bartramia longicauda*	ST	Large expanses of grasslands, pastures, unkempt agricultural land with a mosaic of old fields and crop lands, grassy expanses of airports.	Recent records of probable nesting in Clark County.[b]. Not observed on BBS survey route in Action Area during 15 years of survey (1992-2007) [b]. Marginal habitat for this species exists within the Action Area. **Not expected to occur in Action Area.**

Species[a]	Listing Status	General Habitat Description[a]	Occurrence in Action Area Vicinity
Least flycatcher *Empidonax minimus*	ST	Deciduous forests.	Possible breeding records 1982-1987 and 2006-2010 in 5-county area. Not observed on BBS survey route in Action Area during 15 years of survey (1992-2007)[b] but observed in Action Area during breeding season in 2008[e].
Bald eagle *Haliaeetus leucocephalus*	ST	Lakes, reservoirs, rivers.	Observed in Action Area during the spring 2008 and fall 2008 migration surveys.[e] Marginal habitat for this species exists within the Action Area.
Yellow-bellied sapsucker *Sphyrapicus varius*	SE	Breeds in young forests and along streams, especially in aspen and birch. Winters in variety of forests, especially semi open forests.	Incidental observations recorded in Action Area during surveys for another wind project.[g]
Black-crowned night heron *Nycticorax nycticorax*	ST	Various wetland habitats, including salt, brackish, and freshwater marshes, streams, lakes, and agricultural fields.	As cited in West 2010, this species was observed during BBS although no nesting was documented.[g] Not expected to regularly occur or breed in Action Area – transient use only.
Dark-eyed junco *Junco hyemalis*	ST	Breed in coniferous and deciduous forests. During winter and migration they use a variety of habitats including open woodlands, grasslands/pasture, roadsides, and gardens.	Incidental sightings recorded in migration period in Action Area during surveys for another wind project.[g]
Hermit thrush *Catharus guttatus*	ST	Open areas inside forests, such as trails, pond edges, or areas partially opened up by fallen trees. In winter, this species occupies forests with dense understory and berry bushes.	Incidental sightings recorded in migration period in Action Area during surveys for another wind project.[g]
Osprey *Pandion haliaetus*	ST	Nest platform or forest near (within 12 miles) shallow, fish-filled water, including rivers, lakes, reservoirs, lagoons, swamps, and marshes.	Incidental sightings recorded in migration period in Action Area during surveys for another wind project.[g] Not expected to regularly occur or breed in Action Area – transient use only.

Listing Status: FE = Federally Endangered, FE = Federally Threatened, FC = Candidate for Federal Listing, ST = State Threatened, SE = State Endangered

[a] Species status and habitat descriptions based on ODNR DOW Division of Wildlife (ODNR DOW 2008).

[b] Ohio Breeding Bird Atlas (2009) and BBS data for Route 66031 from 1992-2007

[c] K. Lott (2009, ODNR DOW Biologist, personal communication)

[e] Based on pre-construction surveys conducted for Project (Stantec 2008a, 2009)
[g] WEST 2010
[h] USFWS, Species Assessment and Listing Priority Assignment Form – *Quadrula cylindrical cylindrica*, 2009
[i] Hull 2009

Appendix A Table 2. State-listed Species of Concern and Special Interest Species Known to Occur in the Action Area and Vicinity.

Species	General Habitat Description	Occurrence within Action Area and Vicinity
State Species of Concern		
Sharp-shinned hawk *Accipiter striatus*	Forests, agricultural, and suburban areas	• Possible breeding records 1982-1987 and 2006-2010 in 5-county area [a] • Observed in Action Area during migration [b] • Not observed on the BBS survey route that crosses the northern portion of the Action Area during 15 years of survey (1992-2007) [c]
Henslow's sparrow *Ammodramus henslowii*	Large, continuous blocks of grassland habitat	• Rare in Champaign County, some records in Clark, Union, and Madison counties [a] • Observed in Action Area during breeding season [b] • Not observed on the BBS survey route that crosses the northern portion of the Action Area during 15 years of survey (1992-2007) [c]
Northern bobwhite *Colinus virginianus*	Forested edges	• Confirmed breeding record 1982-1987 and probable breeding records 2006-2010 in 5-county area and recent records exist for Champaign County [a] • Not detected during surveys within and near the Action Area from 2007- 2009 [b] • Observed on the BBS survey route that crosses the northern portion of the Action Area [c]
Black vulture *Coragypus atratus*	Lowlands along rivers and open landscapes	• Possible breeding records 2006-2010 in 5-county area [a] • Observed in Action Area during migration season [b] • Not observed on the BBS survey route that crosses the northern portion of the Action Area during 15 years of survey (1992-2007) [c]

