

Brian R. Bjella
100 West Broadway, Suite 250
P.O. Box 2798
Bismarck, ND 58502-2798
701.223.6585
bbjella@crowleyfleck.com

February 8, 2016

Mr. Darrell Nitschke
Executive Director
North Dakota Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480



Dear Mr. Nitschke:

In re: Brady Wind, LLC
Application for Certificate of Site Compatibility
PSC Case No. PU-15-690
Our File No. 35-218-026

Enclosed please find for filing 11 copies of the following documents for the Brady Wind Energy Center in Stark County, North Dakota:

1. 2015 Fall Avian Survey
2. Whopping Crane Likelihood of Occurrence Report
3. Bat Habitat Assessment.

Please call should you have any questions.

Very truly yours,

Brian R. Bjella

bw
Enc.

2015 Fall Avian Survey

Brady Wind Energy Center
Stark County, North Dakota



Prepared for:

Brady Wind, LLC



January 2016



TETRA TECH

Executive Summary

Tetra Tech, Inc. was contracted by Brady Wind, LLC, a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, to undertake fall avian use surveys for the proposed Brady Wind Energy Center (Project) located in Stark 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 August 20th through November 4th, 2015, which included the fall migration season. Point-count surveys (fixed 800-meter [m] radius) were conducted at 15 point-count locations distributed throughout the Project Area. These points were originally sited following an earlier Project layout and boundary (Figure 2); however, following changes to the Project Area, two of the points (Points 14 and 15) were no longer within the Project Area. Data from Points 14 and 15 were included in the analysis, although these two points do not sample the hazardous area around turbines as defined in the Eagle Conservation Plan (ECP) Guidance.

A total of 4,851 birds from 34 species were observed within the Project Area. Overall mean bird use within the Project Area was 26.95 birds/20 minute (min) and ranged from 0 to 440 birds/20-min point count. Mean use was highest for songbirds, pigeons/dove and gamebirds (20.19, 2.23 and 2.19 birds/20 min, respectively). The species with the highest mean use were the red-winged blackbird (11.62 birds/20 min), mourning dove (2.19 birds/20 min), ring-necked pheasant (1.84 birds/20 min), horned lark (1.62 birds/20min) and American crow (1.48 birds/20min). The red-winged blackbird had the highest encounter rate (5.92 birds flying at rotor swept area [RSA] height/20 min). All other species had an encounter rate less than 0.79 birds flying at RSA height/20 min.

The avian community detected within the Project Area during fall avian surveys was characterized by species typical of agricultural lands and cattle pastures in North Dakota. 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. Songbirds were identified as having potential risk of collision due to species within this group having the highest encounter rate within the Project Area and/or relatively high mean use. Songbird species with the highest potential risk was the red-winged blackbird due to an encounter rate of 5.92 birds flying at RSA height/20min. Red-winged blackbirds may be at the greatest fatality risk during the spring and fall due to their flocking characteristics throughout migration, which may also contribute to their relatively high encounter rate. Although risk of turbine-related fatalities at the Project exists, should they occur, they are unlikely to have population-level impacts because North Dakota red-winged blackbird populations are large and relatively stable (8.2 million, PIFSC

2013, Sauer et al. 2012). Pigeons/doves and gamebirds were two other species groups that contained species demonstrating collision risk factors. Mean use was highest for mourning dove and ring-necked pheasant; however, both had low encounter rates (both with 0.00 birds flying at RSA height/20 min respectively). Project-related fatalities of the mourning dove and ring-necked pheasant, should they occur, are unlikely to have population-level impacts because North Dakota populations for each species are large and relatively stable (4.1 and 2.0 million, respectively; PIFSC 2013, Sauer et al. 2012).

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor mortality at wind facilities. Conversely, raptor mortality appears to be low when raptor use is low (less than 1.0 birds/20 min). In the case of this Project, overall raptor use was 1.07 birds/20 minutes, which is just above the low mean use mark of 1.0 birds/20 min. Nesting activity can also contribute to risk of turbine-related mortality. Because raptor activity is typically higher near active nests than areas without active nests, nesting raptors may have increased potential for collision as they repeatedly fly within the Project Area during nesting activities. Raptor nests detected within the Project Area included five occupied Swainson's hawk nests, one occupied red-tailed hawk nest and six small unoccupied nests. Within a 2-mile buffer outside of the Project Area, surveyors located two occupied Swainson's hawk nests, two occupied red-tailed hawk nests, six large unoccupied nests, and 13 small unoccupied nests.

Raptor species observed during the point-count surveys are typical of species found in western North Dakota. Swainson's hawk, northern harriers and red-tailed hawk had the highest mean use among raptors (0.26, 0.26 and 0.23 birds/20 min, respectively). Given the relatively low mean use of Swainson's and red-tailed hawks within the Project Area and relatively low encounter rate (0.15 and 0.16 birds flying at RSA height/20 min, respectively); turbine-related fatalities at the Project are likely to be low. Risk of collision for northern harriers is expected to be low at the Project Area because of the relatively low mean use within the Project Area and relatively low encounter rate (0.00 birds flying at RSA height/20 min). Results from post-construction fatality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities. The red-tailed hawk encounter rate and presence of active nests within the Project Area suggest the Project may pose a collision risk for this species. However, any fatalities at the Project are not expected to have population-level impacts because North Dakota red-tailed hawk populations are large and relatively stable (57,000, PIFSC 2013, Sauer et al. 2012). Other raptor species detected during spring surveys included turkey vulture, American kestrel and ferruginous hawk. Although turkey vultures and American kestrels are commonly found as fatalities at wind facilities, the low mean use and encounter rates of all 3 species (less than 0.22 birds/20min and less than 0.22 birds flying at RSA height, respectively) suggest turbine related fatalities for these species at the Project are likely to be low.

Protected Species

No federally threatened or endangered species were observed during avian point-count surveys, raptor nest survey, or as incidental observations. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA). Although no eagles were observed during avian point-count surveys, eight individual golden eagles and three individual bald eagles were observed incidentally to raptor nest surveys. Five of these eagles were observed within the Project Area and six were observed outside the Project Area. These sightings suggest that golden and bald eagles may occur in the Project Area. No bald or golden eagle nests were found within the Project Area or 2-mile buffer surrounding the Project Area during the raptor nest surveys conducted in June and November 2015; however, there are several known eagle nests within 10 miles of the Project Area, based on data provided by North Dakota Game and Fish Department. Additionally, six large unoccupied stick nests were located on buttes approximately 2-6 miles to the northwest of the Project Area. These nests could be used by nesting golden eagles or ferruginous hawks, and a golden eagle was subsequently viewed perching in proximity to the nests in December 2015. Bald eagles are believed to be at less risk of turbine collision than golden eagles because they tend to focus their hunting efforts for fish and waterfowl in lakes and rivers (Buehler 2000). Golden eagles are believed to be more at risk of turbine collision than bald eagles because they hunt for land-based prey along topographic contours where turbines are often located (Kochert et al. 2002). Although golden eagles may occur in the Project Area during any time of the year, the species is unlikely to breed within the Project Area due to a lack of suitable habitat. Eagle use surveys are underway to evaluate risk of Project activities to eagles.

Most native birds are protected under the Migratory Bird Treaty Act (MBTA), and take of even a single individual is prohibited. Currently, there are no permits for incidental take of migratory birds. Historically, permits were not available under the BGEPA for incidental take from otherwise lawful activities; however, USFWS-promulgated regulations in 2009 provided for permits for incidental take of eagles associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26). Only one incidental take permit for golden eagles has been approved for a wind energy project, and no permits have been issued for incidental take of bald eagles at a wind energy facility to date.

