2010 Spring Avian Survey

Northern Portion of the Baldwin Wind Energy Center
Burleigh County, North Dakota

Prepared for:

NEXTera ENERGY RESOURCES

July 2010

TETRA TECH EC, INC.

EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (Tetra Tech) was contracted by NextEra Energy, LLC (NextEra) to undertake spring avian use surveys for the northern section of the proposed Baldwin Wind Energy Center (hereafter, Project Area) in Burleigh County, North Dakota to supplement previously completed spring avian use surveys. The studies were conducted to identify potential avian impacts associated with building and operating the wind conversion facility. Birds have been identified as a group potentially at risk because of collisions with wind turbines and power lines and displacement due to the presence of the associated structures. To date, eleven weekly surveys were performed at the Project Area from March 25 to June 4, 2010, which included the mid-spring through early summer seasons. In complying with a request from U.S. Fish and Wildlife Service, NextEra has asked Tetra Tech to complete this preliminary report to summarize results to date. An additional two weekly surveys will be preformed and their results will be incorporated into a revised spring avian report. Fixed point count surveys (800-meter [m] radius) were conducted at 6 points distributed throughout the Project Area.

A biologist observed 4,123 birds within the Project Area, 4,090 birds from 70 species and 33 birds that could not be identified to species. Overall mean bird use within the Project Area was 62.47 birds/20 minutes (min) and ranged from 2 to 540 birds/20 min. Comparing bird use rates for the spring season from existing wind energy facilities throughout the country with publicly available data, the Project Area ranked 1st out of 24 surveys for non-raptor use and 12th out of 35 surveys for raptor use.

Songbirds had the highest mean use out of all species groups observed (32.08 birds/20 min). The songbird species with the highest mean use were the red-winged blackbird (11.76 birds/20 min) and horned lark (9.08 birds/20 min). Red-winged blackbird and horned larks have been observed as fatalities at similar North American wind energy development sites. Red-winged blackbirds are a common widespread species in North America that have relatively stable regional populations; as a result, local mortality, should it occur, is unlikely to have population-level consequences. Horned larks have shown declines in North Dakota and across most of the United States. While fatalities of horned larks may occur, they are not expected to have population level impacts as horned larks are found throughout North America. All of the species mentioned are protected by the Migratory Bird Treaty Act.

Waterfowl had the third highest mean use of all species groups (4.82 birds/20 min), the majority of which were Canada geese, the species with the fourth highest mean use (2.45 birds/20min). Additionally, Canada geese had the third highest encounter rate (2.12 birds flying at rotor-swept area height/20 min). Canada geese mortality has been documented at other wind energy facilities but the overall numbers of fatalities are very low. The combination of the high encounter rate and prior evidence of negative turbine interactions suggest that some fatalities of Canada geese could occur at the Project Area. If fatalities do occur at the Project, they are not expected to have population-level impacts as regional populations are considered large and stable.

Cranes/rails as a group ranked second highest in mean use, mostly due to sandhill cranes, a species that had the highest mean use (19.88 birds/20min) of all birds observed. However, all sandhill cranes were observed in flight and 98.2 percent of these observations were above the rotor-swept area (RSA; 1.8 percent of observations were within the RSA). Thus, sandhill cranes had a low encounter rate of 0.32 birds flying at RSA height/20 min. Given the flight height of sandhill cranes, any negative interactions with wind turbines, should they occur, should be limited.

The red-tailed hawk and northern harrier had the highest mean use among raptors (0.35 and 0.32 birds/20 min, respectively). This rate of use, however, is low relative to data available from other wind projects with publicly available data. Additionally, the overall low encounter rates of red-tailed hawks and northern harriers (0.17 and less than 0.01 birds flying at RSA/20 min, respectively) within the Project Area imply a low likelihood of turbine collisions. Fatalities of red-tailed hawks and northern harriers have been reported at other wind energy projects; however, most of fatalities have occurred at older generation windfarms. Red-tailed hawks were the most common nesting raptor species in the vicinity of the Project Area. Additionally, one Swainson's hawk and two great-horned owl nests were also found within the vicinity of the Project Area.

Listed and Sensitive Species

No federally listed species were observed during avian surveys. Fifteen species were detected that are listed as North Dakota State Species of Conservation Priority, including: American white pelican, Swainson's hawk, upland sandpiper, marbled godwit, Franklin's gull, black tern, northern pintail, canvasback, northern harrier, short-eared owl, sharp-tailed grouse, LeConte's sparrow, grasshopper sparrow, bobolink, and chestnut-collared longspur. The designation of Species of Conservation Priority describes a species identified as in decline at the national, regional or state level, or a species whose population status in not well known, but thought to be in decline. Species of Conservation Priority receive special attention from state agencies, but do not require take permits; all of these species are protected under the Migratory Bird Treaty Act. However, all species listed above had encounter rates of less than 0.61 birds/20 min flying within the RSA, primarily because of their low occurrence within the Project Area.

Table ES-1. Spring Avian Use Summary

Variable	Result	Details
Non-raptors		
Mean use	61.65 birds/20 min	Rank: 1st out of 24 studies (Table 7, Figure 8)
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	3	red-winged blackbird, horned lark, Canada goose
Federally listed[1] species observed within the Project Area	No	
State-listed species[2] within the Project Area	Yes	12 state-sensitive species (Section 4.3)
State-listed species observed nesting within the Project Area	No	
State-listed species within RSA	No	
Grouse leks observed within the Project Area	Yes	sharp-tailed grouse
Grouse leks observed within 2 miles of the Project Area	Yes	sharp-tailed grouse
Raptors		
Mean use	0.82 birds/20 min	Rank: 12th out of 35 studies (Table 7, Figure 9)
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	None	
Eagles observed within the Project Area	No	
Federally listed species observed within the Project Area	No	
State-listed species within the Project Area	Yes	Swainson's hawk, northern harrier, short-eared owl (Section 4.3)
State-listed species observed nesting within the Project Area	Yes	Swainson's hawk
State-listed species within the RSA	No	
Lek Surveys		
Number of leks found within the Project Area	1	Sharp-tailed grouse
Habitat		
Native habitat likely to be affected by development	Yes	Native prairie
Lakes (waterfowl attractant)	Yes	Small ponds
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	A few small ponds
Cliffs (raptor nesting and traveling)	No	
River (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	No	

[1]Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.
[2]Hagen et al. 2005.

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1.0 INTRODUCTION

1.1 Wind Energy and Birds

Wind energy provides a clean, renewable energy source that is in high demand. As wind power has become more common, the need to address potential environmental impacts has increased. Birds have been identified as a group potentially at risk because of collisions with wind turbines and power lines and displacement due to the presence of the associated structures (Erickson et al. 2005, Drewitt and Langston 2006, Arnett et al. 2007). Specifically, migrant passerines (e.g., songbirds) are found more often in post-construction mortality monitoring compared to other groups of birds (Arnett et al. 2007). In fact, at newer generation wind energy facilities outside of California, approximately 80 percent of documented mortalities have been songbirds, of which 50 percent are often nocturnal migrants (Erickson et al. 2001, Drewitt and Langston 2006, Johnson et al. 2007, Strickland and Morrison 2008). It is estimated that less than 0.01 percent of migrant songbirds that pass over wind farms are killed, based on radar data and mortality monitoring (Erickson 2007). Locally breeding songbirds may experience lower mortality rates than migrants because many of these species tend not to fly at turbine heights during the breeding season. However, some breeding songbird species have behaviors that increase the risk of collisions with turbines. For example, horned larks have been commonly found as fatalities at wind farms (Erickson et al. 2002). Mortality may be partially attributed to the flight displays in which male horned lark fly to heights of 80 to 250 m (Pickwell 1931).

Despite the observation that most wind farm fatalities are songbirds, raptor mortality historically has received the most attention. Raptor mortality at newer generation wind projects has been low relative to previous generation wind farms, although there is substantial regional variation (Erickson et al. 2002, 2004, Johnson et al. 2002, Kerns and Kerlinger 2004, Jain et al. 2007). Although raptor mortality is reduced at newer generation facilities, mortality may not be eliminated by advances in turbine technology (e.g., turbine height, tower structure) and local micro-siting and site evaluation efforts are still necessary.

In addition to mortality associated with wind farms, concerns have been raised that some bird species may avoid areas near turbines after the wind farm is in operation (Drewitt and Langston 2006). For example, at the Buffalo Ridge wind energy facility in Minnesota, densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines. It was suggested that the reduced density may be due to avoidance of turbine noise and maintenance activities, and reduced habitat quality due to the presence of access roads and large gravel pads surrounding the turbines (Leddy et al. 1999). Reduced abundance of grassland songbirds was found within 50 meters (m) of a turbine pad for a wind farm in Washington and Oregon, but the investigators attributed displacement to the direct loss of habitat or reduced habitat quality and not the presence of the turbines (Erickson et al. 2004). Recent research at two sites in North and South Dakota (Shaffer and Johnson,

2008) suggests that certain grassland songbird species (2 of 4 studied) may avoid turbines by as much as 200 m but these results have not been finalized nor verified at additional sites. None of these studies have addressed whether or not these avoidance effects are temporary (i.e., the birds may habituate to the presence of turbines over time) or permanent.

Particular concern over avoidance issues has been raised with respect to grouse species. Research studies are underway to evaluate the effects of wind energy development on lesser prairie-chickens (*Tympanuchus pallidicinctus*), greater prairie-chickens *(Tympanuchus cupido*), and greater sage grouse (*Centrocercus urophasianus*). However, data from these studies has yet to be published. Conversely, several studies regarding the effects of other anthropogenic structures such as power lines and buildings on grouse have been published. Pitman et al. (2005) demonstrated that lesser prairie-chickens tend to avoid anthropogenic features, especially transmission lines, on the landscape when choosing nest locations and recommended a 1-kilometer (km) development buffer around suitable breeding habitat. Pruett et al. (2009) summarized data that suggests both greater prairie-chickens and lesser prairie-chickens avoid transmission lines in movements around their home range and in lek location selection. Additionally, studies suggest that greater sage-grouse are potentially impacted by transmission lines as they relate to supplying perches for grouse predators (Atamian et al. 2007, Lammers and Callopy 2007). As transmission lines are an associated feature of wind energy facilities, transmission line avoidance by prairie grouse species and greater sage-grouse has implications for facility siting. There is a wide array of recommended buffer distances for prairie-grouse and sage-grouse lek locations and habitat, a variation that is indicative of both species-specific and regional variation and an incomplete understanding of the underlying ecology. In a conservative attempt to accommodate this uncertainty, the U.S. Fish and Wildlife Service (USFWS) recommend an 8-km (5-mile) buffer surrounding active lek locations for all prairie grouse species (Manville 2004).

Finally, all native birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product. Despite extensive liability provisions, the USFWS has narrowly interpreted its permitting authority. “As currently written, USFWS’s regulations establish a permitting scheme for a variety of intentional activities, such as hunting, falconry, certain import and export activities, depredation control, and scientific research. But…there is no permitting scheme for the incidental take of migratory birds during otherwise lawful activities” (Beveridge 2005). There is no permitting framework (i.e., incidental take permits) that allow a wind energy company to protect itself from liability at wind energy facilities; however, the USFWS does not usually take action if good faith efforts have been made to minimize impacts. To date, no wind energy development company has been charged for violations of the MBTA.

1.2 Study Description

NextEra Energy, LLC (NextEra) is planning to develop a wind energy conversion facility in central North Dakota in Burleigh County (Figure 1). Fall and spring avian surveys were completed in 2008-2009 for the Baldwin Wind Energy Center (Project). Since 2009, the Baldwin Wind Energy Center has been expanded. NextEra is committed to environmental due diligence and has contracted Tetra Tech EC, Inc. (Tetra Tech) to conduct spring avian surveys at the expanded northern portion of the Baldwin Wind Energy Center (hereafter, the Project Area) not included in previous avian surveys to quantify local avian use in the area and to identify potential avian impacts associated with building and/or operating the proposed facility.

The Project Area is located on private land approximately 20 miles north of Bismarck. The Project Area is 7,250 acres and is located within the Northwestern Great Plains. This landscape includes the western mixed-grass prairie, short-grass prairie, and associated wetlands of the Missouri Slope and River Breaks regions. This semiarid, unglaciated region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badlands formations. Native grasslands persist in areas of steep or broken topography, but they have been largely replaced by spring wheat, alfalfa and other crops over most of the ecoregion. Land use is predominantly dry-land farming of spring and winter wheat, barley, sunflowers and corn, interspersed with cattle grazing.

North Dakota has 365 documented bird species (Faanes and Stewart 1982) and is situated within the Central Flyway, one of the main bird migratory routes (USFWS 2008). The Central Flyway runs through the central portion of the United States and thus the Project Area. Most birds that move along the Central Flyway travel from Canada through the central states, eventually reaching the tropics of South America via the Gulf of Mexico (USFWS 2008).

2.0 METHODS

To evaluate avian risk at wind energy facilities, standardized protocols for pre-construction point counts have been established and were used in this study. Data collected from these counts are used to identify species or species groups that may be at risk from project development and may provide additional information for micro-siting wind facilities to minimize impacts to birds. Results in this report are presented in terms of species groups, and highlight federal and state-listed species, and species of concern.

2.1 Avian Surveys

Fixed-point Surveys

An experienced field biologist conducted 20-minute (min) point count surveys at 6 locations within the Project Area to evaluate avian use, behavior, and species composition during spring migration (Figure 2). To date, the biologist has completed eleven weekly surveys from March 25 to June 4 (Table 1), thereby encompassing the mid-spring migration to early summer breeding seasons. In complying with a request from the USFWS, NextEra has asked Tetra Tech to complete this preliminary report to

summarize results to date. An additional two weekly surveys will be preformed, and results incorporated into a revised spring avian report. Tetra Tech distributed the survey locations throughout the Project Area and chose locations that maximized the 360-degree sight distance for the observer and covered a diversity of habitats.

The field biologist collected data on all birds observed within an 800-m radius of the point count location. Surveys at each point lasted for 20 min, during which time biologists continuously recorded any visual or auditory observations. The biologist recorded the following data: species, number of individuals, time of observation, height aboveground, behavior, and flight direction. Data on flight direction can be found in Appendix 1. The biologist estimated flight heights and distances by using existing meteorological towers, local transmission lines, and topographic maps for reference.

