Avian Studies for the Crosswinds Proposed Wind Energy Site: Summary of Spring and Fall 2011 Field Seasons - Annual Report

Prepared By:
Joelle Gehring, Ph.D.
Senior Conservation Scientist-Zoology Leader
Michigan State University, Michigan Natural Features Inventory
P.O. Box 30444 Lansing, MI 48909-7944

Prepared For:
Consumer's Energy
1 Energy Plaza Dr.
Jackson, MI 49201-2357

28 November 2011
(revised 27 January 2012)
2012-22

MICHIGAN STATE UNIVERSITY EXTENSION

Executive summary

The development of wind energy has the potential to significantly reduce the emissions of harmful air pollutants, greenhouse gases, and our reliance on fossil fuels. The majority of the areas with high potential for wind energy generation are near the shorelines of the Great Lake's. These shorelines have also been documented to provide important habitat for wildlife, including migratory songbirds and raptors. Avian collisions with wind turbines have been documented, but the frequency of those collisions is site and situation specific. Informed siting of wind turbines can minimize impacts to birds. Due to the potential for avian collisions with wind turbines we conducted surveys of large birds to better understand the densities of large birds in the Project Area, as well as the species composition, habitat use and flight behaviors. These data will help wind energy developers and resource managers to make appropriate decisions regarding the potential impacts to birds and the methods by which they might reduce those impacts.

We established seven raptor and other large bird viewing stations in the Project Area. We conducted 1-hour surveys at the stations in April and May 2011 and again in August through December 2011. During surveys, each raptor, large bird, and sensitive status species was recorded in addition to the bird's flight path, flight direction, approximate flight altitude, and the distance to each bird from the observer. Technicians also recorded the behavior and habitat use of each bird, and weather characteristics. Examination of the spring and fall 2011 large bird survey data suggests that most species' flight behavior does not put them at frequent risk of collision. The high numbers ducks and the overlap between these species' average flight height and the estimated RSA height suggests that the risk of collisions for these species may be higher than for many of the other species observed in the areas. However, some waterfowl species have been documented to actually avoid turbines via their flight behavior (Desholm and Kahlert 2006). Due to avoidance of wind turbines, the structures are thought to displace waterfowl or act as a movement barrier. Some of the other species that appear to potentially fly at the altitude of the RSA include: Ring-billed Gulls, Red-tailed Hawks, Tundra Swans, and Sandhill Cranes. The Short-eared Owl, which is listed as a state endangered species, was not detected at all large bird observation sites, they did concentrate their activities in the

study area. I suggest that additional, geographically broad surveys be conducted for this rare species, with the objective of determining their habitat selection.

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Introduction

The development of wind energy has the potential to significantly reduce the emissions of harmful air pollutants, greenhouse gases, and our reliance on fossil fuels. The U.S. Department of Energy has a goal of 10 GW of wind energy deployment in Michigan by the year 2030. The majority of the areas with high potential for wind energy generation are near the shorelines of the Great Lakes. These shorelines have also been documented to provide important habitat for wildlife, including migratory songbirds and raptors. Shoreline areas have been suggested to be important as stopover sites for Neotropical migratory birds (Ewert 2006, Diehl et al. 2003) and as concentration or funneling areas for migrating raptors which avoid crossing large areas of water (Kerlinger 1989). Waterfowl (e.g., Mallard, Canada Goose) and waterbirds (e.g., gulls, herons, cranes) also use shoreline areas especially during the breeding and migration seasons. Research across North America has demonstrated a relationship between the densities of birds in an area and the numbers of avian collisions. Avian collisions with wind turbines have been documented but the frequency of those collisions is site and situation specific. Birds that use the airspace within the rotor swept area of a turbine are at risk of a collision and therefore the frequency of avian collisions at turbine sites can be directly correlated

to the density of birds in the local area. These data will help wind energy developers and resource managers to make appropriate decisions regarding the potential impacts to birds and the methods in which they might reduce those impacts.

Study Site and Methods

Study site and description

Research was conducted in the Project Area within Tuscola and Huron Counties, located in east-central Michigan, USA (Fig. 1). The land use / land cover of the Project Area consists mainly of agricultural fields (e.g, corn, soybeans, and sugar beets), with some pastures, forested areas, fencerows, and some small wetlands. The natural vegetation in this area is generally described as mesic forests, and wet forests. The forest overstory typically includes components of maple (*Acer* spp.), oak (*Quercus* spp.), ash (*Fraxinus* spp.) and beech (*Fagus grandifolia*). Historically, the eastern inland portion of the Project Area was vegetated with beech-sugar maple forest mixed with black ash swamps. The western portion was predominantly mixed hardwood swamp and areas of mixed conifers with hemlock-white pine. The majority of these areas are now drained for agricultural use (Comer et al. 1995). The western edge of the Project Area is approximately 2.0 miles from the Lake Huron lakeshore (i.e., Saginaw Bay), which is considered by some to be a concentration area for migratory birds. Our Study Area includes the shoreline areas thereby providing a thorough survey effort.