Bobolink *Dolichonyx oryzivorus*	Grassy fields, hayfields, wet prairies, grassy marshes	• Confirmed breeding records 2006-2010 in 5-county area [a] • Observed in Action Area during breeding season [b] • Observed on the BBS survey route that crosses the northern portion of the Action Area [c]
Great egret *Ardea alba*	Shrubs and trees near freshwater pools and lakes, marshes	• Observed in Action Area during surveys for other wind project [d]
Tri-colored bat *Perimyotis subflavus*	Edge habitats near mixed agricultural use areas; roost in foliage or tree cavities. Hibernate in caves and mines in winter.	• Observed 4 miles north of Action Area during fall [b] • Observed in Action Area during summer [b]
Big brown bat *Eptesicus fuscus*	Feed over water, fields, forest openings, urban and suburban areas; roost on buildings and under bridges. Hibernate in caves and mines in winter.	• Observed 4 miles north of Action Area during fall [b] • Observed in Action Area during summer [b]
Northern long-eared bat *Myotis septentrionalis*	Caves and mines are used for hibernation in winter and tree cavities are used in summer.	• Observed 4 miles north of Action Area during fall [b] • Observed in Action Area during summer [b]
Little brown bat *Myotis lucifugus*	Caves and mines are used for hibernation in winter and tree cavities are used in summer.	• Observed 4 miles north of Action Area during fall [b] • Observed in Action Area during summer [b]
Silver-haired bat *Lasionycteris noctivagans*	Roosts in trees during the summer and winter	• Observed in Action Area during fall [b] • Observed in Action Area during summer [b]
Hoary bat *Lasiurus cinereus*	Roosts in trees during the summer and winter	• Observed in Action Area during fall [b] • Observed in Action Area during summer [b]
Red bat *Lasiurus borealis*	Roosts in trees and shrubs in the summer. Overwinters in trees and tree cavities	• Observed in Action Area during fall [b] • Observed in Action Area during summer [b]

State Species of Special Interest		
Blackburnian warbler *Dendroica fusca*	Forests	• Observed in Action Area during breeding season [b] • Not observed on the BBS survey route that crosses the northern portion of the Action Area during 15 years of survey (1992-2007) [c]
Brown creeper *Certhia americana*	Forests	• Observed in Action Area during surveys for other wind project [d]
Northern waterthrush *Parkesia noveboracensis*	Forests, generally near water.	• Observed in Action Area during surveys for other wind project [d]
Golden-crowned kinglet *Regulus satrapa*	Forests	• Observed in Action Area during surveys for other wind project [d]
Pine siskin *Spinus pinus*	Open woodland	• Observed in Action Area during surveys for other wind project [d]
Winter wren *Troglodytes troglodytes*	Forests	• Observed in Action Area during surveys for other wind project [d]
Wilson's snipe *Gallinago delicata*	Marshlands	• Observed in Action Area during surveys for other wind project [d]
American wigeon *Anas americana*	Shallow freshwater wetlands, including ponds, marshes, and rivers	• Observed in Action Area during surveys for other wind project [d]
Western meadowlark *Sturnella neglecta*	Open grasslands, prairies, meadows, and some agricultural fields	• Observed in Action Area during surveys for other wind project [d]
Mourning warbler *Geothlypis philadelphia*	Disturbed second-growth forested areas, with moderately closed canopy and thick understory	• Observed in Action Area during surveys for other wind project [d]
Purple finch *Carpodacus purpureus*	Forests	• Observed in Action Area during surveys for other wind project [d]
Red-breasted nuthatch *Sitta canadensis*	Forests	• Observed in Action Area during surveys for other wind project [d]
Magnolia warbler *Dendroica magnolia*	Forests	• Observed in Action Area during breeding season [b] • Not observed on the BBS survey route that crosses the northern portion of the Action Area during 15 years of survey (1992-2007) [c]

[a] Ohio Breeding Bird Atlas (2009)
[b] Based on pre-construction surveys conducted for Project (Stantec 2008a, 2009)
[c] BBS data for Route 66031 from 1992-2007 (USGS 2010)
[d] WEST 2010

Appendix A Table 3. Breeding birds observed at the Buckeye Wind Project and vicinity in spring 2008.