The survey protocol used in this study is designed to collect data on all bird species and to provide results that are comparable with other studies at wind farms rather than to target specific taxa. The benefit of using this protocol is that it estimates avian use throughout the day and captures activity by a variety of bird species. During the breeding season, and to a lesser extent in the fall and winter, songbirds are most active in the morning and can be difficult to detect during the afternoon. In contrast, raptors become active as the sunlight heats the air and creates thermals, which individuals use for soaring (Ballam 1984). Thus, raptors are more readily detected several hours after sunrise. Therefore, this protocol is appropriate for characterizing the bird community using the Project Area during this time of year.

Tetra Tech chose 20-min survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 min may lead to double-counting of songbirds (i.e., counting the same individual more than once) because individuals may appear and disappear from view. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-min survey, not number of distinct individual birds.

Detectability varies among species and potentially not all individuals within the 800-m radius were counted. This variation in detectability results in an overestimate of mean use for conspicuous species and an underestimate of mean use for reclusive species (Thompson 2002). Birds not easily identifiable, such as those seen under low light conditions or small birds seen at a distance were identified to the lowest taxonomic level possible. Hence, unidentified birds are included in the results.

Raptor Nest Surveys

The purpose of raptor nest surveys is to estimate the number of active and inactive raptor nests in the Project Area. The biologist conducted the raptor nest survey across the Project Area before trees began to leaf out to increase visibility of raptor nests. Where possible, the biologist also surveyed over an approximately 1-mile buffer around the Project Area. Once a nest was located, the biologist returned during the raptor breeding

season to collect data on species, location, and activity status. The activity status (i.e., active or inactive) was determined by the presence of an adult or young, active territory defense by an individual, or the presence of feathers, egg shells or droppings underneath the nest. In addition, the biologist determined the nest condition and substrate. The biologist visited nests a minimum of two times, once to determine the location of the nest and once to determine if the nest was active. This second check also allowed biologists to detect late-nesting species, such as Swainson's hawks. Raptor nest surveys provide an estimate of the number and species of raptors that use stick nests in the area. Ground-nesting raptor species, such as northern harriers, were not surveyed.

Lek Location Surveys

The biologist conducted grouse lek surveys to identify areas of use by breeding prairie grouse in the Project Area and surrounding area. The biologist conducted weekly lek surveys from April 10 to May 8, each conducted from an hour before sunrise to 9:00 am by driving county roads through areas identified as potential lek habitat. Typical grouse lek habitat in North Dakota is classified as open, short grass vegetation that may contain scattered patches of small trees and shrubs with minimal amounts of agriculture. When conducting lek surveys, biologist stopped every half mile and listened for a minimum of five minutes for vocalizations of displaying males. On a calm morning, sharp-tailed grouse males may be heard at a distance of up to ¾ mile and prairie-chickens can be heard from up to one mile away (Davis, et al. 2008). The biologist did not conduct listening stops when winds exceeded 10 mph or if there was any type of precipitation. If a lek was located and visible, the biologist observed the lek for 10 minutes to count the number of males and females. If displaying grouse were heard, but the lek was not visible, the biologist attempted to pinpoint the location by driving county roads.

Incidental Observations

Incidental observations included observations that occurred 1) during travel between points, 2) before or after the official 20-min survey period 3) outside of the 800-m radius circular plot and 4) during raptor nest and grouse lek surveys. The biologist recorded these observations on separate data sheets and these data were not used in the formal analysis; however, a summary of incidental birds is presented to provide additional information about species found in the local area.

Listed Species Information

A list of species currently protected under the Endangered Species Act can be found at http://www.fws.gov/endangered/wildlife.html.

The North Dakota Game and Fish Department (NDGFD) has identified 100 Species of Conservation Priority within North Dakota. These species are ranked in three priority levels based on such factors as known status, funding availability, and presence of breeding habitat within North Dakota (Hagen et al. 2005). The definitions of each rank are listed below:

> Level I: A species having a high level of conservation priority because of declining status either in North Dakota or across their range; or a high rate of occurrence in North Dakota constituting the core of the species' breeding range,

but are at-risk range wide, and non- State Wildlife Grants funding is not readily available to them.

Level II: Species having a moderate level of conservation priority; or a high level of conservation priority, but a substantial amount of non-State Wildlife Grant funding is available to them.

Level III: North Dakota's species having a moderate level of conservation priority, but are believed to be peripheral or do not breed in North Dakota.

Species that are listed under the 100 Species of Conservation Priority are not afforded any formal protection by the state. NDGFD has plans to review and update the list of Species of Conservation Priority in 2010. Additional information on North Dakota Species of Conservation Priority can be found at: http://gf.nd.gov/conservation/toc.html.

Data Quality Assurance/Quality Control

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. To ensure legibility and completeness of data sheets, the biologist reviewed, and clarified if needed, all data sheets before data entry into a Filemaker™ relational database for data storage and analysis. Prior to analysis, an independent reviewer conducted a 100-percent quality review of the data entries. Any questions that arose at this time were directed toward and answered by the field biologist.

2.2 Analysis

Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Tetra Tech defined raptors as vultures, hawks, eagles, falcons, and owls. As turkey vulture flight behavior is similar to raptors and as they are often included as raptors in other studies, Tetra Tech has included them with raptors for the purpose of our analyses. Non-raptors were defined as all other species groups.

Avian Use of the Project Area

Tetra Tech derived avian use (mean use) of the Project Area by calculating the average number of birds observed per 20-min survey at each point. To evaluate the diversity and composition of avian species using the Project Area, Tetra Tech first summarized the number of individuals (birds/20 min) and species. Tetra Tech also calculated a measure of variability (90 percent confidence intervals) for all mean use values. In addition, the number of observations is also presented, where an observation can be either an individual bird or a discrete flock of birds. This information helps evaluate whether high mean use is driven by a single event (e.g., a large flock of birds moving through the Project Area on migration). Because individual birds are not uniquely marked and identified, actual population size or abundance cannot be determined. One individual may be counted multiple times during a survey period or across survey periods. Therefore, avian mean use does not equate to abundance.

Flight Behavior

Tetra Tech evaluated flight behavior by calculating the proportion of flying birds observed below, within, or above the height of the anticipated turbine rotor swept area (RSA). The turbine type to be used at the Project Area is the GE XLE 1.6 Megawatt (MW) turbine therefore; an 80.0-m hub height and 82.5-m rotor diameter was used to calculate the RSA. With these specifications, the estimated RSA was between 38.8 and 121.3 m above ground. Tetra Tech considered a bird to have flown within the height of the anticipated RSA if any of its recorded heights fell within the upper or lower limits of the anticipated RSA.

Encounter Rate

To estimate the rate at which a species flew at the height of the anticipated RSA, Tetra Tech applied the following equation to every species observed in the Project Area:

$$Encounter\ Rate = A*P_f*P_t$$

A is the mean number of birds/20 min for a given species, P_f is the proportion of all activity observations for a given species that were flying; and P_t is the proportion flying observations that were at the height of a turbine RSA for a given species. The encounter rate provides information on the rate at which a species may move at a height that is consistent with the RSA of the proposed turbines. This information is an important component in evaluating risk of collisions; however, this number alone does not indicate risk to a species. Species with a high encounter rate are at a higher risk of collision than species with a low encounter rate, but it does not mean that mortality is certain. Other factors such as turbine location or a species ability to detect turbine blades, flight maneuverability, and habitat selection also influence mortality (Orloff and Flannery 1992). Values are sensitive to large flocks of birds flying within the RSA; that is, a species will have a high encounter rate even if only seen a few times in large flying flocks. Encounter rate also does not account for migrating behavior of nocturnal migrants.

Mortality Risk

The relationship between pre-construction avian use and post-construction mortality is not yet completely defined due to a lack of pre- and post-construction data from sites with moderate to high use. Based on the available data, although limited, it appears that low raptor use equates to low mortality and the few sites with very high raptor use also experience high raptor fatalities. Currently, there are no publicly available use and fatality data from sites with intermediate raptor use. Other factors that contribute to the uncertainty in predicting fatality rates is the highly regional nature of avian mean use across North America (Arnett et al. 2007) and the scarce data on avian mortality at wind farms in many parts of North America. The most comprehensive source of regional information on avian fatality rates is the Avian and Bat Fact Sheet (NWCC 2010). As a result of this uncertainty, Tetra Tech did not attempt to derive mortality estimates from mean use data but will highlight those species or groups that may experience mortality or displacement that could significantly affect local or regional populations, based on the data provided in this report and other information sources.

3.0 RESULTS

3.1 Avian Use and Frequency of Occurrence.

The biologist surveyed 2,979 acres of the Project Area during point count surveys, covering 41.1 percent of the Project Area's total area. The 6 point count locations were surveyed 11 times, resulting in 66 total 20-min surveys. None of the points were missed during the survey. A total 4,123 birds were observed within the Project Area, 4,090 birds from 70 species and 33 birds that could not be identified to species during the 66 fixed-point count surveys (Table 2). Overall mean bird use within the Project Area was 62.47 birds/20 min and ranged from 2 to 540 birds/20 min.

Overall mean use by non-raptors was 61.65 birds/20 min and, among species groups, mean use was highest for songbirds (32.08 birds/20 min, observed in 95.5 percent of all surveys), followed by cranes/rails (19.92 birds/20 min, observed in 13.6 percent of all surveys) and waterfowl (4.82 birds/20 min, observed in 60.6 percent of all surveys; Table 2). The non-raptors with the highest mean use were the sandhill crane (19.88 birds/20 min, observed in 9.1 percent of all surveys), red-winged blackbird (11.76 birds/20 min, observed in 75.8 percent of all surveys), horned lark (9.08 birds/20 min; 51.5 percent of all surveys), and Canada goose (2.45 birds/20min, 19.7 percent of all surveys). Other frequently observed non-raptors were western meadowlark (60.6 percent of all surveys), mourning dove (51.5 percent), vesper sparrow (40.9 percent), mallard (40.9 percent), brown-headed cowbird (37.9 percent) and killdeer (31.8 percent; Table 2).

Non-raptor mean use was highest on April 11 (221.0 birds/20 min; Figure 3). The species that contributed to the high mean use on April 11 was the sandhill crane (986 individuals). The first two survey dates (March 25 and April 6) also had a relatively high mean use as a result of large flocks (greater than 20 individuals) of chestnut collared longspurs, horned larks and Canada geese, with additional sightings of sandhill cranes on April 6 (Figure 3). Mean use for non-raptors was highest at point count location 3 (85.55 birds/20 min) and observations at this point mostly included sandhill crane (362 individuals), red-winged blackbird (200 individuals), and horned lark (183 individuals; Table 3; Figure 4). In addition to point 3, non-raptor mean use was also considered high for points 2, 4, 5, and 6 with sandhill cranes, red-winged blackbirds, and horned larks accounting for most of non-raptors observed at these points. The habitat (mostly agriculture fields) around point count location 3 is typical of the entire Project Area.

Raptors are a group of special interest because of their propensity to fly at heights similar to a turbine RSA. Overall mean use for raptors was 0.82 birds/20 min (Table 2) and raptors were not among the most frequently observed species groups during the spring surveys. The raptors with the highest use were the red-tailed hawk (0.35 birds/20 min; 18.2 percent of all surveys), and northern harrier (0.32 birds/20 min; 24.2 percent of all surveys). Mean use for each other raptor species was 0.06 birds/20 min or fewer: turkey vulture, American kestrel, and Swainson's hawk.

Mean use by raptors was highest on April 11 (0.87 birds/20 min) and included 10 red-tailed hawks and 3 northern harriers (Figure 5). Mean use by raptors was highest at point

count location 1, and observations included 7 red-tailed hawks and 5 northern harriers (Table 4, Figure 6). Raptor mean use was also relatively high at point count location 6 (Table 4; Figure 6); observations included 6 red-tailed hawks and 4 northern harriers. Point count locations 1 and 6 had 2 active red-tailed hawk and 4 unidentified raptor nests within the immediate area (Figure 7). Red-tailed hawks and northern harriers were common throughout the Project Area but were not observed at all point count locations.

3.2 Flight Height and Encounter Rate

During spring avian use surveys, the biologist collected behavioral data for all birds observed during point count surveys. The biologist observed 82.1 percent of birds flying and collected flight height data for 99.6 percent and flight direction for 73.3 percent of flying observations. Of non-raptor species observed flying, 38.1 percent flew below the height of the anticipated RSA, 21.9 percent flew at the height of the anticipated RSA, and 40.0 percent flew above the anticipated RSA (Table 4). Of raptor species observed flying, 56.3 percent flew below the height of the anticipated RSA, 27.1 percent flew at the height of the anticipated RSA, and 16.7 percent flew above the height of the anticipated RSA (Table 4). Data on flight direction are located in Appendix 1.

The red-winged blackbird, horned lark, and Canada goose had the highest encounter rates (3.42, 3.23, and 2.12 birds flying at RSA height/20 min, respectively; Table 5). Red-winged blackbirds and horned larks were recorded at all surveys points. Canada geese were observed at all survey points except point 3. Most Canada geese were observed flying over survey points 1 and 5. The habitat at both locations is not considered unique compared to the rest of the Project Area and neither survey points have habitat that would add an additional attractant to Canada geese. All other species had encounter rates of less than 0.61 birds flying at RSA height/20 min.

Red-tailed hawk had the highest encounter rates for raptors (0.17 birds flying at RSA height/20 min, respectively; Table 5). Red-tailed hawks were observed at all survey points except for point 3. All other raptor species had a 0.0 birds flying at RSA height/20 min encounter rate.

3.3 Raptor Nest Surveys

Fifteen raptor nests were found during the raptor nest surveys (Figure 7). Three red-tailed hawk, two great-horned owls, and one Swainson's hawk nest were identified as active and monitored on subsequent visits (Appendix 2). Nine unknown raptor nests were later noted as inactive upon subsequent visits and are presumed to be old nests from the same species of raptors found in the Project Area. All nests were located in trees either along windbreaks or around riparian corridors and ranged from 5 feet (ft) (Swainson's hawk) to 40 ft (Unknown raptor) in height. One red-tailed hawk, 1 Swainson's hawk, and 1 unknown raptor nest were found within the Project Area (Figure 7).