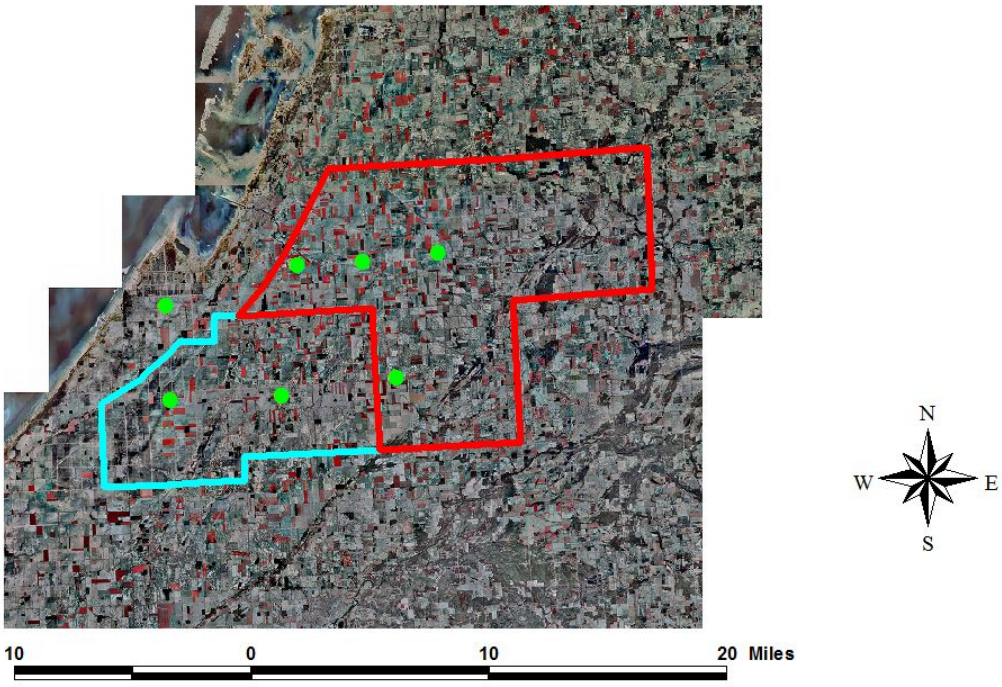

Figure 1. Large bird viewing stations (green dots) were established in Tuscola and Huron Counties, MI in and around the Project Area proposed for wind energy development. Large bird surveys were conducted at the viewing stations in the spring and fall of 2011. The Project Area is predominantly agricultural lands with some interspersed forested areas. Blue lines designate phase 1 and red is phase 2 of the Project Area.

Large bird surveys

We established seven raptor and other large bird viewing stations in the Project Area. These stations provided the best possible viewsheds of the proposed project sites (Fig. 1). Following methods similar to those used by Hawkwatch International, we conducted 1-hour surveys at the stations in April and May 2011 and again in August – mid November 2011. When conducting outdoor research, some flexibility in scheduling is needed and some surveys were missed due to inclement weather.

During surveys each raptor, large bird, and sensitive status species was recorded in addition to the bird's flight path, flight direction, approximate flight altitude (lowest and highest flight altitude), whether it flew within the proposed project area, and the

distance to each bird from the observer. Technicians used landmarks as reference when measuring distance to birds and flight altitude (Fig. 2). Technicians also recorded the behavior and habitat use of each bird. Behavior categories were as follows: perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Any comments or unusual observations were also noted. Weather data were collected in concert with large bird surveys; specifically, temperature, wind speed, wind direction, and cloud cover. The date, start, and end time of observation period, species or best possible identification, number of individuals, sex and age class, distance from plot center when first observed, closest distance, height above ground, activity, and habitat(s) were recorded.

Figure 2. In the spring and fall of 2011 observers surveyed the viewshed for large birds from the viewing stations in the Crosswinds Project Area.

Results and Summary

Large bird surveys – Spring 2011

During the 112 large bird surveys, observers detected 334 large birds of 11 species. There was a mean of 3.0 birds detected per survey (3.0 birds / hour; Table 1). The waterbird group (e.g, gulls, herons, cranes) was the most common species group detected with 1.7 birds / survey, 1.7 birds / hour (Table 2). Waterfowl was the second most frequently detected species group with 0.6 birds / survey, 0.6 birds / hour (Table 2). The corvid group (i.e., American Crow; 0.5 birds / survey, 0.5 birds / hour, Table 2) was the third most frequently detected species.

Assuming the wind turbine rotor-swept area (RSA) would be 50 – 150 m above the ground, 100% of all bird observations were below the RSA, 0% within the RSA, and 0% flew above the RSA. The mean flight altitude of the most common species, the Ring-billed Gull, was 7.9 m with 100% flying below the RSA. This species, among other species of waterbirds and waterfowl used the agricultural fields for foraging and loafing, which is made evident by the low flight altitudes.

