Avian and Bat Studies for the Garden Peninsula Phase I Wind Energy Site: Summary of Fall 2010 Field Season

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Executive summary

Many areas in Michigan possess winds adequate for the efficient generation of wind energy, especially areas near the shorelines of the Great Lakes. 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. In addition to collision risks, some grassland or open-land bird species are not adapted to using areas near any tall structure, including a wind turbine, and can be displaced. Due to the potential for avian collisions with wind turbines or turbine related avian displacement, we conducted surveys of large birds to better understand the densities of birds in the project areas, 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 collected data at 2 raptor and other large bird viewing stations in the Garden Peninsula Phase I Project Area. We conducted 3-hour surveys at the stations in the fall of 2010. 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 fall 2010 large bird survey data suggests that most species' flight behaviors do not put them at frequent risk of collisions, as the majority of birds flew below the RSA. However, flight altitudes of several species are consistent with the potential estimated RSA of the wind turbines suggesting that the risk of collisions for these species may be higher than for the other species observed in the area. This is the case with Bald Eagles, Turkey Vultures, Mallards, and Wood Ducks. The Project Area had much lower passage rates for raptors than regional designated hawk migration observation sites. Future consideration of external, ongoing research may be useful in determining the potential risk that wind turbine construction would provide for these species.

We also collected data on the migrating small birds using the Project Area. No rare or declining birds were detected during our surveys. The small birds detected in our

migration studies were typical of what we would expect to find in this region during the fall migration, such as Snow Buntings, American Pipets, Black-capped Chickadees, and some warblers.

In an effort to quantify the bat use and activity of the Project Area, we collected acoustic, echolocation data (via Anabat SD2 units) to estimate the bat densities in early August – late November 2010. Low frequency bat calls made up 90% of the total calls detected, whereas the high frequency calls were only 9% of the calls. The general Myotis group was qualitatively identified and classified (1.3 bats/ detector night) as were the big brown bat/sliver-haired bat group, and the Eastern red bat. The Eastern pipistrelle were present in the area they were not in high enough densities for our acoustic sampling design to adequately detect and specifically classify them. The species detected were generally consistent with the open / disturbed / agricultural habitats found in the Project Area.

The species expected to be in the Project Area that would be most likely to suffer fatalities at wind turbines include: Eastern red bat, hoary bat, silver-haired bat, and Eastern pipistrelle. Fatalities can potentially be mitigated using different turbine cut-in speeds during periods of the year with high risk for bat fatalities. Specifically, Arnett et al, (2010) determined that if cut-in speeds were increased to 5-6 m per second that fatalities could be reduced by 43-90%. In addition to changes to cut-in speeds, I recommend that water sources and forest edges be buffered in the micro-siting of wind turbines.

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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, and Michigan currently has only about 150 MW deployed - a 99% gap between potential and capacity. The interconnection queue for the Midwest Independent (Transmission) System Operator (MISO) presently includes requests for the interconnection in Michigan of approximately 3,000 MW of wind turbines. 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., Common Loon) 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. Songbird collisions with turbines, as well as with other tall structures, are related to the lighting systems of the structure (Gehring et al. 2009). Songbirds can become attracted to non-blinking lights, especially during nocturnal migration; thereby, increasing their risk of collision with any structure illuminated with these types of lights. Most turbines are lit with Federal Aviation Administration recommended blinking lights which decreases the likelihood of songbirds becoming attracted into the site. 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 at the turbine site.

In addition to collision risks, some grassland or open-land nesting bird species are not adapted to nesting or otherwise using habitat near any tall structure, including a wind turbine (Strickland 2004). These species can be displaced from traditional nesting and foraging areas upon construction of a nearby wind turbine (Leddy et al. 1999).

Due to the potential for avian collisions with wind turbines or turbine related avian displacement from areas previously used we conducted surveys of both large birds and songbirds to better understand the densities of birds in the 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 in which they might reduce those impacts.

Study Site and Methods

<u>Study site and description</u>

Research was conducted in the Garden Peninsula Phase I Project Area in Delta County, located in the upper peninsula of Michigan, USA (Appendix 1). The land use / land cover of the project area is a mixture of agricultural fields (e.g, corn, soybeans, winter wheat), pastures, hay fields, grasslands, and forests (Fig. 1). In the 1800s this area was predominantly vegetated with beech-sugar maple-hemlock forests (Albert 1995). The forest overstory currently includes those species as well as components of white pine (*Pinus strobes*), aspen (*Populus* spp.), and oak (*Quercus* spp.) species. The Project Area is approximately 0.3 - 1.5 miles from the Lake Michigan shoreline (Fig 2).

Figure 1. The Garden Peninsula Phase I Project Area in Delta County, MI includes mowed hayfields, row crops, forests and some grasslands.

Figure 2. The Garden Peninsula Phase I Project Area in Delta County, MI is 0.3 – 1.5 miles from the Lake Michigan shoreline.

Large bird surveys

In the fall of 2010 we collected large bird movement data at two viewing stations in the Project Area. These were the same viewing stations used in the spring of 2010. These stations provided the best possible viewsheds of the proposed project sites (Figs. 3 and 4). Following methods similar to those used by Hawkwatch International, we conducted 3-hour surveys at the stations starting in September and completing in late October 2010. When conducting outdoor research, some flexibility in scheduling is needed and some surveys were missed due to dangerous conditions.

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 (Fig. 5). Technicians used landmarks as reference when measuring distance to birds and flight altitude. 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, gender and age class, distance from plot center when first observed, closest distance, height above ground, activity, and habitat(s) were recorded.

Figure 3. Large bird viewing stations (1 and 2) were established in Delta County, MI in the Garden Peninsula Phase I Project Area. Site 1 was located at 45 degrees 49’ 00.36” N 86 degrees 32’ 28.46” W and Site 2 was located at 45 degrees 47’ 41.99” N 86 degrees 33’ 03.08”. Large bird surveys were conducted at the viewing stations in the fall of 2010.

