2013 Fall Avian Survey

Wilton IV Wind Energy Center
Burleigh County, North Dakota

Prepared for

NextEra Energy

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TETRA TECH

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) was contracted by Wilton Wind IV, LLC (Wilton IV), a subsidiary of NextEra Energy Resources, LLC, 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 a wind energy 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. Weekly surveys were performed at the Project from September 10th through November 15th, 2013, which included the fall migration to early winter seasons. Point-count surveys (fixed 800-meter [m] radius) were conducted at 5 points distributed throughout the Project area.

A total of 4,381 birds from 29 species were observed within the Project area. Overall mean bird use within the Project area was 87.62 birds/20 minute (min) and ranged from 0 to 1,148 birds/20 minute survey.

Mean use was highest for songbirds (46.50 birds/20 min), waterfowl (33.78 birds/20 min), and cranes/rails (5.22birds/20 min). The species with the highest mean use were the snow goose (24.00birds/20 min), common grackle (18.56 birds/20 min), red-winged blackbird (17.12 birds/20 min), and greater white-fronted goose (7.60 birds/20 min). The snow goose had the highest encounter rate (8.00 birds flying at rotor swept area [RSA] height/20 min), followed by the greater white-fronted goose (6.30 birds flying at RSA height/20 min), sandhill crane (3.02 birds flying at RSA height/20 min), and unidentified blackbird (3.00 birds flying at RSA height/20 min).

Cranes/rails and waterfowl species were considered a Project fatality risk. Sandhill cranes had a high mean use and encounter rates. However, there have been no documented fatalities of sandhill cranes at wind facilities with publicly available data, and in addition a study in South Dakota, documented sandhill cranes altering flight direction in response to turbines within their intended flight path. The avoidance behavior observed and lack of documented turbine-related fatalities of the sandhill crane suggests a low risk of Project-related fatality for this species. While no studies have documented avoidance behavior by snow goose or greater white-fronted goose, there has been only one recorded snow goose fatality and no greater white-fronted goose fatalities at wind facilities with publicly available data. The lack of documented fatalities at wind facilities with publicly available data within the migratory pathway for each species suggests a low risk of turbine-related fatalities at the Project.

The two songbird species considered at risk, red-winged blackbird and common grackle, are local resident and migratory species that are commonly documented as fatalities at other wind energy projects. However, Project-related fatalities of red-winged blackbird and common

grackle, should they occur, are unlikely to have population-level impacts because collision fatalities appears to have little effect on North American songbird populations and North Dakota populations for each species are large (8.2, 3.1, and 4.3 million each respectively).

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor mortality at wind farms. Conversely, raptor mortality appears to be low when raptor use is low (less than 1.0 birds/20 min), which is the case for raptor use at the Project (0.52 birds/20 min). Red-tailed hawks and northern harriers had the highest mean use among raptors (0.26and 0.12 birds/20 min, respectively). Results from post-construction fatality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities. However, in a recent study of raptor response to wind farms, although red-tailed hawks were observed engaging in high-risk flight behaviors they also demonstrated collision avoidance behavior while in flight around operational wind facilities. Whereas risk of turbine-related fatalities at the Project exists for red-tailed hawks, turbine-related fatalities are expected to be low given the low level of use within the Project area. As a result, any fatalities observed at the Project are not expected to have population level impacts. Risk of collision for northern harriers is believed to be low because the majority of foraging flights observed at other wind facilities occur below typical RSA heights. Therefore, collision for northern harriers at the Project should be low because all recorded flight observations occurred below the RSA height.

The proximity of the Project area to the Canfield Lake National Wildlife Refuge (NWR) and the Burleigh County Wildlife Production Areas (WPAs) may increase the risk of turbine collision for waterfowl, if use equates to risk, as these areas attract migratory waterfowl. Turbines or any additional power lines sited in close proximity to the NWR or WPAs may also cause avoidance behavior that may be perceived as loss of habitat.

PROTECTED SPECIES

No federally listed threatened or endangered species were detected during avian point-count surveys. One adult bald eagle was detected during point-count surveys on November 1st. The bald eagle is protected under the Bald and Golden Eagle Protection Act.

All native birds are protected under the Migratory Bird Treaty Act, and take of even a single individual is prohibited. Currently, there are no permits available for incidental take of migratory birds.

Table ES-1. Fall Avian Use Summary

Variable	Result	Details
Non-raptors		
Mean use	87.10 birds/20 min	(Section 4.1)
Species detected at Wilton IV that are commonly (> 15 records) detected as wind farm fatalities	Yes	Three species (Section 4.1)
Federally listed[1] species observed within the Project area	No	
State-listed species[2] within the Project area	N/A	
Raptors		
Mean use	0.52 birds/20 min	(Section 4.2)
Species detected at Wilton IV that are commonly (> 15 records) detected as wind farm fatalities	Yes	Red-tailed hawk (Section 4.2)
Eagles observed within the Project area	Yes	Bald eagle (Section 4.3)
Federally listed species observed within the Project area	No	
State-listed species within the Project area	N/A	
Habitat		
Native habitat likely to be affected by development	Yes	Native prairie
Lakes (waterfowl and crane attractant)	Yes	Canfield Lake (2 mile northwest of Project area)
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Burleigh County Waterfowl Production Areas (adjacent to Project) and Kettle ponds and intermittent creeks
Cliffs (raptor nesting and traveling)	None	
Rivers (permanent water source, migration corridor)	None	
Known refuges or habitat features that may funnel migrants	Yes	Canfield Lake National Wildlife Refuge and Burleigh County Waterfowl Production Areas

[1]Federally listed species include species listed as endangered, threatened, or candidate under the Endangered Species Act (ESA).
[2]North Dakota does maintain a list of Species of Conservation Priority (Hagen et al. 2005), but these species are not afforded any formal protection to by the state and there are no permitting requirements for them.

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1.0 INTRODUCTION

1.1 WIND ENERGY AND BIRDS

Wind energy provides a clean, renewable energy source. 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 fatalities have been songbirds, of which 50 percent are often nocturnal migrants (Erickson et al. 2001, Johnson et al. 2002, Drewitt and Langston 2006, Strickland and Morrison 2008). Although nocturnal migrants comprise the majority of songbird fatalities, the proportion of migrating songbirds killed at any given wind project during migration is reported to be low (Strickland et al. 2011). 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 (> 15 records) as fatalities at wind farms and mortality may be partially attributed to the breeding flight displays within the rotor swept area (Pickwell 1931, Johnson and Erickson 2011).