Species	Number of breeding birds observed	State listing status	Federal listing status
	Spring BBS 2008		
Red-winged blackbird	1,324	None	Conservation Concern
Horned lark	427	None	None
American robin	304	None	None
Song sparrow	297	None	None
American crow	246	None	None
European starling	206	None	None
Barn swallow	195	None	None
American goldfinch	191	None	None
Blue jay	191	None	None
Indigo bunting	186	None	None
Field sparrow	162	None	Conservation Concern
Brown-headed cowbird	160	None	None
Mourning dove	158	None	None
Northern cardinal	156	None	None
Common grackle	155	None	None
House wren	126	None	None
Common yellowthroat	80	None	None
Gray catbird	71	None	None
Tufted titmouse	60	None	None
Red-bellied woodpecker	54	None	None
Vesper sparrow	49	None	None
Chipping sparrow	45	None	None
Baltimore oriole	43	None	None
Carolina chickadee	40	None	None
Eastern meadowlark	40	None	None
Wood thrush	39	None	Conservation Concern
Great crested flycatcher	38	None	None
Eastern wood-pewee	36	None	None
Red-eyed vireo	34	None	None
Brown thrasher	33	None	None
Savannah sparrow	32	None	None
Cedar waxwing	28	None	None
Downy woodpecker	28	None	None

Appendix A Table 3. Breeding birds observed at the Buckeye Wind Project and vicinity in spring 2008.

Species	Number of breeding birds observed	State listing status	Federal listing status
	Spring BBS 2008		
Willow flycatcher	27	None	Conservation Concern
Eastern towhee	24	None	None
House sparrow	24	None	None
Tree swallow	24	None	None
White-breasted nuthatch	21	None	None
Blue-gray gnatcatcher	18	None	None
Northern flicker	17	None	Conservation Concern
Bobolink	16	Species of Concern	None
Chimney swift	16	None	None
Red-tailed hawk	15	None	None
Yellow-billed cuckoo	15	None	Conservation Concern
Yellow warbler	15	None	None
Eastern kingbird	14	None	None
Carolina wren	12	None	None
Rock pigeon	11	None	None
Grasshopper sparrow	10	None	Conservation Concern
Orchard oriole	10	None	None
Red-headed woodpecker	9	None	Conservation Concern
Ring-necked pheasant	8	None	None
Rose-breasted grosbeak	8	None	None
Scarlet tanager	8	None	None
Yellow-rumped warbler	8	None	None
Unidentified sp.	6	None	None
Warbling vireo	6	None	None
American redstart	4	None	None
Blackburnian warbler	4	Special Interest	None
Magnolia warbler	4	Special Interest	None
Tennessee warbler	4	None	None
White-eyed vireo	4	None	None
Wild turkey	4	None	None
Woodpecker sp.	4	None	None
Blue-winged warbler	3	None	Conservation

Appendix A Table 3. Breeding birds observed at the Buckeye Wind Project and vicinity in spring 2008.

Species	Number of breeding birds observed	State listing status	Federal listing status
	Spring BBS 2008		
			Concern
Chestnut-sided warbler	3	None	None
Palm warbler	3	None	None
Ruby-throated hummingbird	3	None	None
Black-and-white warbler	2	None	None
Eastern bluebird	2	None	None
Nashville warbler	2	None	None
Northern bobwhite	2	special concern	None
Northern mockingbird	2	None	None
Northern parula	2	None	None
Northern rough-winged swallow	2	None	None
Acadian flycatcher	1	None	Conservation Concern
Black-throated green warbler	1	None	None
Flycatcher sp.	1	None	None
House finch	1	None	None
Least flycatcher	1	Threatened	None
Louisiana waterthrush	1	None	None
Merlin	1	None	None
Northern lapwing	1	None	None
Ovenbird	1	None	None
Prairie warbler	1	None	Conservation Concern
Swamp sparrow	1	None	None
White-throated sparrow	1	None	None
Yellow-breasted chat	1	None	None
Total	**5,643**		

Source: Based on data provided in Stantec 2008*a*.

Appendix A Table 4. Raptors observed at the Buckeye Wind Project and vicinity in 2007 and 2008.