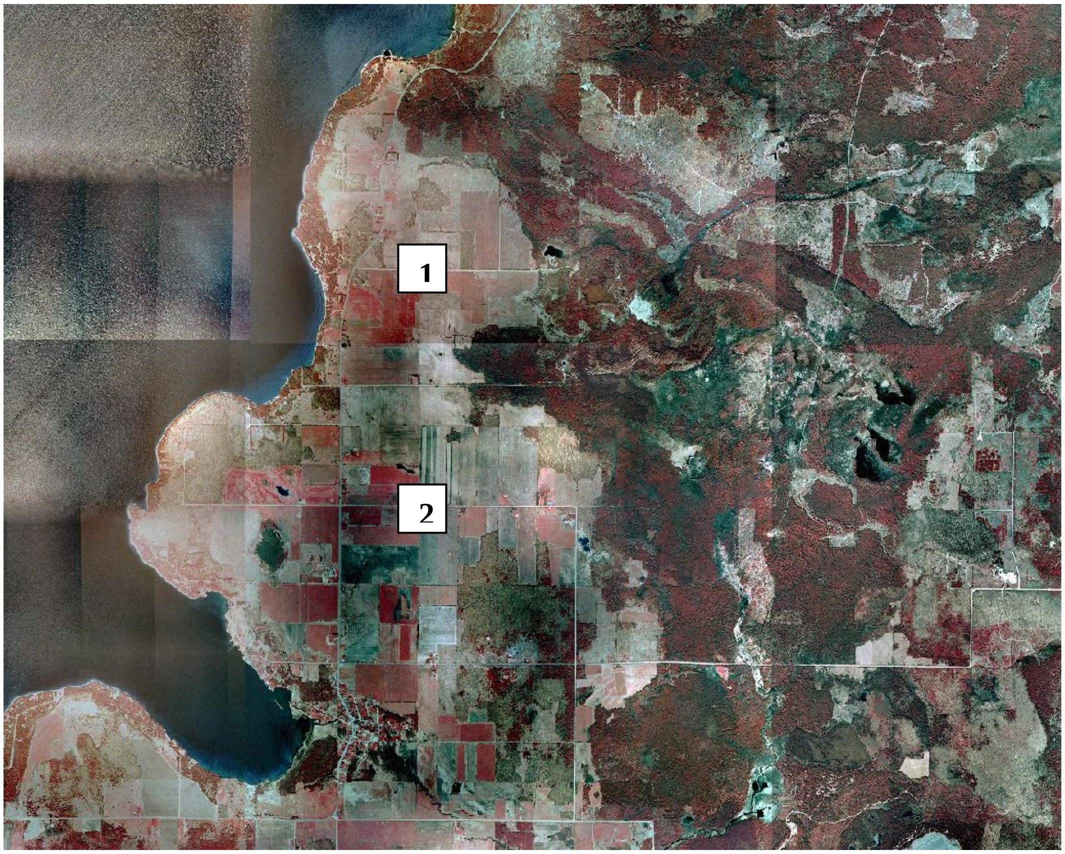

Figure 4. Large bird viewing stations (1 and 2) were established in Delta County, MI in the Garden Peninsula Phase I Project Area. Large bird surveys were conducted at the viewing stations in the fall of 2010.

Figure 5. In the fall of 2010 observers surveyed the viewshed for large birds from the viewing stations in the Garden Peninsula Phase I Project Area, Delta County, MI.

Fall migrant songbird surveys

In an effort to quantify the migrant songbird use of the project areas, we collected data using methods similar to those used in studies estimating breeding bird densities (Reynolds 1995, Johnson et al. 2000). Eight point count locations were established within the Garden Peninsula Phase I Project Area, Delta County, MI (Fig. 6, Table 1). Surveys were conducted in September - November 2010 to focus on quantifying the migrant birds in the Project Area.

Surveys at point count sites were 10 min. long (after 2 minutes of silence) and conducted between 15 minutes before sunrise and 1030 hours. Technicians recorded the following data: date, survey start time, temperature, wind speed, wind direction, cloud cover. Each individual bird observed during a survey was recorded by species, as well as the azimuth to the bird, gender (if known), distance from the observer, estimated flight height (if applicable), and other comments (Fig 7).