3.4 Lek Surveys

One active sharp-tailed grouse lek was found within the Project Area during the grouse lek surveys (Figure 7). Three subsequent visits were made to identify the number of individuals present. The number of individuals present on the lek ranged from 1 to 13, with the maximum count being 15 different individuals (Appendix 3).

3.5 Incidental Observations

The biologist documented 34 species and 3 unidentified species as incidental observations (Table 6). The biologist documented sixteen incidental species—American bittern, bufflehead, common goldeneye, canvasback, great-horned owl, horned grebe, hooded merganser, lesser scaup, northern shrike, orange-crowned warbler, ring-necked duck, ruddy duck, short-eared owl, sharp-tailed grouse, western grebe, and wild turkey - that were not detected during spring point count surveys. The biologist observed three raptor species as both incidentals and during the point count surveys: American kestrel, red-tailed hawk, and northern harrier.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Non-Raptor Use and Encounter Rate

The Project Area ranked 1st out of 24 studies when compared to spring non-raptor use rates reported for existing wind energy facilities throughout the country with publicly available data (Table 7; Figure 8). The species groups contributing to this high mean use were songbirds, waterfowl, and cranes/rails. The high mean use is likely due, in part, to habitat being mostly agriculture within and in the vicinity of the Project Area. The fields and open pastures attract such species as red-winged blackbirds, horned larks and Canada geese during migration. Because studies of avian use do not share identical methodologies (e.g., length of survey period) and there is variance associated with the mean values, comparisons of avian use represent generalizations only. All non-raptor species found at the Project Area are protected by the MBTA except European starling, rock pigeon, and house sparrow.

Songbirds had the highest mean use out of all groups, a value which was driven by red-winged blackbird and horned larks. Red-winged blackbird and horned lark had high encounter rates (3.42 and 3.23 birds flying at RSA height/20 min respectively). Red-winged blackbird (Kerlinger et al. 2006, Jain et al. 2007) and horned lark mortality (Erikson et al. 2004) has been documented at other wind energy facilities. Given the high encounter rates of these species at the Project Area, turbine-related fatalities may occur. However, if fatalities do occur at the Project Area, they are unlikely to have population-level impacts because red-winged blackbirds have large regional populations that are relatively stable (Sauer et al. 2008). Additionally, red-winged blackbirds are attracted to agricultural crops (corn, soybean, and sunflower) and are often targeted by the agriculture industry as a nuisance species through permits issued by the USFWS under the MBTA. Horned larks have shown a population decline in North Dakota and most of North America (Sauer et al. 2008). If any fatalities do occur on the Project Area, they are not expected to have population level consequences as horned larks are a found throughout

North America. All other songbirds had encounter rates less than 0.46 birds flying at RSA height/20 min which is considered a low risk value.

Waterfowl had the third highest mean use of all species groups at the Project Area with the majority of the waterfowl being Canada geese. Canada geese had the third highest encounter rate (2.12 birds flying at RSA height/20 min). Canada geese mortality has been documented at other wind energy facilities but the overall numbers of fatalities are very low (Erickson et al. 2004, Jain et al. 2007). The combination of the high encounter rate and prior evidence of negative turbine interactions suggest that some fatalities of Canada geese could occur at the Project Area. If fatalities do occur at the Project Area, they are not expected to have population-level impacts. Waterfowl Breeding Population and Habitat Surveys (WBPHS) carried out jointly by the USFWS and Canada Wildlife Service (CWS) show an increasing trend in the Great Plains population (includes North Dakota) of Canada geese since 2000 (USFWS 2009). Additionally, local breeding population and regional migratory populations for Canada geese are quite large and stable (Sauer et al. 2008).

Cranes/rails as a group also ranked high in mean use mostly due to sandhill cranes, a species that had the highest mean use of all birds observed. However, all sandhill cranes were observed in flight and 98.2 percent of these observations were above the RSA (1.8 percent of observations were within the RSA) and had a low encounter rate of 0.32 birds flying at RSA height/20 min. All observations were made on April 6th and 11th at the beginning of the survey period. This coincides with the natural migration of sandhill cranes that pass through North Dakota during late March to early April (peak North Dakota migration being around the first week in April) heading north to breeding areas in Canada (Tacha et al. 1992). To date, no sandhill crane fatalities have been reported at North American wind energy facilities based on publicly available data. Given the results of the low encounter rates any negative interactions with the proposed Project Area would be low.

4.2 Raptor Use and Encounter Rate

The Project Area ranked 12th out of 35 studies when compared to spring raptor use rates reported for existing wind energy facilities throughout the country with publicly available data (Table 7; Figure 9). High raptor use has been associated with high raptor mortality at wind farms (Erickson 2007). Conversely, raptor mortality appears to be low when raptor use is low, as defined by Erickson (2007) as less than 1.0 birds/20 min, which is the case for raptor use at the Project Area.

Red-tailed hawks and northern harriers were the most commonly observed raptor species during avian surveys. Red-tailed hawks were seen at all point count locations except point count three (which happened to have an active Swainson's hawk nest nearby) and were also the most commonly observed nesting raptor within the vicinity of the Project Area. Although both species have been reported as fatalities at similar existing wind farms in the United States (Johnson et al. 2002, Young et al. 2003, Erickson et al. 2004, Jain 2005), the very low encounter rates (0.17 and less than 0.01 birds flying at RSA height/20min, respectively) observed at the Project Area suggest that the probability of a

turbine-related fatalities for red-tailed hawk and northern harrier at the Project Area is low.

The biologist also observed turkey vulture, American kestrel, and Swainson's hawk within the Project Area during the point count surveys. One active Swainson's hawk nest was found just east of survey point three. All have low mean use values, thereby minimizing the potential for negative turbine-related impacts to these species. Additionally, great-horned owl and short-eared owls were seen as incidental observations within the Project Area and two great-horned owl nests were found outside of the Project Area. Nine raptor nests were found that the species could not be determined. These nests are possible old nests from the same species of raptors found in the Project Area.

4.3 Listed and Sensitive Species

No federally listed species were observed during avian surveys. Fifteen species were detected that are listed as North Dakota State Species of Conservation Priority:

> Level I - American white pelican, Swainson's hawk, upland sandpiper, marbled godwit, Franklin's gull, black tern, and grasshopper sparrow.
> Level II - northern pintail, canvasback, northern harrier, short-eared owl (incidental), sharp-tailed grouse (incidental and during lek surveys), LeConte's sparrow, bobolink, and chestnut collared longspur.

The designation of Species of Conservation Priority describes a species identified as in decline at the national, regional or state level, or a species whose population status in not well known, but thought to be in decline (Hagen et al. 2005). Species of Conservation Priority receive special attention from agencies, but do not require take permits or have other regulatory implications regardless of status (Level I or II), but all of these species are protected under the Migratory Bird Treaty Act. All species listed above had encounter rates of less than 0.60 birds/20 min flying within the RSA, primarily because of their low occurrence within the Project Area.

4.4 Non-listed Species of State Interest

The sharp-tailed grouse is managed as a gamebird in North Dakota, and is also listed as a Level II State Species of Conservation Priority. Much of North Dakota currently provides suitable habitat for sharp-tailed grouse (NDGFD 2009). Sharp-tailed grouse were observed as an incidental observation and one active lek was found within the Project Area during lek surveys (Figure 7 and Appendix 3). Wind energy development in grouse lekking habitat could result in direct habitat loss, habitat loss through avoidance, predator facilitation, and construction-related disturbance. Sharp-tailed grouse typically fly low to the ground and, therefore, are at low risk of collision with turbines or power lines.

Research investigating the effects of wind turbines on prairie grouse leks is on-going; however, research on the similar species lesser-prairie chickens has occurred for other development activities. Pruett et al. (2009) outlines that lesser-prairie chickens will readily move across open lands with minor habitat alterations such as fences and roads but will nest further away and seldom approach tall structures such as buildings and

transmission lines. Additionally, studies on greater-prairie chickens show that individuals stay at least 0.5 km away from transmission lines possibly due to raptors using the lines as vantage points for hunting (Pruett et al. 2009). These avoidance buffers can greatly decrease the amount of useable habitat by prairie grouse. Vehicular traffic from wind energy development may have similar implications. Road development may also facilitate the movement of predators into the Project Area (Frey and Conover 2006, Pescador and Peris 2007), potentially increasing predation on grouse nests. To further minimize disturbances to leks, construction between March 15 and June 1 should not occur during the early morning hours or evening period when grouse display. Currently, NextEra has plans to begin construction of the Project Area staring in late July to early August.

4.5 Project Area Conclusions

Spring non-raptor use at the Project Area ranked 1st out of 24 mean use studies at other wind generation facilities, primarily due to high use by red-winged blackbirds, sandhill cranes, horned larks, and Canada geese. The species with high encounter rates (red-winged blackbird and Canada geese) have stable regional populations (Sauer et al. 2008); therefore, if fatalities do occur they are unlikely to have population-level consequences or receive a high level of scrutiny from state or federal wildlife agencies. Horned larks also had a high encounter rate and have shown some population declines regionally in North Dakota and North America (Sauer et al. 2008). While fatalities of horned larks may occur, they are not expected to have population level impacts as horned larks are found throughout North America. Nocturnal migrants (e.g., some songbirds) may pass through the Project Area and would not be detected by the survey methods used in this study if the birds did not stop-over within the Project Area. However, mortality of nocturnal migrants at the Project Area is not expected to have population-level implications because less than 0.01 percent of nocturnal migrants that fly through wind farms are killed (Erickson 2007).

Fall raptor use at the Project Area ranked 12th out of 35 mean use studies at other wind generation facilities. Red-tailed hawks had the highest encounter rate at 0.17 birds flying at the RSA height/20 minutes which is considered very low. The level of raptor use at the Project Area suggests that raptor mortality is anticipated to be low, especially based on the results by Young et al. (2003). Red-tailed hawks and northern harriers were the most common raptors observed at the Project Area and fatalities of both species have occurred at wind farms (Johnson et al. 2002, Young et al. 2003, Erickson et al. 2004, Jain 2005). However, the overall numbers of red-tailed hawks and northern harriers detected at the Project Area were low, thereby minimizing the probability of negative interactions with turbines.

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Jason Jones	June 28, 2010
Lead Technical Review	Date
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FIGURES

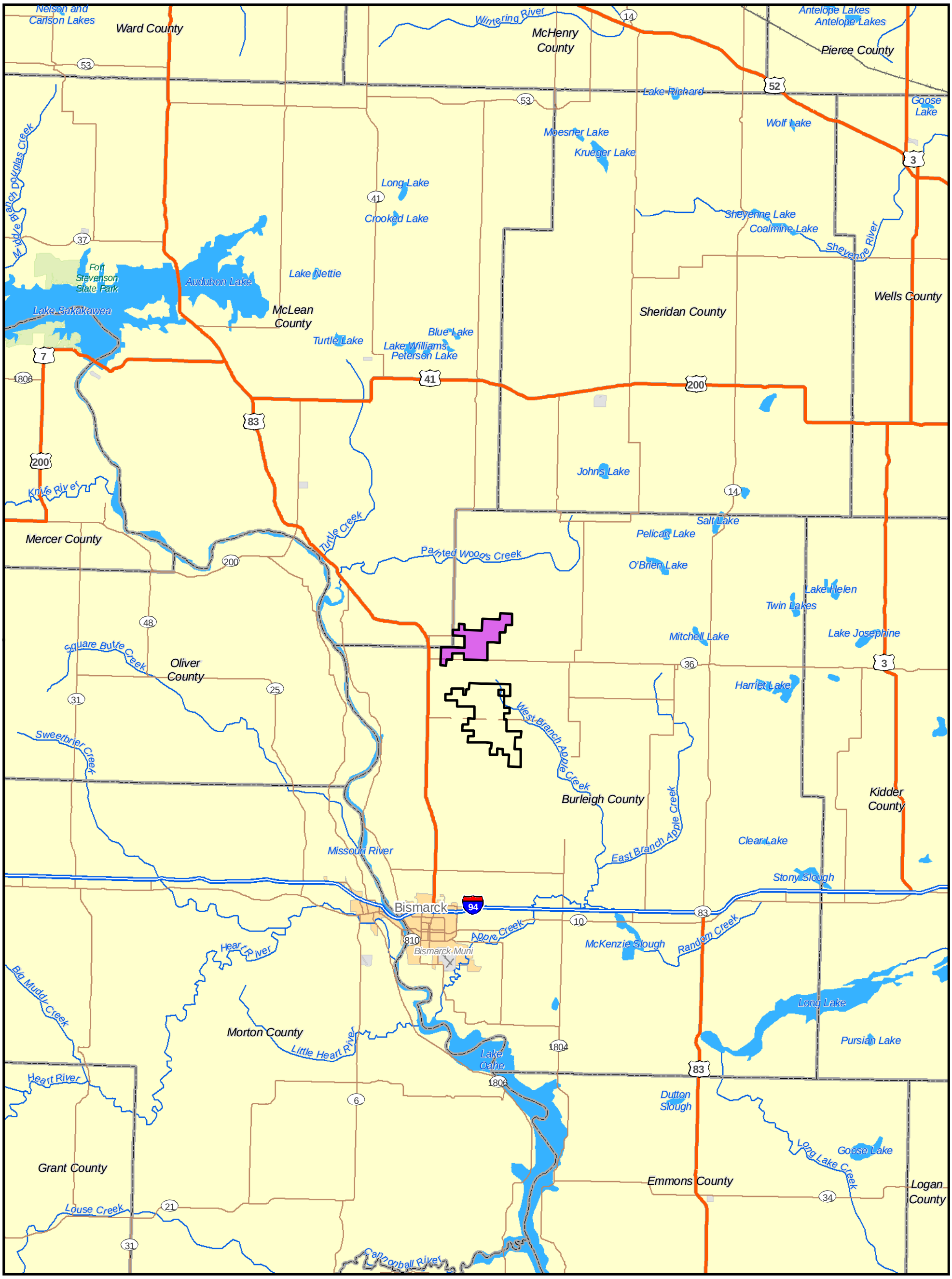


Figure 1

Vicinity map

Northern Portion of the Baldwin Wind Energy Center

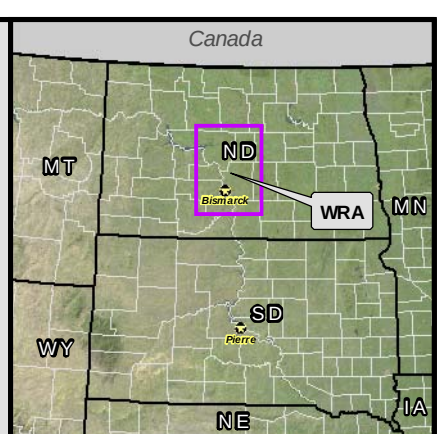
Burleigh County, ND

NEXTera ENERGY RESOURCES

1:500,000
NAD 1983 UTM 14

Norther Portion of Project Area (3-18-2010)
Entire Project Area
County Boundary
River/Stream
Lake/Pond
Interstate Highway
Federal Highway
State Highway

