Exhibit 08-8 Avian Risk Assessment (2009)



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AVIAN RISK ASSESSMENT FOR THE PROPOSED HARDIN COUNTY NORTH WIND FARM, ADA AND DOLA, OHIO

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EXECUTIVE SUMMARY

JW Great Lakes, LLC (JW) contracted BHE Environmental, Inc. (BHE) to complete an avian risk assessment for the proposed Hardin County North Wind Farm Project near the towns of Ada and Dola, Hardin County, Ohio. This assessment includes a review of appropriate literature and databases; results of agency data base queries; coordination with the Ohio Department of Natural Resources (ODNR), Ohio Power Siting Board (OPSB), and US Fish and Wildlife Service (USFWS); and summary of field investigations conducted in October 2008 and March 2009 by a qualified ornithologist. These data provide an understanding of the species and numbers of birds known or suspected to use the Project area and are used to assess the potential risk to birds, if any, as a result of the proposed wind farm.

The proposed 49.5 megawatts (MW) Hardin County North Wind Farm Project is located near the towns of Ada and Dola in Hardin County, Ohio. JW has proposed to install between 19-27 wind turbine machines at 80-100 meters (m) hub height and 90-100 m diameter rotors on the approximately 3,371 acre (ac) site dominated by intensive row crop agriculture production (Figure 1). Over 98% of the Project area is cropland.

The Hardin County North Wind Farm site is privately owned farmland. The terrain on the site is nearly flat. There are paved and gravel section roads throughout the Project area and a single set of railroad tracks crosses the property. The area was effectively drained in the 1940s and deep linear drainage ditches cross the property and feed into Hog Creek Ditch, which drains the site to the west. The property is predominantly intensively managed for soybean and corn agriculture.

During the Fall Raptor Migration survey and Spring Northern Harrier Nest Survey, no federally endangered or threatened species were observed on or within 1/4 mile of the Project perimeter. The state endangered Northern Harrier (*Circus cyaneus*) and state species of concern Sharp-shinned Hawk (*Accipiter striatus*) were observed flying through the area well below the height of rotor swept areas. During Spring Raptor surveys, Sharp-shinned Hawks were observed passing through the Project area. Nest searches for Northern Harriers produced no finds. Habitat is not suitable for Sharp-shinned Hawk nesting. A query of the ODNR Natural Heritage Database revealed no records of endangered or threatened species on or within five miles of the Project area.

Nothing in the literature, databases, and examination of the habitats on the site suggest that the property is an important nesting, foraging, or migratory stop-over site for federal or Ohio State endangered, threatened, avian species of concern. There was no indication that the proposed wind farm site harbored large numbers of migrating or wintering birds or that the site is situated along a major migratory pathway.

Due to the intensive agricultural practices, there was no indication of high densities or abundant availability of prey species that could attract raptor species.

The results of the site visits, literature reviews, database searches and survey of the avian species that utilize the site compared with what is known about avian risk factors at wind farms in North America indicate that the risk to avian species at the Hardin County North Wind Farm site is low.

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1.0 INTRODUCTION

1.1 PROPOSED PROJECT

JW Great Lakes, LLC (JW) proposes to construct a 49.5 megawatts (MW) wind farm (Hardin County North Wind Farm Project) near the towns of Ada and Dola, Hardin County, Ohio. The Project area represents the maximum area considered for placement of turbines and facility infrastructure. The actual area occupied by the turbines and access roads that will comprise the facility will be a very small percentage (4% during construction; <1% when built) of the Project area. Turbines will be on tubular towers and lighted according to Federal Aviation Administration (FAA) regulations. The proposed 3,351 acre (ac) Project area is dominated (98%) by intensive row crop agriculture (Figures 1 and 2).

Though number and specific model of turbines has not yet been selected, the Hardin County North facility will consist of 19 to 27 wind turbines located in strings or arrays within the Project area. Models and number of turbines under consideration include Kenersys K100 (19 turbines), Siemens SWT 2.3-101 (21 turbines), or Vestas V90 (27 turbines). This risk assessment is applicable to each of the three options.

The Siemens SWT 2.3-101 model will have a nameplate generating capacity of 2.3 MW, yielding a total nameplate project capacity of 48.3 MW. The proposed hub height is about 100 meters (m) (328 feet [ft]) above ground level (agl). Rotor diameter will be approximately 101 m (331 ft) and individual blades will be approximately 49 m (160.8 ft) long. With the rotor tip in the 12 o'clock position, the wind turbines will reach a maximum height of approximately 150.5 m (494 ft) agl. At the 6 o'clock position, the rotor tip will be approximately 49.5 m (162 ft) agl. The turbine rotor will turn at a maximum operating speed of 16 revolutions per minute (rpm). The turbines have a nominal "cut-in speed" of 4 m per second (m/s) (8.9 miles per hour [mph]). Wind speeds above 4 m/s will result in blade speeds of 6 to 16 rpm, depending upon wind speeds.

The Vestas V90 model will have a nameplate generating capacity of 1.8 MW, yielding a total nameplate project capacity of 48.6 MW. The proposed hub height is about 80 m (262 ft) agl. Rotor diameter will be approximately 90 m (295 ft) and individual blades will be approximately 44 m (144 ft) long. With the rotor tip in the 12 o'clock position, the wind turbines will reach a maximum height of approximately 125 m (410 ft) agl. At the 6 o'clock position, the rotor tip will be approximately 35 m (115 ft) agl. The turbine rotor will turn at a maximum operating speed of 16.6 rpm. The turbines have a nominal "cut-in speed" of 4 m/s (8.9 mph). Wind speeds above 4 m/s will result in blade speeds of 9.3 to 16.6 rpm, depending upon wind speeds.

The Kenersys K100 model will have a nameplate generating capacity of 2.5 MW, yielding a total nameplate project capacity of 47.5 MW. The proposed hub height is about 100 m (328 ft) agl. Rotor diameter will be approximately 100 m (328 ft) and individual blades will be approximately 48.7 m (160 ft) long. With the rotor tip in the 12 o'clock position, the wind turbines will reach a maximum height of approximately 150 m (492 ft) agl. At the 6 o'clock position, the rotor tip will be approximately 50 m (164 ft) agl. The turbine rotor will turn at a maximum operating speed of 14.1 rpm. The turbines have a nominal "cut-in speed" of 3.5 m/s (7.9 mph). That is, winds of 3.5 m/s contain sufficient energy to support the generation of electric power by the turbine. At wind speeds below 3.5 m/s, as measured by an anemometer atop each nacelle, the turbine's "primary brake" is applied (i.e., the turbine



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blades are feathered by orienting the primary surface of each blade parallel to the wind direction). With the primary brake applied, the blades will not rotate around the hub, or will rotate very slowly (less than 1 rpm). Control systems allow the cut-in wind speed to be set independently at each turbine. Wind speeds above 3.5 m/s will result in blade speeds of 1 to 14.1 rpm, depending upon wind speeds. If wind speeds at an operating (spinning) turbine drop below the cut-in speed, the primary brake is applied and the blades come to a stop within approximately one minute.

As a result of the proposed Project, some existing roads will be improved and new roads constructed to allow access for construction and maintenance of the turbines. Electric lines will be primarily underground.

The ownership of the property is private. No Town, County, State, or Federal property occurs within the Project limits.

1.2 TOPOGRAPHIC/PHYSIOGRAPHIC AND HABITAT DESCRIPTION

Habitat at the Hardin County North Project can be broadly characterized through a review of the ecoregional type. An ecoregion is an area with similar or related physiography, where communities or associations of plants and animals, both common and rare, have adapted to that particular environment. Climate, soils, drainage, and anthropogenic factors all may have an effect on biological communities and ecoregions.