Table ES-1. Fall avian use summary

Variable	Result	Details
Non-raptors		
Mean use	25.88 birds/20 min	(Section 3.1)
Species detected at Brady that are commonly (> 15 records) detected as wind farm fatalities	Yes	Red-winged blackbird, western meadowlark, horned lark, American robin, European starling, mourning dove, ring-necked pheasant, gray partridge, mallard, killdeer. (Section 4.1)
Federally listed ¹ species observed within the Project Area	No	
State-listed ² species within the Project Area	No	
State-listed ² species within RSA	No	
Raptors		
Mean use	1.07 birds/20 min	(Section 3.1)
Species detected at Brady that are commonly (> 15 records) detected as wind farm fatalities	Yes	Red-tailed hawk, turkey vulture, American kestrel (Section 4.2)
Eagles observed within the Project Area	Yes	Incidental to raptor nest surveys (Section 4.3)
Eagles observed within the RSA	No	
Eagles observed nesting within the Project Area	No	
Federally listed species observed within the Project Area	No	
State-listed ² species within the Project Area	No	
State-listed ² species within the RSA	No	
Habitat		
Native habitat likely to be affected by development	Yes	Grassland prairie
Lakes (waterfowl and crane attractant)	No	
Wetlands (attractant for cranes, waterfowl, and other water-based species)	No	
Cliffs (raptor nesting and traveling)	No	
Rivers (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	No	

1 Federally listed species include species listed as endangered, threatened, or candidate under the Endangered Species Act (ESA).
 2 Only species protected by the federal ESA are considered threatened or endangered in North Dakota. The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (Hagen et al. 2005) but these species are not afforded any formal protection by the state of North Dakota and there are no state permitting requirements covering them.

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1 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), and effects of these fatalities upon population trends appear to be minimal (Erickson et al. 2014). 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 lower 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.

Agencies and non-governmental groups have raised particular concern over avoidance issues (e.g., habitat displacement) with respect to grouse species (Manville 2004, USFWS 2012). The existing information on avoidance by grouse species is limited to observational studies, with results varying by grouse species and source of disturbance (roads, oil and gas wells, vertical structures, transmission lines). Studies of grouse and anthropogenic features have observed that some species of grouse avoid transmission lines, improved roads, buildings, oil and gas wells, and communication towers (Pitman et al. 2005, Pruett et al. 2009, Johnson et al. 2011). But other studies have found no evidence of avoidance of transmission lines or of wind facilities (Johnson et al. 2011, Johnson et al. 2012, Sandercock et al. 2013).

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 native migratory bird, part, nest, egg or product. The USFWS has established a permitting scheme for a variety of intentional activities, such as hunting and scientific research, but has not done so for the incidental take of migratory birds associated with otherwise lawful activities. As a result, currently there is no permitting framework that allows a wind energy company to protect itself from liability at wind energy facilities.

Brady Wind, LLC (Brady Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC is planning to develop the Brady Wind Energy Center (Project) in Stark County, North Dakota (Figure 1), located on private lands. Brady Wind 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 on bird species detected during the survey. These study objectives are consistent with recommendations from Tier 3 of the *USFWS Land-Based Wind Energy Guidelines* (USFWS 2012; USFWS Guidelines).

The Project Area covers 29,983 acres and is located in the Missouri Plateau Ecoregion of the Northwestern Great Plains Ecoregion (Bryce et al. 1996). This semi-arid region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badland formations. Historically, much of the landscape was a mix of western mixed-grass prairie and short-grass grassland prairie with associated wetlands (Bryce et al. 1996). Today, most grassland prairie has been largely replaced by agriculture in level areas. Remnant grassland prairie may still persist in areas of steep or broken topography. Agriculture in the area consists predominantly of dry-land

farming of wheat and alfalfa interspersed with cattle grazing pastures. The Project Area consists of wide open agricultural grasslands and various cattle ranches.

North Dakota has 353 documented bird species (Faanes and Stewart 1982) and is situated within the Central Flyway, one of several broad bird migratory routes in North America (USFWS 2011). 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 and eventually reach wintering grounds near the Gulf of Mexico and as far away as South America (USFWS 2011).

2 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 USFWS *Wind Energy Guidelines* (WEG; 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 as well as eagles.

2.1 Avian Surveys

2.1.1 Point-Count Surveys

An experienced field biologist (biologist) conducted 20-minute (min) point-count surveys at 15 locations to evaluate avian use, behavior, and species. These points were originally sited following an earlier Project layout and boundary (Figure 2); however, following changes to the Project boundary, two of the points (Points 14 and 15) were no longer within the boundary. Data from Points 14 and 15 were included in the analysis, although these two points do not sample the hazardous area around turbines as defined in the ECP Guidance. The biologist conducted 12 weekly surveys from August 20th through November 4th, 2015 (Table 1), thereby encompassing the fall migration. Tetra Tech distributed the survey locations throughout the Project Area and chose locations that maximized 360-degree sight viewshed for the biologist while covering a diversity of habitats (Figure 2).

Data were collected on all birds detected within an 800-meter (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 avian visual or auditory observations including: species, number of individuals, time of observation, height above ground, flight distance, flight direction 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, used 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-min 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 Raptor Nest Surveys

Tetra Tech conducted raptor nest surveys with the primary objective of documenting the presence of bald and golden eagles and other large raptor nests within and adjacent to the Project. An initial ground-based survey was conducted on June 10-11, 2015. The survey was conducted from public roadways by a local field biologist equipped with a spotting scope. The primary objective was to locate any nesting raptors within 2 miles of the Project Area.

A follow up aerial survey for the purpose of inventorying nests was conducted on November 17-18, 2015, during the non-breeding season, but after trees had dropped their leaves to increase visibility of raptor nests. The aerial survey consisted of searches of suitable habitat for all raptors within the Brady Project Area plus a 2-mile buffer. The aerial survey was conducted from a Bell-206 Jet Ranger helicopter (Double M Helicopters, Mandan, North Dakota) that was flown approximately 200 feet above ground level at an approximate speed of 60 miles per hour. The crew consisted of a Tetra Tech biologist, a local field biologist, and pilot. Surveyors primarily focused on potentially suitable nesting habitat on buttes and any large trees sufficient to support nesting by large raptors.

A global positioning system (GPS) receiver using World Geodetic System 1984 (WGS84) Datum coordinates was used to aid in navigation and data recording. Additionally, standardized data forms were used to record information.

If a nest was found, the following data were collected:

- **Nest Identification Number:** corresponding with GPS waypoint number.
- **Raptor Species:** using 4-letter American Ornithologists' Union codes (e.g., RTHA = red-tailed hawk, GHOW = great-horned owl).
- **Proximity of Adult:** On = bird sitting on nest, NEAR = bird near the nest, UNK = Unknown.
- **Eggs or Young:** number of eggs or young observed.
- **Nest Substrate:** structure in which nest was located (e.g., broadleaf tree, cut bank, transmission pole, etc.).
- **Nest Height:** Height relative to the structure it is on (e.g., on top of transmission pole, $\frac{3}{4}$ of height of tree).

To assess nest activity, the following criteria were used (Postupalsky 1974, USFWS 2013):

- **Occupied:** nest containing eggs, young, or an adult sitting on the nest indicating incubation or brooding or a nest showing evidence of use in the survey year such as fresh lining, droppings, feathers on or underneath, or adults near the nest (i.e., in tree) but not sitting on the nest.
- **Unoccupied:** nest showing no evidence of use and no adults present at the nest. Unoccupied eagle nests are categorized as eagle nests based on size of nest, size of material used in construction, and location (i.e., ospreys do not build nests as large as bald eagles and rarely builds nests in live trees).