Table 1. Large bird abundance and richness in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2011 at seven large bird survey sites.

	Large Bird Survey
No. Species	11
Mean No. Species / Survey	1.6
Mean No. Species / Hour	1.6
Mean No. Birds / Survey	3.0
Mean No. Birds / Hour	3.0

Table 2. Mean bird abundance in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2011 at seven large bird survey sites.

Group	Mean Abundance [a]
Corvids	0.5
Raptors	0.1
Other	0.1
Waterbirds	1.7
Waterfowl	0.6

[a] Mean Abundance = mean number of individuals observed per survey

Table 3. Avian abundance and richness in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2011 at seven large bird survey sites.

Species	No. Bird
American Crow	52
Canada Goose	58
Double-crested Cormorant	2
Great Egret	12
Mallard	11
Northern Harrier	2
Ring-billed Gull	136
Ring-necked Pheasant	14
Red-tailed Hawk	1
Turkey Vulture	8

Large bird surveys – Fall 2011

During the 387 large bird surveys observers detected 18,510 large birds of 28 species. There was a mean of 47.8 birds detected per survey (47.8 birds / hour) (Table 4). The waterfowl group (e.g., Canada Goose, ducks) was the most abundant of the bird groups per survey (34.3 birds / survey, 34.3 birds / hour; Table 5), followed by the waterbirds (e.g, gulls, herons, cranes; 10.6 birds / survey, 10.6 birds / hour; Table 5). The corvid group was the third most common species group (e.g., American Crow; 1.5 birds / survey, 1.5 birds / hour, Table 5). The ducks (Mallards and unidentified duck species)

were the most common waterfowl detected during the surveys (10,185 birds total, 26.3 birds / survey, 26.3 birds / hour, Table 6).

Assuming the potential wind turbine rotor-swept area (RSA) would be 50 – 150 m above the ground, 55% of all birds flew below the RSA, 7% within the RSA, and 38% flew above the RSA. The mean flight altitude of the most common species group, ducks, was 304 m with 27% flying below the RSA, 7% within the RSA, and 66% above the RSA. As previously mentioned, waterfowl are currently not believed to collide with wind turbines as frequently as some other avian groups, such as raptors. Some waterfowl species have been documented to actually avoid turbines via their flight behavior (Desholm and Kahlert 2006). Due to avoidance of wind turbines, the structures are thought to displace waterfowl or act as a movement barrier.

Table 4. Large bird abundance and richness in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the fall of 2011 at a large bird survey site.

	Large Bird Survey
No. Species	28
Mean No. Species / Survey	2.1
Mean No. Species / Hour	2.1
Mean No. Birds / Survey	47.8
Mean No. Birds / Hour	47.8

Table 5. Mean bird abundance in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the fall of 2011 at a large bird survey site.

Group	Mean Abundance [a]
Waterfowl	34.3
Corvids	1.5
Raptors	1.4
Waterbirds	10.6

[a] Mean Abundance = mean number of individuals observed per survey

Table 6. Avian abundance and richness in Tuscola and Huron Counties, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the fall of 2011 at a large bird survey site.

Species	No. Bird
American Golden Plover	60
American Crow	593
American Kestrel	39
Bald Eagle	5
Broad-winged Hawk	1
Canada Goose	2937
Cooper's Hawk	31
Double-crested Cormorant	1
Great Blue Heron	32
Great Egret	3
Gull	16
Herring Gull	6
Killdeer	33
Mallard	5501
Merlin	4
Northern Harrier	71
Osprey	2
Ring-billed Gull	3801
Red-tailed Hawk	123
Ring-necked Pheasant	23
Rough-legged Hawk	7
Sandhill Crane	29
Semi-palmated Plover	100
Short-eared Owl	15
Snowy Owl	10
Tundra Swan	136
Turkey Vulture	221
Unknown large raptor	7
Unknown ducks	4684
Unknown shorebird	15
Wild Turkey	1

Summary of large bird flight behavior in the Project Area

Upon examination of the spring and fall 2011 large bird survey data, it appears that most species' flight behavior did not put them at frequent risk of collisions (Figs. 3 and 4). The overlap of flight altitudes and the estimated RSA in the spring data suggests that Turkey Vultures were at the highest risk for collisions; however, it is important to note that the

sample size of eight birds is low. In the fall, Ring-billed Gulls, Sandhill Cranes, Tundra Swans, and Red-tailed Hawks were at the highest risk. The sample size of Bald Eagles was very low (Table 6), therefore caution should be used when considering the level of risk. As mentioned earlier, waterfowl (ducks and geese) have demonstrated the ability to avoid wind farms and collisions (Desholm and Kahlert 2006).