The proposed Hardin County North Wind Farm is located in the Central Till Plains, Beech Maple Section of the Eastern Broadleaf forest Ecoregion (Appendix B). This Section is part of the Central Lowlands geomorphic province, characterized by its flatness and by shallow entrenchment of its drainages. This is a level to gently rolling till-plain (glacial ground moraine), with broad bottom lands along the few major river valleys. Elevation ranges from 200 to 300 m (650 to 1,000 ft). Local relief is mainly a few meters, but in places, hills rise as much as 25 m (80 ft). The topography of the proposed Hardin County North Wind Farm is essentially flat. Topographic changes consist of drainage ditch banks and an elevated railroad track.

1.3 METHODS

Literature and database searches were completed, including a review of relevant printed, published, unpublished, and electronic material including US Geological Survey (USGS) Breeding Bird Surveys, Ohio Breeding Bird Atlas, Audubon Christmas Bird Counts, hawk migration literature, Ohio Natural Heritage Inventory, Ohio Department of Natural Resources (ODNR) information, US Fish and Wildlife Service (USFWS) information, and other sources of information concerning the birds that may nest, migrate through, forage, rest, or use the site as a wintering area.

Coordination was sought from the ODNR and USFWS. Field investigation methods were based upon agency input and the study intensity maps included within the ODNR "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio." Queries of agency databases were conducted (Appendix A).

Vegetation and habitats were surveyed October 30 - 31, 2008. The survey area included the Project area as well as the surrounding one-fourth mile area. Pedestrian surveys of the railroad bed, representative ditches, and the adjacent woodlot identified the dominant

vegetation in each habitat type. An automobile survey was conducted throughout the property to assure that no habitat features were excluded and to survey the agricultural areas.

Avian surveys were conducted two days a week from October 9-31, 2008. These surveys were conducted with the aid of 10 magnification binoculars and included periods of stationary observation and automobile surveys. Local residents were interviewed about wildlife species that were nocturnal or seldom seen, but likely occurred on the site. Ditch bottoms were inspected for bird tracks and other identifying signs.

Raptor migration surveys were conducted October 9 - 31, 2008. The counts occurred from 0900 to 1600 hours, two days per week. Estimated raptor flight height above ground level was recorded to assess usage of air space within turbine rotor swept area. Methods used were consistent with Section 2.2 Diurnal Bird/Raptor Migration Monitoring of the On-Shore Bird and Bat Pre- and Post- Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio, issued by ODNR, except surveys were conducted one less day per week and did not start by the recommended September 1 start up date.

As requested by ODNR, nest searches for the Northern Harrier (*Circus cyaneus*), an Ohio Endangered Species, were conducted March 26-27 and April 28-29, 2009. Due to the distinctive flight patterns during hunting and courtship, observations were conducted from points along public roads where expanses of potentially suitable habitat could be scanned for birds.

A list of birds species detected during these surveys is provided (Table 1).

2.0 LITERATURE REVIEW

2.1 NATIONAL AUDUBON SOCIETY CHRISTMAS BIRD COUNT

Christmas Bird Counts, initiated in 1900, are organized by the National Audubon Society and have been an annual event for 109 years. From the original 25 counts taken in 1900, 124 counts were completed in 2008. The count consists of volunteers attempting to count all of the birds seen or heard in a predetermined, twelve-mile diameter circle.

A Christmas Bird Count was not conducted on the site, but was conducted near Kenton, Ohio, approximately 12 miles (mi) southwest of the Project area. A total of 61 species were identified during the 2008 Hardin County Christmas Bird Count (Table 2).

The lack of habitat diversity limits the occurrence of a diversity of birds using the Project area during the winter. Of the species identified during the Christmas Bird Count, only thirteen species were observed during the surveys of the proposed Project area.

2.2 BREEDING BIRDS

2.2.1 Information from Breeding Bird Survey

The North American Breeding Bird Survey (BBS) is a long-term, international avian monitoring program initiated in 1966 to track the status and trends of North American avian populations. The USGS Patuxent Wildlife Research Center and the Canadian Wildlife Service jointly coordinate the program.

Family	Species
Ardeidae - Herons, Bitterns	Ardea herodias - Great Blue Heron
Cathartidae - New World Vultures	Cathartes aura - Turkey Vulture
	Circus cyaneus - Northern Harrier
	Accipiter striatus - Sharp-shinned Hawk
Accipitridae - Hawks, Kites, Eagles	Accipiter cooperii - Cooper's Hawk
Ardeidae - Herons, Bitterns Cathartidae - New World Vultures Accipitridae - Hawks, Kites, Eagles Charadriidae - Lapwings, Plovers Columbidae - Pigeons, Doves Corvidae - Crows, Jays Alaudidae - Larks Paridae - Chickadees, Titmice Sittidae - Nuthatches Turdidae - Thrushes Sturnidae - Starlings Bombycillidae -Waxwings Parulidae - Emberizids Cardinalidae - Emberizids Icteridae - Blackbirds Fringillidae - Fringilline and Cardueline Finches Passeridae - Old World Sparrows	Buteo jamaicensis - Red-tailed Hawk
	Falco sparverius - American Kestrel
Charadriidae - Lanwings Ployers	Charadrius vociferous - Killdeer
charadinade - Lapwings, riovers	Pluvialis dominica - American Golden-Plover
Columbidae - Pigeons Doves	Columba livia - Rock Dove
	Zenaida macroura - Mourning Dove
Corvidge - Crows Javs	Cyanocitta cristata - Blue Jay
	Corvus brachyrhynchos - American Crow
Alaudidae - Larks	Eremophila alpestris - Horned Lark
Paridae - Chickadees Titmice	Baeolophus bicolor - Tufted Titmouse
Fundue - Chickadees, Humce	Poecile carolinensis - Carolina Chickadee
Sittidae - Nuthatches	Sitta carolinensis - White-breasted Nuthatch
Turdidaa Thrushos	Sialis sialis - Eastern Bluebird
Tururdude - Thrushes	Turdus migratorius - American Robin
Sturnidae - Starlings	Sturnus vulgaris - European Starling
Bombycillidae -Waxwings	Bombycilla cedrorum - Cedar Waxwing
Parulidae - Wood-Warblers	Dendroica coronata - Yellow-rumped Warbler
	Melospiza melodia - Song Sparrow
	Melospiza georgiana - Swamp Sparrow
Emberizidae - Emberizids	Zonotrichia albicollis - White-throated Sparrow
	Zonotrichia leucophrys - White-crowned Sparrow
	Plectrophenax nivalis - Snow Bunting
	Junco hyemalis - Dark-eyed Junco
Cardinalidae - Cardinals, Saltators, Allies	Cardinalis cardinalis - Northern Cardinal
	Sturnella magna - Eastern Meadowlark
Icteridae - Blackbirds	Agelaius phoeniceus - Red-winged Blackbird
	<i>Quicalus quicula</i> - Common Grackle
	Molothrus ater - Brown-headed Cowbird
Fringillidae - Fringilline and Cardueline	Carpodacus mexicanus - House Finch
Finches	Carduelis tristis - American Goldfinch
Passeridae - Old World Sparrows	Passer domesticus - House Sparrow

Table 1. Species of birds observed on proposed Hardin County North Wind Farm.

