2011 Fall Avian Survey

Wilton IV Wind Energy Center
Burleigh County, North Dakota

Prepared for

NEXTera ENERGY RESOURCES

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TETRA TECH EC, INC.

EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (Tetra Tech) was contracted by Wilton Wind IV, LLC (Wilton IV), a subsidiary of NextEra Energy Resources, LLC (NextEra), to undertake fall avian use surveys for the proposed Wilton IV Wind Energy Center (Project) in Burleigh County, North Dakota. The studies were conducted to identify potential avian impacts associated with building and operating the Project. 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. Weekly surveys were performed for the Project from August 9 to November 11, 2011, which included the fall through early winter seasons. Fixed point count surveys (800-meter [m] radius) were conducted at 7 points distributed throughout the Project Area, which encompasses 15,752 acres of privately owned predominantly agricultural land.

A total 4,083 birds were observed within the Project Area, comprised of 3,087 birds from 42 species and 996 birds that could not be identified to species. Overall mean bird use within the Project Area was 41.66 birds/20 minutes (min) with individual 20-min surveys ranging 0 to 600 birds/20 min.

Three non-raptor species and one unidentified species were the most frequently observed within the Project Area. The non-raptors with the highest mean use were unidentified blackbird (may include red-winged blackbird, common grackle, and brown-headed cowbird; 10.15 birds/20 min), red-winged blackbird (8.47 birds/20 min), horned lark (8.23 birds/20 min) and snow goose (5.51 birds/20 min). The red-winged blackbird, horned lark, and snow goose are all widespread species. These species had high encounter rates (6.40, 0.62, and 1.17 birds flying at RSA height/20 min, respectively) within the anticipated RSA but also have large regional breeding populations in North Dakota (red-winged blackbird and horned lark) and northern Canada (snow geese). If fatalities do occur they are unlikely to have population-level consequences.

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 0.35 birds/20 min. Red-tailed hawks and northern harriers were the most common raptors observed at the Project but in low numbers (0.17 and 0.10 birds/20 min). Red-tailed hawk had a low encounter rate (0.06 birds flying at RSA height/20 min) and northern harrier had no encounter rate within the intended RSA. As a result any potential for turbine-related impacts to these species is anticipated to be low. Additional raptor species observed during point counts included: Swainson's hawk, American kestrel, unidentified buteo, sharp-shinned hawk, and broad-winged hawk.

LISTED AND SENSITIVE SPECIES

No federally listed avian species were observed during fall avian surveys or as an incidental observation within the Project Area.

At the state level, North Dakota does not have a list defined by statute for threatened or endangered species comparable to the federal Endangered Species Act (ESA). North Dakota has instead identified 100 Species of Conservation Priority under the State Wildlife Action Plan. State-designated Species of Conservation Priority observed at the Project include grasshopper sparrow (level I), Swainson's hawk (level I), ferruginous hawk (level I), northern harrier (level

II), and sharp-tailed grouse (level II). 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 in North Dakota. Species of Conservation Priority receive special attention from state 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 except sharp-tailed grouse. The sharp-tailed grouse is managed as a game-bird in North Dakota. All species listed above had no encounter rates within the intended RSA, primarily because of their low occurrence within the Project.

Table ES-1. Fall avian use summary

Variable	Result	Details
Non-raptors		
Mean use	41.32 birds/20 min	
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	2	red-winged blackbird and snow goose (Section 3.2)
Federally listed[1] species observed within the Project	No	
State-listed species[2] within the Project	Yes	grasshopper sparrow and sharp-tailed grouse (Section 4.3)
State-listed species within RSA	No	
Raptors		
Mean use	0.35 birds/20 min	
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	None	
Eagles observed within the Project	No	
Federally listed species observed within the Project	No	
State-listed species within the Project	Yes	Swainson's hawk, ferruginous hawk and northern harrier (Section 4.3)
State-listed species within the RSA	No	
Habitat		
Native habitat likely to be affected by development	Yes	Native prairie
Lakes (waterfowl attractant)	Yes	Small cattle ponds
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Scattered throughout
Cliffs (raptor nesting and traveling)	No	
River (permanent water source, migration corridor)	Yes	West branch of Apple Creek
Known refuges or habitat features that may funnel migrants	None	

[1]Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.
[2]The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (Hagen et al. 2005) but there are no permitting requirements for listed species. State species listed are those in addition to federally listed species.

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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). Data based on radar data and mortality monitoring suggest that less than 0.01 percent of migrant songbirds that pass over wind farms are killed (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 territorial flight displays in which male horned lark fly to heights of 80 meters (m) 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 a 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 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). Research at two sites in North and South Dakota (Shaffer and Johnson 2008) suggests that certain grassland songbird species (two of four 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.

Finally, most native, migratory 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 company to protect itself from liability at wind facilities; however, the USFWS does not usually take action if good faith efforts have been made to minimize impacts. To date, no wind development company has been charged for violations of the MBTA.

1.2 STUDY DESCRIPTION

Wilton Wind IV, LLC (Wilton IV), a subsidiary of NextEra Energy Resources, LLC, is planning to develop the Wilton IV Wind Energy Center (Project) in Burleigh County, North Dakota (Figure 1). Wilton IV is committed to environmental due diligence and has contracted Tetra Tech EC, Inc. (Tetra Tech) to conduct fall avian surveys at the Project Area 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 encompasses 15,752 acres and is located in the Northwestern Glaciated Plains Ecoregion, with western portions of the Project Area located in the Northwestern Great Plains Ecoregion (Bryce et al. 1996). Historically, much of the landscape was a mix of western mixed-grass prairie, short-grass prairie, with associated wetlands of the Missouri Slope and River Breaks subregions (Bryce et al. 1996). This semiarid region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badlands formations. Today, native grasslands still persist in mostly areas of steep or broken topography and have been largely been replaced by agriculture. Land use is predominantly dry-land farming of barley, sunflowers, corn, spring and winter wheat interspersed with cattle grazing.