- **Unknown:** The nest cannot be found or the nest is present, but because of its location (e.g., a tree cavity, rock cavity), a determination cannot be made.
- **Gone:** A nest that was located during a previous survey, but has subsequently been found to be destroyed and no longer exists. No evidence remains.

To assess nest condition, the following criteria were used (Postupalsky 1974, USFWS 2013):

- **Excellent:** defined cup or nest bowl with a well-maintained rim.
- **Good:** nest bowl intact and rim defined; minor repair needed for nest to be used; margins of nest in loose configuration, minor slumping occurring.
- **Fair:** nest bowl intact and nest not dilapidated; but needs significant repair in order to be used; material is slumping or sliding.
- **Poor:** loose structure of nest bowl still present; nest walls and side falling out; nest is in need of major repair to be used.
- **Remnant:** nest bowl not defined; scant material remaining and not usable unless fully rebuilt.

Data collected within the survey area included an inventory of all stick nests (occupied or unoccupied), status of nests, numbers of eggs or nestlings, and any observations of bald or golden eagles.

2.1.3 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, 3) outside of the 800-m radius circular plot, and 4) during the raptor nest survey. The biologist recorded these observations on separate data sheets and these data were not used in the formal analysis; however, a summary of incidental observed species is presented to provide additional information about species found in the local area.

2.2 Protected Species Information

The Endangered Species Act (ESA), administered by the U.S. Fish and Wildlife Service (USFWS), mandates protection of species federally listed as threatened or endangered and their associated habitats. The ESA makes it unlawful to knowingly violate the “take” provisions of the ESA. “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 2013a). Significant modification or degradation of listed species’ habitats where the modification actually kills or injures wildlife by significantly impairing

essential behavioral patterns is considered “harm” under ESA regulations. According to a current list of endangered, threatened and candidate species for North Dakota Counties maintained by the USFWS, the only listed avian species known to occur in Stark County is the whooping crane (USFWS 2015a).

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. The USFWS promulgated regulations in 2009 which provided for permits for incidental take of bald and golden eagles associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26). Applications for incidental take permits under BGEPA are being considered by USFWS for bald eagles throughout the contiguous U.S. Incidental take permits for golden eagles are available only to projects located west of the 100th meridian, and this project would qualify (USFWS 2013b). However, since 2009, only one incidental take permit for golden eagles has been granted to a wind energy project, and no permits for incidental take of bald eagles at a wind energy facility have been issued. The USFWS issued an Advanced Notice of Rulemaking in April 2012 and is currently undergoing a process to revise the permit regulations in response to public comment relative to eagle population management objectives, compensatory mitigation, and programmatic permit issuance. It is unknown at this time what changes will be made or how they may affect the permitting process.

In addition to federal listing, the North Dakota Game and Fish Department (NDGF) maintains a list of Species of Conservation Priority (Hagen et al. 2005) although these species are not afforded any formal protection by the state of North Dakota and there are no state permitting requirements covering them. Only species protected by the federal ESA are considered threatened or endangered in North Dakota, therefore the only state-listed species with potential to occur in Stark County is the whooping crane.

2.3 Data Quality Assurance/Quality Control

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. To ensure legibility and completeness of data sheets, the field 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.

2.4 Analysis

2.4.1 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.

2.4.2 Avian Use

Tetra Tech derived avian use (mean use) of the Project Area by calculating the average number of birds observed per 20-min (birds/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 and frequency (percentage of surveys where a species was detected) for each species observed. 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 relative high 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 nor 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.

2.4.3 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). Brady Wind plans to develop the Project using GE (General Electric) 1.715 MW and 1.79 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 approximately 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.

2.4.4 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:

$$\text{Encounter Rate} = A \times P_f \times P_t$$

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 of 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 considered 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, Garvin et al. 2011, Nagy et al. 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 observed once as a large flock in flight.

2.4.5 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 are 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 species groups with high use values that may experience Project-related mortality or whose regional population could be impacted by the Project development. Additionally, in this report, Tetra Tech highlights species with high frequencies (greater than 50 percent) of observation, high encounter rates (greater than 0.99 birds flying at RSA height/20 min), 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 Results

3.1 Avian Use and Frequency of Occurrence

The biologist surveyed 6,448 acres of the Project Area during point-count surveys, covering approximately 21.5 percent of the total Project Area (29,983 acres). The 15 point-count locations were surveyed 12 times each, resulting in 180 total 20-minute surveys. A total of 4,851 birds from 34 species were recorded during the point-count surveys (Table 2). A total of 9 species groups were identified within the Project Area during point-count surveys: Songbirds, Pigeons/Doves, Gamebirds, Raptors, Waterfowl, Waterbirds, Gulls/Terns, Cranes/Rails, and Woodpeckers (Table 2). Overall mean bird use for the Brady Wind Energy Center was 26.95 birds/20 min (Table 2) and ranged from 0 to 440 birds observed during all surveys.

Overall mean use by non-raptors was 25.88 birds/20 min. Species with the highest mean use belonged to three species groups: Songbirds, Pigeons/Doves and Gamebirds. Songbirds had the highest mean use (20.19 birds/20 min) among non-raptor species groups, and comprised 74.9 percent of all birds observed (Table 2). The songbird species with the highest mean use were the red-winged blackbird, horned lark and American crow (11.62, 1.62 and 1.48 birds/20 min, and observed in 22.8, 24.4 and 16.7 percent of all surveys, respectively; Table 2). Overall, these 3 species accounted for 54.6 percent of all birds observed in the Project Area (Table 2). Pigeons/Doves had the second highest mean use (2.23 birds/20 min) and comprised 8.3 percent of all birds observed (Table 2). The pigeon/dove species with the highest mean use was the mourning dove (2.19 birds/20 min and observed in 39.4 percent of all surveys; Table 2). The mourning dove comprised 8.1 percent of all birds observed and was distributed throughout the Project Area (Table 3). Gamebirds had the third highest mean use (2.19 birds/20 min) and comprised 8.1 percent of all birds observed (Tables 2). The gamebird species with the highest mean use was the ring-necked pheasant (1.84 birds/20 min and observed in 41.7 percent of all surveys; Table 2). The ring-necked pheasant comprised 6.8 percent of all birds observed and was distributed throughout the Project Area (Table 3). The remaining non-raptor species groups that were observed during surveys included Waterfowl, Waterbirds, Gulls/Terns, Cranes/Rails, and Woodpeckers. Each of the species within these groups had mean use values less than 1.00 birds/20 min.

Although western meadowlark was not among the top 3 songbirds with highest mean use, it had a relatively high frequency of observation in comparison to other species (observed in 35.0 percent of all surveys). Additionally, the sharp-tailed grouse was observed 9 times with a total of 45 individuals and had a mean use of 0.25 birds/20 min and were observed in 5.0 percent of all surveys (Table 2).

Non-raptor use was relatively consistent through mid-September and then slightly decreased for the remainder of the season (Figure 3). The primary contributors to the high mean use observed on September 1 were observations of red-winged blackbirds (1120 individuals in 8 flocks of 60 to 250 individuals). Non-raptor mean use was highest at point-count location 6 (52.08 birds/20 min;

Figure 4). Red-winged blackbird was the species primarily contributing to the high mean use at point-count location 6 (400 individuals; Table 3). The habitat at point-count location 6 consists of agriculture (wheat) and grassland that is not unique within the Project Area.

Raptors are a group of special interest because of their propensity to fly at heights similar to a turbine RSA. Overall mean use for raptors was 1.07 birds/20 min (Table 2); the fourth highest value among the nine species groups. The raptor species with the highest mean use were the Swainson's hawk, northern harrier and red-tailed hawk (0.26, 0.26 and 0.23 birds/20 min and observed in 24.4, 24.4 and 22.2 percent of all surveys, respectively; Table 2). Other raptor species detected were the turkey vulture, American kestrel and ferruginous hawk, each with mean use values less than 0.22 birds/20 min and observed in less than 11.0 percent of all surveys (Table 2).