Common Name	Year	Number	Number Per Hour	Hours
Snow Goose	109	6	0.184615385	32.5
Cackling Goose	109	14	0.430769231	32.5
Canada Goose	109	2808	86.4	32.5
Mute Swan	109	2	0.061538462	32.5
Tundra Swan	109	6	0.184615385	32.5
American Wigeon	109	1	0.030769231	32.5
American Black Duck	109	15	0.461538462	32.5
Mallard	109	854	26.27692308	32.5
Northern Shoveler	109	3	0.092307692	32.5
Northern Pintail	109	62	1.907692308	32.5
duck sp.	109	80	2.461538462	32.5
Canvasback	109	2	0.061538462	32.5
Ring-necked Duck	109	2	0.061538462	32.5
Lesser Scaup	109	1	0.030769231	32.5
Common Merganser	109	14	0.430769231	32.5
Red-breasted Merganser	109	5	0.153846154	32.5
merganser sp.	109	10	0.307692308	32.5
Wild Turkey	109	6	0.184615385	32.5
Great Blue Heron (Blue form)	109	5	0.153846154	32.5
Bald Eagle	109	1	0.030769231	32.5
Cooper's Hawk	109	4	0.123076923	32.5
Accipiter sp.	109	1	0.030769231	32.5
Red-tailed Hawk	109	12	0.369230769	32.5
Buteo sp.	109	1	0.030769231	32.5
American Kestrel	109	14	0.430769231	32.5
Ring-billed Gull	109	169	5.2	32.5
Rock Pigeon	109	32	0.984615385	32.5
Eurasian Collared-Dove	109	13	0.4	32.5
Mourning Dove	109	40	1.230769231	32.5
Belted Kingfisher	109	3	0.092307692	32.5
Red-headed Woodpecker	109	1	0.030769231	32.5
Red-bellied Woodpecker	109	6	0.184615385	32.5
Downy Woodpecker	109	22	0.676923077	32.5
Hairy Woodpecker	109	2	0.061538462	32.5
Northern Flicker	109	1	0.030769231	32.5
Pileated Woodpecker	109	1	0.030769231	32.5
small woodpecker sp.	109	1	0.030769231	32.5
Blue Jay	109	36	1.107692308	32.5
American Crow	109	5	0.153846154	32.5
Horned Lark	109	112	3.446153846	32.5

Table 2. Christmas Bird Count Results

Common Name	Year	Number	Number Per Hour	Hours
Carolina Chickadee	109	24	0.738461538	32.5
Tufted Titmouse	109	6	0.184615385	32.5
White-breasted Nuthatch	109	7	0.215384615	32.5
Brown Creeper	109	2	0.061538462	32.5
Carolina Wren	109	11	0.338461538	32.5
American Robin	109	21	0.646153846	32.5
European Starling	109	1390	42.76923077	32.5
Yellow-rumped Warbler	109	1	0.030769231	32.5
American Tree Sparrow	109	135	4.153846154	32.5
Song Sparrow	109	25	0.769230769	32.5
Swamp Sparrow	109	4	0.123076923	32.5
White-crowned Sparrow	109	1	0.030769231	32.5
sparrow sp.	109	1	0.030769231	32.5
Dark-eyed Junco	109	118	3.630769231	32.5
Lapland Longspur	109	1	0.030769231	32.5
Northern Cardinal	109	47	1.446153846	32.5
Common Grackle	109	2	0.061538462	32.5
Brown-headed Cowbird	109	1	0.030769231	32.5
House Finch	109	38	1.169230769	32.5
American Goldfinch	109	98	3.015384615	32.5
House Sparrow	109	519	15.96923077	32.5

	Table 2.	Christmas	Bird	Count	Results
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Each year during the height of the breeding season (June for most of the US and Canada), volunteers skilled in avian identification collect breeding bird data along roadside routes. Each survey route is 24.5 mi long with stops at 0.5 mi intervals. At each stop a 3 minute point count is conducted where every bird seen or heard within 0.25 mi is recorded. Surveys begin $\frac{1}{2}$ hour before local sunrise and take approximately 5 hours to complete. Over 4,100 survey routes are located across North America.

A BBS has not been conducted on the site due to the intensive agricultural practices which limit nesting habitat. The nearest USGS Breeding Bird Survey occurs near Kenton, Ohio, approximately ten mi to the east. Ninety species were identified during the survey. Seven of the ninety species identified during the USGS Breeding Bird survey were listed as endangered, threatened, or species of concern by federal regulatory agencies or by the State of Ohio. The results of the survey are included in Table 3.

The lack of habitat diversity on the proposed Hardin North Wind Farm precludes breeding of many of the species observed in the Kenton survey.

2.2.2 Breeding Bird Atlas

A Breeding Bird Atlas is a grid-based survey designed to ascertain the status and distribution of all avian species breeding within a country, state or county. For the Ohio Breeding Bird Atlas, the State was divided into 4,437 atlas blocks of approximately 10 square mi. The atlasing field effort began in 2006 and will run through 2010.

Breeding bird data is classified into 4 categories: observed, possible, potential, and confirmed. Birds observed once during "safe dates" (the period of the breeding season that excludes non-breeding migrants or dispersing individuals) is determined to be "observed." Birds seen during "safe dates" and in appropriate breeding habitat are considered "possible." Birds observed exhibiting some indication of breeding activity (territorial disputes, pairs of birds together, etc.) are considered potential. Direct observations of active nests, adults carrying food items or fledglings are classified as confirmed.

The proposed Project area was not included in the 1982-1987 Breeding Bird Atlas project. A survey block adjacent to the Project area was surveyed during the 1982-1987 Atlas and that effort identified ten species as possible breeders, thirty two species as probable and thirty-six species were confirmed as breeding in the area, for a total of seventy eight species.

Of the seventy eight species identified during the five year Breeding Bird Atlas survey, nine species are included in the Federal or Ohio list of endangered, threatened, or species of concern. A summary of the results of the 1982 - 1987 Breeding Bird Atlas is included in Table 4.

Extensive observations of the avian species on the proposed wind farm site compiled a total of only thirty-six species. These surveys were conducted during fall and spring migration and during a portion of the breeding seasons. Available nesting habitat diversity will restrict species richness and diversity. Species such as Song Sparrows (*Melospiza melodia*), Swamp Sparrows (*Melospiza georgiana*), Mallards (*Anas platyrhynchos*), and Common Yellowthroat (*Geothlypis trichas*) may nest in the grasses lining the drainage ditches. The only listed species observed on the proposed wind farm site were Northern Harriers and Sharp-shinned Hawks. Both species were seen migrating through the site at low elevations and did not stop on the property. Preferred breeding habitat for these species is limited or lacking on the site.

Table 3. Results of the Kenton, Ohio Birding Bird Survey Route (66033) from 1966 to 2007. Results are listed in taxonomic order.

	s or deri	
Canada Goose	Northern Flicker	Brown Thrasher
Wood Duck	Eastern Wood-Pewee	European Starling
Mallard	Acadian Flycatcher	Cedar Waxwing
Ring-necked Pheasant	Willow Flycatcher	Yellow Warbler
Northern Bobwhite	Eastern Phoebe	Common Yellowthroat
Great Blue Heron	Great Crested Flycatcher	Yellow-breasted Chat
Green Heron	Eastern Kingbird	Scarlet Tanager
Turkey Vulture	White-eyed Vireo	Eastern Towhee
Bald Eagle	Yellow-throated Vireo	Chipping Sparrow
Cooper's Hawk	Warbling Vireo	Field Sparrow
Red-tailed Hawk	Red-eyed Vireo	Vesper Sparrow
American Kestrel	Blue Jay	Savannah Sparrow
Killdeer	American Crow	Grasshopper Sparrow
Upland Sandpiper	Horned Lark	Song Sparrow
Ring-billed Gull	Purple Martin	Northern Cardinal
	T C U	Rose-breasted
Black Tern	Tree Swallow	Grosbeak
Rock Pigeon	Northern Rough-winged Swallow	Blue Grosbeak
Mourning Dove	Barn Swallow	Indigo Bunting
Black-billed Cuckoo	Carolina Chickadee	Dickcissel
Yellow-billed Cuckoo	Black-capped Chickadee	Bobolink
Great Horned Owl	Tufted Titmouse	Red-winged Blackbird
Barred Owl	White-breasted Nuthatch	Eastern Meadowlark
Common Nighthawk	Carolina Wren	Western Meadowlark
Chimney Swift	House Wren	Common Grackle
Ruby-throated		Brown-headed
Hummingbird	Blue-gray Gnatcatcher	Cowbird
Belted Kingfisher	Eastern Bluebird	Orchard Oriole
Red-headed Woodpecker	Wood Thrush	Baltimore Oriole
Red-bellied Woodpecker	American Robin	House Finch
Downy Woodpecker	Gray Catbird	American Goldfinch
Hairy Woodpecker	Northern Mockingbird	House Sparrow