The Short-eared Owl (listed as a state endangered species) was detected later in the survey season of fall 2011. While they were not detected at all large bird observation sites, they did concentrate their activities in the study area (Figure 7). I suggest that additional, geographically broad surveys be conducted for this rare species, with the objective of determining their habitat selection. It may be possible to for wind turbine siting to avoid areas of Short-eared Owl high use in the Project Area. I suggest that these surveys be initiated by February 2012 and continue until late March 2012.

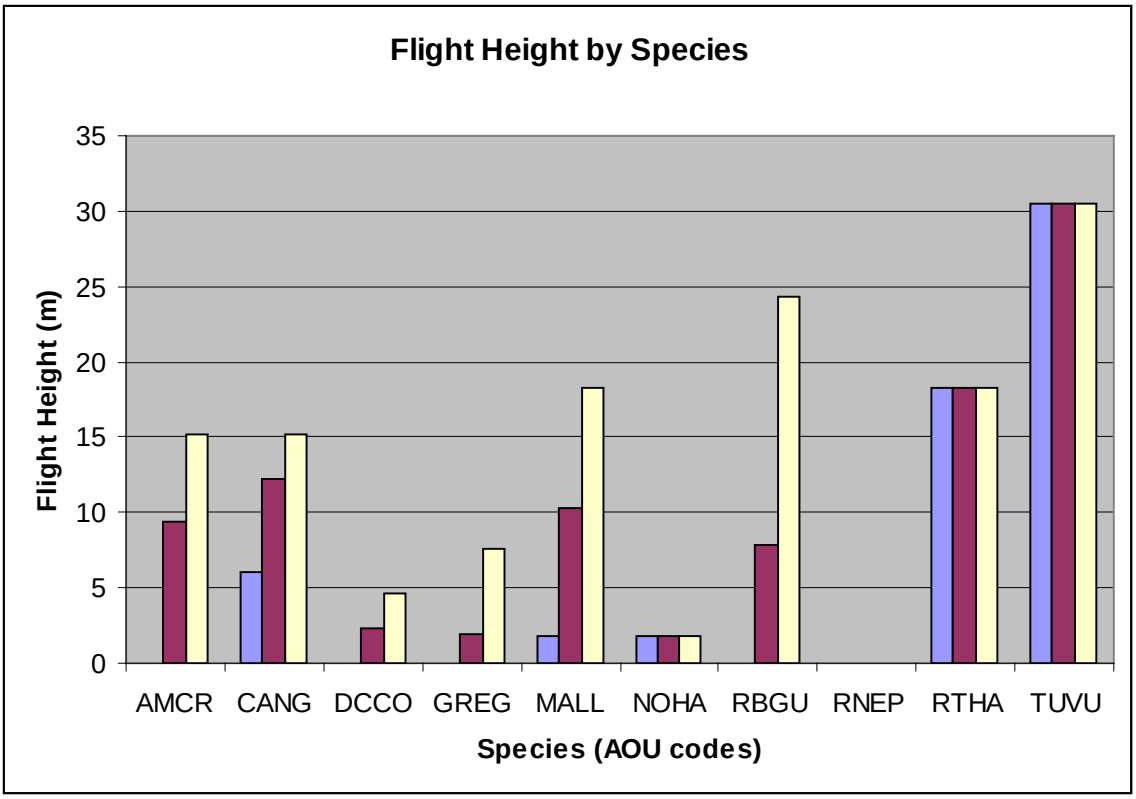

Figure 3. In the spring of 2011 large bird surveys were conducted in Tuscola and Huron Counties, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The AOU species codes are detailed in Appendix A, the top of the blue bars represent the minimum height of flight, the top of the dark red bar represents the mean height of flight, and the top of the cream bar represents the maximum flight height of each species. The rotor swept area is positioned at a higher altitude than the bird's flight height.

