Appendix C

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Avian Surveys
Campbell County Wind Farm

Prepared for:

FAGEN ENGINEERING, LLC
Dave Plagge
180 8th Avenue
Granite Falls, MN 56241

Prepared by:

WENCK ASSOCIATES, INC.
301 1st Street NE, Suite 202
Mandan, ND 58554
(701) 751-3370

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1.0 Introduction

1.1 PROJECT OVERVIEW

Dakota Plains Energy is planning to develop a wind energy facility in Campbell County, South Dakota. The proposed Campbell County Wind Farm is located on private land in north-central South Dakota. Wenck Associates, Inc. (Wenck) was contracted by Fagen Engineering to conduct a variety of wildlife surveys associated with building and/or operating the proposed facility.

The data from these studies were used to identify species, species groups or species of concern that are present in the project area and that may be at a higher risk of mortality and/or displacement. Data is presented in several categories, and highlight federally listed species, state listed species, and species of concern.

1.2 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

Spring and fall are migration periods for non-resident avian species. During the spring, birds move north from wintering grounds to summer breeding grounds. In the fall, birds move south to wintering grounds. Spring and fall are prime periods to conduct avian surveys on potential wind farm areas to observe migratory species and resident species.

Avian surveys focus on inventory and monitoring with specific objectives that include: 1) an inventory of bird species in a specific project area; 2) determining the relative abundance of species; and 3) monitoring seasonal changes in species composition and relative abundance (Whitworth et al. 2007). Diurnal fixed-point surveys are one of the most common methods used to determine avian composition and abundance. Point counts not only focus on visual cues but also on auditory cues to give the observer an advantage in rough terrain. For some species, vocal cues may be the only reliable means of detection (Whitworth et al. 2007).

Incidental avian surveys are used to obtain bird distribution and composition information between point count locations. Larger birds, such as game birds, raptors, and waterfowl, large flocks of smaller birds, and birds that are a rarity in the area are typically recorded during incidental surveys.

1.3 SHARP-TAILED GROUSE

Male sharp-tailed grouse (*Tympanuchus phasianellus*) congregate at historical/communal leks in the spring to compete for breeding opportunities. Both sexes return to their natal breeding grounds annually for their entire life. Leks are typically found in areas with low vegetation growth on a hill, knoll or other point of high visibility. Fidelity to these locations is extremely high for sharp-tailed grouse. Sharp-tailed grouse require nesting habitat within close proximity to the lek that is comprised of dense or residual vegetative cover to conceal and protect their nest from predators (Vodehnal and Haufler 2007).

Since sharp-tailed grouse typically fly low to the ground, mortality from turbine collisions is low. Fences and power lines, however, may be a significant cause of direct mortality by collision (Bidwell et al. 2003). Disturbance of prairie grouse during the lekking and nesting season may occur from the construction of turbines, location of turbines, turbine noise, and physical movement of turbines during operation. Loss of habitat and fragmentation related to wind energy development may affect local prairie grouse populations by decreasing the area of habitat available for lekking, nesting and brood-rearing and by increasing predation (Pittman et al. 2005). Therefore, federal and state wildlife agencies are concerned about the placement of turbines in areas with known prairie grouse populations. Sharp-tailed grouse leks need to be detected to ensure that wind turbines and/or associated roads are sited so as not to directly impact the lek.

1.4 RAPTOR NESTS

Raptors spend much of their time hunting and soaring within elevation ranges that correspond to the wind turbine rotor-sweep-area (RSA), making them susceptible to turbine blades (Erickson et al. 2002). Because raptors are long-lived species with low reproduction rates, potential population impacts from collision-related mortality are of concern (Erickson et al. 2002). Although specific studies are lacking, adults and recently fledged young could be at particular risk of collision with turbines because of their higher use of areas near nest sites. Adult raptors often fly near nest sites during the breeding season to attend to young and deliver prey. After young raptors fledge, fledglings often spend significant amounts of time flying and roosting near nest locations until they become capable flyers and hunters. Additionally, construction activities near active nests during the breeding season may potentially result in disturbance or abandonment of nest sites.

1.5 WHOOPING CRANES

The whooping crane (*Grus americana*) is a federally listed endangered species. Whooping crane injury or death caused by any wind energy project feature would be considered "take" under the Endangered Species Act. Avoidance of habitat by the cranes due to the construction and operation of turbines can be considered habitat loss and "take" under ESA.