Despite the observation that most wind farm fatalities are songbirds, raptor mortality historically has received the most attention due to high fatality rates at the Altamont Wind Project in California (Thelander et al. 2003). Raptor mortality at newer generation wind projects has been low relative to previous generation wind farms, although there is substantial regional variation (Johnson et al. 2002, Erickson et al. 2002, 2004, Kerns and Kerlinger 2004, Jain et al. 2007). Although raptor mortality is reduced at newer generation facilities, raptors remain the avian species group considered most susceptible to collisions with turbines (Strickland et al. 2011). Therefore local micro-siting and site evaluation efforts are still necessary to minimize potential project-related impacts to raptors.

In addition to mortality associated with wind farms, there is potential for bird species to avoid areas near turbines or experience habitat displacement after the wind farm is in operation (Drewitt and Langston 2006). To date, evidence of this potential impact to birds does not demonstrate a distinct trend; some studies have found decreased density or abundance of birds near turbines (e.g., grassland songbirds, Leddy et al. 1999, Erickson et al. 2004, Shaffer and Johnson 2009), while others have found no evidence of declines near turbines (Devereux et al. 2008, Shaffer and Johnson 2009, Pearce-Higgins et al. 2012). However, Pearce-Higgins et al.

(2012) detected disturbance-related effects during construction, indicating that disturbance effects may occur on a short-term basis.

Finally, most native, migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA it is unlawful to take (i.e., kill) any migratory bird, including nests and nest contents. Currently, there are no permits for incidental take of migratory birds (Beveridge 2005).

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), located entirely on private lands. Wilton IV is committed to environmental due diligence and has contracted Tetra Tech, Inc. (Tetra Tech) to conduct fall avian surveys at the Project to quantify local avian use in the area and to evaluate the potential impacts of the Project to birds detected during the survey. These study objectives meet the requirements recommended under Tier 3 of the voluntary *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (USFWS 2012).

The Project area covers approximately 24,375 acres and is mostly located in the Northwestern Glaciated Plains Ecoregion (Bryce et al. 1996). This semi-arid region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badlands formations. Historically, much of the landscape was a mix of western mixed-grass prairie and short-grass prairie with associated wetlands (Bryce et al. 1996). Today, most native grasslands have been largely replaced by agriculture in level areas. Remnant native grasslands may still persist in areas of steep or broken topography. Agriculture in the area consists predominantly of dry-land farming of alfalfa, sunflowers, corn, and soybeans and is interspersed with cattle grazing pastures of short-grass prairie. The area has numerous open water sources consisting mostly of kettle ponds in lowland areas.

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 in North America (USFWS 2011a). The Central Flyway runs through the central portion of the U.S. and, as a consequence, the Project area. During fall migration, most birds that move along the Central Flyway travel from breeding grounds as far away as Alaska and northern Canada through the central states, eventually reaching wintering grounds as far away as 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 voluntary *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (USFWS 2012). 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 any federal and state-listed species and eagles.

2.1 AVIAN SURVEYS

2.1.1 Point-count Surveys

An experienced field biologist conducted 20-minute (min) point-count surveys at 5 locations within the Project area to evaluate avian use, behavior, and species (Figure 2). Although data were initially collected at 7 point-count locations, after a reduction of the Project area, 2 point-count locations fell outside of the updated Project boundary and were removed from analysis. The biologist conducted 10 weekly surveys from September 10th through November 15th, 2013 (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 (Figure 2).

The field biologist collected data on all birds detected within an 800-m radius of the point-count location. Surveys at each point-count location lasted for 20 minutes, during which time the biologist continuously recorded any visual or auditory observations. The biologist recorded data including: species, number of individuals, time of observation, height above ground, and behavior. The biologist estimated flight heights and distances using existing reference points such as meteorological towers and local transmission lines, as well as landscape contours shown on topographic maps. Flight direction was recorded for individuals making directional flights, but was not recorded for individuals making localized movements.

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 entire bird community using the Project. It should be noted, however, that this survey protocol can only detect nocturnal migrants should they be local breeders within the Project area or if they utilize the Project as stopover habitat.

Tetra Tech chose 20-minute survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 minutes 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 could result 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 point-count locations, 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 Protected Species Information

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the take of any bald or golden eagle, alive or dead, including any part, nest, or egg. "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" a bald or golden eagle. "Disturb" means to agitate or bother an eagle to a degree that causes, or is likely to cause, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Applications for incidental take permits under BGEPA are being considered by USFWS for bald eagles throughout the contiguous U.S. and for golden eagles west of 100 degrees west longitude which includes this Project (USFWS 2013).

The Endangered Species Act (ESA), as administered by the USFWS, mandates protection of species federally listed as threatened or endangered and their associated habitats. The ESA makes it unlawful to "take" a listed species. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to engage in any such conduct" (USFWS 2011b). A list of endangered, threatened and candidate species for Burleigh County can be found at: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=38015. Permits for incidental take of ESA protected species are available from USFWS.

The State of North Dakota does not have a state-endangered or -threatened species list. Only those species listed by the ESA are considered threatened or endangered in North Dakota.

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 all data sheets, providing clarification as needed, 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 biologist.

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, kites, harriers, and owls. All other species groups are defined as non-raptors.

2.2.2 Avian Use

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-count location. To evaluate the diversity and composition of avian species using the Project area, Tetra Tech 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 mean use values are driven by a single event (e.g., a large flock of birds moving through the Project area on migration) or the result of more sustained use of the area by species. Because individual birds are not uniquely marked and easy to distinguish from one another, actual population size or abundance cannot be determined. One individual may be counted multiple times during a survey period or across survey periods. Although mean use of a given species does not equate to abundance, it does provide an index

that is likely proportional to abundance and activity within the Project for species with similar detectability.