Raptor use was highest during early fall and tapered off as the season progressed. Mean use by raptors was highest from August 20th through September 1st (ranging from 1.60 to 1.80 birds/20 min; Figure 5). Mean use for raptors was less than 1.30 birds/20 min on all other survey dates (Figure 5) and highest at point-count location 9 (2.33 birds/20 min; Figure 6). Species contributing to the high mean use at this point-count location was turkey vulture, Swainson's hawk and northern harrier (15, 7 and 5 individuals, respectively; Table 3). The habitat at point-count location 9 consists of row crop agriculture (wheat and alfalfa) and pastureland that may provide foraging opportunities for raptors, however these features are not unique to this point-count location or within the Project Area. Raptor mean use was less than 1.85 birds/20 min at all other point-count locations.

3.2 Flight Height and Encounter Rate

During fall avian use surveys, the biologist collected behavioral data for all birds observed during point-count surveys and 92.8 percent of these were observed flying. The biologist collected flight height data for 100 percent and flight direction for 72.7 percent of the individuals observed flying. Of non-raptor individuals observed flying, 69.1 percent flew below the height of the anticipated RSA and 30.9 percent flew at the height of the anticipated RSA (Table 4). Of raptor individuals observed flying, 49.7 percent flew below the height of the anticipated RSA and 50.3 percent flew at the height of the anticipated RSA. There were no raptor or non-raptor species observed flying above the height of the anticipated RSA during point-count surveys. Generally, birds observed in flight were moving in a southerly direction (55.6 percent). Data on flight direction are located in Appendix 1.

The red-winged blackbird had the highest encounter rate (5.92 birds flying at RSA height/20 min; Table 5). All other species had an encounter rate less than 1.0 birds flying at RSA height/20 min.

3.3 Raptor Nest Surveys

Raptor nests detected within the Project Area included five occupied Swainson's hawk nests, one occupied red-tailed hawk nest and six small unoccupied nests (Figure 7). Outside of the Project Area, surveyors located two occupied Swainson's hawk nests, two occupied red-tailed hawk nests, six large unoccupied nests, and 13 small unoccupied nests (Figure 7). There were two groups of large unoccupied nests detected during the fall 2015 aerial survey; a cluster of five nests and a single nest. All 6 of the large unoccupied nests were located on sandstone buttes. These large stick nests are most likely to be used by large raptor species such as golden eagles or ferruginous hawks, and a golden eagle was subsequently viewed perching in proximity to the cluster of 5 large unoccupied nests. The small unoccupied nests were all located in trees and are most likely used by smaller raptor species found within the Project Area (e.g., red-tailed hawk and Swainson's hawk). The presence of raptor nests may increase the risk for collisions during breeding season.

3.4 Incidental Observations

The biologist documented three species incidentally to point-count surveys (Table 6), all of which were also observed during point-count surveys. Most of these observations occurred north or northeast of point-count locations 8 and 9 outside of the Project Area. In addition, surveyors observed eight golden and three bald eagles, (five within and six outside the Project Area), during the aerial raptor nest surveys.

3.5 Protected Species

No federally threatened or endangered species were observed during avian point-count surveys, the raptor nest survey, or as an incidental observation. No eagles were observed during avian point-count surveys, however eight individual golden eagles and three individual bald eagles were observed incidentally during the raptor nest surveys (Section 3.4).

4 Discussion

The avian community detected within the Project Area during fall surveys was characterized by species associated with agricultural lands and pasture vegetation typical of North Dakota. Within disturbed habitats such as those found in the Project Area, the greatest potential impact of wind facilities to avian species is collisions with turbines rather than disturbance or displacement. Recent meta-analyses relevant to the proposed Project have estimated an average all-bird fatality rate of 1.81 birds/MW/year in the Great Plains (Loss et al. 2013) and 2.29 small birds/MW/year in the Prairie biome (Erickson et al. 2014). Annual avian fatality rates at the Project, should fatalities occur, are expected to fall within this range.

4.1 Non-Raptor Use and Collision Risk

Songbirds were identified as having potential risk of collision due to high encounter rates and/or relatively high mean use rates. These songbird species included the red-winged blackbird, horned lark, American crow and western meadowlark. Encounter rate was highest for red-winged blackbirds (5.92 birds flying at RSA height/20 minutes; Table 5). All other songbird species had encounter rates less than 0.79 birds flying at RSA height/20 min. The western meadowlark had a relatively high frequency of detection compared to the other species (observed in 35.0 percent of all surveys) but relatively low mean use (1.32 birds/20 min) and an encounter rate of 0.00 birds flying at RSA height/20 min. Red-winged blackbirds are local year-round residents and transient migratory species in this region of North Dakota and may be at the greatest fatality risk during the spring and fall due to their flocking characteristics, which may also be contributing to their relatively high encounter rate in comparison to other species. The red-winged blackbird (Kerlinger et al. 2006, Thelander et al. 2003), horned lark (Johnson and Erickson 2011, Downes and Gritski 2012), American crow (Downes and Gritski 2012, Jain et al. 2007) and western meadowlark (Johnson and Erickson 2011, Thelander et al. 2003) have been documented as fatalities at wind energy projects according to publically available data, particularly the horned lark which presented the highest fatality numbers of the four species and exhibits breeding flight displays that may bring them into the height of the RSA (Johnson and Erickson 2011). Although risk of turbine-related fatalities at the Project exists for each of these species, should they occur, are unlikely to have population-level impacts because North Dakota populations for each species are large and relatively stable (8.2, 4.3, and 5.6 million, respectively; PIFSC 2013, Sauer et al. 2012).

Mourning dove and ring-necked pheasant were species outside the songbird group with highest mean use and frequency of observation (2.19 and 1.84 birds/20min and 39.4 and 41.7 percent of all surveys, respectively). Sharp-tailed grouse had a mean use of 0.25 birds/20 min and were observed in 5.0 percent of all surveys (Table 2). However, the encounter rates for all 3 species were 0.00 as none were observed flying at the height of the RSA. Project-related fatalities of the mourning dove, ring-necked pheasant and sharp-tailed grouse, should they occur, are unlikely to have population-level impacts because North Dakota populations for each species are large and relatively stable (4.1 million, 2.0 million and 170,000, respectively; PIFSC 2013, Sauer et al. 2012). Additionally, the ring-necked pheasant is an introduced species and not protected by the MBTA.

The remaining non-raptor species detected during spring surveys have low risk of 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 wind facilities with publically available results of mortality studies.

4.2 Raptor Use and Collision Risk

A recent meta-analysis suggests that pre-construction studies provide poor indicators of post-construction mortality (Ferrer et al. 2012). Prior to Ferrer et al. (2012), high raptor use (greater 2.0 birds/20 min) has often been associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality often appears to be low when raptor use is low (< 1.0 birds/20 min; Strickland et al. 2011). In the case of this Project, overall raptor use was 1.07 birds/20 minutes, which is just above the low mean use mark of 1.0 birds/20 min. As more wind energy facilities complete both pre- and post-construction studies, the relationship between bird use and fatality rates may be better understood.

Swainson's hawks, northern harriers and red-tailed hawk had the highest mean use (0.26, 0.26 and 0.23 birds/20 min, respectively) for the raptor species group, and were also among the most frequently detected raptor species at the Project Area (observed at 24.4, 24.4 and 22.2 percent of all surveys, respectively). Although the Swainson's hawk and red-tailed hawk had similar mean use and frequency rates to the northern harrier, their encounter rates differed (0.15, 0.16 and 0.00 birds flying at RSA height/20 min, respectively). These species are commonly associated with agricultural and grassland prairie habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine collisions (Thelander et al. 2003); however, there are no known features that would concentrate golden eagles or other large raptors within the Project Area.