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Species	Breeding Evdence ¹	Species	Breeding Evidence ¹	Species	Breeding Evdence ¹
Canada Goose (Branta canadensis)	Confirmed (34)	Eastern Wood-Pewee (Contopus virens)	Probable (23)	Yellow Warbler (Dendroica petechia)	Probable (22)
Wood Duck (Aix sponsa)	Confirmed (34)	Acadian Flycatcher (Empidonax virescens)	Possible (10)	Cerulean Warbler (Dendroica cerulea)	Possible (10)
Mallard (Anas platyrhynchos)	Probable (21)	Willow Flycatcher (Empidonax traillii)	Confirmed (34)	American Redstart (Setophaga ruticilla)	Probable (24)
Ring-necked Pheasant (Phasianus colchicus)	Probable (22)	Eastern Phoebe (Sayornis phoebe)	Possible (10)	Common Yellowthroat (Geothlypis trichas)	Probable (22)
Northern Bobwhite (Colinus virginianus)	Probable (21)	Great Crested Flycatcher (Myiarchus crinitus)	Probable (21)	Yellow-breasted Chat (Icteria virens)	Probable (21)
Green Heron (Butorides virescens)	Probable (21)	Eastern Kingbird (Tyrannus tyrannus)	Confirmed (34)	Scarlet Tanager (Piranga olivacea)	Probable (21)
Turkey Vulture (Cathartes aura)	Possible (10)	White-eyed Vireo (Vireo griseus)	Probable (21)	Eastern Towhee (Pipilo erythrophthalmus)	Probable (23)
Red-tailed Hawk (Buteo jamaicensis)	Probable (23)	Red-eyed Vireo (Vireo olivaceus)	Confirmed (31)	Chipping Sparrow (Spizella passerina)	Confirmed (30)
American Kestrel (Falco sparverius)	Confirmed (34)	Blue Jay (Cyanocitta cristata)	Confirmed (36)	Field Sparrow (Spizella pusilla)	Confirmed (38)
Killdeer (Charadrius vociferus)	Confirmed (34)	American Crow (Corvus brachyrhynchos)	Possible (10)	Vesper Sparrow (Pooecetes gramineus)	Confirmed (30)
Spotted Sandpiper (Actitis macularius)	Possible (10)	Horned Lark (Eremophila alpestris)	Confirmed (34)	Savannah Sparrow (Passerculus sandwichensis)	Confirmed (30)
Rock Pigeon (Columba livia)	Confirmed (39)	Tree Swallow (Tachycineta bicolor)	Probable (26)	Grasshopper Sparrow (Ammodramus savannarum)	Confirmed (30)
Mourning Dove (Zenaida macroura)	Confirmed (34)	Northern Rough-winged Swallow (Stelgidopteryx serripennis)	Confirmed (34)	Song Sparrow (Melospiza melodia)	Confirmed (31)
Yellow-billed Cuckoo (Coccyzus americanus)	Probable (21)	Barn Swallow (Hirundo rustica)	Confirmed (39)	Northern Cardinal (Cardinalis cardinalis)	Confirmed (34)
Black-billed Cuckoo (Coccyzus erythropthalmus)	Possible (10)	Black-capped Chickadee (Poecile atricapillus)	Probable (21)	Rose-breasted Grosbeak (Pheucticus ludovicianus)	Probable (23)
Eastern Screech-Owl (Megascops asio)	Probable (23)	Tufted Titmouse (Baeolophus bicolor)	Probable (23)	Indigo Bunting (Passerina cyanea)	Confirmed (30)
Great Horned Owl (Bubo virginianus)	Confirmed (34)	White-breasted Nuthatch (Sitta carolinensis)	Probable (26)	Bobolink (Dolichonyx oryzivorus)	Probable (23)
Barred Owl (Strix varia)	Possible (10)	House Wren (Troglodytes aedon)	Confirmed (36)	Red-winged Blackbird (Agelaius phoeniceus)	Confirmed (39)
Chimney Swift (Chaetura pelagica)	Possible (10)	Eastern Bluebird (Sialia sialis)	Confirmed (34)	Eastern Meadowlark (Sturnella magna)	Probable (24)
Ruby-throated Hummingbird (Archilochus colubris)	Possible (10)	Veery (Catharus fuscescens)	Probable (21)	Common Grackle (Quiscalus quiscula)	Confirmed (34)
Belted Kingfisher (Megaceryle alcyon)	Probable (21)	Wood Thrush (Hylocichla mustelina)	Probable (23)	Brown-headed Cowbird (Molothrus ater)	Confirmed (34)
Red-headed Woodpecker (Melanerpes erythrocephalus)	Probable (23)	American Robin (Turdus migratorius)	Confirmed (38)	Orchard Oriole (Icterus spurius)	Probable (24)
Red-bellied Woodpecker (Melanerpes carolinus)	Probable (23)	Gray Catbird (Dumetella carolinensis)	Confirmed (31)	Baltimore Oriole (Icterus galbula)	Probable (22)
Downy Woodpecker (Picoides pubescens)	Probable (21)	Brown Thrasher (Toxostoma rufum)	Confirmed (34)	House Finch (Carpodacus mexicanus)	Confirmed (39)
Hairy Woodpecker (Picoides villosus)	Probable (23)	European Starling (Sturnus vulgaris)	Confirmed (39)	American Goldfinch (Carduelis tristis)	Confirmed (30)
Northern Flicker (Colaptes auratus)	Confirmed (36)	Cedar Waxwing (Bombycilla cedrorum)	Confirmed (39)	House Sparrow (Passer domesticus)	Confirmed (39)
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Table 4. Breeding Bird Atlas Records from 1982-1987. Results are listed in taxonomic order. Codes describing breeding evidence are provided below.

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2.3 MIGRATING BIRDS

2.3.1 Habitat Types Attractive to Migratory Birds

Habitats that attract migrant birds such as forests, wetlands, hedge rows, and shrubby thickets are virtually absent from the Project area (Figure 2). There are a series of drainage ditches within the Project area, but these habitat types are limited in size and will not concentrate migratory birds.

Large farm fields are attractive to Horned Larks (*Eremophila alpestris*), Snow Buntings (*Plectrophenax nivalis*), and other grassland migrants. There is extensive acreage of this habitat type throughout the Midwest, so this habitat within and surrounding the Project area is unlikely to concentrate these migrant species.

2.3.2 Nocturnal Songbird Migration

It is generally accepted that passerine migration occurs along a broad front, not focused into narrow routes. This suggests that any area may be over-flown by migrating songbirds. Passerines also migrate nocturnally. There have been a number of studies concerning the potential risk of wind-energy development on nocturnal migrating songbirds (Kunz et al. 2007; GAO 2005; National Academy of Sciences 2007). Erickson et al. (2001) reviewed 31 studies of bird fatalities at commercial wind energy projects and found that 78% of the avian fatalities were passerines, of which approximately half were nocturnal migrants.

The National Academy of the Sciences (2007) summarized studies up to that time and found that bird mortality averaged 1.98 birds/turbine/year in the Pacific Northwest, 1.5 birds/turbine/year in the Rocky Mountain region, 2.22 birds/turbine/year in the Upper Midwest, and the highest average mortality was recorded in the eastern US in the Appalachian Mountains where the average mortality was 4.27 birds/turbine/year. Eastern forested areas have shown the highest bird mortality, while western and Midwestern farmlands have shown lower mortality.

Songbird habitat is lacking within and near the Hardin North Project area. Songbird or other night migrants would not be expected to be attracted to the area due to its lack of forest, wetlands, and other habitats useful to night migrants that may otherwise utilize the site during migration. Moreover, any night migrant birds flying over the Project area would be expected to fly well above the rotor swept area of the turbines. A radar study by Able (1970) indicates that a mean height for a majority of migratory passerines was between less than 1,900 ft agl and 3,037 ft agl on clear nights during the fall migrants down to elevations of less than 1,000 ft agl.