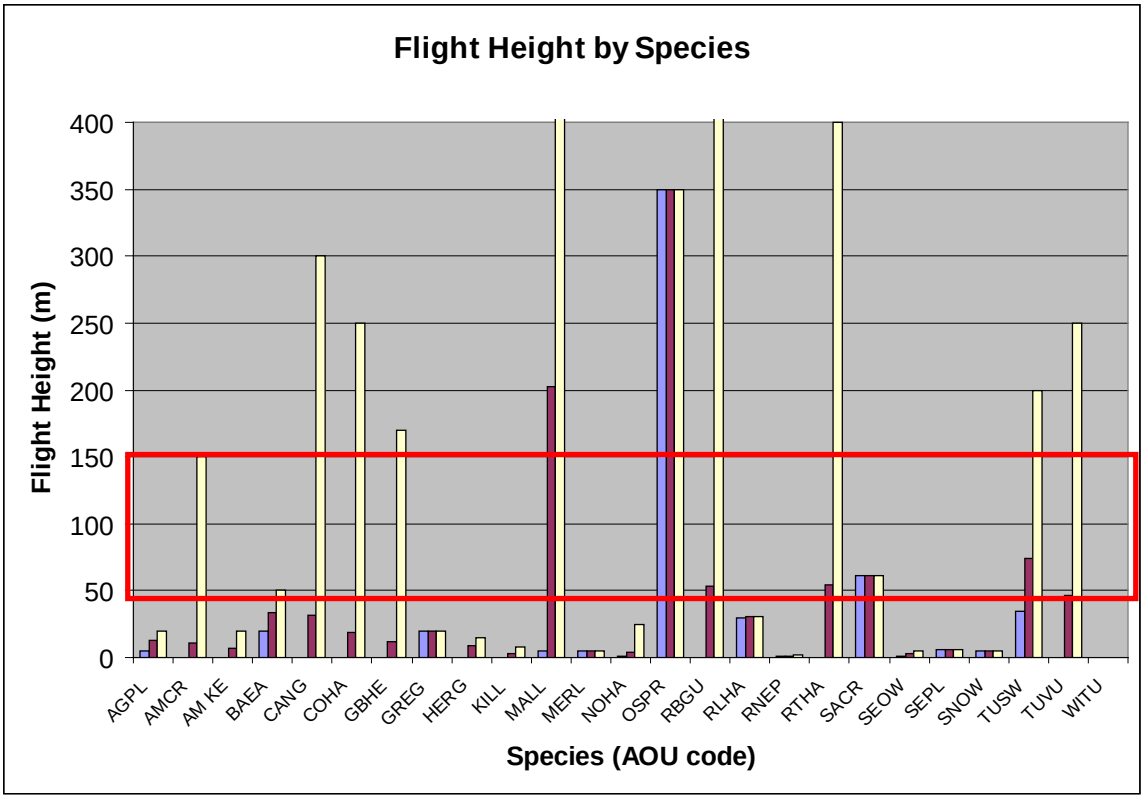

Figure 4. In the fall of 2011 large bird surveys were conducted in Tuscola and Huron Counties, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The AOU species codes are detailed in Appendix A, the top of the blue bars represent the minimum height of flight, the top of the dark red bar represents the mean height of flight, and the top of the cream bar represents the maximum flight height of each species. The horizontal red bar is approximately the rotor swept area of a wind turbine. MALL flew at a maximum height of 800 m AGL, and RTHA flew at a maximum of 500 m.