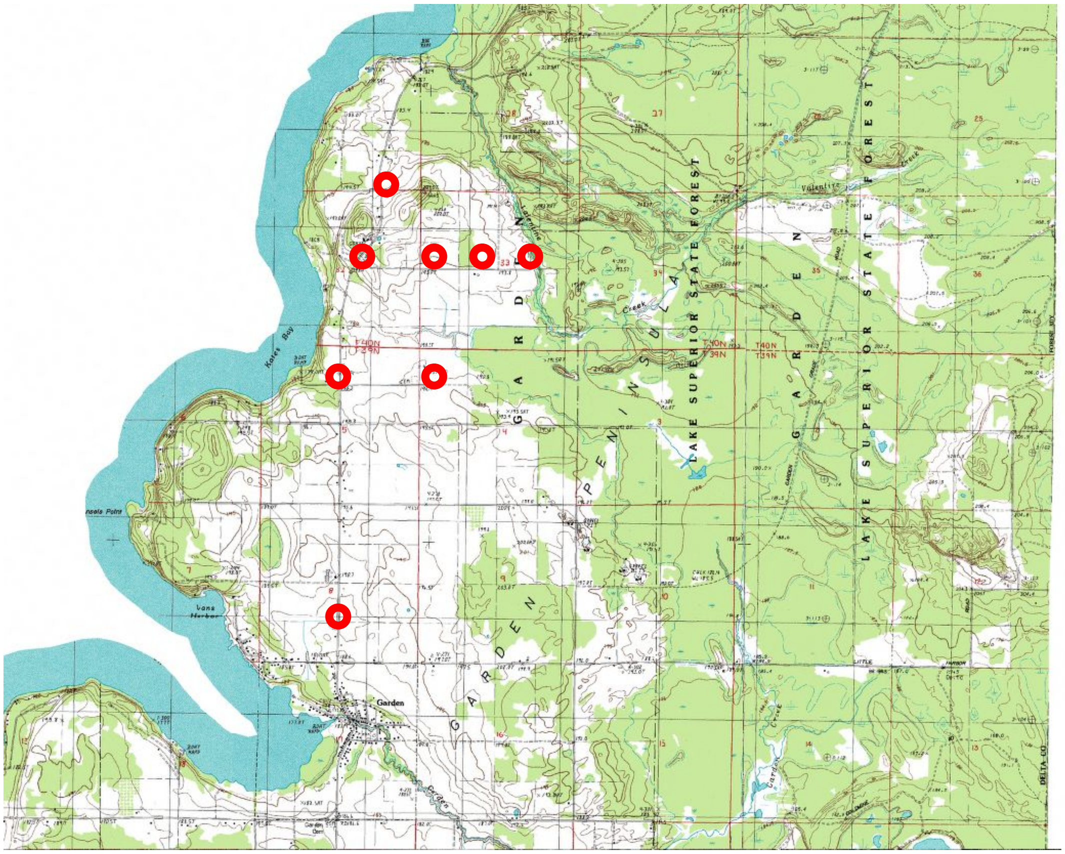

Figure 6. Migrant bird point counts (red circles) were established in Delta County, MI in the Garden Peninsula Phase I Project Area in the fall of 2010.

Table 1. Migrant bird point counts (red circles) were established in Delta County, MI in the Garden Peninsula Phase I Project Area in the fall of 2010.

Point Count number	Migrant small bird locations
No. 1	45^{o} 49’25.38”N 85^{o} 32’53.90”W
No. 2	45^{o} 49’01.43”N 85^{o} 33’03.98”W
No. 3	45^{o} 49’00.46”N 85^{o} 32’30.32”W
No. 4	45^{o} 49’00.97”N 85^{o} 32’07.53”W
No. 5	45^{o} 49’01.17”N 85^{o} 31’44.33”W
No. 6	45^{o} 48’21.43”N 85^{o} 33’14.24”W
No. 7	45^{o} 48’22.62”N 85^{o} 32’34.65”W
No. 8	45^{o} 47’04.57”N 85^{o} 33’12.79”W

Figure 7. In the fall of 2010 observers conducted point counts for migrant songbirds in the Garden Peninsula Phase I Project Area, Delta County, MI.

Bat acoustics data collection

In an effort to quantify the bat activity and species composition of the Project Area, we collected data using methods similar to those used in studies at other wind energy projects (Fiedler 2004, Gruver 2002, Jain 2005). Data were recorded using Anabat SD2 zero-crossing ultrasonic detectors synchronized and programmed to start recording 15 minutes before sunset until 15 minutes after sunrise, thereby focusing on the nightly periods of bat activity (Titley Electronics Pty Ltd, Ballina, NSW Australia). We calibrated the sensitivity of the Anabats as suggested by Larson and Hayes (2000). Units were secured and weatherized in plastic containers with PVC tubes protecting the microphones but allowing sound to be recorded. The weatherized units were elevated above the ground vegetation but placed at ground level in four locations (moved throughout sample period).

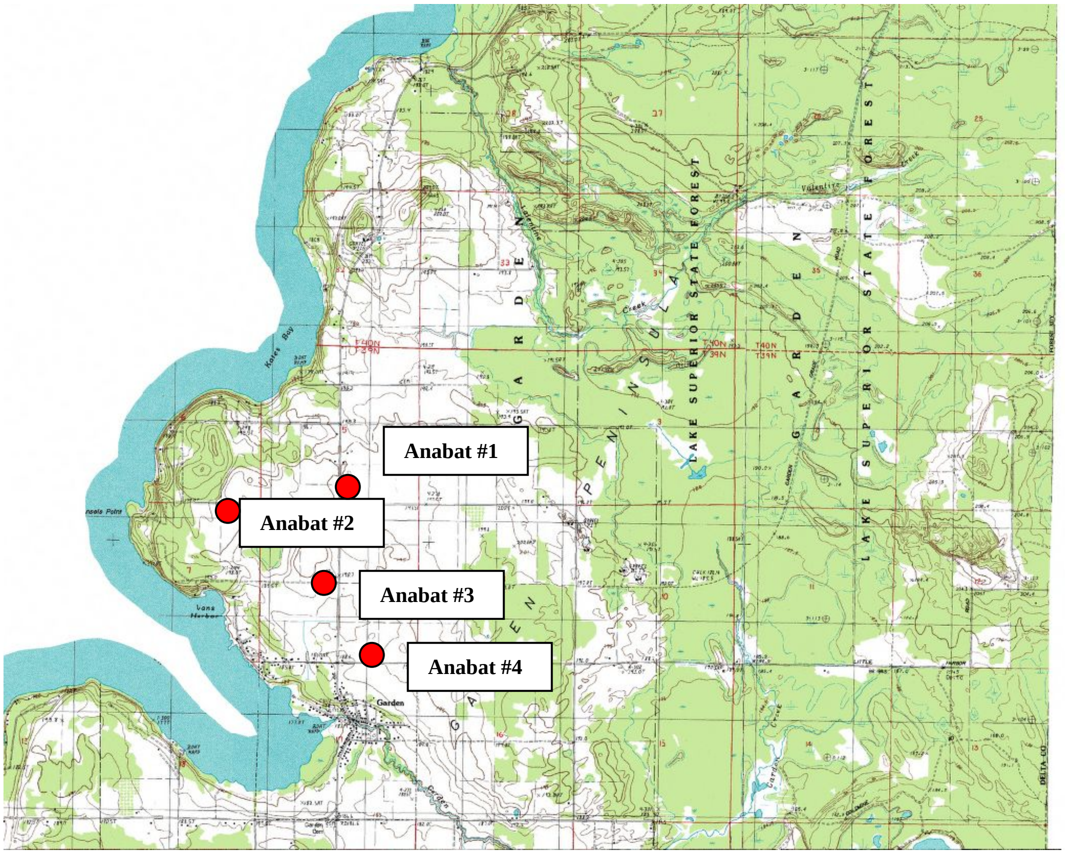

Figure 8. Two Anabats were installed in four locations to collect bat acoustic data in the Garden Peninsula Project Area in Michigan.