2.3.3 Raptor Migration

Throughout the Midwest, hawk migration is normally occurs along a diffuse, broad front. Topographic features, linear ridges, large water bodies, or coastlines sometimes concentrate large numbers of migrating hawks, but these conditions are seldom found in the Midwestern states, with the exception of along and between the Great Lakes. Fall and spring raptor migration pathways may intersect the Project area in the autumn. At the request of ODNR, surveys were conducted weekly of raptor migrations October 9-31, 2008. The results of these surveys are provided in Appendix D.

2.3.4 Waterbirds

A review of wetland inventories and land use land cover data showed water resources on the Project area to be minimal. Water on the proposed Hardin North Wind Farm is restricted to Hog Creek Ditch and the drainage systems (Figure 2). The limited acreage of this habitat type will not attract significant numbers of water fowl or wetland associated bird species.

3.0 IMPORTANT BIRD AREAS, FEDERAL AND STATE WILDLIFE REFUGES, AND PRIVATE PROTECTED AREAS

A query of the ODNR Natural Heritage Database showed no designated conservation or natural resources areas within 5 mi of the Project area.

Two Important Birds Areas are located in the general vicinity of the proposed Hardin County North Wind Farm, the Metzger/Ferguson Reservoirs, approximately 25 mi west near Lima, Ohio and Lawrence Woods, approximately 15 mi southeast of the site. Lawrence Woods is identified as an Ohio State Natural Area under the jurisdiction of the ODNR.

No National Wildlife Refuges are in the vicinity of the Project area.

The Big Darby Nature Reserve is located approximately 30 mi southeast of the proposed Project area. The Reserve is owned and operated by the Nature Conservancy. In conjunction with the Nature Conservancy's Nature Reserve, neighboring properties are also protected.

Natural areas are generally lacking in the Project area.

4.0 SURVEY RESULTS

4.1 HABITAT DESCRIPTIONS AND BIRDS PRESENT

4.1.1 Agricultural Fields

Between 1869 and 1946, a network of drainage ditches was constructed throughout the Project area, effectively dewatering the area for agriculture. As a result, the land use on a vast majority (98%) of the proposed wind farm is the cultivation of corn (*Zea mays*) and soybeans (*Glycine max*) (Figures 1 and 2). These intensive agricultural practices and herbicide application control vegetation diversity. In a study of the effects of wind turbines on upland nesting birds in Conservation Reserve Program (CRP) grasslands, Leddy et. al. (1999) recommends turbines be placed within cropland habitats that support lower densities of grassland passerines than those found in CRP grasslands.

Horned Larks (*Eremophila alpestris*), killdeer (*Charadrius vociferous*), and Red-winged Blackbirds (*Agelaius phoeniceus*) were the birds most commonly observed in the agricultural lands.

4.1.2 Drainage Ditches

The Ohio Wetland Inventory (OWI) Map identified a total of 11.9 ac of wetlands within the Project area (Figure 2). The wetlands were approximately 6 - 8 ft in depth and parallel to the roads and section lines, emptying to the west or southwest into Hog Creek Ditch. They

span approximately 10 mi within the Project area. Water quality appeared poor due to the great amount of sediment observed in the water. Presumably, due to channelization and agricultural runoff, stream substrate was mud with no aquatic stream structure such as riffles, sand bars, or gravel bars. Within the drainage ditches, some hydrophytic vegetation existed. The drainage systems resulted in removal of wetlands that historically existed on site and allowed conversion of the land to intensive agricultural, therein limiting habitat types on the property.

Wetland plant and wildlife communities are restricted to these ditches and compose an extremely limited amount of the site. Dominant vegetation along the ditches included reed canarygrass (*Phalaris arundinacea*), narrow-leaf cattail (*Typha angustifolia*), and duckweed (*Lemna minor*). Hydrophytic shrub species and high quality wildlife food species, such as buttonbush (*Cephalanthus occidentalis*) or duck potato (*Sagittaria latifolia*), were entirely lacking within this habitat type.

The ditches within the Project area offer little in terms of wetland habitat. Due to the limited size of this habitat type and seasonality of inundation, aquatic species were also limited. Local residents relayed that a majority of the ditches lack water during the summer months and that Hog Creek Ditch, while perennial, contains few, if any, fish species. Bird species identified using the ditches were Great Blue Heron (*Ardea herodias*), Song Sparrow (*Melospiza melodia*), and Swamp Sparrow (*Melospiza georgiana*) Wood Duck (*Aix sponsa*), and Mallard (*Anas Platyrhynchos*). The two species of waterbirds (Wood Duck and Mallard) were seen in extremely small numbers (1-2 birds) during the migratory season.

4.1.3 Railroad Bed

An active set of railroad tracks transects the property just north of Route 81 (Figure 1). The elevated tracks are the highest area on the property and have been colonized by a variety of upland plant species. Dominant plants along the tracks are common milkweed (*Asclepias syriaca*), giant foxtail (*Setaria faberi*), and tall fescue (*Festuca arundinacea*). Scattered shrubs, such as elderberry (*Sambucus canadensis*) and common cottonwood (*Populus deltoides*), added limited vertical diversity and provided perching, feeding, and nesting opportunities for birds such as Gray Catbirds (*Dumetella carolinensis*) and Brown Thrashers (*Toxostoma rufum*).

Birds identified along the railroad tracks were the Song Sparrow (*Melospiza melodia*), Cooper's Hawk (*Accipiter cooperii*), and Northern Cardinal (*Cardinalis cardinalis*). During migration, the cover and feeding potential offered by this habitat type attracted a few fall migrants such as the White-throated Sparrow (*Zonotrichia albicollis*), White-crowned Sparrow (*Zonotrichia leucophrys*), and Yellow-rumped Warbler (*Dendroica coronata*). These species are transient and migrate to wintering grounds located much further south.

4.1.4 Woodlot

A two-ac woodlot is near the northeast quadrant of the property and is the only location of forest habitat within the property boundary or the ¹/₄ mi buffer zone (Figure 2). This woodlot contains the remnants of an oak/maple forest community. Tree species identified in this habitat type were white oak (*Quercus alba*), American basswood (*Tilia americana*), and American Hackberry (*Celtis occidentalis*). Shrub and understory species in the woodlot were red-panicle dogwood (*Cornus racemosa*), Virginia creeper (*Parthenocissus quinquefolia*), serviceberry (*Amelanchier* sp.), and raspberry (*Rubus* sp.). Bird species identified within the

woodlot habitat type were Red-tailed Hawk (*Buteo jamaicensis*), Carolina Chickadee (*Poecile carolinensis*), and White-breasted Nuthatch (*Sitta carolinensis*).

4.2 SPECIES SPECIFIC SURVEYS

4.2.1 Raptor Migration

The most common species observed were Turkey Vultures. The highest count in a single day was 381 Turkey Vultures on October 16, flying at an estimated altitude of 1,000 ft agl). Sightings of Red-tailed Hawks averaged three birds per day for a total of 24 birds. Red-tailed Hawks were observed soaring at heights ranging from approximately 25 ft to 200 ft. They were also observed perched on telephone poles and in the few trees located on the property. Five Northern Harriers were counted for an average of 0.6 birds per day. Average height agl for the harriers was an estimated ten ft. Cooper's Hawks averaged 0.7 birds per day (6 birds observed) and Sharp-shinned Hawks averaged 0.4 birds per day based on a total of 3 birds observed. The Cooper's and Sharp-shinned Hawks were observed flying at low altitudes through the site, less than an estimated 25 ft agl. The other raptor commonly observed on the property was the American Kestrel, with an average of 0.6 birds per day (total of 5 birds) identified during the monitoring period. Kestrels were observed perched on power lines and flying at heights of approximately 50 - 100 ft agl.