Species	Number of raptors observed					State listing status	Federal listing status
	Fall Raptor 2007	Spring Raptor 2008	Fall Raptor 2008	Spring BBS 2008	Total		
Turkey vulture	380	1,347	537	46	2,310	None	None
Red-tailed hawk	14	98	42	0	154	None	None
American kestrel	1	7	10	1	19	None	None
Cooper's hawk	3	4	8	3	18	None	None
Unidentified raptor	12	2	0		14	None	None
Northern harrier	2	5	7	1	15	Endangered	None
Sharp-shinned hawk	4	2	0	0	6	Species of Concern	None
Black vulture	3	0	0	0	3	Species of Concern	None
Unidentified accipiter	1	2	0	0	3	None	None
Bald eagle	0	1	1	0	2	Threatened	Protected by BGEPA, MBTA and Conservation Concern
Merlin	0	2	0	0	2	None	None
Northern goshawk	1	0	1	0	2	None	None
Unidentified buteo	0	1	1	0	2	None	None
Broad-winged hawk	0	1	0	0	1	None	None
Golden eagle	0	1	1	0	2	None	Protected by BGEPA and MBTA
Peregrine falcon	0	1	0	0	1	Threatened	Conservation Concern
Red-shouldered hawk	0	1	0	0	1	None	None
Unidentified falcon	0	1	0	0	1	None	None
Totals	**421**	**1,476**	**608**	**51**	**2,556**		

Source: Based on data provided in Stantec 2008*a*.

Appendix A Table 5. Summary of mean flight altitudes of nighttime migrants recorded during 2007 radar surveys conducted immediately north of the Adjusted Project Area.

Sample Night	Mean Altitude (m)	Standard Error (SE)	Percent of targets below 150 m
9/5/2007	506	27	4%
9/6/2007	455	10	2%
9/9/2007	485	13	2%
9/10/2007	466	32	8%
9/11/2007	490	22	4%
9/12/2007	395	36	10%
9/13/2007	445	17	3%
9/14/2007	444	15	2%
9/15/2007	387	16	5%
9/16/2007	284	48	33%
9/17/2007	268	32	38%
9/18/2007	421	16	2%
9/21/2007	415	16	7%
9/22/2007	376	20	6%
9/23/2007	382	32	14%
9/24/2007	409	22	5%
9/25/2007	396	12	5%
9/27/2007	399	23	2%
10/1/2007	346	12	5%
10/2/2007	382	8	4%
10/3/2007	424	23	3%
10/4/2007	408	16	7%
10/5/2007	389	9	7%
10/6/2007	396	14	3%
10/7/2007	441	18	3%
10/9/2007	378	19	5%
10/10/2007	252	43	19%
10/11/2007	372	6	4%
10/12/2007	292	7	6%
10/13/2007	296	21	8%
Entire Sampling Period	393	10	5%

Source: Based on data provided in Stantec 2008*a*.

Appendix A Table 6. Waterfowl and waterbirds observed at the Buckeye Wind Project and vicinity in spring 2008.

Species	Number of waterfowl/water birds observed			State listing status	Federal listing status
	Spring Raptor 2008	Spring BBS 2008	Total		
Killdeer	0	146	146	None	None
Canada goose	0	90	90	None	None
Mallard duck	0	7	7	None	None
Great blue heron	0	5	5	None	None
Wood duck	0	5	5	None	None
Sandhill crane	4	0	4	Endangered	None
Total	**4**	**253**	**257**		

Source: Based on data provided in Stantec 2008*a*.

Appendix A Table 7. Mist-netting capture results by species at the Buckeye Wind Project and surrounding vicinity, summer 2008.

Species	Number of adults and juveniles captured	OH State listing status	Federal listing status
Big brown bat	197	special concern	None
Northern long-eared bat	38	special concern	federal species of concern
Eastern red bat	36	special concern	None
Little brown bat	18	special concern	None
Indiana bat	3	Endangered	Endangered
Hoary bat	3	special concern	None
Tri-colored bat	3	special concern	None
Total	**298**		

Source: Based on data provided in Stantec 2008*b*.

Appendix A Table 8. Species captured at swarm surveys located at 2 cave openings approximately 6.3 km (3.9 mi) north of the Buckeye Wind Adjusted Project Area in fall 2008.