Bat acoustic data analysis

We used the data analysis techniques and definitions suggested by Hayes (2000), Sherwin et al. (2000), and Gannon et al. (2003). Specifically, a “call” was defined as a sequence with duration greater than 10 milliseconds (ms) and including >2 individual calls (Thomas 1988, O’Farrell and Gannon 1999, and Gannon et al. 2003); and calls were considered to be separate events and independent.

Data from the entire survey period were downloaded and processed. Before analysis began all non-bat ultrasonic detections were eliminated from the data set using Analook filters. Remaining data were then separated into two groups based on their minimum frequency of the call; with high frequency calls defined as >35 kHz and low frequency calls defined as <35 kHz calls. These Analook filters were developed by Britzke and Murray (2000) and included a Smoothness value of 15 and a Bodyover value of 240 which assisted in removing additional noise in the data such as echoes, extraneous noise (Smoothness), and pulse fragments and feeding buzzes (Bodyover). The species in this region that would be included in the high frequency calls include: little brown bat (*Myotis lucifugus*), Eastern red bat (*Lasiurus borealis*), migrating Eastern pipistrelle (*Pipistrellus subflavus*), and Northern myotis *(Myotis septentrionalis).* Conversely the bat species with low frequency calls include: big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*).

Although many species of bats are difficult to separate from one another using only acoustic data, we qualitatively identified species or groups based on duration, minimum frequency, interpulse interval, and the shape of the pulse (via frequency-versus-time curve; O'Farrell et al. 1999). The calls of the little brown bat, and Northern myotis overlap in many quantitative call measurements are extremely difficult to differentiate therefore we grouped these 2 species together. This allowed evaluation for the presence of Myotis calls separate from other species to a reasonable level of confidence. Within the low frequency calls the silver-haired bat and big brown bat are not able to be effectively separated and were therefore grouped together (Betts 1998). The species or groups whose potential presence was qualitatively evaluated include: Eastern pipistrelle, Eastern red bat, hoary bat, Myotis general, and big brown bat/silver-haired bat.

Results and Summary

<u>Large bird surveys – both observation sites combined</u>

During the 20 large bird surveys, observers detected 14,656 large birds (600 total birds when all raptors and Common Ravens are tallied) of 15 species (12 and 13 species at sites 1 and 2, respectively). There was a mean of 732.8 birds detected per survey (122.1 birds / hour) (Table 2). The waterbird group (e.g., gulls, herons, cranes) was the most abundant of the bird groups surveyed (394.8 birds / survey, 65.8 birds / hour, Table 3); the corvid group (e.g., American Crows and Common Ravens) was the second most abundant of the bird groups surveyed with 254.6 birds / survey (42.4 birds / hour, Table 3), followed by the waterfowl group (e.g., Canada Goose, ducks; 77.2 birds / survey, 12.9 birds / hour; Table 3). The Ring-billed Gull was the most common waterbird species detected during the surveys (289.9 birds / survey, Table 4). This species are frequently found in high numbers in close proximity to large waterbodies such as Lake Michigan. Gulls can also be associated with farming practices (e.g., tilling, planting) that expose invertebrates and other food items. The raptor group is often a focus of concern when considering the potential impacts of wind farm construction. The Bald Eagle was the most common raptor species detected (2.5 birds / survey, Table 4). The Rough-legged Hawk was also detected in relatively high numbers (1.9 birds / survey; Table 4). Five other raptor species were detected but in lower numbers (Table 4).

Assuming the wind turbine rotor-swept area (RSA) would be 54 – 146 m above the ground (AGL), 84.2% of all birds used areas below the RSA, 13.0% within the RSA, and 2.8% flew above the RSA. The mean flight altitude of the most common raptor species, the Bald Eagle, was 51.4 m AGL with 65% flying below the RSA and 35% within the RSA (Table 5).

Table 2. Large bird abundance and richness in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 2 large bird survey sites.

		Large Bird Survey	
	Total	No. 1	No. 2
No. Species	15	12	13
Mean No. Species / Survey	0.75	1.2	1.3
Mean No. Species / Hour	0.25	0.2	0.2
Mean No. Birds / Survey	732.8	278.6	908.8
Mean No. Birds / Hour	122.1	92.9	151.5

Table 3. Mean bird abundance in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 2 large bird survey sites.

Group		Mean Abundance [a]	
	Total	No. 1	No. 2
Waterfowl	77.2	103.8	50.6
Waterbirds	394.8	123.6	666.0
Raptors	6.0	5.2	7.0
Corvids	254.6	324.6	184.8

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

Table 4. Species composition in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 2 large bird survey sites. E is Endangered Species, TH is threatened, SC is Special Concern (MNFI 2007)

Species		No. Birds		
	Total	No. 1	No. 2	Status
American Crow AMCR	4388	2882	1506	
Bald Eagle BAEA	52	20	32	SC
Canada Goose CAGO	1534	1034	500	
Common Raven CORA	478	184	294	
Herring Gull HERG	6	0	6	
Mallard MALL	2	2	0	
Merlin MERL	1	0	1	TH
Northern Harrier NOHA	8	4	4	SC
Pileated Woodpecker PIWO	4	0	4	
Ring-billed Gull RBGU	5798	944	4854	
Rough-legged Hawk RLHA	38	22	16	
Red-tailed Hawk RTHA	8	2	6	
Sandhill Crane SACR	500	292	208	
Turkey Vulture TUVU	12	2	10	
Unknown raptor	3	2	1	
Unknown waterfowl	2	2	0	
Unknown Gull	1592	0	1592	
Wood Duck WODU	6	0	6	
Total	14432	5392	9040	

Table 5. Species flight height (upon first observation) distribution in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 2 large bird survey sites. The estimated Rotor Swept Area (RSA) was 54 m – 146 m above ground level.