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). NextEra plans to develop the Project using GE (General Electric) 1.715 MW (Megawatt) *Xle* turbines. These turbines have a hub height of 80 meters and rotor diameter of 103 meters. With these specifications, the anticipated RSA is estimated to be between 28.5 and 131.5 m above ground. Tetra Tech considered a bird to have flown within the height range 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 given species flew at the height of the anticipated RSA, Tetra Tech applied the following equation to every species observed in the Project area:

$$\boldsymbol{Encounter\ Rate = A \times Pf \times Pt}$$

A is the mean number of birds/20 min for a given species, *Pf* is the proportion of all activity observations for a given species that were flying; and *Pt* is the proportion flying observations that were within the height range 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 project-related impact 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 turbine-related 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, Drewitt and Langston 2008, Martin 2011). Encounter values are sensitive to large flocks of birds flying within the RSA height; that is, a species will have a high encounter rate even if only seen once in a large flying flock.

2.2.5 Mortality Risk

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, combined with other risk influences such as individual species behavior and weather, contribute to uncertainty in predicting fatality rates (Arnett et al. 2007, Strickland et al. 2011). A recent meta-analysis suggests that pre-construction studies provide poor indicators of post-construction mortality (Ferrer et al. 2012). WEST (2011) suggests that the most accurate predictor of mortality at a wind project is records of species-specific fatalities detected at nearby wind projects. As a result of uncertainty in predicting

fatality rates, Tetra Tech did not attempt to derive mortality estimates from mean use data, but instead highlights those species or groups with high use values that may experience Project-related mortality or whose regional population could be impacted by development. Additionally, in this report, Tetra Tech highlights species with high frequencies of observation, high encounter rates, and those with records of turbine-related fatality at other wind projects, as these variables may also indicate potential collision risk at the Project.

3.0 RESULTS

3.1 AVIAN USE AND FREQUENCY OF OCCURRENCE

Biologists surveyed 2,483 acres of the Project area during point-count surveys, covering 10 percent of the total Project area (24,375 acres). The 5 point-count locations were surveyed 10 times each, resulting in 50 total 20-min surveys. A total of 4,381 birds from 29 species and 226 birds that could not be identified to species were recorded within the Project area during the point-count surveys (Table 2). Overall mean bird use for the Wilton IV Wind Energy Center was 87.62 birds/20 min and ranged from 0 to 1,148 birds/20 min.

Overall mean use by non-raptors was 87.10 birds/20 min. Among species groups, mean use was highest for songbirds (46.50 birds/20 min); Table 2). Songbirds were observed in 82 percent of surveys, comprised 53.1 percent of all birds observed and were distributed throughout the Project area. The songbird species with the highest mean use were common grackle (18.56 birds/20 min, observed in 22.0 percent of all surveys) and red-winged blackbird (17.12 birds/20 min, observed in 14.0 percent of all surveys; Table 2). The songbird species with the highest frequency of observation was not among those species with highest mean use; horned lark was observed in 46.0percent of all surveys, but had a mean use (4.04 birds/20 min; Table 2). Overall, common grackle and red-winged blackbird accounted for 76.7 percent (39.9 and 36.8 percent respectively) of all songbirds and 40.7 percent of all birds observed in the Project area (Table 2).

Waterfowl was the species group with the second highest mean use (33.78 birds/20 minute; Table 2). Waterfowl were observed in 26.0 percent of all avian surveys, comprised 38.6 percent of all birds observed, and were mostly detected at point-count locations 2, 4, and 6 (Tables 2 and 3). Snow goose had the highest mean use of all bird species (24.0 birds/20 min), and was observed in 10.0 percent of all surveys (Table 2). Overall, snow goose accounted for 71.0 percent of all waterfowl and 27.4 of all birds observed in the Project area (Table 2).

Cranes/rails were the group with the third highest mean use (5.22 birds/20 minute; Table 2). Sandhill crane was the only species observed in this group during the surveys. Sandhill cranes were observed in 14.0 percent of all avian surveys and comprised 6.0 percent of all birds observed; Table 2). Sandhill cranes were primarily detected at point-count location 4 (Table 3).

Non-raptor mean use was highest on October 16 (328.60 birds/20 min; Figure 3). The primary contributors to the high mean use on October 16 were observations of common grackle (748 individuals in flocks of 6 to 500 individuals) and red-winged blackbird (702 individuals in flocks of 2 to 500 individuals). Red-winged blackbird and common grackle were mostly observed in large mixed flocks of 10 to 200 individuals. Mean use for non-raptors was highest at Point-count Location 4 (183.70birds/20 min; Figure 4). The largest contributors to the high mean use at this point were common grackle (575 individuals), red-winged blackbird (550 individuals), and snow goose (445 individuals; Table 3). The habitat at Point-count Location 4 consists of row crops (cereal grains) and pastureland which is not unique within the Project area.

Overall mean use for raptors was 0.52 birds/20 min (Table 2); which places the group sixth among the eight species groups observed during point-count surveys. The raptor species with the highest mean use were red-tailed hawk (0.26 birds/20 min; observed in 24.0percent of all surveys) and northern harrier (0.12 birds/20 min; observed in 12.0 percent of all surveys; Table 2). Other raptors detected included Swainson's hawk, merlin, Cooper's hawk, bald eagle, American kestrel, and unidentified hawk each with mean use values equal to or less than 0.04 birds/20 min and observed in fewer than 5.0 percent of all surveys (Table 2).

Mean use by raptors was highest on September 19th and November 1st (1.0 birds/20 min; Figure 5). The raptor species observed on September 19th were Swainson's hawk (2 individuals), red-tailed hawk (1 individual), Cooper's hawk (1 individual) and unidentified hawk (1 individual). The raptor species observed on November 1st were red-tailed hawk (2 individuals), northern harrier (2 individulas) and bald eagle (1 individual). Mean use for raptors was 0.80 birds/20 min or less for all other survey dates (Figure 5). Mean use for raptors was highest at point-count location 5 (0.80 birds/20 min; Figure 6). Species contributing to the mean use at this were red-tailed hawk (4 individuals), northern harrier (2 individuals), Swainson's hawk (1 individual), and bald eagle (1 individual; Table 3). Raptor mean use was equal to or less than 0.60 birds/20 min at all other points. The habitat at Point-count Location 5 includes tame short-grass prairie and agriculture fields (cereal grains and alfalfa), both of which provide foraging opportunities for raptors. These features are not unique to this point-count location or within the Project area.