This survey indicates that the proposed Hardin North Wind Farm site is not located along an important autumn migratory path. Northern Harriers and Sharp-shinned Hawks, while both are Species of Concern in Ohio, they were observed in very low numbers, with a high of 2 Northern Harriers on October 9. When observed, these species flew low, < 10 m agl, and did not stop on the Project area, but flew directly to the south. Data sheets for this survey are included in Appendix D.

USFWS Hawk Migration Maps show that the Hardin North Wind Farm is not located along a migratory flight path. These maps are included as Appendix D.

4.2.2 Northern Harrier Nesting Survey

No Northern Harriers were observed during these surveys, due to a lack of preferred nesting habitat on-site.

5.0 RISK ANALYSIS FOR THE PROPOSED PROJECT

5.1 REVIEW OF RISKS TO BIRDS AT OTHER WIND POWER PROJECTS

5.1.1 Disturbance and Displacement

Construction Impacts

The footprint of wind turbines typically represents a very small amount of a Project area. For example only 4% of the Hardin North Project area will be disturbed during construction and less than 1% of the land will remain in wind energy production during operation. Construction is often completed in 6-12 months depending on the size of the Project and topography of the site. Construction can have a temporary impact upon avian nesting near a wind energy facility which varies based upon the location and configuration of the facility relative to the quality, location and proximity of the habitat. This effect is typically minor.

Operational Impacts

Displacement of birds due to the presence of turbines has been documented in southwestern Minnesota (Leddy et al. 1999) and in Wyoming (Johnson et al. 2000. Breeding and migrating waterfowl and shorebirds have been displaced by wind turbines Drewitt and Langston (2006).

5.1.2 Collision Risk Factors

Perch Availability

Older lattice tower have demonstrated significantly higher bird fatalities (Orloff and Flannery 1992, 1996). Many birds, especially raptors, use the perches and an energy conserving opportunity or as hunting platforms. Modern turbines are mounted on tubular towers. Any of the turbines to be used at the Project area will use tubular towers, thereby eliminating perch availability and reducing this risk factor

Rotor and Blade Tip Speed

Rotor speed on older wind turbines increases collision rates (Orlander and Flannery 1996); Thelander and Rugge 2001). It has been hypothesized that older turbine designs with higher rotation rates and smaller diameter rotors are less visible and therefore presents increased risk to flying birds (Curry 2006; Tucker 1996). Modern turbines such as those proposed by the Applicant at the Hardin North Project area will rotate at much lower speeds, therein reducing the risk. For example, the Siemens turbine under consideration rotates at only 6-16 rpm compared to 72 rpm for older turbines.

Turbine Number and Spacing

While the highest numbers of fatalities have occurred at sites with large numbers of turbines, available data does not correlate turbine numbers with increased risk. With only 19-27 turbines proposed for the Hardin North Project area this risk factor should be low. Moreover, the spacing of the modern turbine arrays at the over 700 ft apart may allow birds sufficient space to maneuver and avoid collisions.

Rotor height

The lowest height of the rotor sweep (rotor height) has been directly correlated with increased collision risk for birds, especially raptors. Curry and Kerlinger (2006) recorded 65.7% of 571 raptor flights below 10 m and an additional 23.1% ranging from 10 to 30 m, for a total of 88.8% of all raptor flights. They also recorded 98% of 32 different species on the site flew below 30 m agl. Smallwood and Thelander (2004) suggest that rotor heights in excess of 28 m agl could substantially reduce raptor mortality.

The hub heights under consideration for the Facility are 80 - 100 m with 90 m rotor diameter. The rotor swept area will be 35 m agl, which may reduce raptor mortality.

Tower Lighting

At present, there is no evidence that FAA lighting in the form of L-864 or L-810 flashing red lights attract birds or that these lights are a causal factor in large scale fatality events at wind turbines. Kerlinger (2000) documented that flashing red strobe lights (L-864) recommended by the FAA and most often used on wind turbines, do not attract migrants like the combination of this type light with L-810 steady burning red lights.

Communication towers pose a greater risk to nocturnally migrating songbirds due to the common usage of steady burning red lights and guy wires (Avery et al. 1980).

Lighting on the turbines on the Project area will follow FAA recommendations that have been shown to be non-attractant to avifauna.

Topography and Physiography

Topographical aspects of the siting of wind turbines may influence the potential risk for avian collisions. Studies suggest that siting turbines on the edge of steep slopes or within depressions increase collision risk, especially for raptor species; Orloff, S. and R. Flannery 1992, 1996; Smallwood, K.S., and C.G. Thelander 2004; Thelander, C.G. and L. Rugge 2001). The flat and unforested farmland on the Project area is consistent with lower risk topography and physiography.

Availability Prey and Density

Habitats with high densities of prey species are preferred by hunting raptors, leading to increased collision risk is situated near turbines. Densities of small mammals are low in areas subjected to intensive farming practices and cultivation (Smallwood, K.S. and C. G. Thelander 2004; Kerlinger et al. 2006).

Siting locations of the wind turbines for the proposed Hardin County North Wind Farm are in areas currently undergoing intensive farming practices, which reduces this collision risk.

5.1.3 Mortality Studies

In 2001, the National Wind Coordinating Committee (NWCC) commissioned Erickson et al. to produce a resource document entitled *Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other sources of Avian Collision Mortality in the US* (Table 5). This document reviewed the existing research concerning avian collision mortality, its causes and recommendations. Highlights of this resource document are as follows: Data collected to date indicate an average of 2.19 avian fatalities/turbine/year in the US for all species combined and 0.033 raptor fatalities/turbine/year.

- Data collected outside California indicate 1.83 avian fatalities/turbine/year and 0.006 raptor fatalities/turbine/year.
- Current estimates of wind plant related avian collision fatalities probably represent from 0.01% to 0.02% (i.e., one out of every 5,000 to 10,000 avian fatalities) of the annual avian collision fatalities in the US.
- Data suggest that while turbines are generally below the flight altitude of most nocturnally migrating birds, weather and other factors that reduce bird flight altitudes may result in collisions with wind turbines as well as other artificial structures.
- For all avian species combined, outside California, estimates of the number of bird fatalities/turbine/year from individual studies have ranged from zero at the Searsburg, Vermont (Kerlinger 1998) and Algona, Iowa sites (Demastes & Trainer 2000) to 4.45 on the Buffalo Ridge, Minnesota Phase III site (Johnson et al. 2000).
- An estimated 488 raptors are killed annually by turbines in the US, nearly all in California, particularly at the Altamont Pass Wind Resource Area.

Common Name	Scientific Name	State Listed ¹	PIF Priority Species
Greater Prairie-Chicken	Tymnpanuchus cupido		Х
Black Rail	Latterallus jamaicensis		Х
Henslow's Sparrow	Ammodramus henslowii		Х
Cerulean Warbler	Dendrioca cerulea		Х
Dickcissel	Spiza americana		Х
Red-headed Woodpecker	Melanerpes erythricephalus		Х
Bell's Vireo	Vireo belii		Х
Northern Bobwhite	Colinus virginiaaus		Х
Chimney Swift	Chaetura pelagica		Х
Field Sparrow	Spizella pusilla		Х
Yellow-billed Cuckoo	Coccyzus americanus		Х
Eastern Wood-Pewee	Contopus virens		Х
Great Crested Flycatcher	Myarchus crinitus		Х
Grasshopper Sparrow	Ammodramus savannarum		Х
Northern Harrier	Circus cyaneus	E	
Sharp-shinned Hawk	Accipiter straitus	SOC	

Table 5.	State and Federally	Listed Endangered,	Threatened a	and Species of	Concern

E = Endangered; SOC = Species of Concern

- Meteorological towers showed estimates of 7.5 bird fatalities/tower/year whereas the turbines showed estimates of 1.8 bird fatalities/turbine/year (Johnson et al. 2001) at Foote Creek Rim, Wyoming. The reason for the difference was the fact that the meteorological towers were guyed as both the towers and wind turbines are approximately 60 m (200 ft) in height.
- Raptor collisions with wind turbines may be more likely to occur while the raptor is concentrating on foraging or stooping towards a prey item. A dense or abundant prey base within a wind resource area may attract a greater number of raptors within the vicinity of wind turbines, and subsequently increasing collision fatality potential among raptor species.
- Water within the vicinity of wind turbines may attract waterfowl, seabirds, and shorebirds, increasing collision potential for these species, although other factors such as adjacent habitat and movement patterns would also greatly influence mortality near these water sources.