Species		Proportion	
	Below RSA	Within RSA	Above RSA
American Crow AMCR	79	22	0
Bald Eagle BAEA	65	35	0
Canada Goose CAGO	89	11	0
Common Raven CORA	75	23	2
Herring Gull HERG	100	0	0
Mallard MALL	100	0	0
Merlin MERL	100	0	0
Northern Harrier NOHA	100	0	0
Pileated Woodpecker PIWO	100	0	0
Ring-billed Gull RBGU	92	8	0
Rough-legged Hawk RLHA	74	26	0
Red-tailed Hawk RTHA	100	0	0
Sandhill Crane SACR	99	1	0
Turkey Vulture TUVU	50	33	17
Unknown raptor	100	0	0
Unknown waterfowl	100	0	0
Unknown Gull	91	9	0
Wood Duck WODU	100	0	0

Large bird surveys – Fall 2010, Site 1

Observers detected 5,572 large birds of 12 species. There was a mean of 278.6 birds detected per survey (92.9 birds / hour) (Table 2). The corvid group (e.g., American Crows and Common Ravens) was the most abundant of the bird groups surveyed (324.6 birds / survey, 54.1 birds / hour, Table 3); waterbird group (e.g., gulls, herons, cranes) was the second most abundant with 123.6 birds / survey (20.6 birds / hour; Table 2), followed by the waterfowl group (e.g., Canada Goose, ducks; 103.8 birds / survey; 17.3 birds / hour, Table 3). The American Crow was the most common corvid species detected during the surveys (288.2 birds / survey, Table 4). Like gulls, American Crows are frequently found in high numbers in close proximity to human dominated landscapes, including agricultural land where farming practices (e.g., tilling, planting) expose invertebrates and other food items. The raptor group is often a focus of concern when considering the potential impacts of wind farm construction. The Rough-legged Hawk was the most common raptor species detected (2.2 birds / survey, Table 4). The Bald Eagle was also detected in relatively high numbers (2.0 birds / survey, Table 4). Four other raptor species were detected but in lower numbers (Table 4).

Assuming the wind turbine rotor-swept area (RSA) would be 54 – 146 m AGL, 87.7% of all birds flew below the RSA, 11.2% within the RSA, and 1.1% flew above the RSA. The mean flight altitude of the most common raptor, the Rough-legged Hawk was 41.6 m AGL with 72.7% flying below the RSA, 27.3% within the RSA, and 0% above the RSA.

Large bird surveys – Fall 2010, Site 2

At Site 2 observers detected 9,088 large birds of 13 species. There was a mean of 908.8 birds detected per survey (151.5 birds / hour, Table 2). The waterbird group (e.g., gulls, herons, cranes; 666.0 birds / survey, 111.0 birds / hour, Table 3) was the most abundant species group. The corvid group (e.g., American Crows and Common Ravens) was the second most abundant of the bird groups surveyed (154.0 birds / survey, 30.8 birds / hour, Table 3) with waterfowl (e.g., Canada Goose, ducks) as the third most abundant of the bird groups (50.6 birds / survey, 8.4 birds / hour; Table 2). The Bald Eagle was the most common raptor species detected during the surveys (3.2 birds / survey, Table 4), the Rough-legged Hawk was the second most common raptor species detected (1.6 bird / survey, Table 4). Four other raptor species were observed at Site 2 (Table 4).

Assuming the wind turbine rotor-swept area (RSA) would be 54 – 146 m AGL, 82.1% of all birds flew below the RSA, 14.2% within the RSA, and 3.7% above the RSA. The mean flight altitude of the most common raptor species, the Bald Eagle, was 43.8 m AGL with 81.2% flying below the RSA and 18.8% flying within the RSA.

Summary of large bird flight behavior in the project area

When compared to regional hawk watch sites the numbers of raptors per hour at the Garden Peninsula Project Area (6.0 raptors / hour) is much lower than designated hawk watch sites. Brockway Mountain in the Keweenaw Peninsula of Michigan collected hawk migration data in the spring of 2010 and found that 19.6 raptors / hour flew over the site. In

Whitefish Point, MI 27.3 raptors / hour were observed in the spring of 2010. No fall 2010 raptor data were found for the either site; however, it is expected that the numbers of raptors would be even fewer than in the spring due to the geography of the Keweenaw Peninsula and Whitefish Point in relation to the direction of raptor migration.

The fall 2010 large bird survey data demonstrated that the majority of birds flew below the RSA. However, flight altitudes of several species were consistent with the potential estimated RSA of the wind turbines suggesting that the risk of collisions for these species may be higher than for the other species observed in the area (Fig. 8). This was the case with Bald Eagles, Turkey Vultures, Mallards, and Wood Ducks. Site 1 had higher numbers of Canada Goose detections and American Crows and Site 2 had more gulls present. Often Canada Goose detections are related to the species loafing and foraging in agricultural fields within the project area. While our collective understanding of avian collision issues is always increasing, currently waterfowl are not believed to collide with wind turbines as frequently as some other avian groups such as raptors. Some waterfowl species have actually been documented to avoid turbines in their flight paths (Desholm and Kahlert 2006). The high densities of gulls in the Project Area could lead to an increased risk of collisions, however; most gull flights were at a lower altitude than the RSA of the turbines.

The flight altitudes of large birds in the Project Area were generally lower than many other sites studied in Michigan. This could be due to the predominance of high winds which prevents birds from flying at higher altitudes due to the “blowing out” of thermal lift from the ground and/or the birds utilizing mechanical lift created by winds striking and directed up from surfaces on the ground. In addition, the future consideration of external, ongoing research may be useful in determining the potential risk that wind turbine construction would provide for avian species. This research provides a better understanding of the species composition and densities of large birds moving through the Project Area as well as the relative level of risk these species may experience if turbines are constructed.