3.2 FLIGHT HEIGHT AND ENCOUNTER RATE

During fall avian use surveys, the biologist collected behavioral data for 100 percent of all birds observed during point-count surveys of which 98.8 percent were observed flying. The biologist collected flight height data for 95.2 percent and flight direction for 71.8 percent of these observations. Of non-raptor individuals observed flying, 55.5 percent flew below the height of the anticipated RSA, 25.6 percent flew at the height of the anticipated RSA and 18.9 percent flew above the height of the anticipated RSA (Table 4). Of raptor individuals observed flying, 70.0 percent flew below the height of the anticipated RSA, 30.0 percent flew at the height of the

anticipated RSA, and none flew above the height of the anticipated RSA (Table 4). Data on flight direction are located in Appendix 1. Generally, birds observed in flight were moving in a southeasterly (56.7 percent) or southerly direction (34.5 percent; Appendix 1).

Snow goose had the highest encounter rate (8.00 birds flying at RSA height/20 min; Table 5), followed by greater white-fronted goose (6.30 birds flying at RSA height/20 min), sandhill crane (3.02 birds flying at RSA height/20 min), and unidentified blackbird (3.0 birds flying at RSA height/20 min; Table 5). The unidentified blackbirds were likely made up of red-winged blackbirds and common grackles, as well as other black songbird species. Each other species had an encounter rate equal to or below 0.28 birds flying at RSA height/20 min.

3.3 INCIDENTAL OBSERVATIONS

The biologist documented 10 species as incidental observations (Table 6). Of these species, 2 non-raptor species (Bonaparte's gull and blue jay) and 1 raptor species (broad-winged hawk) were not detected during fall point-count surveys: (Table 6). Three raptor species, the American kestrel, northern harrier, and red-tailed hawk were detected both incidentally and during the point-count surveys.

3.4 PROTECTED SPECIES

No federally designated threatened or endangered species were observed during avian point-count surveys or as incidental observations. One adult bald eagle was observed on November 1st perched in a solitary tree 450 m northeast of Point-count Location 5. The bald eagle is protected under the BGEPA (Section 2.1.3). No other observations of eagles were made during the fall 2013 point-count surveys.

4.0 DISCUSSION

The avian community detected within the Project area during fall surveys was characterized by species associated with typical mid-western agricultural lands and short-grass prairie vegetation. The majority of the Project area and vicinity has been developed for agricultural use, specifically crops such as wheat, sunflower, alfalfa, and corn, with additional developed lands devoted to tame pastureland with remnants of native prairie mostly for cattle grazing. Within disturbed habitats such as these, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines rather than disturbance or displacement. The close proximity of the Canfield Lake National Wildlife Refuge and Burleigh County WPAs may serve as an attractant to migratory bird species, especially waterfowl, crane/rails, and waterbird species groups, which pass through the area during the spring and fall migration. Publicly available mean avian fatality rates estimated from wind facilities in the Midwest (NE, WI, MN, and IA) range from 0.44 to 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year; Tetra Tech 2012). Any Project-related bird fatalities, should they occur, are expected to fall within this range.

4.1 NON-RAPTOR USE AND COLLISION RISK

Waterfowl and Cranes/Rails are two groups with species at risk of collision due to relatively high encounter rates and/or mean use rates. These species included the snow goose, greater white-fronted goose, and sandhill crane. However, these species are considered to have low risk for turbine-related fatalities either due to demonstrated avoidance behavior and/or few documented fatalities at other wind energy facilities. Sandhill cranes have been documented altering flight direction in response to turbines at a wind facility in South Dakota (Nagy et al. 2011) and multiple studies have documented sandhill cranes gradually climbing as they approach power lines marked with bird flight diverters (Morkill and Anderson 1991, Murphy et al. 2009). In addition there have been no documented turbine-related fatalities of sandhill cranes. While no studies have documented avoidance behavior by snow goose or greater white-fronted goose, there has been only one recorded snow goose fatality (Anderson et al. 2005) and no greater white-fronted goose fatalities at wind facilities with publicly available data (Tetra Tech 2012). The lack of documented fatalities of these species at wind facilities within the migratory pathway (Jain 2005) indicates a low risk of Project-related fatalities. Snow goose, greater white-fronted goose, and sandhill crane are migratory in this region of North Dakota and would be at the greatest fatality risk during the spring and fall.

Songbirds were another species group with species demonstrating a number of collision risk factors. Mean use was highest for common grackle, red-winged blackbird, horned lark, and unidentified blackbird. Common grackle and red-winged blackbird had high mean use rates but low encounter rates (0.16 and 0.00 birds flying at RSA height/20 min respectively) as most individuals were observed flying below the anticipated RSA. However, the group unidentified blackbird had a moderate mean use and high encounter rate, and was likely made up of red-winged blackbird and common grackles, as well as other black songbird species. Horned lark, had a high frequency of detection (observed in 46.0 percent of all surveys) but a moderate mean use rate (4.04 birds/20 min) and an encounter rate of 0.00 birds flying at RSA height/20 min. These three songbird species (red-winged blackbird, common grackle, and horned lark) are local resident and migratory species commonly associated with open pastureland, short-grass prairie, and row-crop agriculture habitats found throughout the Project area, and are widely distributed across North America. The red-winged blackbird, common grackle, and horned lark have all been documented as fatalities at other wind energy projects (Johnson et al. 2000, Derby et al. 2007, Jain et al. 2011), particularly horned larks which exhibit breeding flight displays that may bring them into the height of the RSA (Johnson and Erickson 2011). Thus, risk of turbine-related fatalities exists for each of these species at the Project. However, Project-related fatalities of red-winged blackbird, common grackle, and horned lark, should they occur, are unlikely to have population-level impacts because North Dakota populations for each species are large (8.2, 3.1, and 4.3 million each respectively; PIFSC 2013). Additionally, research suggests that avian

collisions with manmade structures may have no discernable effect on populations (Arnold and Zink 2011).

The remaining non-raptor species detected during fall surveys have low risk for turbine collisions at the Project due to a combination of relatively low mean use rates, infrequent flight within the height of the RSA, and/or few to no records of fatalities at other wind facilities with publically available results of mortality studies. Nonetheless, most avian species are protected by the MBTA.

4.2 RAPTOR USE AND COLLISION RISK

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality appears to be low when raptor use is low (less than 1.0 birds/20 min; Strickland et al. 2011), which is the case for raptor use at the Project.