North Dakota has over 365 documented bird species (Faanes and Stewart 1982) and is situated within the Central Flyway, one of the main bird migratory routes (USFWS 2011a). The Central Flyway runs through the central portion of the U.S. and, as a consequence, the Project. 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 2011a).

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. This protocol is designed to be responsive to the level of effort recommended in the National Wind Coordinating Committee's *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions* (Strickland et al. 2011) and the *U.S. Fish and Wildlife Service Draft Land-Based Wind Energy Guidelines* (USFWS 2011b). 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 federally and state-listed species, and species of concern.

2.1 AVIAN SURVEYS

2.1.1 Fixed-point Surveys

Experienced field biologists conducted 20-minute (min) point count surveys at 7 locations within the Project Area to evaluate avian use, behavior, and species composition during fall migration (Figure 2). The biologists conducted weekly surveys from August 9 to November 11 (Table 1), thereby encompassing the fall migration to early winter seasons. 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 biologists 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. Biologists recorded the following data: species, number of individuals, time of observation, height aboveground, behavior, and flight direction. Flight direction data was only recorded for those birds that were exhibiting clear migratory behavior, and not for those birds that were making localized flights within the Project Area. Data on flight direction can be found in Appendix 1. The biologists estimated flight heights and distances 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 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.

2.1.2 Incidental Observations

Incidental observations included observations that occurred 1) during travel between points, 2) before or after the official 20-min survey period, and 3) outside of the 800-m radius circular plot. Biologists 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.

2.1.3 Listed Species Information

A list of species currently protected under the Endangered Species Act (ESA) can be found at http://www.fws.gov/endangered/. Under the ESA, it is unlawful for a person to take a listed animal without a permit. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Through regulations, the term "harm" is defined as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."

The North Dakota Game and Fish Department (NDGFD) have 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 or require special take permits. Additional information on North Dakota Species of Conservation Priority can be found at: http://www.gf.nd.gov/conservation/levels-list.html.

2.1.4 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,

each biologist reviewed, and clarified if needed, all data sheets before data entry into a FileMaker Pro™ 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 biologists.

2.2 ANALYSIS

2.2.1 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 analysis. Non-raptors were defined as all other species groups.

2.2.2 Avian Use of the Wilton IV Project

Tetra Tech derived avian use (mean use) of the Project 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, 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 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.

2.2.3 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). Wilton IV proposes to use the GE 1.6 MW xle wind turbine for the Project; therefore, a turbine size with an 80-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.

2.2.4 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:

$$\textit{Encounter Rate} = A * P_f * P_t$$

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.

2.2.5 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, raptor fatality rates generally are low at most wind energy developments with exceptions demonstrated at certain facilities in California with a predominance of older generation turbines (NWCC 2010). The highly regional nature of avian mean use across North America and the scarce data on avian mortality at wind farms in many parts of the continent contribute to uncertainty in predicting fatality rates (Arnett et al. 2007). To date, the most comprehensive source of regional information on avian fatality rates is the Avian and Bat Fact Sheet, which shows that estimated fatalities range from 14 birds/MW/year in Tennessee to 0 birds/MW/year in Oklahoma (NWCC 2010). As a result of uncertainty in predicting fatality rates, 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.

Biologists surveyed 3,476 acres of the Project during point count surveys, covering 22 percent of the total Project Area. The 7 point count locations were surveyed 14 times, resulting in 98 total 20-min surveys. A total 4,083 birds were observed within the Project Area, comprised of 3,087 birds from 42 species and 996 birds that could not be identified to species during the 98 fixed-point count surveys (Table 2). Overall mean bird use within the Project was 41.66 birds/20 min and ranged from 0 to 600 birds/20 min survey.

Overall mean use by non-raptors was 41.32 birds/20 min and, among species groups, mean use was highest for songbirds (33.80 birds/20 min; Table 2). Songbirds were observed in the majority of surveys and were widely distributed throughout the Project Area. The songbirds with the highest mean use were unidentified blackbird (10.15 birds/20 min, observed in 10.2 percent of all surveys) red-winged blackbird (8.47 birds/20 min; 14.3 percent of all surveys) and horned lark (8.23 birds/20 min; 40.8 percent of all surveys – Table 2). These two species and the unidentified blackbird comprised 79.5 percent of the songbird species group and 64.5 percent of all birds observed (Table 2). Additional songbird species with a high frequency included American goldfinch (18.4 percent), barn swallow (16.3 percent), common grackle (14.3 percent),

and western meadowlark (11.2 percent). Every other songbird species was detected in less than 10 percent of all surveys.

Among waterfowl, the second highest mean use for species groups (5.91 birds/20 min), the species with a relatively high mean use value was the snow goose (5.51 birds/20 min, was observed in 3.1 percent of all surveys in 3 flocks; Table 2). Snow geese accounted for 93.3 percent of the waterfowl species group.

The remaining species groups, pigeons/doves, raptors, gamebirds, waterbirds, cranes/rails, and woodpeckers had the next highest mean use values in order (0.87, 0.35, 0.33, 0.27, 0.12, and 0.03 birds/20 min respectively; Table 2).