Species	Sex	Swarm survey date (2008)					Subtotals	Totals
		9/15	9/24	10/6	10/20	10/27		
Big brown bat	Female	10					10	
	Male	2					2	12
Little brown bat	Female	20	12	5			37	
	Male	88	48	17	8	3	164	201
Northern long-eared bat	Female	109	60	63	16	2	250	
	Male	131	41	132	73	3	380	
	Unknown			22	1		23	653
Tri-colored bat	Female	2	3	3	1		9	
	Male	3	4	2			9	18
Totals		365	168	244	99	8		884

Source: Based on data provided in Stantec 2008a.

Appendix A Table 9. Distribution of bat acoustic detections by species guild at the Buckeye Wind Project and surrounding vicinity, fall 2007.

Detector	Guild				Total
	Big brown/silver-haired/hoary bat guild (BBSHHB)	Red bat / tri-colored bat (RBTB)	*Myotis* (MYSP)	Unknown (UNKN)	
North High	101	5	1	69	176
North Low	134	13	3	125	275
North Tree	1	3	1	83	88
South High	119	3	0	100	222
South Low	45	2	1	32	80
South Tree	110	253	0	318	681
Total	**510**	**279**	**6**	**727**	**1,522**

Source: Based on data provided in Stantec 2007.

Appendix A Table 10. Distribution of bat acoustic detections by species guild at the Buckeye Wind Project and surrounding vicinity, spring through fall, 2008

Detector	Guild							
	Big brown / silver-haired (BBSH)	Hoary (HB)	Red bat / tri-colored bat (RBTB)	*Myotis* (MYSP)	Unknown			Total
					High frequency (HFUN)	Low frequency (LFUN)	Unknown (UNKN)	
North High	91	9	20	4	35	112	1	272
North Low	495	17	173	21	249	318	32	1,305
North Tree	7,891	44	333	546	1,586	1,312	200	11,912
South High	120	29	25	4	44	161	1	384
South Low	343	24	70	4	102	304	3	850
South Tree	2,298	25	96	24	423	1,046	80	3,992
Total	**11,238**	**148**	**717**	**603**	**2,439**	**3,253**	**317**	**18,715**

Source: Based on data provided in Stantec 2008a.

Appendix B

Appendix B Table 1. Summary of available avian fall radar survey results conducted at proposed (preconstruction) US wind power facilities in eastern US, using X-band mobile radar systems (2004-present)

Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/ km/ hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
Fall 2004									
Sheffield, Caledonia Cty, VT	18	176	Forested ridge	91	19-320	200	566	(125 m) 1%	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
Casselman, Somerset Cty, PA	30	n/ a	Forested ridge	174	n/ a	n/ a	436	(125 m) 7%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Dans Mountain, Allegany Cty, MD	34	318	Forested ridge	188	2-633	193	542	(125 m) 11%	Woodlot Alternatives, Inc. 2004. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
Prattsburgh, Steuben Cty, NY	30	315	Agricultural plateau	193	12-474	188	516	(125 m) 3%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windfarm Prattsburgh Project in Prattsburgh, New York. Prepared for UPC Wind Management, LLC.
Franklin, Pendleton Cty, WV	34	349	Forested ridge	229	7-926	175	583	(125 m) 8%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
Fall 2005									
Dairy Hills, Clinton Cty, NY	57	n/ a	Agricultural plateau	64	n/ a	180	466	(n/ a) 10%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Perry, Wyoming Cty, NY	n/ a	n/ a	Agricultural plateau	64	n/ a	180	466	(125 m) 10%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Alabama, Genesee Cty, NY	59	n/ a	Agricultural plateau	67	n/ a	219	489	(125 m) 11%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Alabama, Genesee Cty, NY	40	n/ a	Agricultural plateau	111	n/ a	35	413	(125 m) 14%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Churubusco, Clinton Cty, NY	38	414	Great Lakes plain/ ADK foothills	152	9-429	193	438	(120 m) 5%	Woodlot Alternatives, Inc. 2005. A Fall Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Marble River Wind Project in Clinton and Ellenburg, New York. Prepared for AES Corporation.
Maple Ridge, Lewis Cty, NY	57	n/ a	Agricultural plateau	158	n/ a	195	415	(125 m) 8%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Swallow Farm, PA	58	n/ a	Forested ridge	166	n/ a	n/ a	402	(125 m) 5%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Sheldon, Wyoming Cty, NY	36	347	Agricultural plateau	197	43-529	213	422	(120 m) 3%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Project in Sheldon, New York. Prepared for Invenergy.
Ellenberg, Clinton Cty, NY	57	n/ a	Great Lakes plain/ ADK foothills	197	n/ a	162	333	(125 m) 12%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Prattsburgh-Italy, NY	41	n/ a	Agricultural plateau	200	n/ a	177	365	(125 m) 9%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Kibby, Franklin Cty, ME (Range 1)	12	101	Forested ridge	201	12-783	196	352	(125 m) 12%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Fayette Cty, PA	26	n/ a	Forested ridge	297	n/ a	n/ a	426	(125 m) 5%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
Preston Cty, WV	26	n/ a	Forested ridge	379	n/ a	n/ a	420	(125 m) 10%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Preston Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Jordanville, Herkimer Cty, NY	38	404	Agricultural plateau	380	26-1019	208	440	(125 m) 6%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Highland, VA	58	n/ a	Forested ridge	385	n/ a	n/ a	442	(125 m) 12%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Clayton, Jefferson Cty, NY	37	385	Agricultural plateau	418	83-877	168	475	(150 m) 10%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.
Bliss, Wyoming Cty, NY	8	n/ a	Agricultural plateau	440	52-1392	n/ a	411	(125 m) 13%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Howard, Steuben Cty, NY	39	405	Agricultural plateau	481	18-1434	185	491	(125 m) 5%	Woodlot Alternatives, Inc. 20065 A Fall 2005 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for Everpower Global.
Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Fairfield, Herkimer Cty, NY	38	423	Agricultural plateau	691	116-1351	198	516	(145 m) 6%1	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York. Prepared for PPM Atlantic Renewable.
Munnsville, Madison Cty, NY	31	292	Agricultural plateau	732	15-1671	223	644	(118 m) 2%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Munnsville Wind Project in Munnsville, New York. Prepared for AES-EHN NY Wind, LLC.