The 2005 US Government Accountability Office (GAO) report on Wind Power Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife reviewed bird and bat mortality studies at wind energy facilities around the country. The review states that "studies show that bird and bat mortality from wind power in other parts of the country is comparatively lower than in California or Appalachia."

Overall bird fatalities from wind power ranged from 0 to 7.28 birds/turbine/year. The high rate of 7.28 birds per turbine was found at a facility of only three turbines. In 2007, the National Academy of Sciences (NAS) released its report titled, *Environmental Impacts of Wind-Energy Projects*. The NAS (2007) reported an average of 2.22 birds/turbine/year fatalities from wind energy facilities in the upper Midwest, which is the region most comparable to the Hardin County North Project area. If the Project area produced similar mortality it may total 60 birds/turbine/year spread among a large number of species, so that any one species would likely realize no more than a few individuals lost to the turbines. To put this number of potential fatalities in context, the NAS (2007) stated:

"Collisions with buildings kill 97 to 976 million birds annually; collisions with high-tension lines kill at least 130 million birds, perhaps more than one billion; collisions with communications towers kill between 4 and 5 million based on "conservative estimates," but could be as high as 50 million; cars may kill 80 million birds per year; and collisions with wind turbines killed an estimated at 20,000 to 37,000 birds per year in 2003, with all but 9,200 of those deaths occurring in California. Toxic chemicals, including pesticides, kill more than 72 million birds each year, while domestic cats are estimated to kill hundreds of millions of songbirds and other species each year. Erickson et al. (2005) estimate that total cumulative bird mortality in the United States "may easily approach 1 billion birds per year." Clearly, bird deaths caused by wind turbines are a minute fraction of the total anthropogenic bird deaths-less than 0.003% in 2003 based on the estimates of Erickson et al. (2005)."... In a review of bird collisions reported in 31 studies at wind-energy facilities, Erickson et al. (2001) reported that 78% of the carcasses found at facilities outside of California were protected passerines (i.e., songbirds protected by the Migratory Bird Treaty Reform Act of 2005). The remainder of the fatalities included waterfowl (5.3%), waterbirds (3.3%), shorebirds (0.7%), diurnal raptors (2.7%), owls (0.5%), fowl-like (galliform) birds (4.0%), other (2.7%), and non-protected birds (e.g., starling, house sparrow, rock dove or feral pigeon) (3.3%).

Based upon published and unpublished information available at this time, it is likely that mortality resulting from the Project will be most similar to that at the Crescent Ridge site in Illinois, Top of Iowa site in Iowa, the Lincoln site in Wisconsin, and the Buffalo Ridge site in Minnesota. Annual mortality estimates based upon post-construction monitoring studies was 1.3 birds per turbine per year at Top of Iowa, Lincoln and Crescent Ridge. Results from multiyear mortality studies conducted at Buffalo Ridge, Minnesota have ranged from 1.0-4.5 birds/turbine/year. With 33 turbines located amidst intensive agricultural land, the Crescent Ridge, Illinois wind farm site is the most similar to the Hardin County North Project.

5.2 AVIAN RISK ASSESSMENT AT HARDIN NORTH WIND FARM

5.2.1 Disturbance and Displacement Risk

The proposed Hardin North Wind Farm property has minimal nesting habitat and a near absence of grassland birds. The site is currently under intensive agricultural management and has little or no diversity of habitat types. The proposed wind farm will not result in habitat fragmentation, because there is virtually no avian habitat to fragment. These factors indicate these risks to be negligible.

5.2.2 Collision Risk

As found in the previously cited mortality studies, wind power presents at least some collision risk to birds. The proposed Hardin North Wind Farm is located in an area with poor avian habitat, low avian use, and low bird density. The Project will use modern turbine and tower designs that have been demonstrated to reduce collision risk. There is the potential for

Horned Larks fatalities, but the turbine design and low number of turbines planned for the Project area will minimize the impact on this common species. The site most similar to the Hardin county North Project is the Crescent Ridge Wind Farm in central Illinois. Results show 1.3 birds/turbine/year were fatalities at that location. If the same mortality is realized at Hardin County North using the maximum 27 turbine layout, it would result in mortality of 35.1 birds per year. The effect upon birds at this rate would be negligible; especially considering the fatalities would be distributed among several species, therein further reducing the effects upon any one species.

5.2.2.1 Nocturnal Migrant Passerines

As the studies cited in this assessment have found, a majority of the fatalities of nocturnal migrant passerines are associated with adverse weather conditions. The lack of suitable stopover habitat reduces the potential for concentrations of nocturnal migrant passerines occurring on the site. The risk of a large number fatality event for nocturnal migrant passerines is low at the proposed Hardin North Wind Farm.

5.2.2.2 Raptors

Few raptors were observed within the Project footprint or in the surrounding area. Some raptors migrate through the site, primarily Turkey Vultures, but they were observed well above the rotor swept area. Northern Harriers, Sharp-shinned Hawks, Cooper's Hawks, and American Kestrels were observed below the rotor swept area of the proposed turbines. Aside from one Red-tailed Hawk nest in the small woodlot in the north central portions of the site, nesting by raptor species is limited. Due to the low use of the Project area by raptors, raptor risk is considered very limited at the proposed Hardin North Wind Farm.

5.2.2.3 Waterbirds

Wetland habitat on the proposed Hardin North Wind Farm is restricted to Hog Creek Ditch and the drainage systems. The limited acreage of this habitat type will not attract significant numbers of water fowl or wetland associated bird species. Risk to these species is low at the proposed Hardin North Wind Farm, due to lack of habitat that would attract them to the area.

5.2.2.4 Wintering Resident Birds

Ohio agricultural fields are not important avian wintering areas. A majority of the wintering bird species observed on the property were Horned Larks and Snow Buntings. Being predominantly ground dwelling species, the collision risk to wintering and resident species is low at the proposed Hardin North Wind Farm.

5.2.2.5 Listed Species

No federally listed species were observed on or near the proposed Project area. No Species of Concern identified by the National Audubon Society Watch List or the Partners in Flight List were identified on the proposed wind farm site. The ODNR has no records of listed species on or within 5 mi of the Project area. Northern Harriers, an Ohio Endangered Species, and Sharp-shinned Hawk, classified as a Species of Concern by ODNR, were observed migrating through the site. Both species were seen flying directly through the property and at heights well below the rotor swept area of the proposed turbines. Collision risk to these species is negligible at the proposed Hardin North Wind Farm.

6.0 CONCLUSIONS

The avian habitat on the Project area is minimal in extent and poor in quality. Few birds would be expected to use the area during anytime of year.

Results of this Risk Assessment indicate that the risks for avian collisions with the proposed turbines are low.

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APPENDIX A

Agency Coordination



July 14, 2009

Ms. Angela Boyer U.S. Fish and Wildlife Service 6950 American Parkway Suite H Reynoldsburg, OH 43068-4127

RE: Data Update for a Study Area in Hardin County, Ohio.

Dear Ms. Boyer:

BHE Environmental, Inc.'s client has been completing scoping for a study area located in Hardin County, Ohio as depicted on the attached USGS topographic map (study area is located entirely within Hardin County). BHE's client is considering this area for development of a wind power electric generating plant and associated facilities and will encompass approximately 3,400 acres.