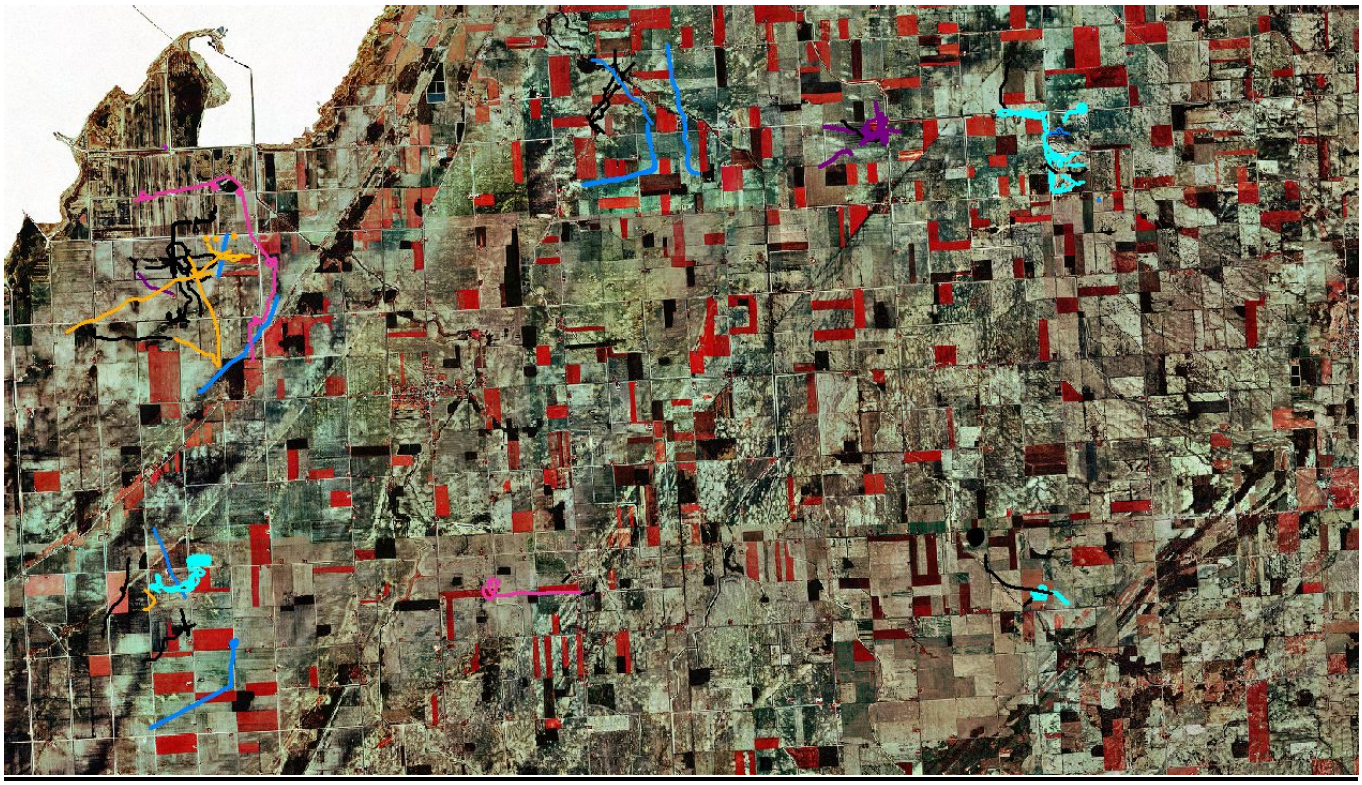

Figure 7. In the 2011 large bird surveys conducted at seven viewing stations in the Crosswinds Project Area, Michigan. The line colors represent flight paths of the following species: blue (Bald Eagles), black (Northern Harriers), dark orange (Snowy Owls), purple (Merlin), pink (Osprey) and turquoise (Short-eared Owls). See the following images for higher resolution and color contrast in order- west to east and north to south.

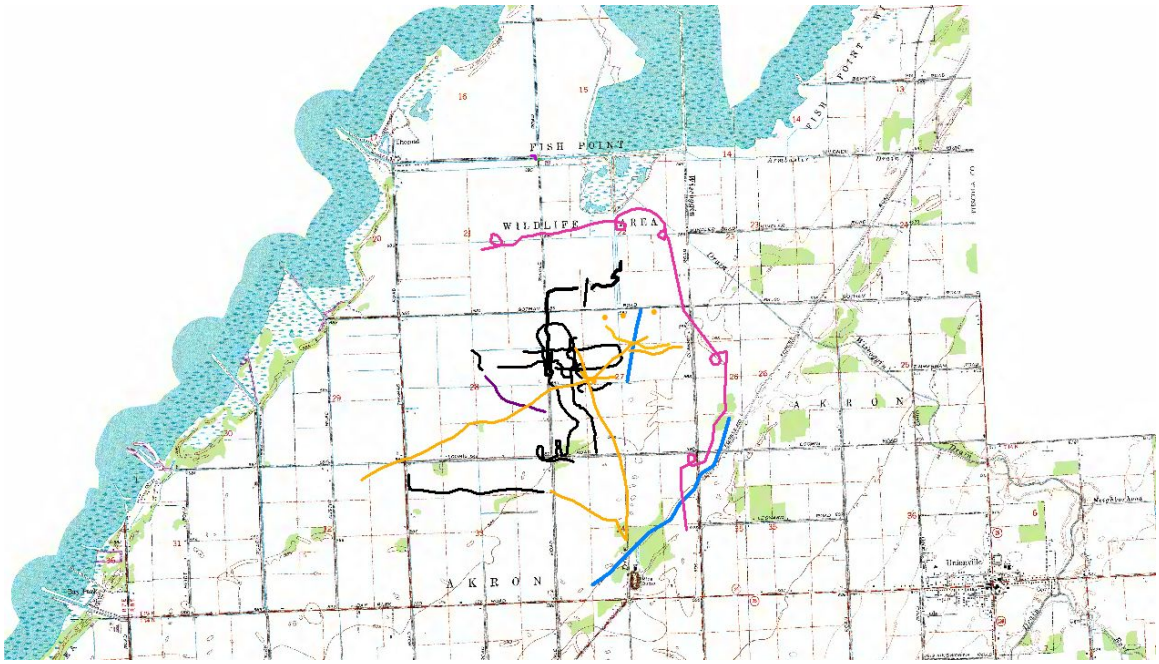

Figure 8. In the 2011 large bird surveys conducted at seven viewing stations in the Crosswinds Project Area, Michigan. The line colors represent flight paths of the following species: blue (Bald Eagles), black (Northern Harriers), dark orange (Snowy Owls), purple (Merlin), pink (Osprey) and turquoise (Short-eared Owls).