0 2 4 6 8 10
Miles



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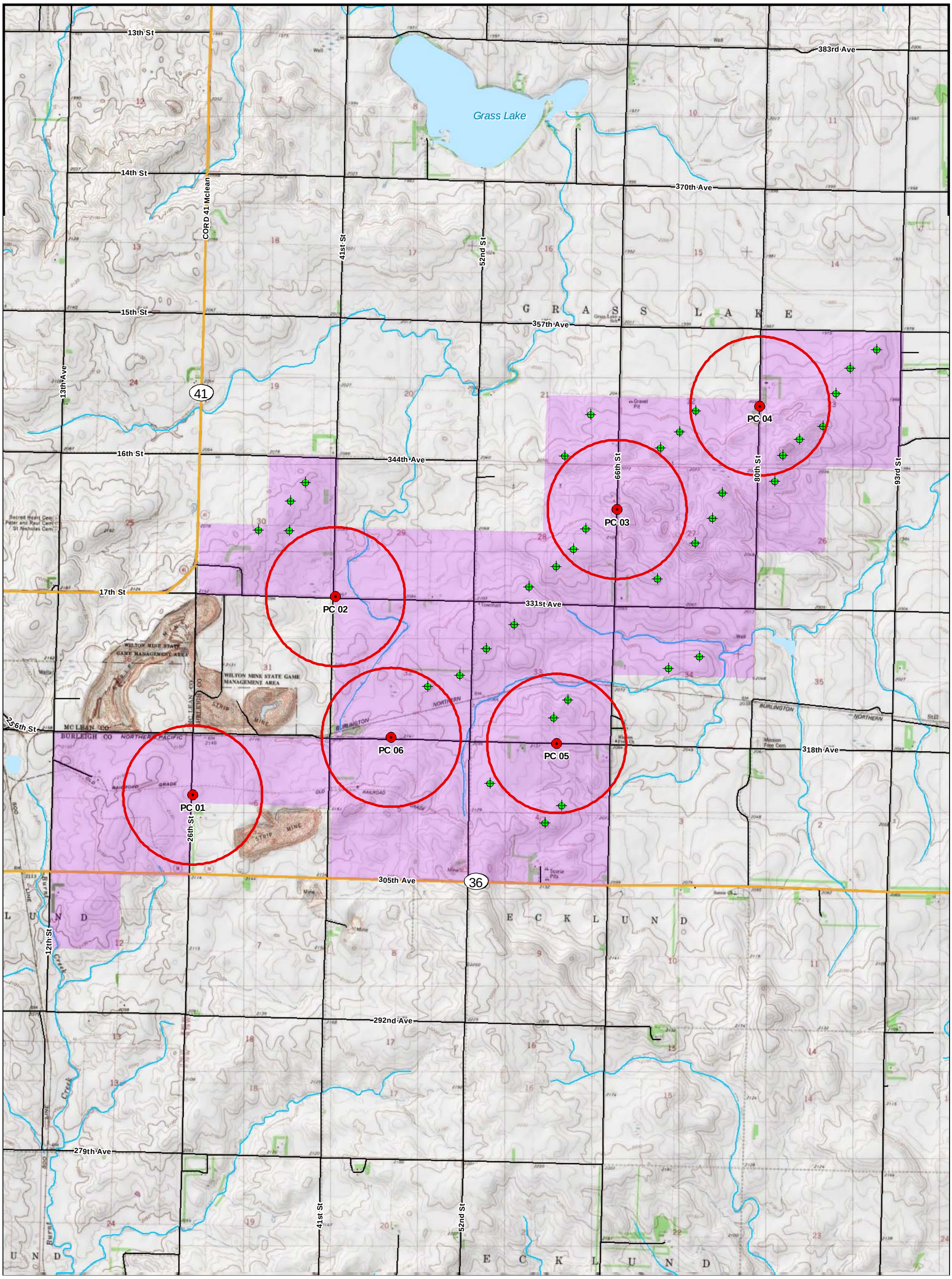

Figure 2

Point count location map (spring 2010)
Northern Portion of the Baldwin Wind Energy Center
Burleigh County, ND

NEXTera ENERGY RESOURCES

1:42,000
NAD 1983 UTM 14
Last Modified: 6-10-2010

Avian Survey Point
Avian Survey Point 800-m Radius
PC# Point Count Number
Project Area (3-18-2010)
Proposed Turbine (5-5-2010)
River/Stream
Lake/Pond
State Highway
Other Road

0 0.5 1
Miles

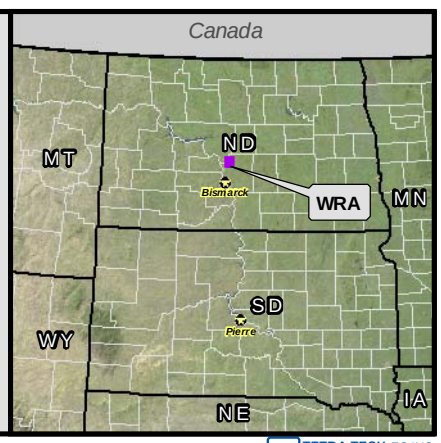

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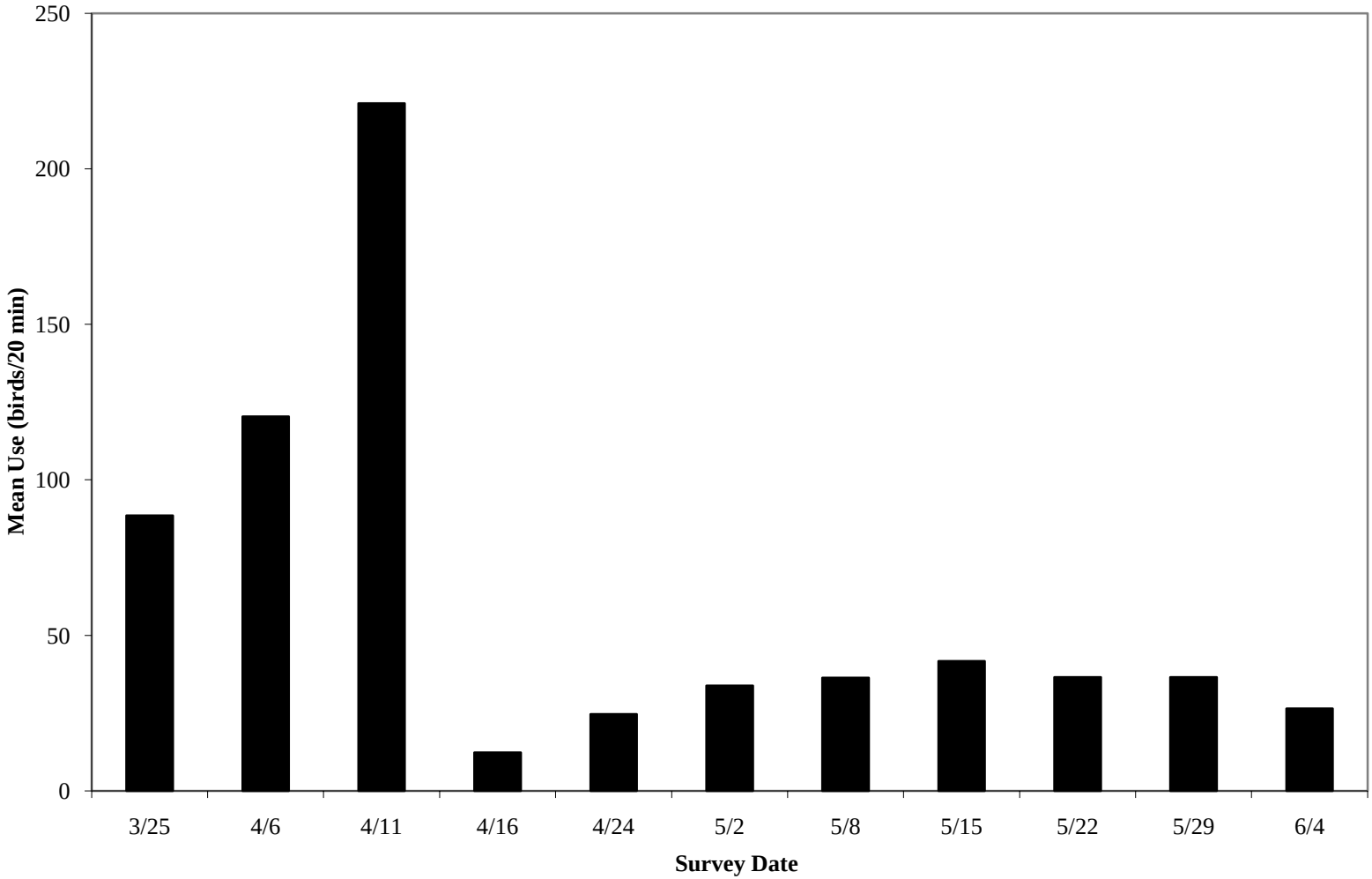
Figure 3. Non-raptor mean use by survey date in Spring 2010 at the Northern Portion of the Baldwin Wind Energy Center.



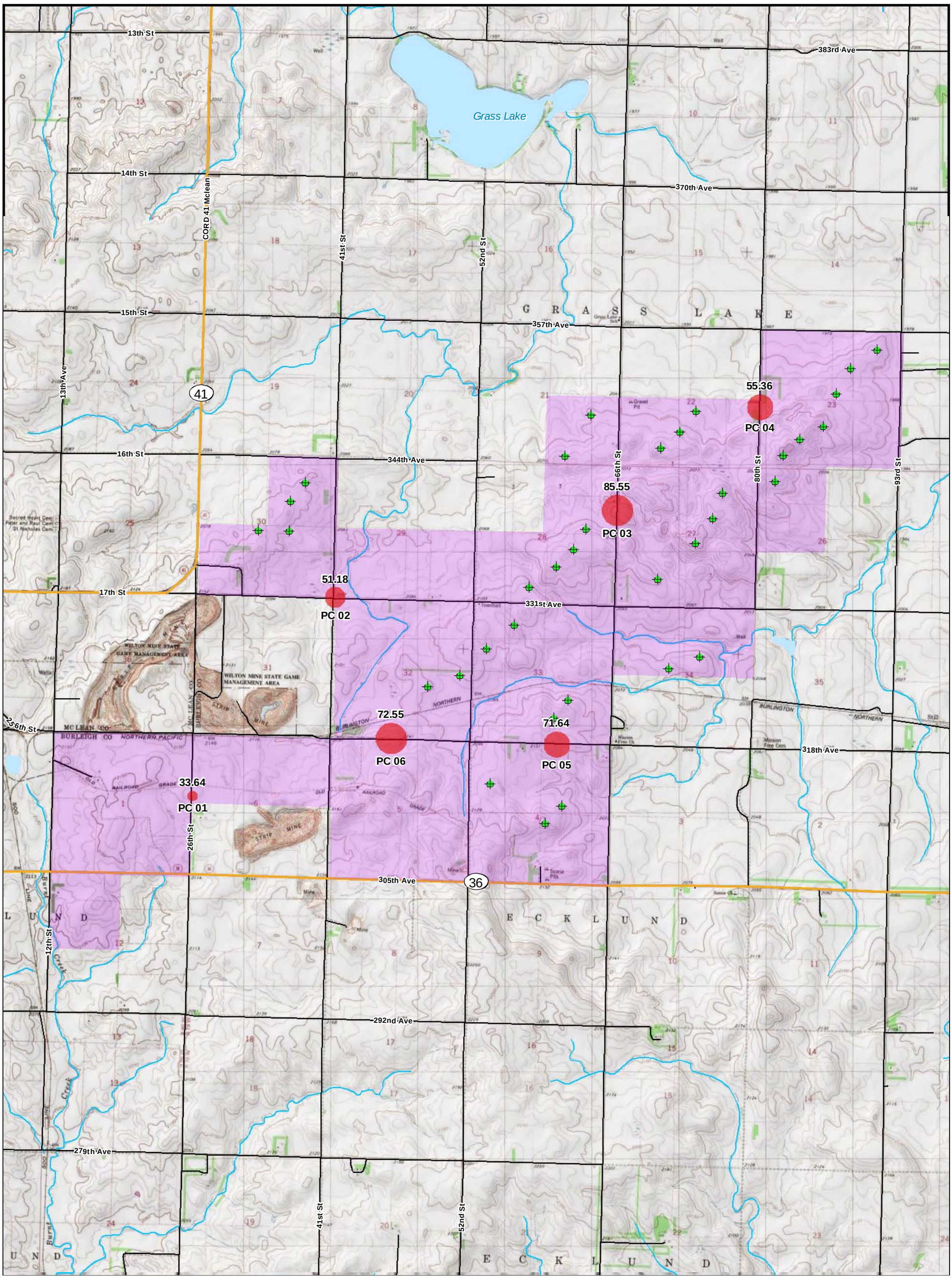


Figure 4

Non-raptor mean use by point count location (spring 2010)

Northern Portion of the Baldwin Wind Energy Center Burleigh County, ND

NEXTera ENERGY RESOURCES

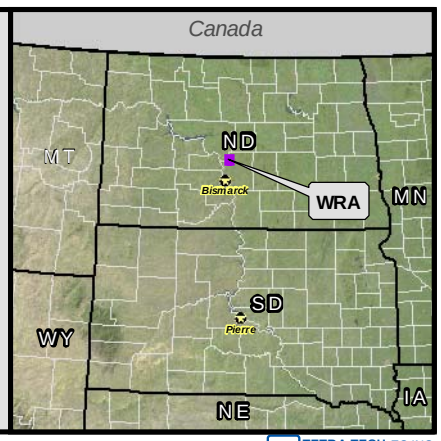
1:42,000
NAD 1983 UTM 14
Last Modified: 6-10-2010