Non-raptor mean use was highest on October 28 (184.29 birds/20 min) and October 20 (103.71 birds/20 min; Figure 3). The species that contributed to high mean use on October 28 were the snow goose (540 individuals in 3 flocks - largest flock was 250 individuals) and unidentified blackbirds (250 individuals all in one flock). The species that contributed to high mean use on October 20 was the red-winged blackbird (665 individuals in 5 flocks – largest flock was 500 individuals). Mean use for non-raptors was highest at point 4 (80.14 birds/20 min) and observations at this point included red-winged blackbirds (633 individuals) and unidentified blackbirds (298 individuals; Table 3; Figure 4). Mean use for non-raptors was also high for point 2 and point 7 (71.71 and 70.21 birds/20min respectively; Figure 4). Observations at point 2 included unidentified blackbird (265 individuals), horned lark (232 individuals), common grackle (118 individuals), and red-winged blackbird (111 individuals, Table 3). Observations at point 7 included unidentified blackbirds (350) horned larks (287) and snow geese (250, Table 3). The snow geese were observed in flight passing over the Project Area without landing in the immediate area. Habitat at point 4 contained several small wetlands and a large field of unharvested sunflowers that may attract a greater number of blackbirds within the Project Area. Habitat at points 2 and 7 was mostly agriculture fields of wheat and corn and are not considered unique to the Project that would concentrate non-raptors to those specific areas.

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 0.35 birds/20 min (Table 2) and raptors were the third most frequently observed species groups during the fall surveys. The raptors with the highest use were the red-tailed hawk (0.17 birds/20 min; observed on 14.3 percent of surveys; 0.4 percent of all birds observed) and the northern harrier (0.10 birds/20 min; observed during 10.2 percent of surveys and comprising 0.2 percent of all observations; Table 2). Mean use for each other raptor species was 0.02 birds/20 min or fewer: Swainson's hawk, American kestrel, unidentified buteo, sharp-shinned hawk, and broad-winged hawk.

Mean use by raptors was highest on September 30 (1.14 birds/20 min) and included 4 red-tailed hawks, 2 northern harriers, 1 broad-winged hawk, and 1 sharp-shinned hawk (Figure 5, Table 3). Mean use by raptors was also high for October 15 (1.00 birds/20 min) and included 4 red-tailed hawks, 1 northern harrier, and 1 Swainson's hawk (Figure 5 and Table 3). Mean use by raptors was lower than 0.44 birds/20 min for all other survey dates. Mean use by raptors was highest at point count locations 4 and 2 (0.57 and 0.43 birds/20 min, respectively; Figure 6). A total of 4 red-tailed hawks, 2 northern harriers, 1 Swainson's hawk, 1 sharp-shinned hawk, were observed

at point 4 (Table 3). Species observed at point 2 included 2 northern harriers, 2 American kestrels, and 1 Swainson's hawk (Table 3). The habitat at point 2 and point 4 is not considered unique to the Project or present geographic features that would concentrate raptors to those specific areas.

3.2 FLIGHT HEIGHT AND ENCOUNTER RATE

During fall avian use surveys, biologists collected behavioral data for 99.9 percent of all birds observed during point count surveys of which 95.7 percent were observed flying. The biologists collected flight height data for 99.9 percent and flight direction for 47.6 percent of observations. Of the individual non-raptors observed flying, 66.1 percent flew below the height of the anticipated RSA, 22.6 percent flew at the height of the anticipated RSA, and 11.3 percent flew above the height of the anticipated RSA (Table 4). Of the individual raptors observed flying, 51.6 percent flew below the height of the anticipated RSA, 29.0 percent flew at the height of the anticipated RSA, and 19.4 percent flew above the height of the anticipated RSA (Table 4). Data on flight direction are located in Appendix 1. The majority of the observations were flying in a southerly or northerly direction.

The red-winged blackbird, snow goose, unidentified blackbird, and horned lark had the highest encounter rates (6.40, 1.17, 0.97, and 0.62 birds flying at RSA height/20 min, respectively; Table 5). All other species had encounter rates of 0.06 birds flying at RSA height/20 min or less.

3.3 LISTED SPECIES

No federally listed avian species were observed during fall avian surveys or as an incidental observation within the Project Area.

State-designated Species of Conservation Priority observed within the Project Area include grasshopper sparrow (level I), Swainson's hawk (level I), ferruginous hawk (priority I), northern harrier (level II), and sharp-tailed grouse (level II). Grasshopper sparrows (total of 11 individuals) were observed during point count surveys at all points except point 7. Swainson's hawks were observed at point 2 and point 4 (one individual at each) and as incidental observations. Northern harriers were observed at all points (total of 10 individuals) and as incidental observations. Two individual sharp-tailed grouse were observed at point 3. One ferruginous hawk was observed as an incidental observation.

3.6 INCIDENTAL OBSERVATIONS

Biologists documented 13 species as incidental observations (Table 6). Biologists documented three incidental species—ferruginous hawk, great horned owl, and gray partridge—that were not detected during fall point count surveys. Biologists observed several raptor species both as incidentals and during the point count surveys including the American kestrel, Swainson's hawk, northern harrier, and broad-winged hawk.

4.0 DISCUSSION

4.1 NON-RAPTOR USE AND ENCOUNTER RATE

The bird community of the Project Area was comprised primarily of grassland birds and shrub-land birds that are commonly found in agricultural areas of the north central United States. The large flocks of snow geese observed in flight over the Project coincide with the annual fall migration in North Dakota for the species (USFWS 2011c). Red-winged blackbirds were the most commonly identified species within the Project Area. Most red-winged blackbirds were observed at point 4 which had a large field of planted sunflowers. Sunflowers are a favorite food source for the red-winged blackbird during the fall and winter seasons (Yasukawa and Searcy 1995). In North Dakota, red-winged blackbirds show a slight decreasing population trend (Sauer et al. 2011) but have a large population (11 million; Blancher et al. 2007). Red-winged blackbirds also had a high encounter rate and have been recorded as fatalities at other wind energy facilities but in low numbers (Kerlinger et al. 2006, Johnson and Erickson 2011). Given the low number of fatalities recorded at other windfarms, any fatalities should they occur at the Project are likely to be low and not expected to have impacts on the North Dakota population. Horned larks were the second most common species at the Project and were observed at all survey points. Horned larks show a slight decreasing population trend (Sauer et al. 2011) but have a large population in North Dakota (6.8 million: Blancher et al. 2007). Horned larks had a high encounter rate and have been observed as fatalities at other wind energy projects (Derby et al. 2007, Stantec 2010, Johnson and Erickson 2011). As a result, fatalities of horned larks may occur at the Project but not expected to have impacts on the North Dakota population.