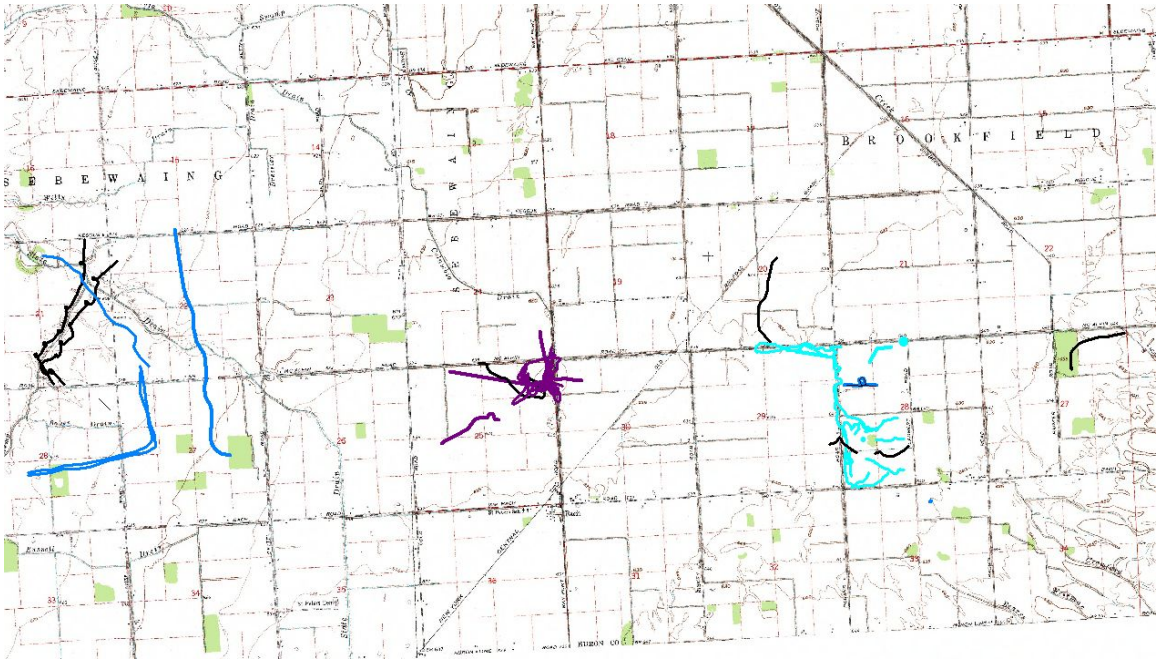

Figure 9. In the 2011 large bird surveys conducted at seven viewing stations in the Crosswinds Project Area, Michigan. The line colors represent flight paths of the following species: blue (Bald Eagles), black (Northern Harriers), dark orange (Snowy Owls), purple (Merlin), pink (Osprey) and turquoise (Short-eared Owls).

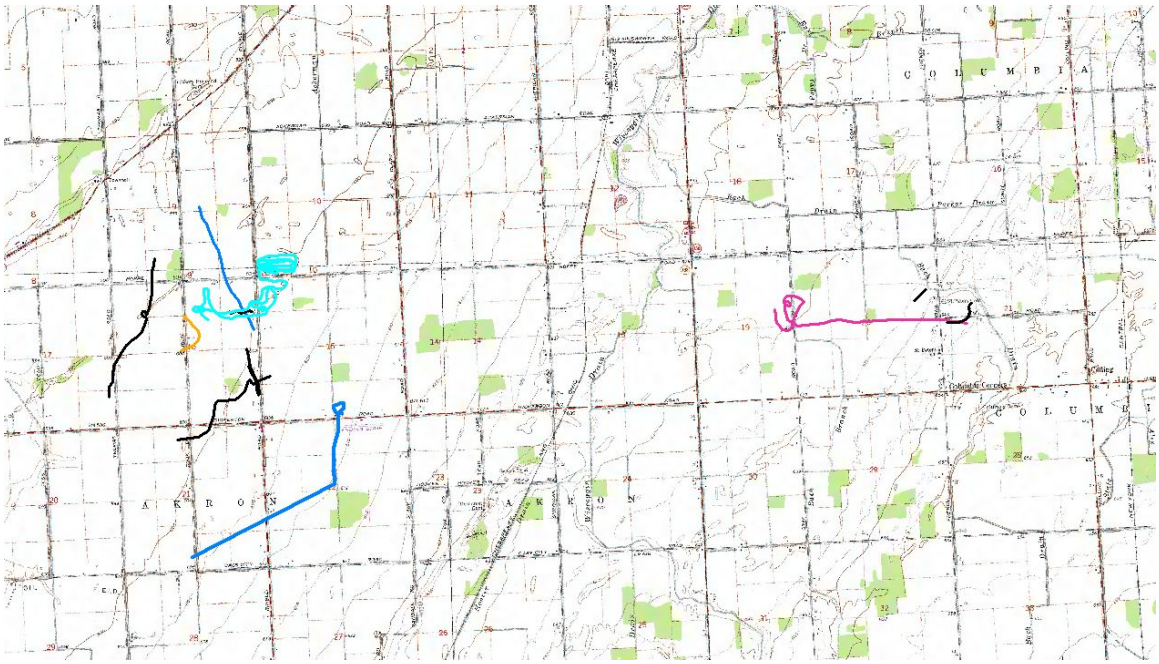

Figure 10. In the 2011 large bird surveys conducted at seven viewing stations in the Crosswinds Project Area, Michigan. The line colors represent flight paths of the following species: blue (Bald Eagles), black (Northern Harriers), dark orange (Snowy Owls), purple (Merlin), pink (Osprey) and turquoise (Short-eared Owls).