cont

Appendix B Table 1 continued

Fall 2006									
Villenova, Chautauqua Cty, NY	36	n/ a	Great Lakes plain	189	16-604	216	353	(120 m) 9%	Stantec Consulting Services Inc. 2008. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Ball Hill Windpark in Villenova and Hanover, New York. Prepared for Noble Environmental Power, LLC and Ecology and Environment.
Wethersfield, Wyoming Cty, NY	56	n/ a	Agricultural plateau	256	31-701	208	344	(125 m) 11%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Centerville, Allegany Cty, NY	57	n/ a	Agricultural plateau	259	12-877	208	350	(125 m) 12%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Somerset Cty, PA	29	n/ a	Forested ridge	316	n/ a	n/ a	374	(125 m) 8%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Cape Vincent, Jefferson Cty, NY	63	508	Great Lakes plain	346	n/ a	209	490	(125 m) 8%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Bedford Cty, PA	29	n/ a	Forested ridge	438	n/ a	n/ a	379	(125 m) 10%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Stetson, Washington Cty, ME	12	77	Forested ridge	476	131-1192	227	378	(125 m) 13%	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
Dutch Hill, Steuben Cty, NY	21	n/ a	Agricultural plateau	535	n/ a	215	358	(125 m) 11%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Lempster, Sullivan Cty, NH	32	290	Forested ridge	620	133-1609	206	387	(125 m) 8%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Nocturnal Bird Migration, Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
Chateaugay, Franklin Cty, NY	35	327	Agricultural plateau	643	38-1373	212	431	(120 m) 8%	Woodlot Alternatives, Inc. 2006. Fall 2006 Radar Surveys at the Proposed Chateaugay Windpark in Chateaugay, New York. Prepared for Ecology and Environment, Inc. and Noble Power, LLC.
Fall 2007									
Buckeye, Champaign and Logan Cty, OH	**30**	**n/ a**	**Agricultural plateau**	**74**	**0-404**	**194**	**393**	**(150 m) 5%**	**Stantec Consulting Services Inc. 2008. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the Buckeye Wind Power Project in Champaign and Logan Counties, Ohio. Prepared for EverPower Renewables.**
New Grange, Chautauqua Cty, NY	57	n/ a	Great Lakes plain	112	n/ a	208	458	(125 m) 10%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Laurel Mountain, Barbour Cty, WV	20	212	Forested ridge	321	76-513	209	533	(130 m) 6%	Stantec Consulting Services Inc. 2007. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
Errol, Coos County, NH	29	232	Forested ridge	366	54 to 1234	223	343	(125 m) 15%	Stantec Consulting Inc. 2007. Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
Rollins, Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
Allegany, Cattaraugus Cty, NY	46	n/ a	Forested ridge	451	n/ a	230	382	(150 m) 14%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
New Creek, Grant Cty, WV	20	n/ a	Forested ridge	811	263-1683	231	360	(130 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the New Creek Wind Project, West Virginia. Prepared for AES New Creek, LLC.
Wolfe Island, Ontario, Canada*	n/ a	n/ a	Great Lakes island	n/ a	n/ a	95	233	(125m) 23%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http:/ / www.dec.ny.gov/ docs/ wildlife_pdf/ radarwindsum.pdf
Fall 2008									
Hounsfield, Jefferson Cty, NY	60	674	Great Lakes island	281	64-835	207	298	(125 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Hounsfield Wind Project, New York. Prepared for American Consulting Professionals of New York, PLLC.
Georgia Mountain, VT	21	n/ a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind.
Oakfield, Penobscot Cty, ME	20	n/ a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Fall 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Tenney, Grafton Cty, NH	45	509	Forested ridge	470	94-1174	260	342	(125m) 13%	Stantec Consulting Services Inc. 2008. Fall 2008 Radar Survey Report for the Groton Wind Project. Prepared for Groton Wind, LLC.
Highland, Somerset Cty, ME	20	216	Forested ridge	549	68-1201	227	348	(130.5m) 17%	Stantec Consulting. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC
Fall 2009									
Sisk (Kibby Expansion) Franklin Cty, ME	20	210	Forested ridge	458	44-1067	206	287	(125m) 23%	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
Vermont Community Wind Farm, Orleans Cty, VT	20	227	Forested ridge	443	110-1029	215	330	(130m) 15%	Stantec Consulting Services. 2009. Fall 2009 Bird and Bat Survey Report. Nocturnal Radar, Acoustic, and Diurnal Raptor Surveys performed for the Vermont Community Wind Farm Project in Rutland County, Vermont. Prepared for Vermont Community Wind Farm, LLC.
Stetson, Washington Cty, ME	18	201	Forested ridge	457	106-1746	227	420	(119m) 2%	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.