Snow geese were the third most common birds observed at the Project. During the fall, snow geese are commonly observed migrating through North Dakota on their way to wintering grounds in the southern part of the United States (USFWS 2011c). Results of the fall survey at the Project show that snow geese were observed in three large flocks (of up to several hundred birds each) flying in a southerly direction. None of the snow geese were observed on the ground or landing in the immediate area of the Project. However, the snow geese did have a high encounter rate. The Mid-continental light geese (which include the snow geese) breeding population trend in Canada (which migrate through North Dakota) were estimated at over 3 million with a 19 percent increase from 2010 (USFWS 2011c). Overall, the Mid-continental light geese population has shown a population increase dating back to 1970 (USFWS 2011c). Despite the abundance of snow geese, only one fatality has been documented at one wind energy facility (Anderson et al. 2005). Given the low amount of fatalities recorded at other wind energy facilities, it is anticipated that any fatalities of snow geese at the Project would be low. Additionally, North Dakota has a hunting season for snow geese in the fall from September 24 to December 30 (NDGF 2010).

4.2 RAPTOR USE AND ENCOUNTER RATE

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 <1.0 birds/20 min, which is the case for raptor use at the Project.

Red-tailed hawks and northern harriers were the most commonly observed raptor species during avian surveys. However, red-tailed hawks had a low encounter rate (0.06 birds flying at RSA height/20 min) and northern harriers had no encounter rate. As a result, any potential for turbine-related impacts to these species is anticipated to be low.

Swainson's hawks, American kestrels, sharp-shinned hawks, and broad winged hawks were also observed at the Project but with low use values of 0.02 birds/20 min or less (Table 2), thereby minimizing the potential for negative turbine-related impacts to these species. Mean use by raptors was highest at point count locations 2 and 4. However, the habitats at these points are not unique on the landscape regarding raptor species and these data should not be used to guide turbine siting discussions.

4.3 LISTED AND SENSITIVE SPECIES

No federally listed avian species were observed during fall avian surveys or as an incidental observation within the Project Area.

State-designated Species of Conservation Priority, observed at the Project include grasshopper sparrow (priority I), Swainson's hawk (priority I), northern harrier (priority II), and sharp-tailed grouse (priority II). 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 in North Dakota (Hagen et al. 2005). Species of Conservation Priority receive special attention from state 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 except sharp-tailed grouse. The sharp-tailed grouse is managed as a game-bird in North Dakota (NDGF 2010). All species listed above had no encounter rates within the anticipated RSA, primarily because of their low occurrence within the Project Area.

4.4 CONCLUSION

Fall non-raptor use at the Project was relatively high, primarily due to high use by red-winged blackbirds (and unidentified blackbirds which may include red-winged blackbird, common grackle, and brown-headed cowbird), horned larks, and snow geese. These species have high encounter rates but also have large regional breeding populations in North Dakota (red-winged blackbirds and horned larks) and northern Canada (snow geese). If fatalities do occur they are unlikely to have population-level consequences. 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 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).

The level of raptor use at the WRA suggests that raptor mortality is anticipated to be low, especially based on the results by Erickson (2007). Red-tailed hawks and northern harriers were the most common raptors observed at the Project but in low numbers. Red-tailed hawk had a low encounter rate and northern harrier had no encounter rate within the anticipated RSA. Any potential for turbine-related impacts to these species is anticipated to be low.

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Irina Gumennik	Nov. 25, 2011
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Robert Friedel	Nov. 17, 2011
GIS	Date

Figure 1

Vicinity map

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND

- Project area (9-28-2011)
- Urban area
- State boundary
- County boundary
- Interstate highway
- Federal highway
- State highway
- Lake/pond
- River/stream

N

1:500,000

NAD 1983 UTM 14

0 2.5 5 7.5 10

Miles

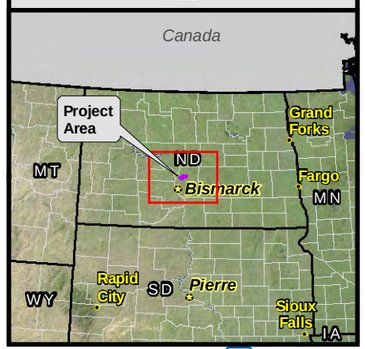

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Figure 2

Point count location map (Fall 2011)

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND

- Avian survey point
- Avian survey point 800-m radius
- PC# Point count number
- Project area (9-28-2011)
- Proposed turbine (9-21-2011)
- Local road

N

1:55,000
NAD 1983 UTM 14
Last modified: 11-28-2011

0 0.5 1
Miles

TETRA TECH EC,INC

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Figure 3. Non-raptor mean use by survey date in Fall 2011 at the Wilton IV Wind Energy Center.