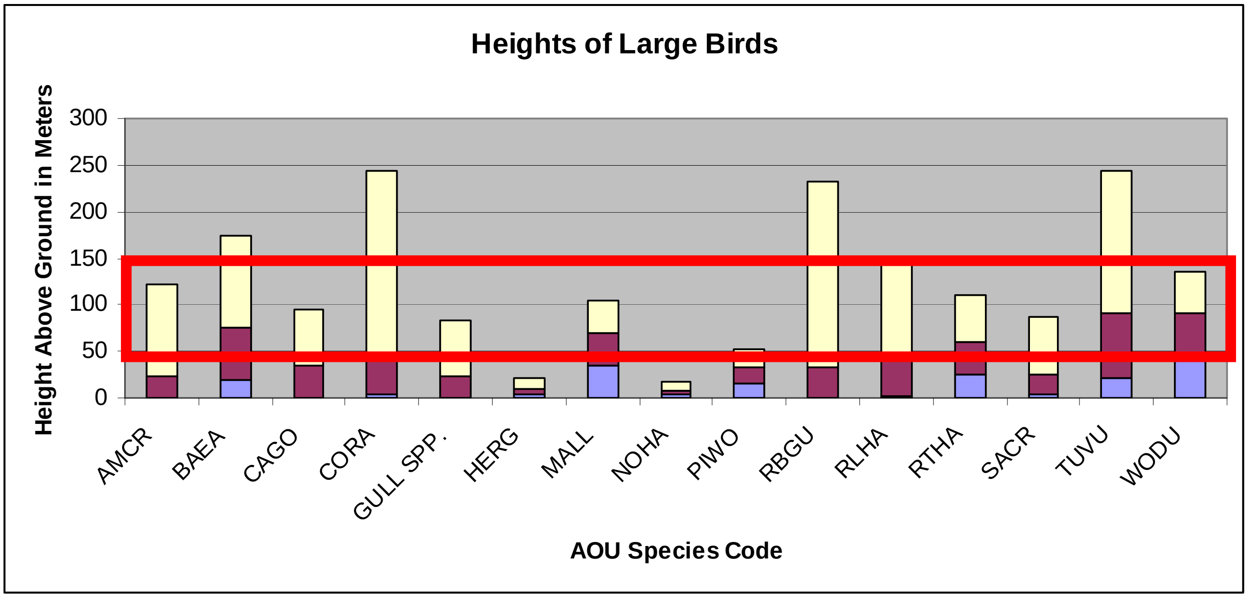

Figure 8. In the fall of 2010 large bird surveys were conducted at two viewing stations in the Garden Peninsula Project Area, Michigan. The AOU species codes are detailed in Table 4, the top of the blue bars represent the minimum height of flight, the top of the dark red bar represents the mean height 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.

Fall Migratory Small Bird Surveys

We completed 8 point counts between September 15th and November 30th, 2010. Surveys of point count stations detected 1183 birds of 30 species in the Project Area (Table 6 and 7). We detected a mean of 73.3 birds per point count visit (mean of 1.9 species / survey, Table 6).

The 3 most abundant bird groups per survey were the corvids (19.6 birds / survey), followed by the waterfowl (17.4 birds / survey) and cranes (12.6 birds / survey) (Table 7). When focusing in on the small birds detected during surveys the most abundant species group was the Snow Buntings and American Pipets (6.4 birds / survey), followed by the woodpeckers (3.9 birds / survey) and Black-capped Chickadees and White-breasted Nuthatches (3.8 birds / survey) (Table 7). These species groups were consistent with the Projects Area's open / agricultural habitats interspersed with forest woodlots with nearby waterbodies. No rare or declining species were detected during the fall migration surveys. This research provides a better understanding of the species composition and densities of small birds migrating through the Project Area. These data help us to assess the level of concern for potentially impacting small birds.

Table 6. Small bird abundance and richness in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 8 point count survey sites.

	Point Counts
No. Species	30
Mean No. Individuals / Survey	73.3
Mean No. Species/Survey	1.9

Table 7. Mean bird abundance in richness in Delta County, MI in the Garden Peninsula Phase I Project Area proposed for the development of wind energy by Heritage Sustainable Energy. Data were collected in the fall of 2010 at 8 point count survey sites.

Group		No. of Individuals	Mean Abundance [a]
Blackbirds			0.6
	Common Grackle	7	
	Eastern Meadowlark	3	
Chickadees/Nuthatches			3.8
	Black-capped Chickadee	59	
	White-breasted Nuthatch	2	
Corvids			19.6
	Blue Jay	5	
Cranes			12.6
Finches			1.3
	American Goldfinch	20	
Buntings and Pipets			6.4
	American Pipet	50	
	Snow Buntings	53	
Gull			0.8
Invasives			3.1
	European Starling	26	
	House Sparrow	7	
	Rock Pigeons	16	
Sparrows			2.1
	Song Sparrow	5	
	Swamp Sparrow	10	
	Unknown Sparrow	7	
	White-crowned Sparrow	11	
Warblers			1.9
	Unknown Warbler	8	
	Yellow-rumped Warbler	22	
Waterfowl			17.4
Woodpeckers			3.9
	Downy Woodpecker	1	
	Hairy Woodpecker	60	
	Pileated Woodpecker	1	
	Red-bellied Woodpecker	1	
Other			
	American Robin	1	
	Cedar Waxwing	2	
Total		377	

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

Bat Acoustics Results

We detected a total of 8,525 bat calls from all 2 detectors placed in 4 locations between 1 August through the 15 November 2010. Although bats were detected in November 2010, most of the bat detections were in August through October of our sampling period (Fig. 9). This is relatively consistent with other studies of a similar topic and design (Fiedler 2004, Gruver 2002, Jain 2005). Figure 10 details bat activity in relation to the time of the night for all of the bat detectors together. In general, more bat activity was detected immediately after sunset and in the middle of the night.