Non-raptors per 20 minutes

- 0.01 - 18.00
- 18.01 - 36.00
- 36.01 - 54.00
- 54.01 - 72.00
- 72.01 - 90.00

Project Area (5-18-2010)
Proposed Turbine (5-5-2010)
River/Stream
Lake/Pond
State Highway
Other Road
Mean Use Value
PC# Point Count Number

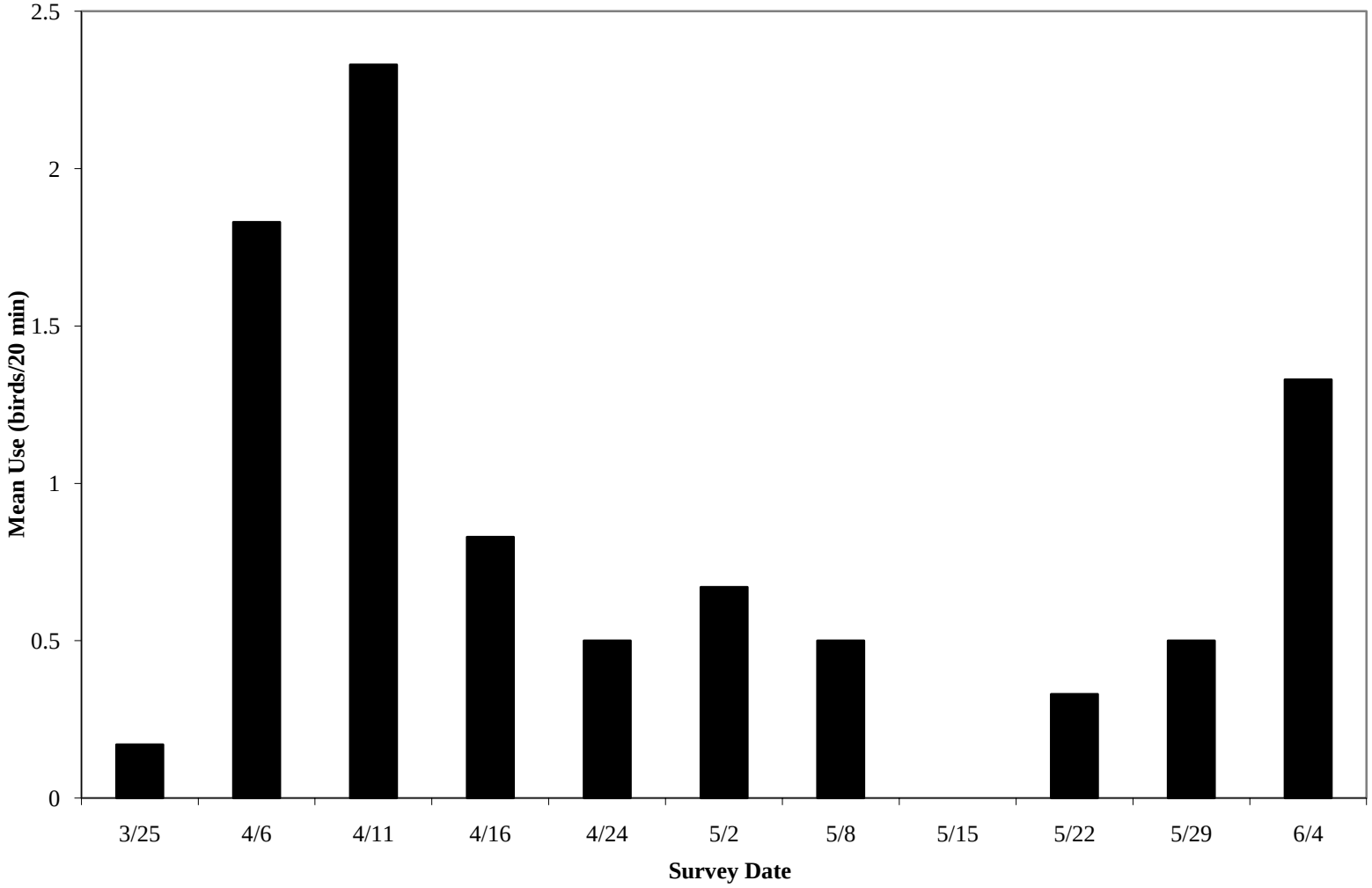
0 0.5 1 Miles



TETRA TECH EC,INC

P:\GIS_PROJECTS\NextEra\Baldwin\MXDs\Avian_Survey\2010\Spring\Report_Maps\NextEra_Baldwin_AvianSurvey_Figure4_NonRaptorMU_063010_PTab.mxd - Last Accessed: 6/30/2010 - Map Scale correct at: ANSI B (11" x 17")

Figure 5. Raptor mean use by survey date in Spring 2010 at the Northern Portion of the Baldwin Wind Energy Center



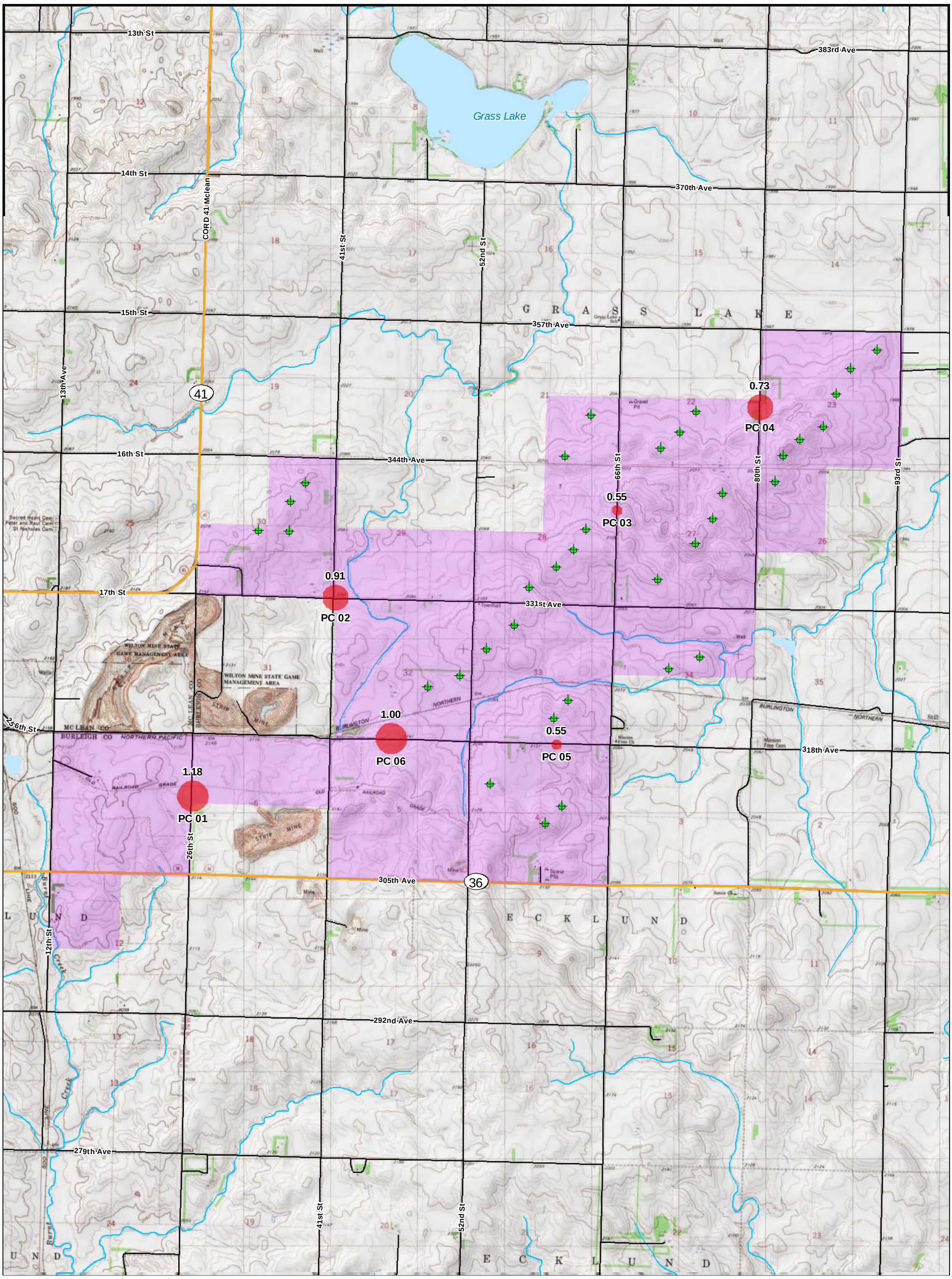


Figure 6

Raptor mean use by point count location (spring 2010)

Northern Portion of the Baldwin Wind Energy Center

Burleigh County, ND

NEXTera ENERGY RESOURCES

1:42,000
NAD 1983 UTM 14
Last Modified: 6-10-2010

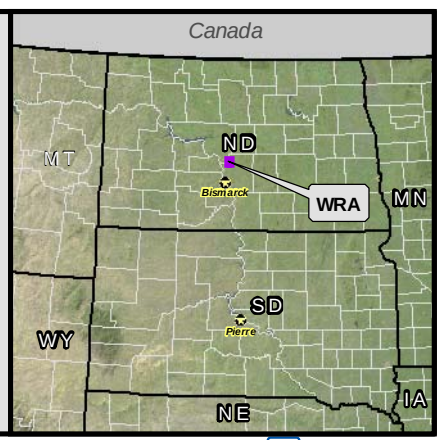
Raptors per 20 minutes

- 0.00 - 0.24
- 0.25 - 0.55
- 0.56 - 0.72
- 0.73 - 0.96
- 0.97 - 1.20

Project Area (5-18-2010)
Proposed Turbine (5-5-2010)
River/Stream
Lake/Pond
State Highway
Other Road

Mean Use Value
PC# Point Count Number

0 0.5 1
Miles



TETRA TECH EC,INC

P:\GIS_PROJECTS\NextEra\Baldwin\MXDs\Avian_Survey\2010\Spring\Report_Maps\NextEra_Baldwin_AvianSurvey_Figure6_RaptorMU_063010_PTab.mxd - Last Accessed: 6/30/2010 - Map Scale correct at: ANSI B (11" x 17")

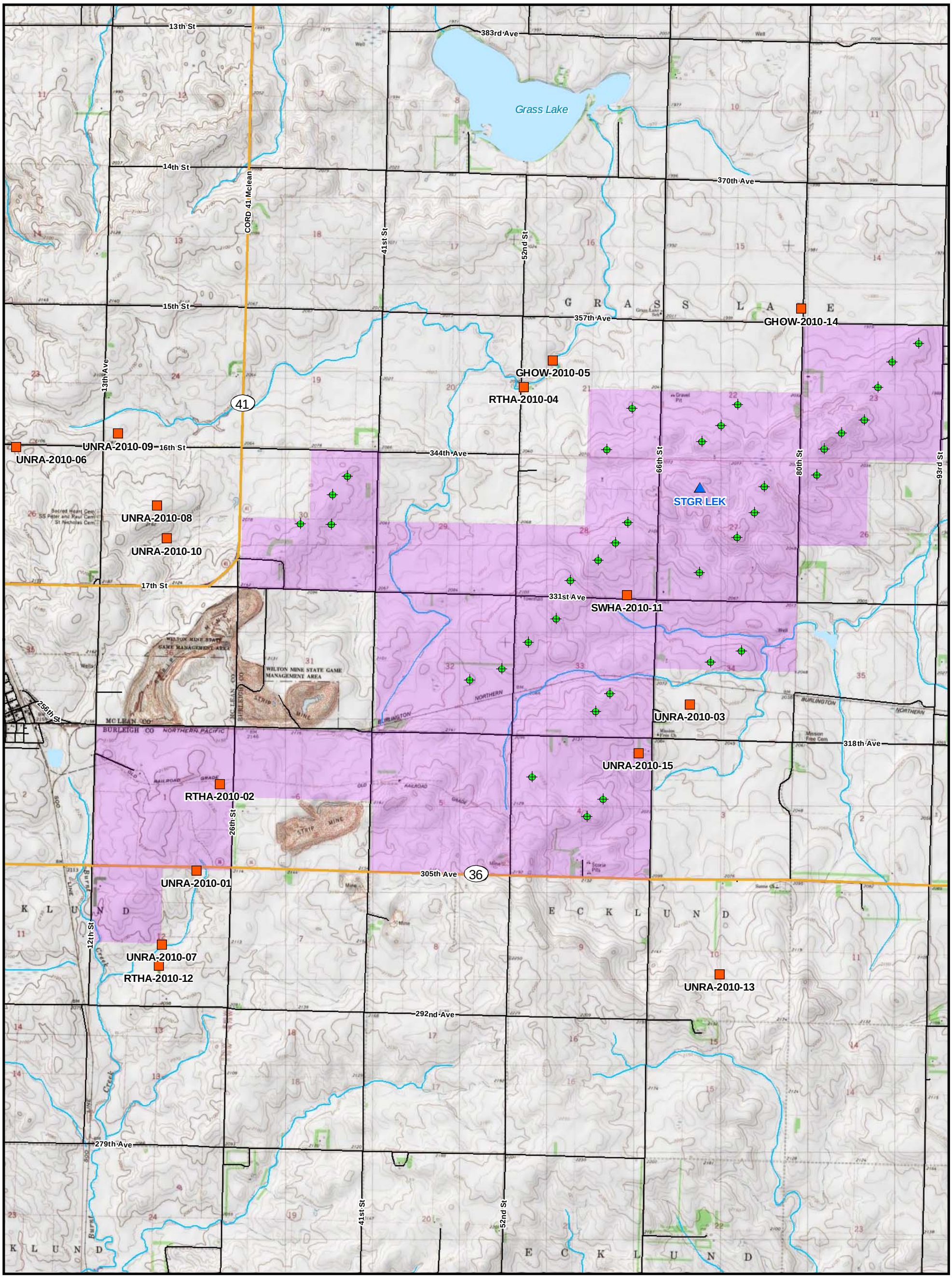


Figure 7

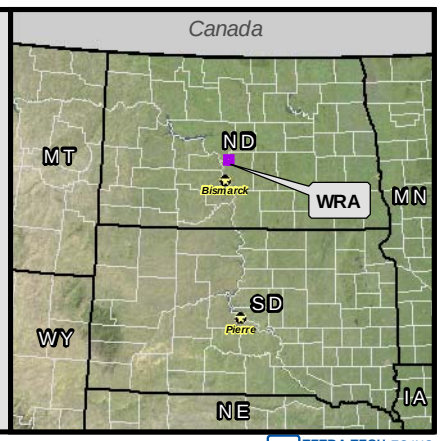
Raptor nest and lek location map (spring 2010)
Northern Portion of the Baldwin Wind Energy Center
Burleigh County, ND

NEXTera ENERGY RESOURCES

1:42,000
NAD 1983 UTM 14
Last Modified: 6-10-2010

Raptor Nest
Sharp-tailed Grouse Lek
Project Area (3-18-2010)
Proposed Turbine (5-5-2010)
River/Stream
Lake/Pond
State Highway
Other Road

0 0.5 1
Miles



TETRA TECH EC,INC

P:\GIS_PROJECTS\NextEra\Baldwin\MXDs\Avian_Survey\2010\Spring\Report_Maps\NextEra_Baldwin_AvianSurvey_Figure7_RaptorNests_061010_PTab.mxd - Last Accessed: 6/30/2010 - Map Scale correct at: ANSI B (11" x 17")

Figure 8. Comparison of non-raptor mean use at Northern Portion of the Baldwin Wind Energy Center to other mean use studies at wind projects.