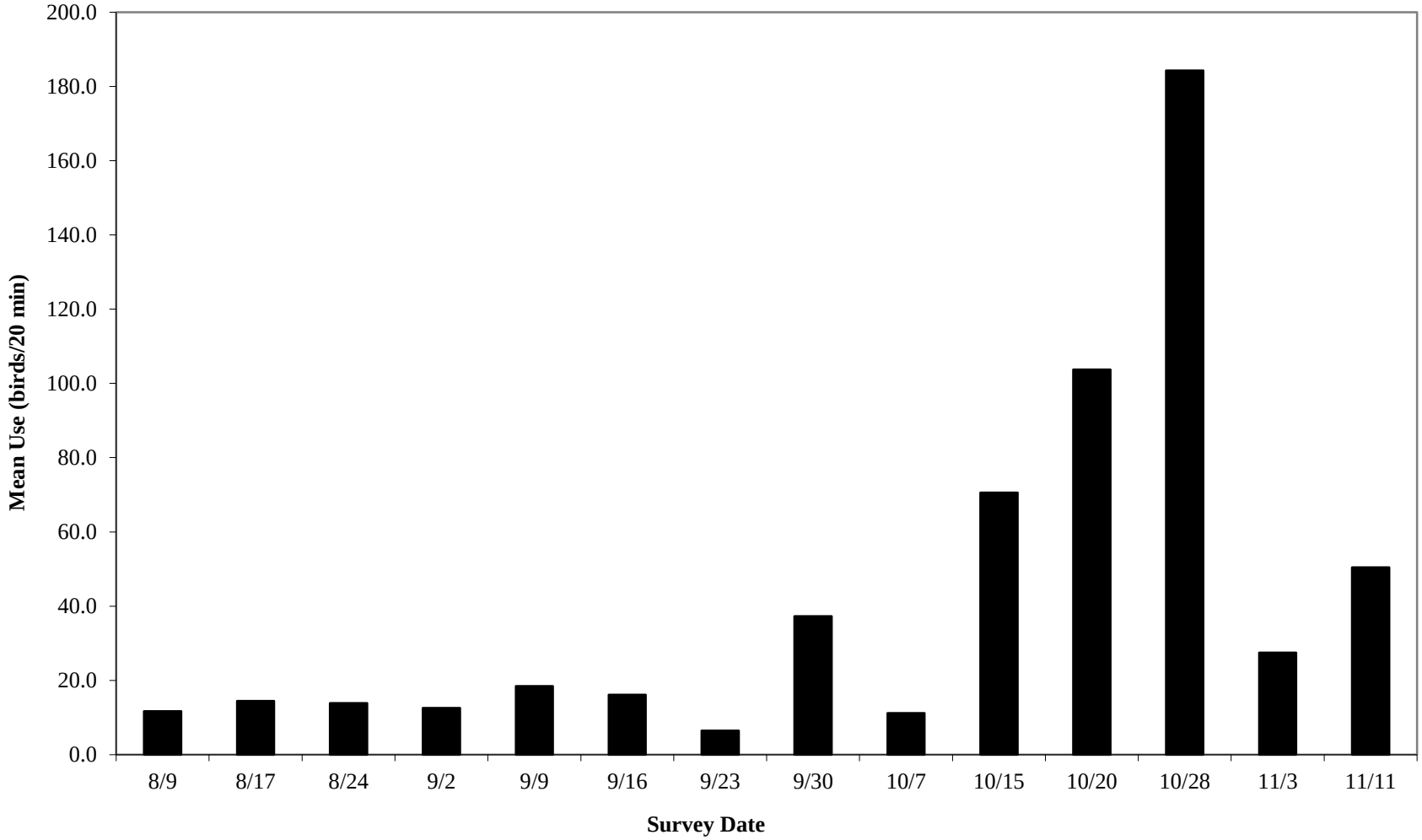

Figure 4

Non-raptor mean use by point count location (Fall 2011)

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND

Non-raptors per 20 minutes

- 0.01 - 25.00
- 25.01 - 50.00
- 50.01 - 75.00
- 75.01 - 100.00
- # Mean use value
- PC# Point count number
- Project area (9-28-2011)
- Proposed turbine (9-21-2011)
- Local road

N

1:55,000
NAD 1983 UTM 14
Last modified: 11-28-2011

0 0.5 1
Miles

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Figure 5. Raptor mean use by survey date in Fall 2011 at the Wilton IV Wind Energy Center.