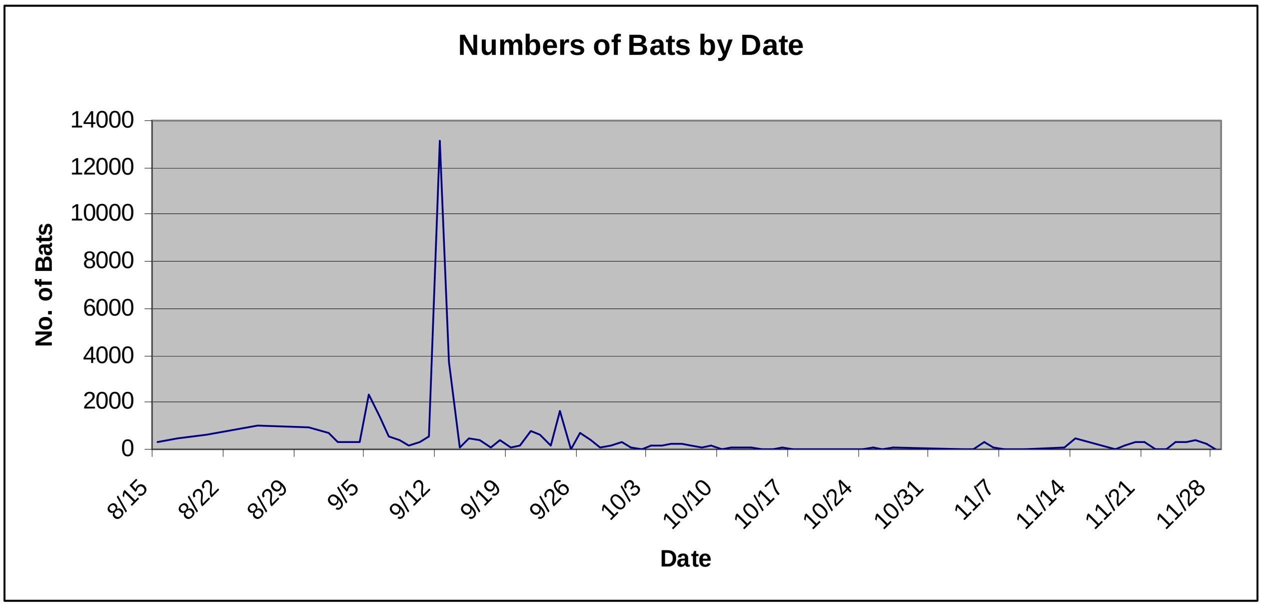

Figure 9. The number bat calls by the night of the field season August – November 2010 in the proposed Garden Peninsula Project Area, in southeastern Michigan.

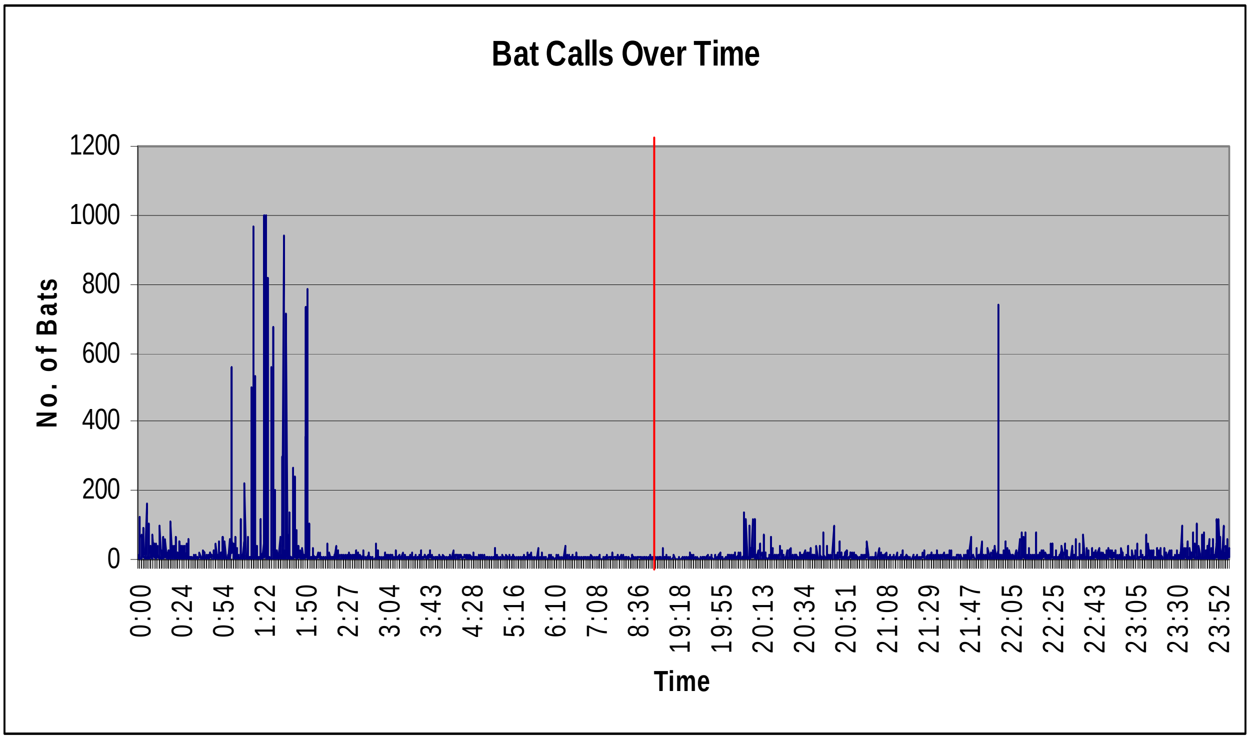

Figure 10. The number of bat calls by the time of night from August – November 2010 at all Anabat locations in the proposed Garden Peninsula Project Area. The red line delineates the break between early morning and evening data collection periods.

Comparison of bat vocalization frequency

Low frequency bat calls made up 90% of the identified calls, whereas the high frequency calls were only 9% of the calls. Consistent with those general classifications, the general Myotis group was detected at a rate of 1.3 bats/ detector night. While we also detected the big brown bat/sliver-haired bat group (0.3 bats/ detector night), and the Eastern red bat (0.1 bats/ detector night). We expect that the Eastern pipistrelle may also have been present in the area but they were not in high enough densities for our acoustic sampling design to adequately detect and specifically classify them. The bat species detected and classified were consistent with the open / disturbed / agricultural habitats found in the Project Area.