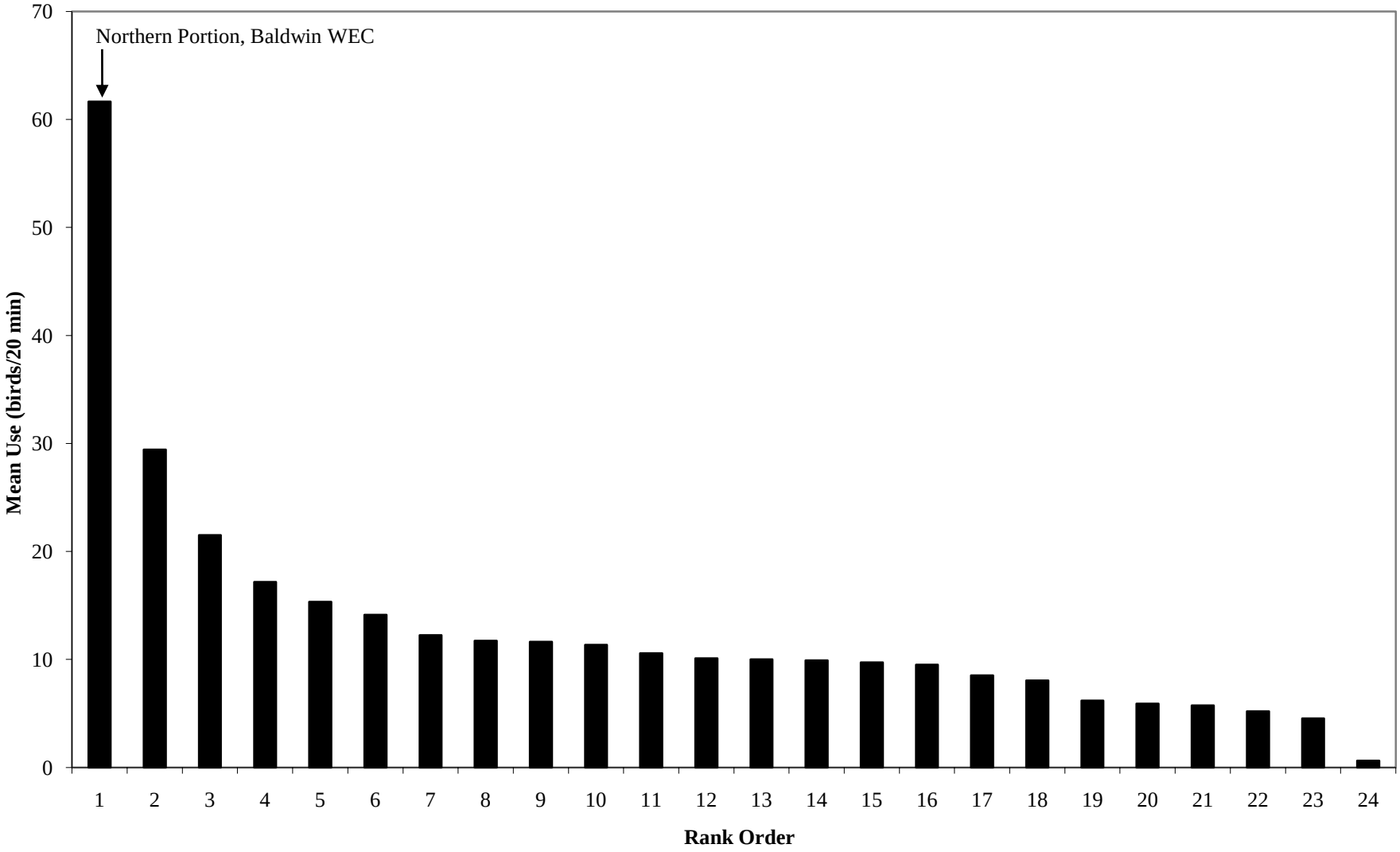
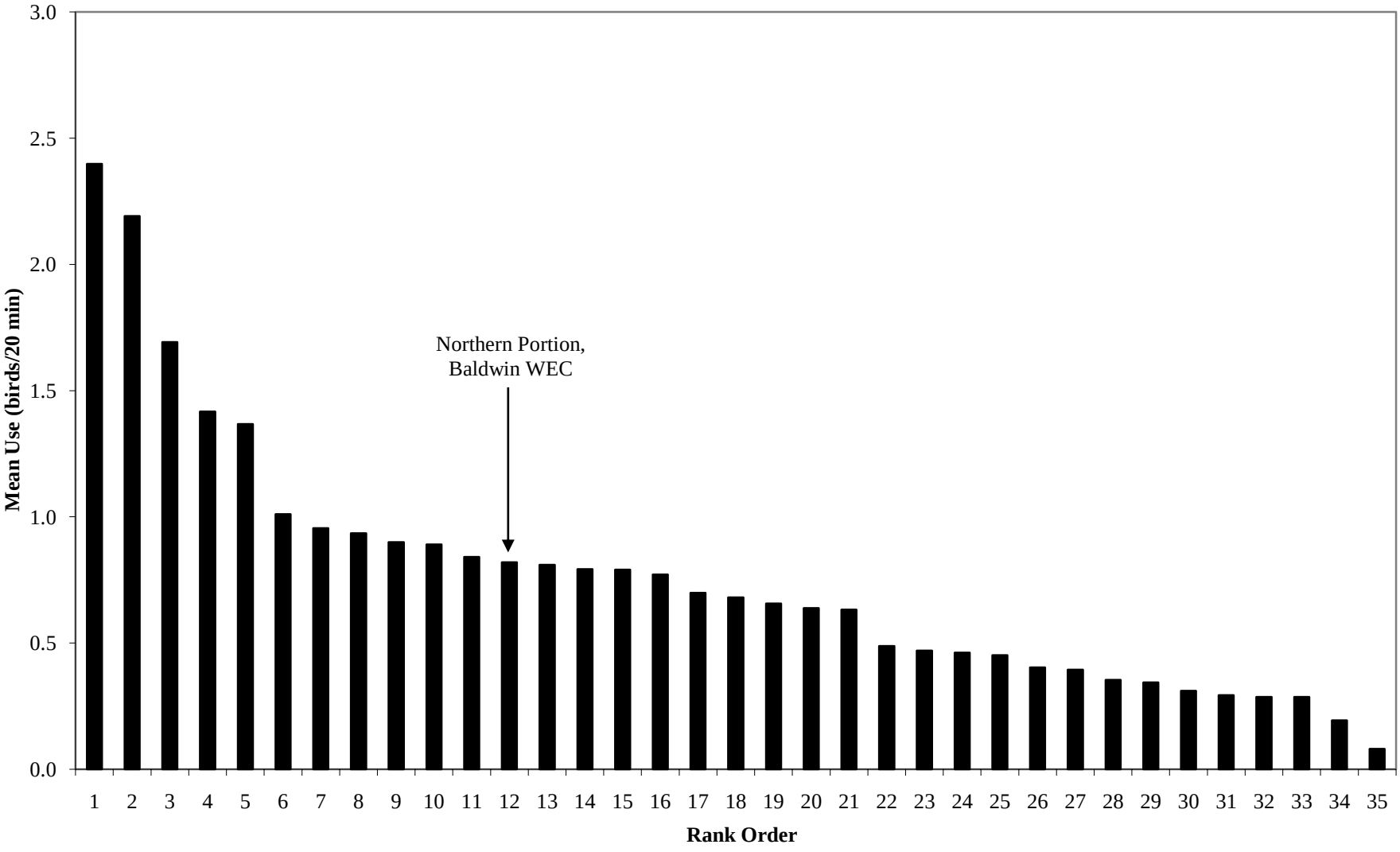


Figure 9. Comparison of raptor mean use at the Northern Portion of the Baldwin Wind Energy Center to other mean use studies at wind projects.



TABLES

Table 1. Spring 2010 point count survey dates at the Northern Portion of the Baldwin Wind Energy Center.

Survey number	Date(s)
1	3/25
2	4/6
3	4/11
4	4/16
5	4/24
6	5/2
7	5/8
8	5/15
9	5/22
10	5/29
11	6/4

Table 2. Avian species, by species grouping, observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
Songbirds								
red-winged blackbird	2	776	130	11.76	(6.82-16.70)	75.8	36.7%	18.8%
horned lark	3	599	49	9.08	(2.47-15.69)	51.5	28.3%	14.5%
brown-headed cowbird	5	126	40	1.91	(0.00-3.90)	37.9	6.0%	3.1%
chestnut-collared longspur	7	86	6	1.30	(0.00-2.81)	4.5	4.1%	2.1%
western meadowlark	10	75	74	1.14	(0.91-1.37)	60.6	3.5%	1.8%
American goldfinch	11	54	34	0.82	(0.51-1.13)	27.3	2.6%	1.3%
vesper sparrow	13	42	39	0.64	(0.45-0.83)	40.9	2.0%	1.0%
common grackle	14	38	16	0.58	(0.24-0.92)	21.2	1.8%	0.9%
American crow	14	38	8	0.58	(0.00-1.38)	10.6	1.8%	0.9%
American robin	16	34	25	0.52	(0.32-0.72)	31.8	1.6%	0.8%
barn swallow	17	33	23	0.50	(0.27-0.73)	25.8	1.6%	0.8%
bobolink	18	29	26	0.44	(0.23-0.65)	22.7	1.4%	0.7%
clay-colored sparrow	20	28	27	0.42	(0.26-0.58)	28.8	1.3%	0.7%
western kingbird	21	24	13	0.36	(0.16-0.56)	15.2	1.1%	0.6%
eastern kingbird	27	13	9	0.20	(0.08-0.32)	12.1	0.6%	0.3%
yellow-headed blackbird	29	12	8	0.18	(0.06-0.30)	10.6	0.6%	0.3%
tree swallow	29	12	7	0.18	(0.05-0.31)	9.1	0.6%	0.3%
song sparrow	32	11	10	0.17	(0.09-0.25)	15.2	0.5%	0.3%
Brewer's blackbird	32	11	5	0.17	(0.00-0.34)	6.1	0.5%	0.3%
unidentified sparrow	35	10	3	0.15	(0.00-0.35)	4.5	0.5%	0.2%
yellow warbler	38	8	7	0.12	(0.02-0.22)	7.6	0.4%	0.2%
savannah sparrow	38	8	6	0.12	(0.02-0.22)	7.6	0.4%	0.2%
brown thrasher	40	7	7	0.11	(0.05-0.17)	10.6	0.3%	0.2%
Le Conte's sparrow	42	6	6	0.09	(0.02-0.16)	7.6	0.3%	0.1%
least flycatcher	43	5	5	0.08	(0.03-0.13)	7.6	0.2%	0.1%
warbling vireo	45	4	4	0.06	(0.01-0.11)	6.1	0.2%	0.1%

Table 2. Avian species, by species grouping, observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
cedar waxwing	45	4	1	0.06	(0.00-0.16)	1.5	0.2%	0.1%
American tree sparrow	45	4	2	0.06	(0.00-0.14)	3.0	0.2%	0.1%
orchard oriole	52	3	3	0.05	(0.01-0.09)	4.5	0.1%	0.1%
common yellowthroat	52	3	3	0.05	(0.01-0.09)	4.5	0.1%	0.1%
willow flycatcher	57	2	2	0.03	(0.00-0.06)	3.0	0.1%	0.0%
spotted towhee	57	2	2	0.03	(0.00-0.06)	3.0	0.1%	0.0%
unidentified swallow	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
Tennessee warbler	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
Say's phoebe	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
marsh wren	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
house wren	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
house finch	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
grasshopper sparrow	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
eastern bluebird	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
black-capped chickadee	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
bank swallow	62	1	1	0.02	(0.00-0.04)	1.5	0.0%	0.0%
Group Total		**2117**	**610**	**32.08**	(23.66-40.50)	**95.5**		**51.3%**
Cranes/Rails								
sandhill crane	1	1312	17	19.88	(4.36-35.40)	9.1	99.8%	31.8%
sora	52	3	3	0.05	(0.01-0.09)	4.5	0.2%	0.1%
Group Total		**1315**	**20**	**19.92**	(4.41-35.43)	**13.6**		**31.9%**
Waterfowl								
Canada goose	4	162	16	2.45	(0.00-4.91)	19.7	50.9%	3.9%
mallard	6	90	37	1.36	(0.81-1.91)	40.9	28.3%	2.2%
northern shoveler	23	21	9	0.32	(0.10-0.54)	10.6	6.6%	0.5%
unidentified duck	25	18	9	0.27	(0.11-0.43)	12.1	5.7%	0.4%
northern pintail	29	12	6	0.18	(0.06-0.30)	9.1	3.8%	0.3%