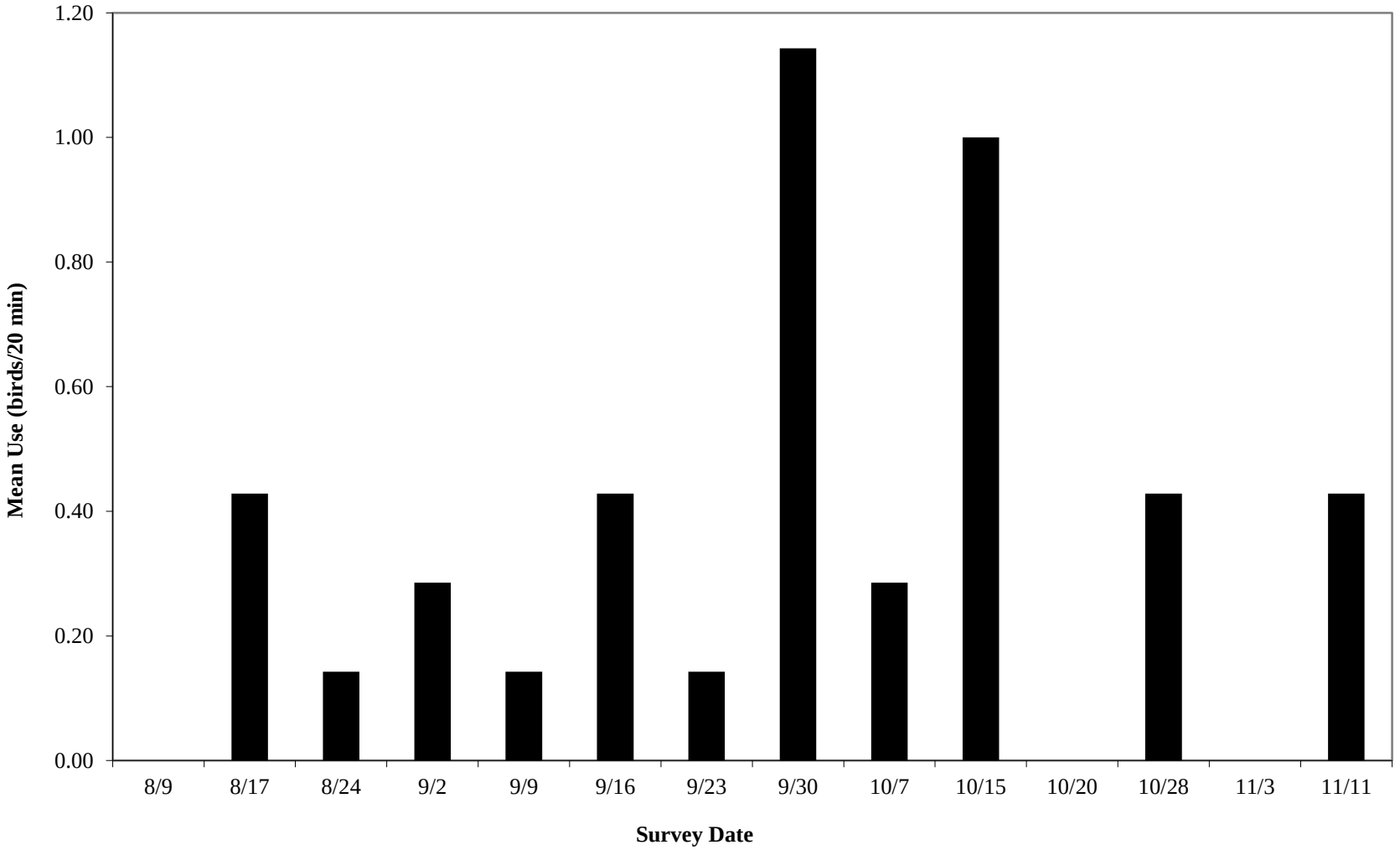

Figure 6

Raptor mean use by point count location (Fall 2011)

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND

Raptors per 20 minutes

- 0.01 - 0.21
- 0.22 - 0.42
- 0.43 - 0.62
- # Mean use value
- PC# Point count number
- Project area (9-28-2011)
- Proposed turbine (9-21-2011)
- Local road

N

1:55,000
NAD 1983 UTM 14
Last modified: 11-28-2011

0 0.5 1
Miles

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Table 1. Fall 2011 point count survey dates at the Wilton IV Wind Energy Center.

Survey number	Date(s)
1	8/9
2	8/17
3	8/24
4	9/2
5	9/9
6	9/16
7	9/23
8	9/30
9	10/7
10	10/15
11	10/20
12	10/28
13	11/3
14	11/11

Table 2. Avian species, by species grouping, observed during Fall 2011 point count surveys at the Wilton IV 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							
unidentified blackbird	1	995	12	10.15 (2.24-18.06)	10.2	30.0%	24.4%
red-winged blackbird	2	830	18	8.47 (0.00-18.55)	14.3	25.1%	20.3%
horned lark	3	807	62	8.23 (4.73-11.73)	40.8	24.4%	19.8%
common grackle	5	269	21	2.74 (0.60-4.88)	14.3	8.1%	6.6%
barn swallow	6	135	30	1.38 (0.56-2.20)	16.3	4.1%	3.3%
American goldfinch	7	90	39	0.92 (0.13-1.71)	18.4	2.7%	2.2%
American crow	9	42	10	0.43 (0.12-0.74)	9.2	1.3%	1.0%
cedar waxwing	10	35	1	0.36 (0.00-0.95)	1.0	1.1%	0.9%
western meadowlark	13	23	12	0.23 (0.06-0.40)	11.2	0.7%	0.6%
European starling	17	16	3	0.16 (0.00-0.35)	2.0	0.5%	0.4%
American robin	18	15	5	0.15 (0.00-0.33)	4.1	0.5%	0.4%
house sparrow	19	13	4	0.13 (0.00-0.27)	3.1	0.4%	0.3%
grasshopper sparrow	21	11	11	0.11 (0.05-0.17)	9.2	0.3%	0.3%
vesper sparrow	24	9	5	0.09 (0.01-0.17)	5.1	0.3%	0.2%
western kingbird	25	6	6	0.06 (0.02-0.10)	6.1	0.2%	0.1%
tree swallow	26	4	2	0.04 (0.00-0.11)	1.0	0.1%	0.1%
eastern kingbird	26	4	3	0.04 (0.00-0.08)	3.1	0.1%	0.1%
American tree sparrow	29	2	1	0.02 (0.00-0.05)	1.0	0.1%	0.0%
yellow warbler	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
northern shrike	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
eastern bluebird	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
chipping sparrow	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
brown thrasher	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
blue jay	34	1	1	0.01 (0.00-0.03)	1.0	0.0%	0.0%
Group Total		**3312**	**251**	**33.80** (19.27-48.33)	**84.7**		**81.1%**
Waterfowl							
snow goose	4	540	3	5.51 (0.09-10.93)	3.1	93.3%	13.2%
Canada goose	12	28	3	0.29 (0.00-0.70)	3.1	4.8%	0.7%
mallard	21	11	2	0.11 (0.00-0.24)	2.0	1.9%	0.3%
Group Total		**579**	**8**	**5.91** (0.48-11.34)	**8.2**		**14.2%**