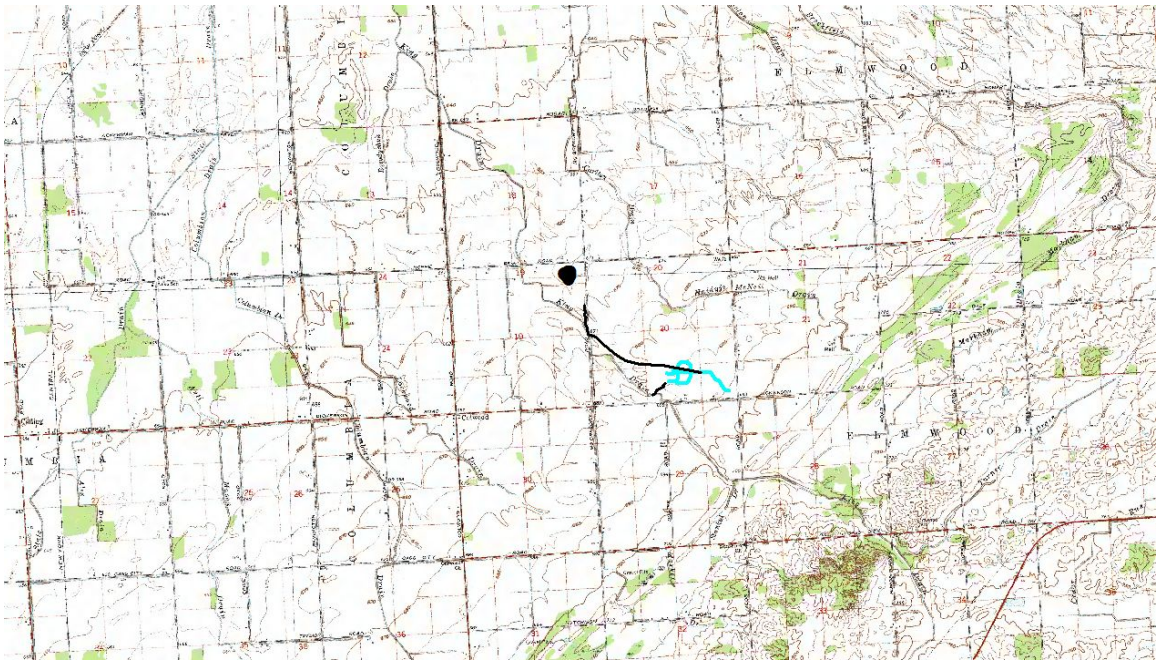

Figure 11. In the 2011 large bird surveys conducted at seven viewing stations in the Crosswinds Project Area, Michigan. The line colors represent flight paths of the following species: blue (Bald Eagles), black (Northern Harriers), dark orange (Snowy Owls), purple (Merlin), pink (Osprey) and turquoise (Short-eared Owls).

Acknowledgments

S. Roys and D. Morris collected the majority of the data for this project. The following individuals provided suggestions for this study: B. Fisher and his colleagues at the United States Fish and Wildlife Service, K. Cleveland and her colleagues at the Michigan Department of Natural Resources. I would like to express my gratitude to M. O'Connor (Consumer's Energy) for her involvement in the process of including natural resource issues in the development of these wind energy projects. My colleagues at the Michigan Natural Features Inventory provide logistical and technical support; especially, Brian Klatt, Sue Ridge, Nancy Toben, Helen Enander, and Rebecca Rogers.

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Appendix A. List of bird species observed during bird surveys conducted in Tuscola and Huron Counties, Michigan, in and around the Project Area proposed for wind energy development. These sites were surveyed in 2011 for bird use.

Species[a]	AOU code	Status
Double-crested Cormorant	DCCO	
Canada Goose	CANG	
Tundra Swan	TUSW	
Mallard	MALL	
Wood Duck	WODO	
Great Blue Heron	GBHE	
Great Egret	GREG	
Wild Turkey	WITU	
Ring-necked Pheasant	RNEP	
Turkey Vulture	TUVU	
Cooper's Hawk	COHA	
Red-tailed Hawk	RTHA	
Broad-winged Hawk	BWHA	
Rough-legged Hawk	RLHA	
Northern Harrier	NOHA	State Special Concern
Bald Eagle	BAEA	State Special Concern
Osprey	OSPR	State Special Concern
American Kestrel	AM KE	
Merlin	MERL	State Threatened
Short-eared Owl	SEOW	State Endangered
Snowy Owl	SNOW	
Sandhill Crane	SACR	
Killdeer	KILL	
American Golden Plover	AGPL	
Semi-palmated Plover	SEPL	
Herring Gull	HEGU	
Ring-billed Gull	RBGU	
American Crow	AMCR	

[a] names of birds follow the AOU Check-list of North American Birds