Table 2. Avian species, by species grouping, observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
blue-winged teal	35	10	2	0.15	(0.00-0.40)	1.5	3.1%	0.2%
snow goose	52	3	1	0.05	(0.00-0.12)	1.5	0.9%	0.1%
gadwall	57	2	1	0.03	(0.00-0.08)	1.5	0.6%	0.0%
Group Total		**318**	**81**	**4.82**	(2.28-7.36)	**60.6**		**7.7%**
Pigeons/Doves								
mourning dove	8	85	50	1.29	(0.90-1.68)	51.5	88.5%	2.1%
rock pigeon	32	11	7	0.17	(0.06-0.28)	10.6	11.5%	0.3%
Group Total		**96**	**57**	**1.45**	(1.06-1.84)	**59.1**		**2.3%**
Gamebirds								
ring-necked pheasant	9	84	75	1.27	(0.99-1.55)	72.7	100.0%	2.0%
Group Total		**84**	**75**	**1.27**	(0.99-1.55)	**72.7**		**2.0%**
Waterbirds								
killdeer	18	29	23	0.44	(0.29-0.59)	31.8	38.7%	0.7%
common snipe	26	14	13	0.21	(0.12-0.30)	19.7	18.7%	0.3%
marbled godwit	27	13	9	0.20	(0.04-0.36)	12.1	17.3%	0.3%
lesser yellowlegs	40	7	2	0.11	(0.00-0.26)	3.0	9.3%	0.2%
upland sandpiper	43	5	5	0.08	(0.03-0.13)	7.6	6.7%	0.1%
American white pelican	45	4	1	0.06	(0.00-0.16)	1.5	5.3%	0.1%
great blue heron	57	2	2	0.03	(0.00-0.06)	3.0	2.7%	0.0%
American coot	62	1	1	0.02	(0.00-0.04)	1.5	1.3%	0.0%
Group Total		**75**	**56**	**1.14**	(0.74-1.54)	**48.5**		**1.8%**
Raptors								
red-tailed hawk	22	23	17	0.35	(0.16-0.54)	18.2	42.6%	0.6%
northern harrier	23	21	21	0.32	(0.20-0.44)	24.2	38.9%	0.5%
unidentified buteo	45	4	4	0.06	(0.01-0.11)	6.1	7.4%	0.1%
turkey vulture	52	3	2	0.05	(0.00-0.11)	3.0	5.6%	0.1%
American kestrel	57	2	2	0.03	(0.00-0.08)	1.5	3.7%	0.0%
Swainson's hawk	62	1	1	0.02	(0.00-0.04)	1.5	1.9%	0.0%

Table 2. Avian species, by species grouping, observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
Group Total		**54**	**47**	**0.82**	(0.57-1.07)	**43.9**		**1.3%**
Gulls/Terns								
Franklin's gull	12	45	2	0.68	(0.00-1.68)	3.0	83.3%	1.1%
ring-billed gull	45	4	2	0.06	(0.00-0.14)	3.0	7.4%	0.1%
black tern	45	4	2	0.06	(0.00-0.13)	3.0	7.4%	0.1%
common tern	62	1	1	0.02	(0.00-0.04)	1.5	1.9%	0.0%
Group Total		**54**	**7**	**0.82**	(0.00-1.82)	**10.6**		**1.3%**
Woodpeckers								
northern flicker	35	10	10	0.15	(0.07-0.23)	13.6	100.0%	0.2%
Group Total		**10**	**10**	**0.15**	(0.07-0.23)	**13.6**		**0.2%**
Grand Total		**4123**	**963**	**62.47**	(43.16-81.78)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points					
			1	2	3	4	5	6
sandhill crane	1312	17	0	0	362	40	396	514
red-winged blackbird	776	130	136	177	200	99	26	138
horned lark	599	49	39	89	183	86	187	15
Canada goose	162	16	56	6	0	5	86	9
brown-headed cowbird	126	40	8	15	5	86	5	7
mallard	90	37	18	34	7	19	2	10
chestnut-collared longspur	86	6	1	35	50	0	0	0
mourning dove	85	50	6	17	9	36	9	8
ring-necked pheasant	84	75	13	14	9	16	11	21
western meadowlark	75	74	16	22	18	9	7	3
American goldfinch	54	34	10	0	5	20	6	13
Franklin’s gull	45	2	5	0	0	40	0	0
vesper sparrow	42	39	6	6	11	3	11	5
common grackle	38	16	7	0	6	18	6	1
American crow	38	8	0	32	2	1	2	1
American robin	34	25	7	0	1	20	4	2
barn swallow	33	23	4	4	5	11	4	5
killdeer	29	23	6	8	2	7	1	5
bobolink	29	26	4	16	4	2	0	3
clay-colored sparrow	28	27	7	2	8	5	2	4
western kingbird	24	13	0	0	12	8	3	1
red-tailed hawk	23	17	7	1	0	4	5	6
northern shoveler	21	9	2	15	4	0	0	0
northern harrier	21	21	5	9	1	2	0	4
unidentified duck	18	9	1	9	0	5	0	3
common snipe	14	13	0	6	0	1	1	6
marbled godwit	13	9	0	10	0	0	2	1
eastern kingbird	13	9	2	0	3	5	2	1
yellow-headed blackbird	12	8	0	9	0	1	0	2
tree swallow	12	7	3	0	5	4	0	0
northern pintail	12	6	1	4	0	5	2	0
song sparrow	11	10	1	1	4	5	0	0
rock pigeon	11	7	0	5	0	3	2	1
Brewer's blackbird	11	5	1	0	2	8	0	0
unidentified sparrow	10	3	0	1	0	8	0	1
northern flicker	10	10	1	0	4	4	1	0
blue-winged teal	10	2	0	10	0	0	0	0
yellow warbler	8	7	1	0	0	6	0	1
savannah sparrow	8	6	1	0	3	2	0	2
lesser yellowlegs	7	2	0	7	0	0	0	0

Table 3. Avian species observed by point during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points					
			1	2	3	4	5	6
brown thrasher	7	7	2	0	1	2	1	1
Le Conte's sparrow	6	6	0	1	4	0	1	0
upland sandpiper	5	5	0	1	2	1	1	0
least flycatcher	5	5	1	0	0	3	0	1
warbling vireo	4	4	0	0	1	3	0	0
unidentified buteo	4	4	1	0	0	1	1	1
ring-billed gull	4	2	1	0	0	0	0	3
cedar waxwing	4	1	0	0	0	4	0	0
black tern	4	2	0	0	0	2	2	0
American white pelican	4	1	0	0	4	0	0	0
American tree sparrow	4	2	1	0	0	0	0	3
turkey vulture	3	2	0	0	2	1	0	0
sora	3	3	0	3	0	0	0	0
snow goose	3	1	0	0	0	0	3	0
orchard oriole	3	3	0	0	2	0	0	1
common yellowthroat	3	3	0	2	0	0	1	0
willow flycatcher	2	2	0	0	0	1	0	1
spotted towhee	2	2	0	0	1	0	0	1
great blue heron	2	2	0	1	0	0	0	1
gadwall	2	1	0	0	0	2	0	0
American kestrel	2	2	0	0	2	0	0	0
unidentified swallow	1	1	0	0	0	0	0	1
Tennessee warbler	1	1	0	0	0	0	0	1
Swainson’s hawk	1	1	0	0	1	0	0	0
Say's phoebe	1	1	0	0	0	0	0	1
marsh wren	1	1	0	1	0	0	0	0
house wren	1	1	0	0	0	1	0	0
house finch	1	1	0	0	0	1	0	0
grasshopper sparrow	1	1	1	0	0	0	0	0
eastern bluebird	1	1	0	0	0	1	0	0
common tern	1	1	0	0	1	0	0	0
black-capped chickadee	1	1	1	0	0	0	0	0
bank swallow	1	1	0	0	0	0	1	0
American coot	1	1	0	0	1	0	0	0
Grand Total	**4123**	**963**	**383**	**573**	**947**	**617**	**794**	**809**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

		Birds	
		Number	**Percentage**
Non-raptors			
	Above RSA height (>121.3m)	1328	40.0%
	At RSA height (38.8m–121.3m)	728	21.9%
	Below RSA height (<38.8m)	1268	38.1%
Raptors			
	Above RSA height (>121.3m)	8	16.7%
	At RSA height (38.8m–121.3m)	13	27.1%
	Below RSA height (<38.8m)	27	56.3%

[1] Includes only flying birds with flight height data

[2] These values assume a rotor diameter of 82.5 (m) and a hub height of 80 (m)

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
red-winged blackbird	3.42	11.76 (6.82 - 16.70)	73.3	0.2	39.7	60.1
horned lark	3.23	9.08 (2.47 - 15.69)	94.8	5.3	37.5	57.2
Canada goose	2.12	2.45 (0.00 - 4.91)	91.4	0.0	94.6	5.4
Franklin's gull	0.60	0.68 (0.00 - 1.68)	100.0	11.1	88.9	0.0
chestnut-collared longspur	0.45	1.30 (0.00 - 2.81)	98.8	0.0	35.3	64.7
sandhill crane	0.36	19.88 (4.36 - 35.40)	100.0	98.2	1.8	0.0
red-tailed hawk	0.17	0.35 (0.16 - 0.54)	91.3	33.3	52.4	14.3
northern shoveler	0.12	0.32 (0.10 - 0.54)	76.2	0.0	50.0	50.0
mallard	0.11	1.36 (0.81 - 1.91)	83.3	0.0	9.3	90.7
northern pintail	0.08	0.18 (0.06 - 0.30)	66.7	0.0	62.5	37.5
American goldfinch	0.06	0.82 (0.51 - 1.13)	92.6	0.0	8.0	92.0
killdeer	0.06	0.44 (0.29 - 0.59)	75.9	0.0	18.2	81.8
common snipe	0.06	0.21 (0.12 - 0.30)	85.7	0.0	33.3	66.7
snow goose	0.05	0.05 (0.00 - 0.12)	100.0	0.0	100.0	0.0
unidentified duck	0.04	0.27 (0.11 - 0.43)	83.3	0.0	20.0	80.0
rock pigeon	0.03	0.17 (0.06 - 0.28)	90.9	0.0	20.0	80.0
marbled godwit	0.03	0.20 (0.04 - 0.36)	23.1	0.0	66.7	33.3
American crow	0.03	0.58 (0.00 - 1.38)	100.0	0.0	5.3	94.7
western meadowlark	0.03	1.14 (0.91 - 1.37)	14.7	0.0	18.2	81.8
mourning dove	0.03	1.29 (0.90 - 1.68)	55.3	0.0	4.3	95.7
bobolink	0.03	0.44 (0.23 - 0.65)	65.5	0.0	10.5	89.5
unidentified buteo	0.03	0.06 (0.01 - 0.11)	50.0	0.0	100.0	0.0
black tern	0.03	0.06 (0.00 - 0.13)	100.0	0.0	50.0	50.0
bank swallow	0.02	0.02 (0.00 - 0.04)	100.0	0.0	100.0	0.0
brown-headed cowbird	0.02	1.91 (0.00 - 3.90)	83.3	0.0	1.0	99.0
great blue heron	0.02	0.03 (0.00 - 0.06)	100.0	0.0	50.0	50.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
yellow warbler	0.00	0.12 (0.02 - 0.22)	12.5	0.0	0.0	100.0
yellow-headed blackbird	0.00	0.18 (0.06 - 0.30)	8.3	0.0	0.0	100.0
willow flycatcher	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
western kingbird	0.00	0.36 (0.16 - 0.56)	79.2	0.0	0.0	100.0
warbling vireo	0.00	0.06 (0.01 - 0.11)	25.0	0.0	0.0	100.0
vesper sparrow	0.00	0.64 (0.45 - 0.83)	11.9	0.0	0.0	100.0
upland sandpiper	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
unidentified swallow	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
unidentified sparrow	0.00	0.15 (0.00 - 0.35)	90.0	0.0	0.0	100.0
turkey vulture	0.00	0.05 (0.00 - 0.11)	100.0	0.0	0.0	100.0
tree swallow	0.00	0.18 (0.05 - 0.31)	100.0	0.0	0.0	100.0
Tennessee warbler	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
Swainson’s hawk	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
spotted towhee	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
song sparrow	0.00	0.17 (0.09 - 0.25)	0.0	0.0	0.0	0.0
sora	0.00	0.05 (0.01 - 0.09)	0.0	0.0	0.0	0.0
savannah sparrow	0.00	0.12 (0.02 - 0.22)	37.5	0.0	0.0	100.0
Say's phoebe	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.27 (0.99 - 1.55)	2.4	0.0	0.0	100.0
ring-billed gull	0.00	0.06 (0.00 - 0.14)	100.0	0.0	0.0	100.0
orchard oriole	0.00	0.05 (0.01 - 0.09)	33.3	0.0	0.0	100.0
northern harrier	0.00	0.32 (0.20 - 0.44)	100.0	4.8	0.0	95.2
northern flicker	0.00	0.15 (0.07 - 0.23)	40.0	0.0	0.0	100.0
marsh wren	0.00	0.02 (0.00 - 0.04)	0.0	0.0	0.0	0.0
lesser yellowlegs	0.00	0.11 (0.00 - 0.26)	0.0	0.0	0.0	0.0
least flycatcher	0.00	0.08 (0.03 - 0.13)	20.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
Le Conte's sparrow	0.00	0.09 (0.02 - 0.16)	0.0	0.0	0.0	0.0
house wren	0.00	0.02 (0.00 - 0.04)	0.0	0.0	0.0	0.0
house finch	0.00	0.02 (0.00 - 0.04)	0.0	0.0	0.0	0.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.04)	0.0	0.0	0.0	0.0
gadwall	0.00	0.03 (0.00 - 0.08)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.20 (0.08 - 0.32)	69.2	0.0	0.0	100.0
eastern bluebird	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
common yellowthroat	0.00	0.05 (0.01 - 0.09)	0.0	0.0	0.0	0.0
common tern	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
common grackle	0.00	0.58 (0.24 - 0.92)	47.4	0.0	0.0	100.0
cedar waxwing	0.00	0.06 (0.00 - 0.16)	100.0	0.0	0.0	100.0
clay-colored sparrow	0.00	0.42 (0.26 - 0.58)	7.1	0.0	0.0	100.0
blue-winged teal	0.00	0.15 (0.00 - 0.40)	0.0	0.0	0.0	0.0
brown thrasher	0.00	0.11 (0.05 - 0.17)	0.0	0.0	0.0	0.0
Brewer's blackbird	0.00	0.17 (0.00 - 0.34)	72.7	0.0	0.0	100.0
black-capped chickadee	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.50 (0.27 - 0.73)	100.0	0.0	0.0	100.0
American white pelican	0.00	0.06 (0.00 - 0.16)	100.0	100.0	0.0	0.0
American tree sparrow	0.00	0.06 (0.00 - 0.14)	25.0	0.0	0.0	100.0
American robin	0.00	0.52 (0.32 - 0.72)	17.6	0.0	0.0	100.0
American kestrel	0.00	0.03 (0.00 - 0.08)	0.0	0.0	0.0	0.0
American coot	0.00	0.02 (0.00 - 0.04)	0.0	0.0	0.0	0.0

[1]These values assume a rotor diameter of 82.5 (m) and a hub height of 80 (m)

Table 6. Incidental observations of birds during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species
American bittern
American kestrel
barn swallow
bufflehead
Canada goose
canvasback
common goldeneye
common snipe
great horned owl
horned grebe
horned lark
hooded merganser
lesser scaup
lesser yellowlegs
marbled godwit
mallard
northern harrier
northern shoveler
northern shrike
orange-crowned warbler
ring-billed gull
ring-necked duck
red-tailed hawk
ruddy duck
red-winged blackbird
sandhill crane
short-eared owl
song sparrow
sharp-tailed grouse
Swainson's hawk
unidentified buteo
unidentified duck
unidentified sparrow
western grebe
western meadowlark
wild turkey
yellow-headed blackbird

Table 7. Comparison of raptor and other bird use per 20-min survey with other studies of wind projects using similar survey methodology. Project sites are sorted by highest to lowest mean use by raptors.