Table 2. Avian species, by species grouping, observed during Fall 2011 point count surveys at the Wilton IV 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
Pigeons/Doves							
mourning dove	8	67	33	0.68 (0.33-1.03)	25.5	78.8%	1.6%
rock pigeon	15	18	5	0.18 (0.04-0.32)	5.1	21.2%	0.4%
Group Total		**85**	**38**	**0.87** (0.51-1.23)	**29.6**		**2.1%**
Raptors							
red-tailed hawk	16	17	16	0.17 (0.09-0.25)	14.3	50.0%	0.4%
northern harrier	23	10	10	0.10 (0.05-0.15)	10.2	29.4%	0.2%
Swainson's hawk	29	2	2	0.02 (0.00-0.04)	2.0	5.9%	0.0%
American kestrel	29	2	2	0.02 (0.00-0.04)	2.0	5.9%	0.0%
unidentified buteo	34	1	1	0.01 (0.00-0.03)	1.0	2.9%	0.0%
sharp-shinned hawk	34	1	1	0.01 (0.00-0.03)	1.0	2.9%	0.0%
broad-winged hawk	34	1	1	0.01 (0.00-0.03)	1.0	2.9%	0.0%
Group Total		**34**	**33**	**0.35** (0.25-0.45)	**27.6**		**0.8%**
Gamebirds							
ring-necked pheasant	11	30	27	0.31 (0.18-0.44)	22.4	93.8%	0.7%
sharp-tailed grouse	29	2	1	0.02 (0.00-0.05)	1.0	6.3%	0.0%
Group Total		**32**	**28**	**0.33** (0.20-0.46)	**23.5**		**0.8%**
Waterbirds							
American coot	14	21	2	0.21 (0.00-0.55)	2.0	80.8%	0.5%
killdeer	26	4	2	0.04 (0.00-0.09)	2.0	15.4%	0.1%
great blue heron	34	1	1	0.01 (0.00-0.03)	1.0	3.8%	0.0%
Group Total		**26**	**5**	**0.27** (0.00-0.61)	**5.1**		**0.6%**
Cranes/Rails							
sandhill crane	20	12	1	0.12 (0.00-0.32)	1.0	100.0%	0.3%
Group Total		**12**	**1**	**0.12** (0.00-0.32)	**1.0**		**0.3%**
Woodpeckers							
northern flicker	29	2	2	0.02 (0.00-0.04)	2.0	66.7%	0.0%
hairy woodpecker	34	1	1	0.01 (0.00-0.03)	1.0	33.3%	0.0%
Group Total		**3**	**3**	**0.03** (0.00-0.06)	**3.1**		**0.1%**
Grand Total		**4083**	**367**	**41.66** (26.10-57.22)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Fall 2011 point count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points						
			1	2	3	4	5	6	7
unidentified blackbird	995	12	18	265	40	298	24	0	350
red-winged blackbird	830	18	6	111	38	633	34	0	8
horned lark	807	62	11	232	82	73	78	44	287
snow goose	540	3	115	0	0	0	0	175	250
common grackle	269	21	18	118	36	40	4	45	8
barn swallow	135	30	1	103	1	21	0	4	5
American goldfinch	90	39	8	60	6	11	2	1	2
mourning dove	67	33	10	12	3	11	3	5	23
American crow	42	10	12	6	7	16	0	1	0
cedar waxwing	35	1	0	35	0	0	0	0	0
ring-necked pheasant	30	27	2	4	4	3	3	9	5
Canada goose	28	3	0	0	0	1	27	0	0
western meadowlark	23	12	1	9	3	0	1	1	8
American coot	21	2	0	0	0	1	0	0	20
rock pigeon	18	5	0	0	0	0	3	15	0
red-tailed hawk	17	16	3	0	4	4	2	2	2
European starling	16	3	0	7	0	0	9	0	0
American robin	15	5	0	15	0	0	0	0	0
house sparrow	13	4	0	13	0	0	0	0	0
sandhill crane	12	1	0	0	0	0	0	0	12
mallard	11	2	0	0	0	11	0	0	0
grasshopper sparrow	11	11	1	1	2	2	2	3	0
northern harrier	10	10	1	2	1	2	1	1	2
vesper sparrow	9	5	0	0	0	0	3	1	5
western kingbird	6	6	1	1	1	0	1	2	0
tree swallow	4	2	0	0	4	0	0	0	0
killdeer	4	2	0	2	2	0	0	0	0
eastern kingbird	4	3	0	3	0	0	0	1	0
Swainson's hawk	2	2	0	1	0	1	0	0	0
sharp-tailed grouse	2	1	0	0	2	0	0	0	0
northern flicker	2	2	0	1	1	0	0	0	0
American tree sparrow	2	1	0	2	0	0	0	0	0
American kestrel	2	2	0	2	0	0	0	0	0
yellow warbler	1	1	1	0	0	0	0	0	0
unidentified buteo	1	1	1	0	0	0	0	0	0
sharp-shinned hawk	1	1	0	0	0	1	0	0	0
northern shrike	1	1	0	1	0	0	0	0	0
hairy woodpecker	1	1	0	0	0	0	1	0	0
great blue heron	1	1	0	0	0	1	0	0	0
eastern bluebird	1	1	0	1	0	0	0	0	0

Table 3. Avian species observed by point during Fall 2011 point count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points						
			1	2	3	4	5	6	7
chipping sparrow	1	1	0	1	0	0	0	0	0
broad-winged hawk	1	1	0	1	0	0	0	0	0
brown thrasher	1	1	0	1	0	0	0	0	0
blue jay	1	1	0	0	0	0	1	0	0
Grand Total	**4083**	**367**	**210**	**1010**	**237**	**1130**	**199**	**310**	**987**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Fall 2011 point count surveys at the Wilton IV Wind Energy Center.