Red-tailed hawk and northern harrier were the raptor species with the highest mean use and were also among the most frequently detected raptor species at the Project. Both species are commonly associated with agricultural and grassland habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine-collisions (Thelander et al. 2003). In a recent study of raptor response to wind farms, red-tailed hawks were observed engaging in high-risk flight behaviors at operational wind facilities whereas northern harriers were identified as having a low risk flight behavior for collisions (Garvin et al. 2011). Results from post-construction mortality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities (228 records of red-tailed hawk fatalities; e.g., Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). Any Project-related fatalities are unlikely to have population-level impacts because red-tailed hawks are common nationwide (Sauer et al. 2012). Risk of collision by northern harriers is believed to be low because the majority of foraging flights occur below typical RSA heights (Whitfield and Madders 2006). Thus, risk of turbine-related fatalities of northern harriers at the Project is expected to be low given the typical flight behavior exhibited by the species, an encounter rate of 0.00 birds flying at the RSA height/20 min, and the low level of use at the Project area. Project-related fatalities of northern harrier, should they occur, are unlikely to have population-level impacts because northern harriers are common nationwide (Sauer et al. 2012).

Other raptor species detected during fall surveys included Swainson's hawk, merlin, Cooper's hawk, bald eagle, and American kestrel, and unknown hawk. Of these, American kestrels are commonly found as fatalities at wind facilities (Erickson et al. 2002, Stantec 2010). However, only one American kestrel was observed during surveys, suggesting a low risk for turbine collisions at the Project.

4.3 PROTECTED SPECIES

No federally listed threatened or endangered species were detected during avian point-count surveys. A single bald eagle and no golden eagles were detected during surveys; both species are protected under the BGEPA and MBTA (Section 2.1.3). Historically, permits were not available under the BGEPA for incidental takes from otherwise lawful activities; however, USFWS-promulgated regulations in 2009 provided for permits for incidental take associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26).

Bald eagles are ubiquitous in areas of the North America with large water bodies, and the detection of two bald eagles incidentally during a season of point counts probably indicates a low risk of impacts to this increasingly common species.

4.4 WILTON IV WIND ENERGY CENTER CONCLUSIONS

Results of the fall 2013 avian surveys at the Project suggest an overall low impact of the Project on the local avian community. The mean-use rate at the Project by non-raptors is primarily driven by a few common residents and migratory species. Although there is potential for turbine-related fatalities of snow goose, greater white-fronted goose, sandhill crane, common grackle, red-winged blackbird, horned lark, red-tailed hawk, and northern harrier at the Project, fatalities are not expected to have population-level impacts. If avian fatality rates are similar to other wind facilities within the region, we would expect them to fall between 0.44 – 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year). Additionally, the potential for turbine-related fatalities exists for nocturnal migrant species not identifiable by the methods of this study.

The proximity of the Project area to the Canfield Lake NWR and the Burleigh County WPAs may increase the risk to waterfowl of turbine collisions if use equates to risk, as these areas attract migratory waterfowl. Turbines or any additional power lines sited in close proximity to the NWR or the WPAs may also cause displacement from suitable habitat.

No federally listed threatened or endangered species were detected incidentally during avian point-count surveys. A single bald eagle was detected during point-count surveys. Bald eagles are protected under the BGEPA and MBTA. All native migratory avian species are protected by the MBTA; as stated above, there are no currently no permits available for incidental take of migratory birds.

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FIGURES

Figure 1

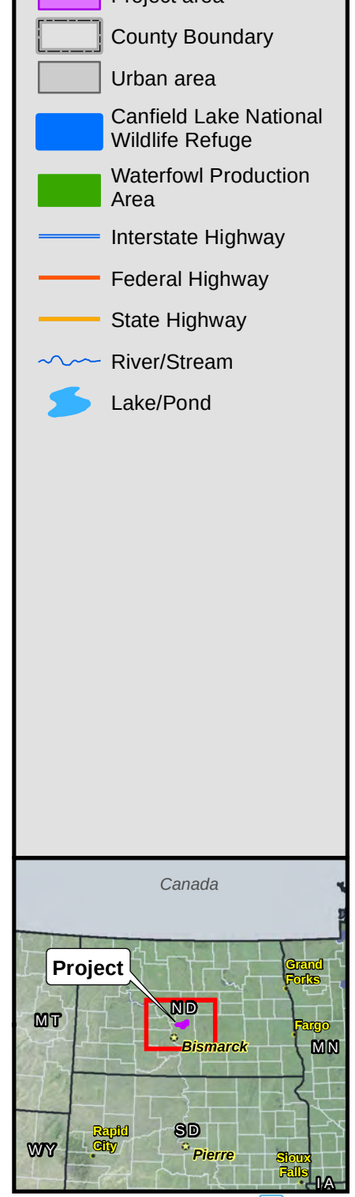
Vicinity Map

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

- Project area
- County Boundary
- Urban area
- Canfield Lake National Wildlife Refuge
- Waterfowl Production Area
- Interstate Highway
- Federal Highway
- State Highway
- River/Stream
- Lake/Pond



TETRA TECH

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Figure 2

Point-count location map (Fall 2013)

NextEra Energy Resources

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Canfield Lake National Wildlife Refuge

PC 02
PC 03
PC-04
PC 05
PC 06

Regan
Wing

- Avian Survey Point
- Avian Survey Point 800-m Radius
- PC# Point count number
- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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Figure 3. Non-raptor mean use by survey date during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