Note:

[1] The percent targets below turbine height can be found in the addendum to the report "Effect of Top Notch (now Hardscrabble) Wind Project revision to turbine layout and model changes on the spring and fall 2005 nocturnal radar survey reports." Prepared August 26, 2009, by Stantec Consulting Services Inc.

Appendix B Table 2. Summary of publicly available raptor survey results for wind projects

Year	Season	Project Site	State	Landscape	Survey Period	# Survey Days	# Survey Hours	# Birds Observed	# Species Observed	Passage Rate (b/hr)	% Below Turbine Height	Citation
1996	Fall	Searsburg, Bennington County	VT	Forested ridge	9/11-11/13	20	80	430	12	5.4	n/a	Kerlinger 1996
1998	Fall	Harrisburg, Lewis County	NY	Great Lakes plain	9/2-10/1	13	68	554	12	8.1	n/a (47 m mean flight height)	Cooper & Mabee 2000
1998	Fall	Wethersfield, Wyoming County	NY	Agricultural plateau	9/2-10/1	24	107	256	12	2.4	n/a (48 m mean flight height)	Cooper & Mabee 2000
2004	Fall	Prattsburgh, Steuben County	NY	Agricultural plateau	9/2-10/28	13	73	220	10	3.0	(125 m) 62%	Woodlot 2005b
2004	Fall	Cohocton, Steuben County	NY	Agricultural plateau	9/2-10/28	8	41	128	8	3.1	(125 m) 80%	ED&R 2006b
2004	Fall	Deerfield, Bennington County	VT	Forested ridge	9/2-10/31	10	60	147	11 for sites combined	2.5	(100 m) 9% for sites combined	Woodlot 2005c
2004	Fall	Deerfield, Bennington County	VT	Forested ridge	9/2-10/31	10	57	725	11 for sites combined	12.7	(100 m) 9% for sites combined	Woodlot 2005c
2004	Fall	Sheffield, Caledonia County	VT	Forested ridge	9/11-10/14	10	60	193	10	3.2	(125 m) 31%	Woodlot 2006a
2005	Fall	Cohocton, Steuben County	NY	Agricultural plateau	9/7-10/1	7	40	131	10	3.3	(125) 63%	ED&R 2006b
2005	Fall	Churubusco, Clinton County	NY	Great Lakes plain	10/6-10/22	10	60	217	15	3.6	(120 m) 69%	Woodlot 2005l
2005	Fall	Dairy Hills, Clinton County	NY	Great Lakes Shore	9/11-10/10	4	16	48	7	3.0	n/a	Young et al. 2006
2005	Fall	Howard, Steuben County	NY	Agricultural plateau	9/1-10/28	10	57	206	12	3.6	(91 m) 65%	Woodlot 2005o
2005	Fall	Munnsville, Madison County	NY	Agricultural plateau	9/6-10/31	11	65	369	14	5.7	(118 m) 51%	Woodlot 2005r
2005	Fall	Mars Hill, Aroostook County	ME	Forested ridge	9/9-10/13	8	43	115	13	1.5	(120 m) 42%	Woodlot 2005t
2005	Fall	Lempster, Sullivan County	NH	Forested ridge	Fall	10	80	264	10	3.3	(125 m) 40%	Woodlot 2007c