Project Site	State	Mean Use by Raptors					Mean Use by Other Birds					Duration of Surveys (minutes)	Correction Factor [a]
		Spr	Sum	Fall	Win	Ann	Spr	Sum	Fall	Win	Ann		
Alabama Ledge [1]	New York	2.40		2.04								60	0.33
Cape Vincent [2]	New York	2.19		1.84								60	0.33
Cotterel Mountain [3]	Idaho	1.69	1.89	1.49	0.18		9.53	5.76	7.38	14.08		20	1.00
Hoctor Ridge [4]	Washington	1.42	1.33				10.00	17.92				20	1.00
Lower Linden Ranch [5]	Washington	1.37					11.63					20	1.00
Kittitas Valley [6]	Washington	1.01	1.03	0.73			14.13	8.13	11.47			20	1.00
Klickitat County PEIS [7]	Washington	0.96	1.12				15.34	14.30				20	1.00
Columbia Hills [8]	Washington	0.94	1.34	0.78	0.26	0.75						20	1.00
Golden Hills [9]	Oregon	0.90	0.56	0.38	0.44		8.53	6.40	9.12	22.30		20	1.00
Combined Study of: Kittitas [10]	Washington	0.89	0.85	0.76	0.51	0.75	11.72	8.18	7.99	15.64	10.88	20	1.00
Buffalo Ridge Phase II [8]	Minnesota	0.84	0.69	0.83	0.10	0.52						20	1.00
N.P. of Baldwin [11]	North Dakota	0.82					61.65					20	1.00
Elkhorn [12]	Oregon	0.81										20	1.00
Windy Point [7]	Washington	0.79			0.77		17.17			14.52		20	1.00
Combine Hills [13]	Oregon	0.79	0.55	0.43	0.64		5.93	2.62	1.33	2.67		30	0.67
Windy Flats [14]	Washington	0.77	0.88	0.82	0.86		21.51	13.66	16.03	24.56		20	1.00
Hatchet Ridge [15]	California	0.70	1.02	0.91	0.12	0.69	5.21	6.91	6.29	4.01	5.63	30	0.67
Buffalo Ridge Reference [8]	Minnesota	0.68	0.52	0.69	0.44	0.56						20	1.00
Buffalo Ridge Phase I [8]	Minnesota	0.66	0.43	0.76	0.13	0.42						20	1.00
Buffalo Ridge Phase III [8]	Minnesota	0.64	0.54	0.85	0.18	0.48						20	1.00
Dairy Hills [16]	New York	0.63		0.58			0.63		8.38			60	0.33
Foote Creek WEC [17]	Wyoming	0.49	0.75	0.96	0.21							40	0.50

Table 7. Comparison of raptor and other bird use per 20-min survey with other studies of wind projects using similar survey methodology. Project sites are sorted by highest to lowest mean use by raptors.

Project Site	State	Mean Use by Raptors					Mean Use by Other Birds					Duration of Surveys (minutes)	Correction Factor [a]
		Spr	Sum	Fall	Win	Ann	Spr	Sum	Fall	Win	Ann		
Klondike Phase I [8]	Oregon	0.47	0.39	0.39	0.57	0.47						20	1.00
White Creek [18]	Washington	0.46	0.87	0.56	0.38		9.91	9.10	15.24	11.01		20	1.00
Wild Horse [19]	Washington	0.45	0.45	0.30	0.14		5.75	5.75	4.00	3.23		30	0.67
Bighorn Site [20]	Washington	0.40	0.44				9.72	10.04				20	1.00
Leaning Juniper [21]	Oregon	0.39	1.07	0.53	0.24		11.36	5.68	19.09	47.00		20	1.00
Nine Canyon [8]	Washington	0.35	0.20	0.16	0.31	0.26						20	1.00
Sand Ridge [22]	Washington	0.34	0.46				6.19	5.21				20	1.00
Biglow Canyon [23]	Oregon	0.31	0.39	0.19	0.32		10.12	3.33	7.15	11.59		30	0.67
Stateline Wind [24]	Oregon/Washin	0.29	0.26	0.17	0.21	0.23						10	2.00
Vantage [25]	Washington	0.29	0.40	0.14	0.15		10.57	8.83	3.70	4.90		20	1.00
Maiden [26]	Washington	0.29	0.35	0.62	0.15	0.37	4.55	4.69	11.87	8.53	7.53	30	0.67
Zintel Canyon [8]	Washington	0.19	0.30	0.70	0.51	0.44						20	1.00
Dry Lake [27]	Arizona	0.08	0.14	0.21	0.14	0.15	8.06	10.97	16.02	17.91	13.45	30	0.67
High Winds [28]	California					4.15					125.60	30	0.67

[a] Multiplication factor to standardize mean use to birds/20

[1]Young et al. 2007. Avian and bat studies for the proposed Alabama Ledge Wind Project, Genesee County, NY [2]Young et al. 2007. Avian and bat studies for the proposed Cape Vincent Wind Project, Jefferson County, NY. [3]BLM (Bureau of Land Management, Twin Falls District, Burley Field Office). 2006. Final environmental impact statement for the proposed Cotterel Wind Power Project and proposed resource management plan amendment. Burley, Cassia County, ID [4]Johnson et al. 2006. Baseline Ecological Studies for the Hoctor Ridge Wind Energy Project Klickitat County, WA. [5]Johnson et al. 2007. Baseline Ecological Studies for the Lower Linden Ranch Wind Energy Project Klickitat County WA. [6]Erickson et al. 2003. Wildlife Baseline Study for the Kittitas Valley Wind Project [7]Johnson et al. 2006. Analysis of Potential Wildlife Impacts from the Windy Point Wind Energy Project, Klickitat County, WA. [8]Erickson et al. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. [9]Jeffrey et al. 2008. Wildlife baseline studies for the Golden Hills Wind Resource Area, Sherman County, OR. [10]Young et al. 2003. Baseline Avian Studies For the Proposed Desert Claim Wind Power Project, Kittitas County, Washington, March 2002 – March 2003 [11]This Study [12]West. 2005. Ecological Baseline Study at Elkhorn Wind Power Project. [13]Young et al. 2002. Avian and Sensitive Species Baseline Study Plan and Interim Report TPC Combine Hills Turbine Ranch, Umatilla County, OR. [14]Johnson et al. 2007. Baseline Avian Studies for the Windy Flats Wind Energy Project, Klickitat County WA. [15]Young et al. 2007. Ecological Baseline Studies for the Hatchet Ridge Wind Energy Project Shasta County, CA. [16]Young et al. 2006. Avian and Bat Studies for the Proposed Dairy Hills Wind Project, Wyoming County, NY. [17]Johnson et al. 2000. Wildlife monitoring studies, SeaWest Windpower Project,

Carbon County, WY. [18]Kronner et al. 2005. Ecological Baseline Studies and Wildlife Impact Assessment for the White Creek Wind Power Project. [19]Erickson et al. 2003. Wildlife Baseline Study for the Wild Horse Wind Project, Summary of Results from 2002-2003 Wildlife Surveys. [20]Johnson and Erickson. 2004. Analysis of Potential Wildlife/Wind Plant interactions Bighorn Site Klickitat County WA. [21]Kronner et al. 2005. Wildlife Baseline Study for the Leaning Juniper Wind Power Project Gilliam County, OR. [22]Johnson et al. 2007. Baseline Ecological Studies for the Sand Ridge Wind Energy Project Klickitat County WA. [23]WEST. 2005b. Wildlife and habitat baseline study for the proposed Biglow Canyon wind power project, Sherman County, OR. [24]Erickson et al. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001 – December 2003. [25]Jeffrey et al. 2007. Wildlife and Habitat Baseline Study for the Proposed Vantage Wind Power Project, Kittitas County Washington. [26]Young et al. 2002. Baseline avian studies for the proposed Maiden Wind Farm, Yakima and Benton Counties, WA. [27]Young et al. 2007. Ecological Baseline Studies Report Proposed Dry Lake Wind Project Navajo County, AZ. [28]Kerlinger et al. 2005. Post construction avian monitoring study for the High Winds Wind Power Project, Solano County, CA.

APPENDICES

Appendix 1. Flight directions of birds observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
sandhill crane	1312	17	44.4	0.0	22.9	22.9	0.0	0.0	3.0	6.9	0.0
horned lark	559	16	5.4	0.0	19.7	0.0	42.0	0.0	32.9	0.0	0.0
red-winged blackbird	238	10	10.9	0.0	10.9	0.0	73.1	0.0	5.0	0.0	0.0
Canada goose	147	9	2.0	0.0	4.8	0.0	35.4	0.0	57.8	0.0	0.0
chestnut-collared longspur	86	6	0.0	0.0	41.9	0.0	58.1	0.0	0.0	0.0	0.0
American crow	34	4	38.2	0.0	2.9	0.0	58.8	0.0	0.0	0.0	0.0
mallard	23	6	30.4	0.0	60.9	0.0	0.0	0.0	8.7	0.0	0.0
red-tailed hawk	15	12	20.0	0.0	13.3	0.0	26.7	0.0	20.0	20.0	0.0
unidentified sparrow	8	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
rock pigeon	7	4	0.0	0.0	0.0	0.0	85.7	0.0	14.3	0.0	0.0
killdeer	7	5	14.3	0.0	57.1	0.0	14.3	0.0	14.3	0.0	0.0
northern shoveler	6	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
northern harrier	5	5	40.0	0.0	40.0	0.0	0.0	0.0	20.0	0.0	0.0
mourning dove	5	2	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Franklin's gull	5	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
American white pelican	4	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
snow goose	3	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
American robin	3	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
western meadowlark	2	2	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
unidentified duck	2	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
unidentified buteo	2	2	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
northern pintail	2	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
gadwall	2	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Swainson's hawk	1	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
eastern bluebird	1		0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix 1. Flight directions of birds observed during Spring 2010 point count surveys at the Northern Portion of the Baldwin Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
common snipe	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total	**2480**	**112**	**27.1**	**0.0**	**20.4**	**12.1**	**22.2**	**0.0**	**14.4**	**3.8**	**0.0**

[1] Includes only flying birds with flight directions

Appendix 2: Raptor nests observed at the Northern Portion of the Baldwin Wind Energy Center, 2010.

Nest Number	Dates Surveyed	Species	Status	Substrate	Nest Height (m)	Nest Condition
GHOW-2010-05	4/16/2010 4/24/2010 5/1/2010 5/8/2010	NA great horned owl great horned owl great horned owl	Active Active Active Active	Cottonwood	25	Good
GHOW-2010-14	5/1/2010 5/8/2010	great horned owl great horned owl	Active Active	Tree	25	Excellent
RTHA-2010-02	4/16/2010 4/24/2010 5/1/2010 5/8/2010	NA NA NA NA	Inactive Inactive Active Inactive	Tree	15	Excellent
RTHA-2010-04	4/16/2010 4/24/2010 5/1/2010 5/8/2010	NA NA NA NA	Inactive Inactive Active Inactive	Tree	20	Good
RTHA-2010-12	5/1/2010	NA	Active	deciduous	20	Excellent
SWHA-2010-11	5/8/2010	Swainson's hawk	Active	Tree	5	Good
UNRA-2010-01	4/16/2010 4/24/2010 5/8/2010	NA NA NA	Inactive Inactive Inactive	Tree	15	Good
UNRA-2010-03	4/16/2010 4/24/2010 5/2/2010 5/8/2010	unidentified raptor unidentified raptor unidentified raptor unidentified raptor	Inactive Active Inactive Inactive	Tree	25	Good
UNRA-2010-06	4/16/2010 4/24/2010	NA NA	Inactive Inactive	Tree	15	Fair
UNRA-2010-07	04/24/2010 5/1/2010	NA NA	Inactive Inactive	Tree	20	Good
UNRA-2010-08	4/24/2010	NA	Inactive	Tree	20	Good
UNRA-2010-09	4/24/2010	NA	Inactive	Tree	25	Good
UNRA-2010-10	4/24/2010	NA	Inactive	Tree	20	Fair
UNRA-2010-13	5/1/2010	NA	Inactive	Tree	40	Good
UNRA-2010-15	5/1/2010	NA	Inactive	Tree	15	Fair

NA means not applicable

Appendix 3 Grouse surveys at the Northern Portion of the Baldwin Wind Energy Center, 2010.

Lek Number	Survey #	Survey date	Survey time	Species	Status	# Total	# Males	# Females	# Unknown*
01									
	5/8	5/8/2010	2015	sharp-tailed grouse	Active	13	13	0	-
	4/10	4/10/2010		sharp-tailed grouse	Active	2	-	2	-
	4/18	4/18/2010	0630	sharp-tailed grouse	Active	13	13	0	-
	4/24	4/24/2010	0721	sharp-tailed grouse	Active	13	12	1	-

* indicates the presence of an unknown number of birds