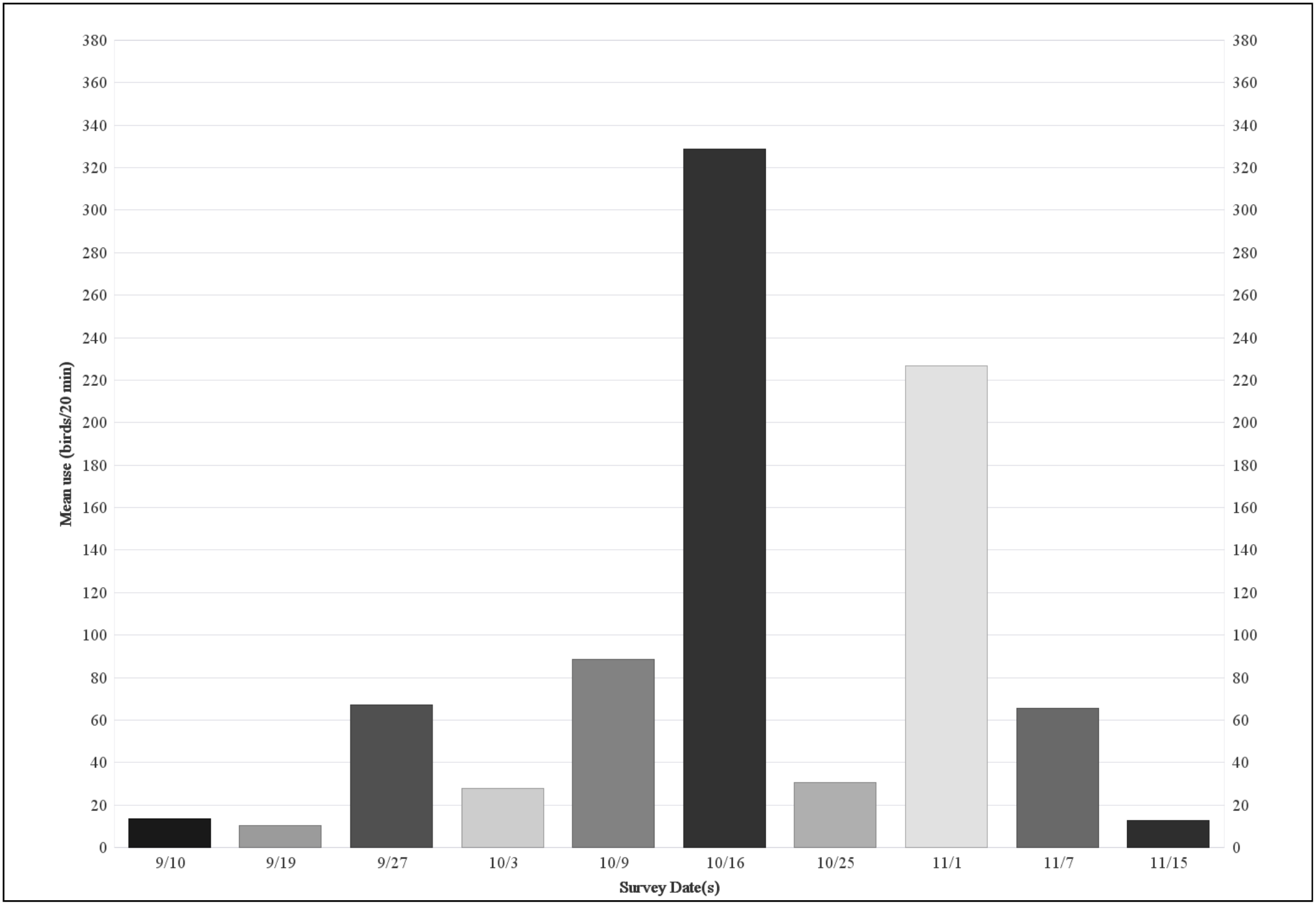

Figure 4

Non-raptor mean use by point-count location (Fall 2013)

NextEra ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Canfield Lake National Wildlife Refuge

81.30
PC 02

25.90
PC 03

183.70
PC 04

34.50
PC 05

110.10
PC 06

Non-raptors Per 20 Minutes

- 0.01 - 50.00
- 50.01 - 100.00
- 100.01 - 150.00
- 150.01 - 200.00

 # Mean use value
PC# Point count number

- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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Figure 5. Raptor mean use by survey date during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

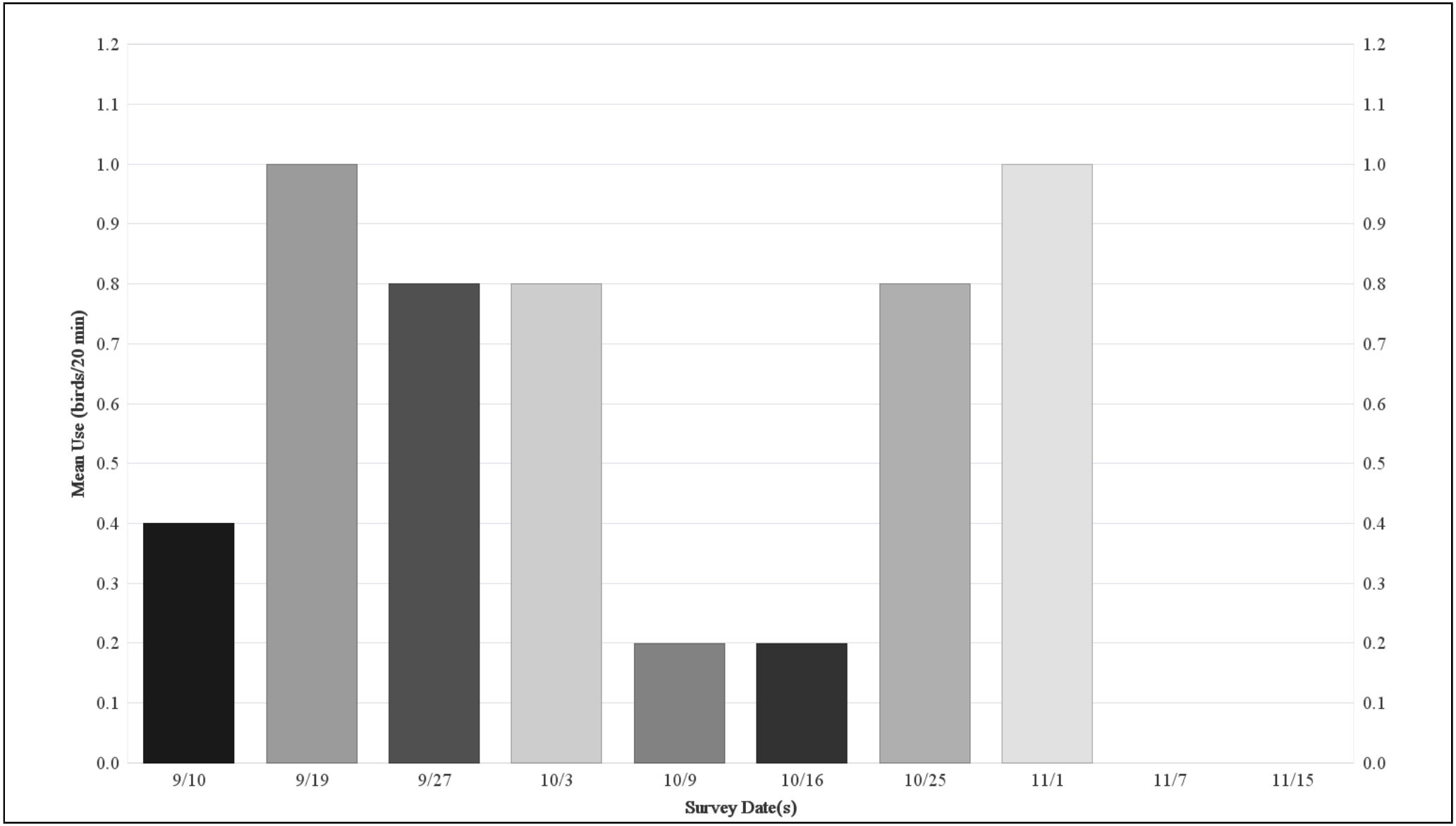

Figure 6

Raptor mean use by point-count location (Fall 2013)