It is unknown how whooping cranes would respond to the presence of wind turbines. Avoidance of wind farms by whooping cranes may reduce the probability of collision, but could amount to loss of stopover habitat. The construction and operation of wind turbines could result in direct mortality from collision with the turbines or by avoidance of habitat in areas where turbines are located.

Power lines located in the vicinity of foraging or roosting habitat pose a threat to whooping cranes due to individual birds often flying at low altitudes (33 to 49 feet above ground) when moving among foraging and roosting sites (Canadian Wildlife Service and United States Fish and Wildlife Service 2005, Stehn and Wassenich 2006). Since 1956, at least 46 whooping cranes have been killed or seriously injured as a result of collisions with power lines (Stehn and Wassenich 2006).

2.0 Methodology

2.1 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

2.1.1 Fixed-point Surveys

Avian point count (PC) surveys were conducted in winter 2011-2012 December 2011 to February 2012), spring 2012 (March 2012 to June 2012) and fall 2012 (August 2012 to November 2012) to capture migrating and resident species at the Campbell County Wind Farm (Table 1). Survey data was used to evaluate avian use, behavior, and species composition during spring and fall migration and to determine summer resident species at the Campbell County Wind Farm. Diurnal fixed-point count surveys were conducted at seven circular plots. Point counts were selected to capture a diverse range of habitats and at locations with the best possible viewshed. .

All observations within an 800-meter radius at each point count were recorded; any observations outside the 800-meter radius were considered incidental. Each PC survey lasted for 20 minutes; all audio and visual observations were recorded. Surveys were conducted by an experience ornithologist. Surveys were rotated to cover all daylight hours to ensure each PC was surveyed at various times of the day. Data recorded for each observation included species, number of individuals, time, height above ground, behavior, and flight direction. A range finder and topographic maps were used as references to determine bird distances to the observer and flight heights. Birds not easily identifiable due to low light conditions and distance were identified to the lowest taxonomic level possible.

The data collected from this study can be used to project the potential effects of wind turbines on avian species at the project area. This survey protocol estimates avian use throughout the day and captures a variety of bird species. Songbirds are most active in the morning during the breeding season and can be difficult to detect during the afternoon, compared to raptors which become more active as the sunlight heats the air and creates thermals, which individuals use for soaring.

Twenty-minute survey periods provide adequate time to detect both raptors and non-raptors. Double counting may occur during the 20 minute survey because individuals may appear and disappear from view. 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-minute survey, not number of distinct individual birds.

The ability to detect all species within the 800-meter survey radius varies among species and potentially not all individuals within the survey area are counted. This variation in detectability results in an overestimate of mean use in conspicuous species and an underestimate of mean use in reclusive species (Thompson 2002).

2.1.2 Incidental Observations

Incidental observations included observations that occurred while traveling between PC locations, pre- and post-PC survey time period, and outside the 800-meter radius circular plot. These observations were recorded but not used in the formal analysis. Incidental observations are presented in Table 8.

2.1.3 Species Groupings

The data is presented in two primary groups of interest: raptors and non-raptors. Raptors were defined as vultures, hawks, eagles, falcons, and owls. Non-raptors were defined as all other avian species.

2.1.4 Mean Avian Use

Mean use was calculated by dividing the total number of birds per species observed by the total number of surveys conducted. Mean use was also calculated for each individual point count location to determine if there were areas with a higher mean use compared to other areas. The number of observations is also presented. This information helps depict whether a high mean use is driven by a single observation.

2.1.5 Flight Behavior

Flight behavior was evaluated by calculating the proportion of flying birds that were observed flying below, within, or above the turbine RSA. Fagen Engineering is proposing turbines with a hub height of 80 meters with a 77 meter diameter RSA. Therefore, an RSA between 41.5 and 118.5 meters above the ground was used.

2.1.6 Encounter Rate

The encounter rate is the rate in which a species was observed flying through the RSA during the avian point count surveys at the Campbell County Wind Farm project area and suggests potential mortality risk from flight behavior.