Swainson's hawk fatalities have been recorded at other wind energy facilities with publicly available data (Erickson et al. 2004, Gritski et al. 2010, Johnson and Erickson 2011). Additionally, 7 occupied Swainson's hawk nests were found within 2 miles of the Project area during raptor nest surveys (5 within the Project Area and 2 outside the Project Area); this may increase the risk for collisions during nesting activities. Given the low mean use of Swainson's hawks within the Project Area and low encounter rate; turbine-related fatalities at the Project are likely to be low. Although northern harriers have been seldom recorded as fatalities at other wind farms with publicly available data (Erickson et al. 2002, Young et al. 2003, Johnson and Erickson 2011), the majority of foraging flights for the northern harrier occur below typical RSA heights (Whitfield and Madders 2006). The 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 and low encounter rate of 0.00 birds flying at the RSA height/20 min within the Project Area. Project-related fatalities of Swainson's hawk and northern harrier, should they occur, are unlikely to have population-level impacts because both species' populations are relatively stable (Sauer et al. 2012).

In a 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 (Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). Drewit and Langston (2008) summarized that bird activity is typically higher near active nests than areas without active nests, as a result, red-tailed hawks may have increased potential for collision as they repeatedly fly within the Project Area during nesting activities and during the time when young begin to fledge from the nests. A total of 3 occupied red-tailed hawk nests were found within 2 miles of the Project Area (1 nest within the Project Area and 2 outside the Project Area); as previously mentioned, the presence of occupied raptor nests may increase the risk for collisions during nesting activities. However, Project-related fatalities are unlikely to have population-level impacts because red-tailed hawks populations are relatively stable (Sauer et al. 2012).

Other raptor species detected during fall point counts included the turkey vulture, American kestrel and ferruginous hawk. Both turkey vultures and American kestrels are commonly found as fatalities at wind facilities (Erickson et al. 2002, Stantec 2010). However, a low encounter rate of 0.00 birds flying at the RSA height/20 min for both of these species suggests a low risk for turbine collisions at the Project. The ferruginous hawk is not commonly found as fatalities at wind energy facilities according to publicly available data. Additionally, low use of the Project Area and an encounter rate of 0.00 birds flying at the RSA height/20 min, suggesting a low risk of collision with Project turbines.

4.3 Protected Species

No federally threatened or endangered species were observed during avian point-count surveys, raptor nest survey, or as an incidental observation. Although no eagles were observed during avian point-count surveys, eight individual golden eagles and three individual bald eagles were observed incidentally to raptor nest surveys. These sightings suggest that golden and bald eagles may occur in the Project Area. No bald or golden eagle nests were found within the Project Area or 2-mile buffer surrounding the Project Area during the raptor nest surveys conducted in June and November 2015; however, there are several known eagle nests within 10 miles of the Project Area. Two bald eagle nests were located during spring 2015 aerial raptor nest surveys conducted in support of another proposed wind energy facility (now canceled). The nearest bald eagle nest is located approximately three miles to the east of the Project Area in an isolated stand of trees surrounded by agricultural habitat. The other bald eagle nest is located approximately 8.5 miles to the northeast of the Project Area, along the Heart River. There are also six known golden eagle nests clustered on large sandstone buttes 8-9 miles to the northwest of the Project Area, possibly indicating 1-2 territories based on spacing of the nests. The nest locations were provided by NDGF in response to a request for locations of known significant ecological communities and sensitive plant and wildlife occurrences within the vicinity of Project Area. Additionally, the presence of

large stick nests on buttes approximately 2 miles to the northwest of the Project Area indicate that golden eagles may nest nearby.

Six bald eagle fatalities associated with wind energy facilities within the United States were reported from 1997 through June 2012 (Pagel et al. 2013). Since publication of the Pagel et al (2013) summary, one bald eagle fatality has been reported at a wind energy facility in North Dakota (Public Prairie Broadcasting 2015). Bald eagles are believed to be at less risk of turbine collision than golden eagles because they tend to focus their hunting efforts for fish and waterfowl in lakes and rivers (Buehler 2000). Although the landscape within the Project Area does not support any large waterbodies or an abundance of smaller waterbodies that would attract bald eagles for nesting or foraging, there are 2 known bald eagle nests located within 10 miles of the Project. The presence of occupied bald eagle nests in the vicinity of the Project Area suggests that the species may hunt or pass through the Project Area during the breeding season. Eagles use surveys are underway to evaluate risk of Project activities to eagles.

Seventy-nine golden eagle mortalities associated with wind energy facilities within the United States were reported from 1997 through June 2012, excluding the Altamont Pass Wind Resource Area in California (Pagel et al. 2013.); however, to date no golden eagle mortalities have been reported at wind energy facilities in North Dakota. Golden eagles are believed to be more at risk of turbine collision than bald eagles because they hunt for land-based prey along topographic contours where turbines are often located (Kochert et al. 2002). Several known golden eagle nests occur on sandstone bluffs within 10 miles of the Project Area. Although golden eagles may occur in the Project Area during any time of the year, the species is unlikely to breed within the Project Area due to a lack of suitable habitat. Eagles use surveys are underway to evaluate risk of Project activities to eagles.

Hagen et al. (2005) has provided a list of North Dakota's 100 Species of Conservation Priority. There were six species of conservation priority found within the Project Area. The level 1 species observed were the Swainson's hawk and Ferruginous hawk. The level 2 species observed at the Project Area were northern harrier, golden eagle, bald eagle and sharp-tailed grouse. According to Hagen et al (2005), Level 1 species are those having a high level of conservation priority because of declining status in North Dakota or across their range; or have a high rate of occurrence in North Dakota, constituting the core of the species breeding range, but may be at-risk range-wide. These are species that are in decline and presently receive little or no monetary support or conservation efforts.

5 Brady Wind Energy Center Conclusions

Results of the fall 2015 avian surveys at the Brady Wind Energy Center 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 flock observations of a few common residents and migratory species. Although there is potential for turbine-related fatalities of red-winged blackbirds and Swainson's hawks at the Project, fatalities involving these species are not expected to have population-level impacts (e.g., Erickson et al. 2014). If avian fatality rates are similar to other wind facilities within the region, we would expect them to fall between 0.38 and 11.83 birds/turbine/year (0.42 – 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.

No federally listed threatened or endangered species were detected during avian point-count surveys. There were no eagles observed during avian point-count surveys, however eight golden eagles and three bald eagles were observed incidentally to raptor nest surveys. Additionally, there is a confirmed bald eagle nest approximately 3 miles from the Project Area and potential golden eagle nests approximately 2 miles from the Project Area. Both bald and golden eagles are protected under the BGEPA and all native migratory avian species are protected by the Migratory Bird Treaty Act of 1918. Currently, there are no permits for incidental take of migratory birds.