NextEra ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Canfield Lake National Wildlife Refuge

0.60
PC 02

0.50
PC 03

0.50
PC 04

0.80
PC 05

0.20
PC 06

Raptors Per 20 Minutes

- 0.01 - 0.20
- 0.21 - 0.40
- 0.41 - 0.60
- 0.61 - 0.80

 # Mean use value
PC# Point count number

- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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TABLES

Table 1. Fall 2013 point-count survey dates at the Wilton IV Wind Energy Center.

Survey number	Date(s)
1	9/10
2	9/19
3	9/27
4	10/3
5	10/9
6	10/16
7	10/25
8	11/1
9	11/7
10	11/15

Table 2. Avian species, by species grouping, observed during Fall 2013 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							
common grackle	2	928	16	18.56 (0.00-37.92)	22.0	39.9%	21.2%
red-winged blackbird	3	856	8	17.12 (0.00-35.69)	14.0	36.8%	19.5%
horned lark	6	202	26	4.04 (2.04-6.04)	46.0	8.7%	4.6%
unidentified blackbird	7	195	2	3.90 (0.00-9.02)	4.0	8.4%	4.5%
American tree sparrow	9	30	1	0.60 (0.00-1.59)	2.0	1.3%	0.7%
barn swallow	12	25	5	0.50 (0.02-0.98)	8.0	1.1%	0.6%
American crow	13	24	5	0.48 (0.07-0.89)	10.0	1.0%	0.5%
western meadowlark	14	20	18	0.40 (0.18-0.62)	24.0	0.9%	0.5%
snow bunting	16	16	2	0.32 (0.00-0.81)	4.0	0.7%	0.4%
American goldfinch	19	11	7	0.22 (0.07-0.37)	14.0	0.5%	0.3%
European starling	20	10	2	0.20 (0.00-0.45)	4.0	0.4%	0.2%
brown-headed cowbird	21	7	1	0.14 (0.00-0.37)	2.0	0.3%	0.2%
northern shrike	26	1	1	0.02 (0.00-0.05)	2.0	0.0%	0.0%
Group Total		**2325**	**94**	**46.50** (8.56-84.44)	**82.0**		**53.1%**
Waterfowl							
snow goose	1	1200	8	24.00 (2.83-45.17)	10.0	71.0%	27.4%
greater white-fronted goose	4	380	4	7.60 (0.08-15.12)	8.0	22.5%	8.7%
Canada goose	8	89	4	1.78 (0.16-3.40)	8.0	5.3%	2.0%
tundra swan	14	20	2	0.40 (0.00-0.90)	4.0	1.2%	0.5%
Group Total		**1689**	**18**	**33.78** (11.59-55.97)	**26.0**		**38.6%**
Cranes/Rails							
sandhill crane	5	261	7	5.22 (0.95-9.49)	14.0	100.0%	6.0%
Group Total		**261**	**7**	**5.22** (0.95-9.49)	**14.0**		**6.0%**
Gamebirds							
sharp-tailed grouse	11	26	9	0.52 (0.16-0.88)	12.0	56.5%	0.6%
gray partridge	17	14	1	0.28 (0.00-0.74)	2.0	30.4%	0.3%

Table 2. Avian species, by species grouping, observed during Fall 2013 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
ring-necked pheasant	22	6	6	0.12 (0.03-0.21)	10.0	13.0%	0.1%
Group Total		**46**	**16**	**0.92** (0.32-1.52)	**18.0**		**1.0%**
Gulls/Terns							
unidentified gull	9	30	1	0.60 (0.00-1.59)	2.0	100.0%	0.7%
Group Total		**30**	**1**	**0.60** (0.00-1.59)	**2.0**		**0.7%**
Raptors							
red-tailed hawk	18	13	12	0.26 (0.15-0.37)	24.0	50.0%	0.3%
northern harrier	22	6	6	0.12 (0.04-0.20)	12.0	23.1%	0.1%
Swainson's hawk	25	2	2	0.04 (0.00-0.09)	4.0	7.7%	0.0%
unidentified hawk	26	1	1	0.02 (0.00-0.05)	2.0	3.8%	0.0%
merlin	26	1	1	0.02 (0.00-0.05)	2.0	3.8%	0.0%
Cooper's hawk	26	1	1	0.02 (0.00-0.05)	2.0	3.8%	0.0%
bald eagle	26	1	1	0.02 (0.00-0.05)	2.0	3.8%	0.0%
American kestrel	26	1	1	0.02 (0.00-0.05)	2.0	3.8%	0.0%
Group Total		**26**	**25**	**0.52** (0.37-0.67)	**44.0**		**0.6%**
Waterbirds							
double-crested cormorant	24	3	1	0.06 (0.00-0.16)	2.0	100.0%	0.1%
Group Total		**3**	**1**	**0.06** (0.00-0.16)	**2.0**		**0.1%**
Pigeons/Doves							
mourning dove	26	1	1	0.02 (0.00-0.05)	2.0	100.0%	0.0%
Group Total		**1**	**1**	**0.02** (0.00-0.05)	**2.0**		**0.0%**
Grand Total		**4381**	**163**	**87.62** (44.32-130.92)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points				
			2	3	4	5	6
snow goose	1200	8	495	60	445	0	200
common grackle	928	16	32	18	575	74	229
red-winged blackbird	856	8	42	14	550	50	200
greater white-fronted goose	380	4	65	40	0	0	275
sandhill crane	261	7	49	0	165	2	45
horned lark	202	26	82	53	35	8	24
unidentified blackbird	195	2	0	0	0	150	45
Canada goose	89	4	13	40	0	10	26
unidentified gull	30	1	30	0	0	0	0
American tree sparrow	30	1	0	0	0	0	30
sharp-tailed grouse	26	9	0	4	22	0	0
barn swallow	25	5	0	13	3	9	0
American crow	24	5	0	1	0	8	15
western meadowlark	20	18	3	2	1	7	7
tundra swan	20	2	0	6	14	0	0
snow bunting	16	2	0	0	15	0	1
gray partridge	14	1	0	0	0	14	0
red-tailed hawk	13	12	3	3	2	4	1
American goldfinch	11	7	2	1	4	3	1
European starling	10	2	0	0	0	7	3
brown-headed cowbird	7	1	0	7	0	0	0
ring-necked pheasant	6	6	0	0	4	2	0
northern harrier	6	6	2	1	1	2	0
double-crested cormorant	3	1	0	0	3	0	0
Swainson’s hawk	2	2	0	1	0	1	0
unidentified hawk	1	1	0	0	0	0	1
northern shrike	1	1	0	0	1	0	0
mourning dove	1	1	0	0	0	1	0
merlin	1	1	1	0	0	0	0
Cooper's hawk	1	1	0	0	1	0	0
bald eagle	1	1	0	0	0	1	0
American kestrel	1	1	0	0	1	0	0
Grand Total	**4381**	**163**	**819**	**264**	**1842**	**353**	**1103**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