Several of the species observed in or expected to be in the Project Area have been detected as bat fatalities at existing wind farms in the United States (Fiedler 2004, Gruver 2002, Jain 2005). Those species expected to be in the Project Area that would be most sensitive to wind turbine fatalities include: Eastern red bat, silver-haired bat, Eastern pipistrelle, and hoary bat.

Summary of bat acoustic data collection

The species detected and classified were consistent with the Project Area land cover type (i.e., predominantly agricultural fields). Preliminary data suggest that bat fatalities at wind farms are positively correlated with seasonal densities of bats using the wind farm; however, nightly variation in fatalities was not always correlated with the numbers of detections at a particular turbine (Fiedler 2004, Gruver 2002, Jain 2005). Therefore, these data were not presented in relation to the location of the bat detectors. In addition, we did not analyze bat data in relation to the location of the Anabat due to the correlation between the Anabat location and the time of year. Specifically, any differences in bat densities at different locations may have been more related to the timing of data collection and less related to the location of the Anabat instruments. If interpreted incorrectly the data could have been misleading. Recent data suggest that increasing the height above ground level of bat detectors results in more complete data and an increased level of correlation between bat detections and bat fatalities. The data collected for this Garden Peninsula project generally provide useful information on the bat activity and species diversity in the Project Area.

Additional efforts to consider the potential impact of the Project on birds and bats

As the project plans progress, the estimated rotor-swept area presented in this report should be revisited to validate that it is capturing the correct height estimate for the specific turbines to be used in the project.

Heritage Sustainable Energy has continued to remain in contact with both the United States Fish and Wildlife Service and the Department of Natural Resources and the Environment to insure that their environmental studies are complete and acceptable to these regulatory agencies.

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Literature Cited

Albert, D. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: a working map and classification. 4th Edition. General Technical Report NC-178. United States Department of Agriculture, North Central Forest Experimental Station. Saint Paul, MN.

Arnett, E, M. Huso, M. Schirmacher, J. Hayes. 2010. Altering turbine speed reduces bat mortality at wind-energy facilities. Frontiers in Ecology and the Environment 101101071900096 DOI: 10.1890/100103

Betts, B. J. 1998. Effects of interindividual variation in echolocation calls on identification of big brown and silver-haired bats. Journal of Wildlife Management, 62:1003–1010.

Britzke, E. R., and K. L. Murray. 2000. A quantitative method for selection of identifiable search-phase calls using the Anabat system. Bat Research News 41: 33–36.

Diehl, R., R. Larkin, and J. Black. 2003. Radar observations of bird migration over the Great Lakes. Auk 120:278-290.

Desholm, M. and J. Kahlert. 2006. Avian collision risk at offshore wind farms. Journal of Ornithology 147(Suppl. 5): 156.

Ewert, D. 2006. Migratory bird stopover site attributes in the western Lake Erie Basin. The Nature Conservancy Report.

Fiedler, J. K. 2004. Assessment of bat mortality and activity at Buffalo Mountain Windfarm, eastern Tennessee. M.S. Thesis, University of Tennessee, Knoxville, Tennessee, USA.

Gannon, W. L., R. E. Sherwin, and S. Haymond. 2003. On the importance of articulating assumptions when conducting acoustic studies of bats. Wildlife Society Bulletin 31: 45–61.

Gehring, J. L., P. Kerlinger, and A. Manville. 2009. Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications. 19: 505-514.

Gruver, J. C. 2002. Assessment of bat community structure and roosting habitat preferences for the hoary bat (Lasiurus cinereus) near Foote Creek Rim, Wyoming. Thesis, University of Wyoming, Laramie.

Hayes, J. P. 2000. Assumptions and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2: 225–236.

Jain, A. A. 2005. Bird and bat behavior and mortality at a northern Iowa windfarm. Thesis. Iowa State University, Ames, Iowa.

Kerlinger, P. 1989. Flight Strategies of Migrating Hawks. University of Chicago Press. Chicago, IL

Larson, D. J., and J. P. Hayes. 2000. Variability in sensitivity of Anabat II bat detectors and a method of calibration. Acta Chiropterologica 2: 209–213.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. Wilson Bull. 111:100-104.

Michigan Natural Features Inventory. 2007. Rare Species Explorer (Web Application). Available online at http://web4.msue.msu.edu/mnfi/explorer [Accessed Jan 20, 2010]

O'Farrell, M. J., and W. L. Gannon. 1999. A comparison of acoustic versus capture technique for the inventory of bats. Journal of Mammalogy 80: 24–30.

O'Farrell, M. J., B. W. Miller, and W. L. Gannon. 1999. Qualitative identification of freeflying bats using the Anabat detector. Journal of Mammalogy, 80:11–23.

Sherwin, R. E., W. L. Gannon, and S. Haymond. 2000. The efficacy of acoustic techniques to infer differential use of habitat by bats. Acta Chiropterlogica 2: 145–153.

Strickland, D. 2004. Overview of non-collision related impacts from wind projects. Pages 34-38 *In* Proceedings of the Wind Energy and Birds/Bats Workshop: understanding and resolving bird and bat impacts. Washington, D.C. May 18-19, 2004. Prepared by RESOLVE, Inc. Washington, D.C., Susan Savitt Schwartz, ed. September 2004.

Thomas, D. W. 1988. The distribution of bats in different ages of Douglas-fir forests. Journal of Wildlife Management 52: 619–626.

Appendix 1. The Delta County, MI, Garden Peninsula Phase I Project Area, is predominantly agricultural lands and hay fields with some interspersed grassland and forested areas.

Layout version 4
Generator lead / Garden Sub to ATC sub
21
22
29
28
27
20th Ln
alt
1
2
19.5 Ln
32
33
34
3
4
alt
N 25
18.5 Ln
5
6
5
4
3
6
14
7
18th Rd
15
8
alt
9
10
11
17.5 Rd
7
8
9
10
12
13
Oo Ln
17th Rd
Winter St
18
17
16
15
0
700
1,400
2,800
4,200
5,600
Feet