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Tetra Tech staff who contributed to the writing of this report:

Angel Anderson	December 1, 2015
Report Author	Date
Rich Young	December 14, 2015
Peer Review #1	Date
Mark Martell	December 15, 2015
Peer Review #2	Date
Chris Farmer, Ph.D.	January 24, 2016
Senior Technical Review	Date
Anne-Marie Griger	December 21, 2015
Project Manager	Date
Kristina Dick	December 7, 2015
GIS	Date

FIGURES

Figure 2

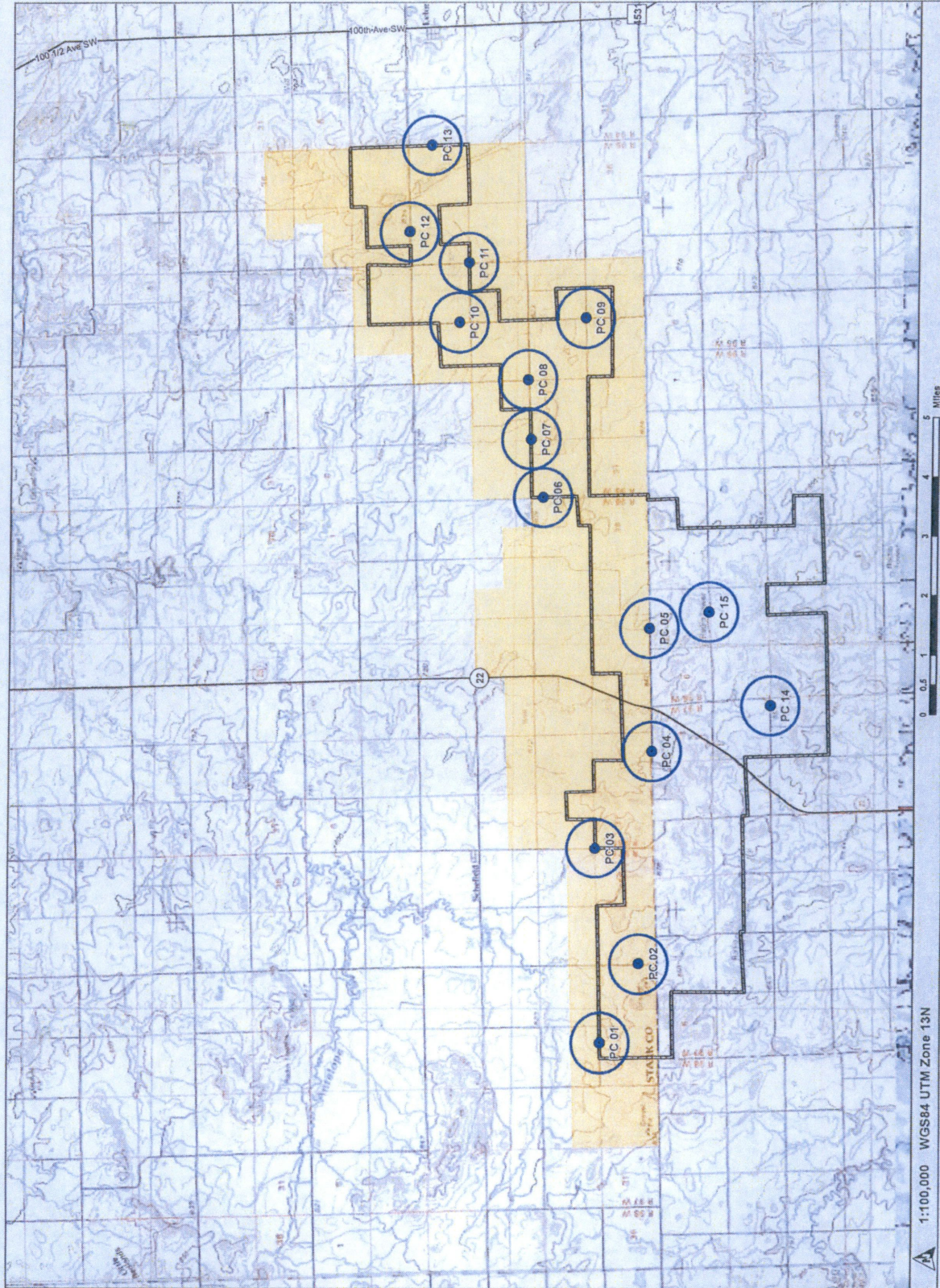
Point-count location map
(Fall 2015)



Brady Wind Energy Center

Stark County, ND
Last modified: 01-16-2016

- Avian Survey Point
- Avian Survey Point 800-m Radius
- PC# Point count number
- Proposed Project Area (10-21-2015)
- ▭ Original Proposed Project Boundary (05-28-2015)
- Secondary Road



1:100,000 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

Figure 3. Avian (non-raptor) mean use by survey date during fall 2015 point-count surveys at Brady Wind Energy Center

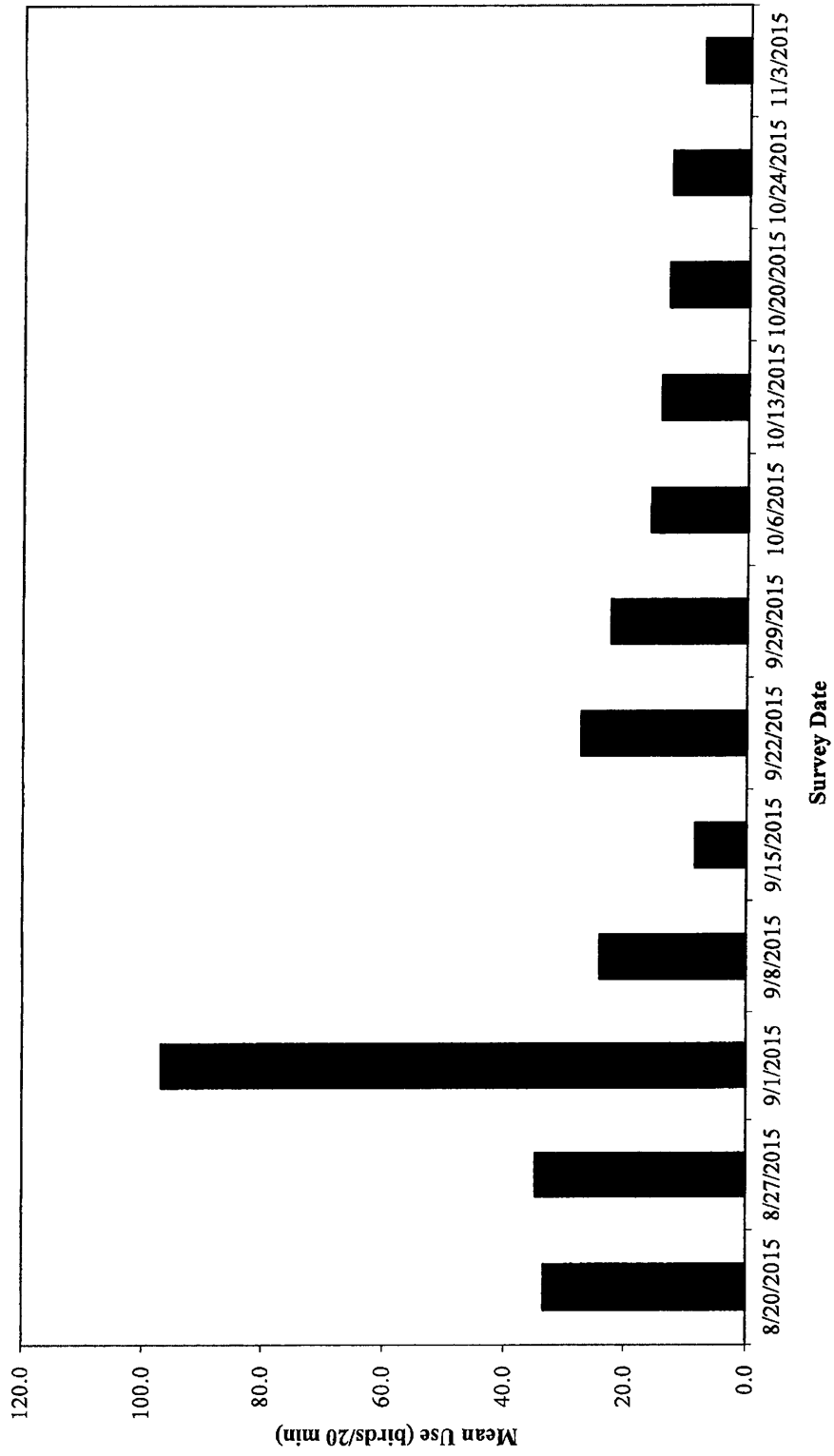


Figure 5. Raptor mean use by survey date during fall 2015 point-count surveys at Brady Wind Energy Center