		Birds	
		Number	**Percentage**
Non-raptors			
	Above RSA height (>131.5m)	775	18.9%
	At RSA height (28.5m–131.5m)	1052	25.6%
	Below RSA height (<28.5m)	2277	55.5%
Raptors			
	At RSA height (28.5m–131.5m)	6	30.0%
	Below RSA height (<28.5m)	14	70.0%

[1] Includes only flying birds with flight height data

[2]These values assume a rotor diameter of 103 meters and a hub height of 80 meters

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2013 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
snow goose	8.00	24.00 (2.83 - 45.17)	83.3	60.0	40.0	0.0
greater white-fronted goose	6.30	7.60 (0.08 - 15.12)	100.0	17.1	82.9	0.0
sandhill crane	3.02	5.22 (0.95 - 9.49)	100.0	42.1	57.9	0.0
unidentified blackbird	3.00	3.90 (0.00 - 9.02)	100.0	0.0	76.9	23.1
tundra swan	0.28	0.40 (0.00 - 0.90)	70.0	0.0	100.0	0.0
Canada goose	0.26	1.78 (0.16 - 3.40)	100.0	0.0	14.6	85.4
common grackle	0.16	18.56 (0.00 - 37.92)	100.0	0.0	0.9	99.1
red-tailed hawk	0.10	0.26 (0.15 - 0.37)	69.2	0.0	55.6	44.4
merlin	0.02	0.02 (0.00 - 0.05)	100.0	0.0	100.0	0.0
American goldfinch	0.02	0.22 (0.07 - 0.37)	100.0	0.0	9.1	90.9
American crow	0.00	0.48 (0.07 - 0.89)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
American tree sparrow	0.00	0.60 (0.00 - 1.59)	100.0	0.0	0.0	100.0
bald eagle	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
barn swallow	0.00	0.50 (0.02 - 0.98)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.14 (0.00 - 0.37)	100.0	0.0	0.0	100.0
Cooper's hawk	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
double-crested cormorant	0.00	0.06 (0.00 - 0.16)	100.0	0.0	0.0	100.0
European starling	0.00	0.20 (0.00 - 0.45)	0.0	0.0	0.0	0.0
gray partridge	0.00	0.28 (0.00 - 0.74)	100.0	0.0	0.0	100.0
horned lark	0.00	4.04 (2.04 - 6.04)	99.0	0.0	0.0	100.0
mourning dove	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
northern harrier	0.00	0.12 (0.04 - 0.20)	100.0	0.0	0.0	100.0
northern shrike	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
ring-necked pheasant	0.00	0.12 (0.03 - 0.21)	0.0	0.0	0.0	0.0
red-winged blackbird	0.00	17.12 (0.00 - 35.69)	100.0	0.0	0.0	100.0
snow bunting	0.00	0.32 (0.00 - 0.81)	93.8	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.52 (0.16 - 0.88)	50.0	0.0	0.0	100.0
Swainson’s hawk	0.00	0.04 (0.00 - 0.09)	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 2013 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
American tree sparrow	0.00	0.60 (0.00 - 1.59)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
American crow	0.00	0.48 (0.07 - 0.89)	100.0	0.0	0.0	100.0

[1]These values assume a rotor diameter of 103 (m) and a hub height of 80 (m)

Table 6. Incidental observations of birds during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

Species
American kestrel
blue jay
Bonaparte's gull
broad-winged hawk
Canada goose
European starling
Franklin's gull
northern harrier
red-tailed hawk
tundra swan

APPENDICES

Appendix 1. Flight directions of birds observed during Fall 2013 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
snow goose	1000	7	0.0	0.0	4.5	89.5	0.0	6.0	0.0	0.0	0.0
common grackle	553	3	0.0	8.1	0.0	0.0	90.4	0.0	0.0	1.4	0.0
red-winged blackbird	550	2	0.0	9.1	0.0	0.0	90.9	0.0	0.0	0.0	0.0
greater white-fronted goose	380	4	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
sandhill crane	261	7	0.0	0.0	1.5	80.5	16.1	1.9	0.0	0.0	0.0
unidentified blackbird	195	2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Canada goose	89	4	0.0	0.0	0.0	70.8	29.2	0.0	0.0	0.0	0.0
unidentified gull	30	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American crow	15	3	0.0	13.3	86.7	0.0	0.0	0.0	0.0	0.0	0.0
tundra swan	14	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
red-tailed hawk	8	7	0.0	0.0	12.5	50.0	0.0	0.0	0.0	37.5	0.0
sharp-tailed grouse	4	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	3	3	0.0	0.0	33.3	33.3	33.3	0.0	0.0	0.0	0.0
double-crested cormorant	3	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Swainson's hawk	2	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
merlin	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
American kestrel	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Grand Total	**3109**	**50**	**1.0**	**3.1**	**2.2**	**56.7**	**34.5**	**2.1**	**0.1**	**0.4**	**0.0**

[1] Includes only flying birds with flight directions