We know that prior coordination and database requests have been made for the project but would like to have the most up to date data. Therefore, we would like to request any data your agency can provide regarding rare/sensitive habitat or natural features and communities within 0.25 miles of the study area. In addition, please provide information regarding federally listed endangered, threatened, and candidate species and critical habitat that may be present within the study area proper or within 0.25 miles of the study area proper or within 0.25 miles of the study area proper or within the study area proper or within 0.25 miles of the study area. We understand recent Indiana bat captures have occurred in Ohio as part of wind farm siting studies. Please advise whether this data is relevant to JW's proposed project area.

If possible, please provide us with hard copies as well as latitude/longitude locations so that we may include this information on environmental constraints base maps that will be produced for the project. It would be greatly appreciated if we could get a quick response to this request. I have provided GIS shapefiles of the project boundary to help expedite the process.

Please contact Mike Sponsler at 614-856-4681 or <u>msponsler@bheenvironmental.com</u> if you have any questions about this data request. Thank you in advance for your timely response.

Sincerely,

Sponster

Mike Sponsler Director

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June 24, 2009

Ohio Department of Natural Resources Division of Natural Areas and Preserves Attn: Butch Grieszmer 2045 Morse Road Building F-1 Columbus, OH 43229

RE: Natural Heritage Database Search update for the Hardin County North Wind Farm

Dear Mr. Grieszmer:

BHE Environmental, Inc.'s client has been completing scoping for a study area located in Hardin County, Ohio as depicted on the attached USGS topographic map (study area is located entirely within Hardin County). BHE's client is considering this area for development of a wind power electric generating plant and associated facilities and will encompass approximately 3,400 acres.

We know that prior coordination and database requests have been made for the project but would like to have the most up to date data to assure any permit applications reflect the most recent information. Therefore, we would like to request a Natural Heritage database search for federally and state-listed species, protected wildlife, unique habitats, natural areas, and other ecologically sensitive resources within 5 miles of the study area. We would also like to request your comments on wildlife species likely to be present within 5 miles of the study area and any other general information about the study area that you feel may be pertinent.

If possible, please provide us with hard copies as well as latitude/longitude locations so that we may include this information on environmental constraints base maps that will be produced for the project. I have also provided GIS shapefiles and a map of the project boundary to help expedite the process.

Please contact Mike Sponsler at 614-856-4681 or <u>msponsler@bheenvironmental.com</u> if you have any questions about this data request. Thank you in advance for your timely response.

Sincerely,

Myponster

Mike Sponsler Director

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Cc: P. Endres



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Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR

SEAN D. LOGAN, DIRECTOR

Division of Natural Areas & Preserves Steven D. Maurer, Chief 2045 Morse Road, F-1 Columbus, OH 43229-6693 Phone: (614) 265-6453 Fax: (614) 267-3096

July 15, 2009

Mike Sponsler BHE Environmental, Inc. 5300 E. Main St., Suite 101 Columbus, OH 43224

Dear Mr. Sponsler:

After reviewing our Natural Heritage maps and files, I find the Division of Natural Areas and Preserves has no records of rare or endangered species within 5 miles of the BHE Environmental, Inc. Hardin County North Wind Farm project #1865.004. The site is located in Secs. 8, 9, 10, 16, 17, 18, 20, and 21, Washington Twp., Hardin Co., Ada and Dunkirk Quadrangles.

There are no existing or proposed state nature preserves within 5 miles of the project site. We are also unaware of any unique ecological sites, geologic features, breeding or non-breeding animal concentrations, state parks, state forests, scenic rivers, or wildlife areas within 5 miles of the project area.

Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Although we inventory all types of plant communities, we only maintain records on the highest quality areas.

Please contact me at (614) 265-6409 if I can be of further assistance.

Sincerely,

Butch Grieszmer, Data Specialist Resource Services Group

ohiodnr.com

APPENDIX B

Ecoregions of the United States



Source: R.G. Bailey [Ecoregions of the United States, USDA Forest Service (scale 1:7,500,000, revised 1994)]

APPENDIX C

Site Photographs



Photo 1. Typical agricultural land use.





Photo 2. Typical agricultural land use.



Photo 3. Grassy vegetation along rail road through the project area.



Photo 5. Typical agricultural land use.



Photo 6. Typical degraded, channeled/grassy watercourse.



Photo 7. Shrubby vegetation along a road.



Photo 9. Typical degraded, channeled/grassy watercourse and typical isolated woodlot.





Photo 10. Typical isolated woodlot and trees clustered in a yard.



Photo 11. Trees clustered in a yard.

Photo 12. Typical woodlot.

APPENDIX D

Ohio Raptor Migration Maps



FALL RAPTOR MIGRATION ROUTES

SYMBOL	COMMON NAME
AK	American Kestrel
BE	Bald Eagle
BO	Boreal Owl
BW	Broadwing
СН	Cooper's Hawk
GE	Golden Eagle
LEO	Long-eared Owl
ML	Merlin
NG	Northern Goshawk
NH	Northern Harrier
NSWO	Northern Saw-whet Owl
OS	Osprey
PG	Pregrine Falcon
RL	Rough-legged Hawk
RS	Red-shouldered Hawk
RT	Red-tailed Hawk
SEO	Short-eared Owl
SS	Sharp-shinned Hawk
TV	Turkey Vulture

Major Raptor Migration Observation Sites

- Hitchcock Nature Area (CH,RT,SS,TV,SW,NH)
- 2 Illinois Dunes State Park (ML,NH,PG,SEO)
- 3 Muskegon State Park (SS,RL,RT)
- 4 Lake Erie Metropark (TV,OS,BE,NH,SS,CH,RT, RL,GE,AK,ME,PG)
- **6** Port Huron (PG,ML)
- Hawk Ridge, Duluth (TV,OS,BE,NH,SS,BW,NG, RT,RL,AK,ML,PG,BO,NSWO,LEO)
- Ittle Suemico (SS,BW,NSWO)
- **(B)** Sleeping Bear Dunes NL (RL,RT,SS)

Legend Number of Birds 2,500 - 25,000 25,000 - 50,000 50,000 - 100,000 >100,000

Map Created for: Division of Migratory Birds October, 2006

Fall Migratory Bird Information provided by USFWS Migratory Bird Biologist Bob Russell



U.S. Fish & Wildlife Service Region 3 NWRS Division of Conservation Planning Twin Cities, Minnesota 55111



SPRING RAPTOR MIGRATION ROUTES

SYMBOL	COMMON NAME
AK	American Kestrel
BE	Bald Eagle
во	Boreal Owl
BW	Broadwing
СН	Cooper's Hawk
GE	Golden Eagle
LEO	Long-eared Owl
ML	Merlin
NG	Northern Goshawk
NH	Northern Harrier
NSWO	Northern Saw-whet Owl
OS	Osprey
PG	Pregrine Falcon
RL	Rough-legged Hawk
RS	Red-shouldered Hawk
RT	Red-tailed Hawk
SEO	Short-eared Owl
SS	Sharp-shinned Hawk
TV	Turkey Vulture

Major Raptor Migration Observation Sites

- West Skyline Observatory, Duluth (TV,OS,BE,SS, BW,RT,RL,GE)
- (2) Chequemegon Bay, Ashland (TV,SS,BW,RT,GE,BE)
- Apostle Islands (AK,ML,PG)
- 4 Manitou Island/Keewenaw Peninsula (OS,SS,RL, NH,BE,PE,ML)
- Whitefish Point (TV,BE,NH,SS,RS,BW,RT,RL,GE, AK,ML,PG,NSWO,BO,LEO)
- 6 Straits of Mackinac (TV,BE,SS,CH,RS, RT,RL,BW,GE)
- Port Huron (TV,SS,RS,RT,BW)
- 8 Lake Erie Islands (TV,SS,BE,NH,OS,ML,PG)
- Indiana Dunes NL (OS,NH,SS,RS,BW,RT,AK)



Map Created for: Division of Migratory Birds October, 2006

Fall Migratory Bird Information provided by USFWS Migratory Bird Biologist Bob Russell



U.S. Fish & Wildlife Service Region 3 NWRS Division of Conservation Planning Twin Cities, Minnesota 55111