TABLES

Table 1. Fall 2015 point-count survey dates at the Brady Wind Energy Center

Survey number	Date(s)	
1	8/20-8/21	2015
2	8/27	2015
3	9/1-9/2	2015
4	9/8	2015
5	9/15-9/16	2015
6	9/22	2015
7	9/29-10/1	2015
8	10/6	2015
9	10/13-10/15	2015
10	10/20	2015
11	10/24-10/27	2015
12	11/3-11/4	2015

Table 2. Avian species, by species grouping, observed during Fall 2015 point-count surveys at the Brady Wind Energy Center

Species Grouping	Overall Rank ¹	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Songbirds							
red-winged blackbird	1	2091	43	11.62 (6.68-16.56)	22.8	57.5%	43.1%
horned lark	4	292	45	1.62 (1.21-2.03)	24.4	8.0%	6.0%
American crow	5	267	30	1.48 (1.00-1.96)	16.7	7.3%	5.5%
western meadowlark	6	237	65	1.32 (1.00-1.64)	35.0	6.5%	4.9%
American robin	7	220	20	1.22 (0.73-1.71)	11.1	6.1%	4.5%
barn swallow	8	151	17	0.84 (0.43-1.25)	9.4	4.2%	3.1%
common grackle	9	132	9	0.73 (0.32-1.14)	5.0	3.6%	2.7%
eastern kingbird	11	76	20	0.42 (0.22-0.62)	11.1	2.1%	1.6%
brown-headed cowbird	12	74	4	0.41 (0.00-0.82)	1.7	2.0%	1.5%
European starling	13	54	8	0.30 (0.11-0.49)	4.4	1.5%	1.1%
western kingbird	20	34	15	0.19 (0.09-0.29)	8.3	0.9%	0.7%
dark-eyed junco	29	3	1	0.02 (0.00-0.05)	0.6	0.1%	0.1%
vesper sparrow	30	2	1	0.01 (0.00-0.03)	0.6	0.1%	0.0%
northern shrike	30	1	1	0.01 (0.00-0.02)	0.6	0.0%	0.0%
Group Total		3634	279	20.19 (14.87-25.51)	71.1		74.9%
Pigeons/Doves							
mourning dove	2	394	91	2.19 (1.74-2.64)	39.4	98.0%	8.1%
rock pigeon	26	8	4	0.04 (0.00-0.08)	2.2	2.0%	0.2%
Group Total		402	95	2.23 (1.78-2.68)	41.7		8.3%
Gamebirds							
ring-necked pheasant	3	331	85	1.84 (1.43-2.25)	41.7	84.0%	6.8%
sharp-tailed grouse	17	45	9	0.25 (0.10-0.40)	5.0	11.4%	0.9%
gray partridge	24	18	4	0.10 (0.01-0.19)	2.2	4.6%	0.4%
Group Total		394	98	2.19 (1.76-2.62)	47.8		8.1%
Raptors							
Swainson's hawk	15	47	45	0.26 (0.20-0.32)	24.4	24.4%	1.0%

Table 2. Avian species, by species grouping, observed during Fall 2015 point-count surveys at the Brady 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
northern harrier	15	46	46	0.26 (0.20-0.32)	24.4	23.8%	0.9%
red-tailed hawk	18	42	42	0.23 (0.17-0.29)	22.2	21.8%	0.9%
turkey vulture	19	37	5	0.21 (0.05-0.37)	2.8	19.2%	0.8%
American kestrel	21	20	19	0.11 (0.07-0.15)	10.6	10.4%	0.4%
ferruginous hawk	30	1	1	0.01 (0.00-0.02)	0.6	0.5%	0.0%
Group Total		193	158	1.07 (0.89-1.25)	70.0		4.0%
Waterfowl							
Canada goose	10	111	12	0.62 (0.30-0.94)	6.1	76.6%	2.3%
blue-winged teal	21	19	4	0.11 (0.02-0.20)	2.2	13.1%	0.4%
gadwall	26	8	1	0.04 (0.00-0.11)	0.6	5.5%	0.2%
mallard	26	7	2	0.04 (0.00-0.09)	1.1	4.8%	0.1%
Group Total		145	19	0.81 (0.47-1.15)	10.0		3.0%
Waterbirds							
killdeer	14	49	24	0.27 (0.15-0.39)	13.3	96.1%	1.0%
pie-billed grebe	30	2	1	0.01 (0.00-0.03)	0.6	3.9%	0.0%
Group Total		51	25	0.28 (0.16-0.40)	13.9		1.1%
Gulls/Terns							
ring-billed gull	21	20	2	0.11 (0.00-0.24)	1.1	100.0%	0.4%
Group Total		20	2	0.11 (0.00-0.24)	1.1		0.4%
Cranes/Rails							
sandhill crane	25	11	1	0.06 (0.00-0.16)	0.6	100.0%	0.2%
Group Total		11	1	0.06 (0.00-0.16)	0.6		0.2%
Woodpeckers							
northern flicker	30	1	1	0.01 (0.00-0.02)	0.6	100.0%	0.0%
Group Total		1	1	0.01 (0.00-0.02)	0.6		0.0%
Grand Total		4851	678	26.95 (21.27-32.63)			

¹ A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Fall 2015 point-count surveys at the Brady Wind Energy Center

Species	Number of Birds Obs.	Points														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
red-winged blackbird	2091	0	148	164	140	91	400	370	186	9	30	40	29	239	9	236
mourning dove	394	18	31	51	19	16	39	37	26	25	21	25	22	26	7	31
ring-necked pheasant	331	1	22	16	30	42	16	14	21	23	20	18	32	13	49	14
horned lark	292	45	21	12	5	7	34	41	6	11	20	17	23	11	32	24
American crow	267	30	0	25	5	0	41	33	40	21	0	48	28	0	15	11
western meadowlark	237	65	16	20	13	8	26	11	19	17	9	13	9	16	15	31
American robin	220	20	7	67	16	0	20	28	40	0	0	20	0	16	6	0
barn swallow	151	17	16	19	14	8	3	5	0	30	16	13	11	1	0	6
common grackle	132	9	17	0	0	0	22	0	37	15	24	0	0	11	0	6
Canada goose	111	12	0	17	0	0	6	0	0	0	0	17	0	0	17	54
eastern kingbird	76	20	2	0	9	1	12	1	9	8	1	0	22	6	0	5
brown-headed cowbird	74	4	0	0	30	0	0	0	30	0	0	14	0	0	0	0
European starling	54	8	0	18	6	0	4	18	4	0	0	4	0	0	0	0
killdeer	49	24	1	10	0	3	3	9	0	5	0	5	8	0	5	0
Swainson's hawk	47	45	0	3	6	3	3	2	5	3	7	2	5	1	1	1
northern harrier	46	46	1	5	1	2	2	5	1	2	5	3	6	4	6	2
sharp-tailed grouse	45	9	4	0	0	18	0	1	0	4	0	0	15	3	0	0
red-tailed hawk	42	42	8	1	2	6	0	1	4	0	0	3	1	4	7	2
turkey vulture	37	5	0	0	9	0	0	0	0	3	15	0	10	0	0	0
western kingbird	34	15	0	7	4	2	2	1	7	0	3	0	0	1	3	4
American kestrel	20	19	0	2	3	0	1	3	2	2	0	1	0	3	0	0
ring-billed gull	20	2	0	9	0	0	0	0	0	11	0	0	0	0	0	0
blue-winged teal	19	4	0	19	0	0	0	0	0	0	0	0	0	0	0	0
gray partridge	18	4	0	0	1	0	0	0	0	0	0	7	0	4	0	6
sandhill crane	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	11
gadwall	8	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0
rock pigeon	8	4	0	0	0	0	0	0	0	0	8	0	0	0	0	0
mallard	7	2	0	3	0	0	0	0	0	0	0	0	4	0	0	0
dark-eyed junco	3	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
pie-billed grebe	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
vesper sparrow	2	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0
ferruginous hawk	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
northern flicker	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
northern shrike	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Grand Total	4851	112	451	355	247	306	636	588	390	157	207	276	136	376	175	439