		Birds	
		Number	**Percentage**
Non-raptors			
	Above RSA height (>121.3m)	437	11.3%
	At RSA height (38.8m–121.3m)	876	22.6%
	Below RSA height (<38.8m)	2557	66.1%
Raptors			
	Above RSA height (>121.3m)	6	19.4%
	At RSA height (38.8m–121.3m)	9	29.0%
	Below RSA height (<38.8m)	16	51.6%

[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 Fall 2011 point count surveys at the Wilton IV 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	6.14	8.47 (0.00 - 18.55)	100.0	0.0	72.5	27.5
snow goose	1.17	5.51 (0.09 - 10.93)	100.0	78.7	21.3	0.0
unidentified blackbird	0.97	10.15 (2.24 - 18.06)	95.4	0.0	10.0	90.0
horned lark	0.62	8.23 (4.73 - 11.73)	99.0	0.0	7.6	92.4
red-tailed hawk	0.06	0.17 (0.09 - 0.25)	88.2	40.0	40.0	20.0
killdeer	0.02	0.04 (0.00 - 0.09)	100.0	0.0	50.0	50.0
American crow	0.01	0.43 (0.12 - 0.74)	95.2	0.0	2.5	97.5
unidentified buteo	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
sharp-shinned hawk	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
broad-winged hawk	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
yellow warbler	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
western meadowlark	0.00	0.23 (0.06 - 0.40)	39.1	0.0	0.0	100.0
western kingbird	0.00	0.06 (0.02 - 0.10)	66.7	0.0	0.0	100.0
vesper sparrow	0.00	0.09 (0.01 - 0.17)	33.3	0.0	0.0	100.0
tree swallow	0.00	0.04 (0.00 - 0.11)	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
sharp-tailed grouse	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
sandhill crane	0.00	0.12 (0.00 - 0.32)	100.0	100.0	0.0	0.0
rock pigeon	0.00	0.18 (0.04 - 0.32)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	0.31 (0.18 - 0.44)	3.3	0.0	0.0	100.0
northern shrike	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern harrier	0.00	0.10 (0.05 - 0.15)	100.0	0.0	0.0	100.0
northern flicker	0.00	0.02 (0.00 - 0.04)	50.0	0.0	0.0	100.0
mourning dove	0.00	0.68 (0.33 - 1.03)	59.7	0.0	0.0	100.0
mallard	0.00	0.11 (0.00 - 0.24)	100.0	0.0	0.0	100.0
house sparrow	0.00	0.13 (0.00 - 0.27)	76.9	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
grasshopper sparrow	0.00	0.11 (0.05 - 0.17)	0.0	0.0	0.0	0.0
great blue heron	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
European starling	0.00	0.16 (0.00 - 0.35)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.04 (0.00 - 0.08)	100.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2011 point count surveys at the Wilton IV 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
eastern bluebird	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
common grackle	0.00	2.74 (0.60 - 4.88)	99.6	0.0	0.0	100.0
chipping sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
cedar waxwing	0.00	0.36 (0.00 - 0.95)	100.0	0.0	0.0	100.0
Canada goose	0.00	0.29 (0.00 - 0.70)	100.0	0.0	0.0	100.0
brown thrasher	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
blue jay	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
barn swallow	0.00	1.38 (0.56 - 2.20)	100.0	0.0	0.0	100.0
American tree sparrow	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
American robin	0.00	0.15 (0.00 - 0.33)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 0.04)	50.0	0.0	0.0	100.0
American goldfinch	0.00	0.92 (0.13 - 1.71)	96.7	0.0	0.0	100.0
American coot	0.00	0.21 (0.00 - 0.55)	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 Fall 2011 point count surveys at the Wilton IV Wind Energy Center.

Species
American crow
American kestrel
American robin
broad-winged hawk
European starling
ferruginous hawk
great horned owl
gray partridge
mallard
northern harrier
red-tailed hawk
Swainson's hawk
western meadowlark

Appendix 1. Flight directions of birds observed during Fall 2011 point count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
red-winged blackbird	737	11	67.8	0.0	0.0	0.0	12.9	0.0	0.0	14.9	0.0
snow goose	540	3	0.0	0.0	0.0	67.6	32.4	0.0	0.0	0.0	0.0
unidentified blackbird	400	2	37.5	0.0	0.0	0.0	0.0	0.0	0.0	62.5	0.0
American crow	35	5	0.0	0.0	0.0	60.0	5.7	8.6	0.0	0.0	0.0
Canada goose	28	3	0.0	14.3	0.0	85.7	0.0	0.0	0.0	0.0	0.0
horned lark	21	9	19.0	0.0	0.0	0.0	0.0	0.0	19.0	14.3	28.6
red-tailed hawk	15	14	20.0	20.0	0.0	26.7	13.3	6.7	13.3	0.0	0.0
mourning dove	13	5	0.0	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0
sandhill crane	12	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
rock pigeon	11	3	0.0	0.0	0.0	72.7	0.0	0.0	0.0	0.0	0.0
barn swallow	10	4	0.0	30.0	0.0	0.0	10.0	0.0	0.0	30.0	0.0
American robin	10	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	9	9	22.2	0.0	11.1	11.1	44.4	0.0	11.1	0.0	0.0
American goldfinch	6	6	0.0	0.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0
common grackle	3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
western kingbird	2	2	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0
Swainson's hawk	2	2	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	0.0
American tree sparrow	2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
unidentified buteo	1	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
sharp-shinned hawk	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
eastern kingbird	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
broad-winged hawk	1	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Grand Total	**1860**	**86**	**36.0**	**0.5**	**0.1**	**23.4**	**15.2**	**0.3**	**0.4**	**19.7**	**0.4**

[1] Includes only flying birds with flight directions