2005	Fall	Clayton, Jefferson County	NY	Agricultural plateau	9/9-10/16	11	64	575	13	9.1	(150 m) 89%	Woodlot 2005m
2006	Fall	Stetson, Penobscot County	ME	Forested ridge	9/14-10/26	7	42	86	11	2.1	(125 m) 63%	Woodlot 2007b
2007	Fall	Buckeye, Champaign and Logan Counties	OH	Agricultural plateau	8/30-10/11	11	66	421	8	6.4	(125) 78%; (150) 84%	*Not publicly available*
2008	Fall	Buckeye, Champaign and Logan Counties	OH	Agricultural plateau	9/1-12/15	24	167	581	7	3.5	(150 m) 93%	*this report*
1999	Spring	Wethersfield, Wyoming County	NY	Agricultural plateau	4/20-5/24	24	97	348	12	3.6	n/a (23 m mean flight height)	Cooper and Mabee 2000
2003	Spring	Westfield, Chautaugua	NY	Great Lakes shore	4/16-5/15	50	101	2578	17	25.6	n/a (278 m mean flight height)	Cooper et al.2004c
2005	Spring	Churubusco, Clinton County	NY	Great Lakes plain	Spring	10	60	170	11	2.8	(120 m) 69%	Woodlot 2005a
2005	Spring	Dairy Hills, Clinton County	NY	Great Lakes Shore	4/15-4/26	5	20	50	7	3.0	n/a	ED&R 2006b
2005	Spring	Clayton, Jefferson County	NY	Agricultural plateau	3/30-5/7	10	58	700	14	12.1	(150 m) 61%	Woodlot 2005b
2005	Spring	Prattsburgh, Steuben County	NY	Agricultural plateau	Spring	10	60	314	15	5.2	(125 m) 83%	Woodlot 2005u
2005	Spring	Cohocton, Steuben County	NY	Agricultural plateau	Spring	10	60	164	11	2.7	(125 m) 77%	ED&R 2006b
2005	Spring	Munnsville, Madison County	NY	Agricultural plateau	4/5-5/16	10	60	375	12	6.3	(118 m) 78%	Woodlot 2005d
2005	Spring	Sheffield, Caledonia County	VT	Forested ridge	April - May	10	60	98	10	1.6	(125 m) 69%	Woodlot 2006b
2005	Spring	Deerfield, Bennington County	VT	Forested ridge	4/9-4/29	7	42	44	11 (for both sites combined)	1.1	(125 m) 83% (at both sites combined)	Woodlot 2005g
2005	Spring	Deerfield, Bennington County	VT	Forested ridge	4/9-4/29	7	42	38	11 (for both sites combined)	0.9	(125 m) 83% (at both sites combined)	Woodlot 2005g
2006	Spring	Lempster, Sullivan County	NH	Forested ridge	Spring	10	78	102	n/a	1.3	125 m (18%)	Woodlot 2007c
2006	Spring	Howard, Steuben County	NY	Agricultural plateau	4/3-5/19	9	53	260	11	5.0	(125 m) 64%	Woodlot 2006d
2006	Spring	Mars Hill, Aroostook County	ME	Forested ridge	4/12-5/18	10	60	64	9	1.1	(120 m) 48%	Woodlot 2006g
2008	Spring	Buckeye, Champaign and Logan Counties	OH	Agricultural plateau	3/1-5/15	32	216	1476	12	6.8	(150 m) 95%	*this report*