Table 4. Summary of avian flight heights¹ in relation to the turbine rotor swept area (RSA)² during Fall 2015 point-count surveys at the Brady Wind Energy Center

	Birds	
	Number	Percentage
Non-raptors		
At RSA height (28.5m–131.5m)	1331	30.9%
Below RSA height (<28.5m)	2980	69.1%
Raptors		
At RSA height (28.5m–131.5m)	95	50.3%
Below RSA height (<28.5m)	94	49.7%

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 2015 point-count surveys at the Brady 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	5.92	11.62 (6.68 - 16.56)	100.0	0.0	51.0	49.0
American crow	0.78	1.48 (1.00 - 1.96)	100.0	0.0	52.8	47.2
Canada goose	0.50	0.62 (0.30 - 0.94)	100.0	0.0	81.1	18.9
turkey vulture	0.21	0.21 (0.05 - 0.37)	100.0	0.0	100.0	0.0
red-tailed hawk	0.16	0.23 (0.17 - 0.29)	100.0	0.0	71.4	28.6
Swainson's hawk	0.15	0.26 (0.20 - 0.32)	93.6	0.0	63.6	36.4
common grackle	0.06	0.73 (0.32 - 1.14)	100.0	0.0	8.3	91.7
sandhill crane	0.06	0.06 (0.00 - 0.16)	100.0	0.0	100.0	0.0
ring-billed gull	0.05	0.11 (0.00 - 0.24)	100.0	0.0	45.0	55.0
American robin	0.02	1.22 (0.73 - 1.71)	100.0	0.0	1.4	98.6
American kestrel	0.00	0.11 (0.07 - 0.15)	95.0	0.0	0.0	100.0
barn swallow	0.00	0.84 (0.43 - 1.25)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.41 (0.00 - 0.82)	100.0	0.0	0.0	100.0
blue-winged teal	0.00	0.11 (0.02 - 0.20)	100.0	0.0	0.0	100.0
dark-eyed junco	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.42 (0.22 - 0.62)	77.6	0.0	0.0	100.0
European starling	0.00	0.30 (0.11 - 0.49)	100.0	0.0	0.0	100.0
ferruginous hawk	0.00	0.01 (0.00 - 0.02)	100.0	0.0	0.0	100.0
gadwall	0.00	0.04 (0.00 - 0.11)	0.0	0.0	0.0	0.0
gray partridge	0.00	0.10 (0.01 - 0.19)	33.3	0.0	0.0	100.0
horned lark	0.00	1.62 (1.21 - 2.03)	100.0	0.0	0.0	100.0
killdeer	0.00	0.27 (0.15 - 0.39)	75.5	0.0	0.0	100.0
mallard	0.00	0.04 (0.00 - 0.09)	100.0	0.0	0.0	100.0
mourning dove	0.00	2.19 (1.74 - 2.64)	80.5	0.0	0.0	100.0
northern flicker	0.00	0.01 (0.00 - 0.02)	100.0	0.0	0.0	100.0
northern harrier	0.00	0.26 (0.20 - 0.32)	100.0	0.0	0.0	100.0
northern shrike	0.00	0.01 (0.00 - 0.02)	0.0	0.0	0.0	0.0
pied-billed grebe	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
ring-necked pheasant	0.00	1.84 (1.43 - 2.25)	39.3	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)¹ during Fall 2015 point-count surveys at the Brady 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
rock pigeon	0.00	0.04 (0.00 - 0.08)	100.0	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.25 (0.10 - 0.40)	100.0	0.0	0.0	100.0
vesper sparrow	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
western kingbird	0.00	0.19 (0.09 - 0.29)	79.4	0.0	0.0	100.0
western meadowlark	0.00	1.32 (1.00 - 1.64)	95.8	0.0	0.0	100.0

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

Table 6. Incidental observations of birds during Fall 2015 point count surveys at the Brady Wind Energy Center

Species	Number of individuals
red-tailed hawk	7
Swainson's hawk	7
northern harrier	1
Grand Total	15

APPENDIX

Appendix 1. Flight directions of birds observed during Fall 2015 point-count surveys at the Brady 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	1610	36	10.4	0.0	12.4	9.0	67.4	0.8	0.0	0.0	0.0	0.0	
mourning dove	268	67	29.5	0.0	24.3	0.0	24.3	0.0	22.0	0.0	0.0	0.0	
American crow	237	28	7.6	0.0	0.0	4.2	85.7	1.3	1.3	0.0	0.0	0.0	
barn swallow	151	17	29.8	0.0	10.6	0.0	29.8	0.0	29.8	0.0	0.0	0.0	
common grackle	132	9	11.4	0.0	4.5	13.6	26.5	27.3	16.7	0.0	0.0	0.0	
horned lark	120	17	9.2	0.0	9.2	0.0	76.7	0.0	5.0	0.0	0.0	0.0	
Canada goose	111	12	0.0	0.0	0.0	0.0	81.1	7.2	11.7	0.0	0.0	0.0	
American robin	96	11	24.0	0.0	0.0	7.3	47.9	0.0	20.8	0.0	0.0	0.0	
ring-necked pheasant	90	11	54.4	0.0	3.3	0.0	15.6	0.0	26.7	0.0	0.0	0.0	
brown-headed cowbird	74	4	18.9	0.0	58.1	0.0	0.0	0.0	0.0	0.0	0.0	23.0	
western meadowlark	54	19	46.3	0.0	5.6	0.0	38.9	0.0	9.3	0.0	0.0	0.0	
European starling	54	8	61.1	7.4	0.0	0.0	7.4	7.4	16.7	0.0	0.0	0.0	
northern harrier	46	46	21.7	2.2	8.7	2.2	50.0	4.3	8.7	2.2	0.0	0.0	
Swainson's hawk	39	38	28.2	2.6	5.1	7.7	35.9	5.1	12.8	2.6	0.0	0.0	
red-tailed hawk	39	39	28.2	2.6	5.1	0.0	33.3	7.7	17.9	5.1	0.0	0.0	
sharp-tailed grouse	36	8	44.4	0.0	8.3	0.0	0.0	0.0	47.2	0.0	0.0	0.0	
turkey vulture	25	3	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
ring-billed gull	20	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
blue-winged teal	19	4	21.1	0.0	78.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
American kestrel	17	16	17.6	0.0	5.9	11.8	35.3	0.0	29.4	0.0	0.0	0.0	
sandhill crane	11	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
rock pigeon	8	4	50.0	0.0	25.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	
mallard	7	2	42.9	0.0	0.0	0.0	0.0	0.0	57.1	0.0	0.0	0.0	
eastern kingbird	6	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
northern flicker	1	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	

Appendix 1. Flight directions of birds observed during Fall 2015 point-count surveys at the Brady Wind Energy Center

Species	Number of Birds ¹ Observations	Percentage of Flights									
		N	NE	E	SE	S	SW	W	NW	Variable	
Grand Total	3271	405	16.5	0.2	11.5	5.7	55.6	2.2	7.7	0.1	0.5

¹ Includes only flying birds with flight directions