To estimate the rate at which a species flies through the RSA, the following equation was applied to every species observed in the Campbell County Wind Farm:
Encounter Rate = A*P*f*P*t*

- A is the mean use of birds/20 minutes for a given species
- P*f* is the proportion of all activity observations for a given species that were flying
- P*t* is the proportion of flying observations that were within the turbine RSA

The encounter rate index is relative to the observations of species during the surveys and within the study area and cannot be extrapolated to the species that may use the Campbell County Wind Farm in the future. The encounter rate index from this study does not take into consideration behavior (e.g. foraging, courtship), habitat use, and turbine avoidance differences between species.

2.2 SHARP-TAILED GROUSE

Sharp-tailed grouse surveys were conducted in early April through early May 2010 and 2012, from ½ hour before sunrise to two hours after sunrise. Peak attendance by females on leks typically occurs from April 15 to 25, but these dates vary by up to a week depending on weather conditions (Schroeder and Robb 1993). Listening stops were made throughout the project area and within 1-mile from the project boundary to identify lek locations. Sharp-tailed grouse males may be heard at a distance of up to 0.5 mile. Listening stops were not conducted if winds exceeded 10 miles per hour (mph) or during precipitation events. After a lek was located, the birds were observed and the number of males and females were counted. Lek locations were documented using Global Positioning System (GPS) coordinates. Given the sensitive nature of this species, and the fact that females may be nesting near the lek, disturbance to breeding prairie grouse was kept to a minimum.

2.3 RAPTOR NESTS

A raptor nest survey was conducted to locate raptor nests and determine nest activity status and the species using those nests. The initial surveys were conducted in early April 2010 and 2012, before trees leafed out, to locate nests and to identify early breeding species. The project area and a 1-mile buffer area were surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations were documented with GPS coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data were recorded for each nest. An additional visit was conducted in May 2012 to document the activity status of nests located during the initial survey and to identify nesting attempts by late nesting raptors such as Swainson's hawks. Raptors may use nests intermittently among years as well as re-nest after a nest failure; therefore, early and late-season nest surveys allow for a more accurate summary of breeding raptors.

2.4 WHOOPING CRANES

Sandhill/Whooping crane surveys were conducted between early April and late April 2012 and again from early October to early November 2012, when the highest numbers of cranes are expected to occur in the project area (USFWS 2007). Sandhill/Whooping crane surveys were conducted by driving a vehicle along the roads within the project area. Stops were made at good vantage points and the biologist glassed and listened for the presence of cranes. On calm mornings sandhill cranes may be heard at a distance of 2.5 miles (Tacha et al. 1992). Each stop consisted of listening and using binoculars and/or spotting scopes to scan the surrounding terrain to visually identify sandhill and/or whooping cranes. Listening stops were conducted at, but not limited to, established avian point count locations. Stops were not conducted during excessively harsh weather conditions.

3.0 Results

3.1 CAMPBELL COUNTY WIND FARM

Of the approximately 11,750 acres that comprise the Campbell County Wind Farm, approximately 2,253 acres were surveyed within the project area boundary during PC surveys, covering 19.2 percent of the total project area. Seven point count locations were surveyed at the Campbell County Wind Farm (Figure 1). The winter 2011-2012 surveys were conducted six times while the spring and fall 2012 surveys were done 13 times at all of the seven PC locations, which resulted in a total of 224, 20-minute surveys (Table 1).

3.2 SPECIES COMPOSITION

The winter 2011-2012 survey consisted of 346 avian individuals (14 different species) that were recorded during the 6 fixed-PC surveys (Table 2). The most frequently observed birds were Lapland longspur (*Calcarius lapponicus*) (69.94 percent of all birds observed), European starling (*Sturnus vulgaris*) (7.51 percent), house sparrow (*Passer domesticus*) (6.36 percent) and ring-necked pheasant (*Phasianus colchicus*) (5.20 percent) (Table 3). The remaining 10 species comprised 10.99 percent of the total number of birds observed.

The spring 2012 survey consisted of 7,250 avian individuals (93 different species) that were recorded during the 13 fixed-PC surveys (Table 2). The most frequently observed birds were common grackle (*Quiscalus quiscula*) (35.79 percent of all birds observed), cliff swallow (*Petrochelidon pyrrhonota*) (16.21 percent) and red-winged blackbird (*Agelaius phoeniceus*) (9.10 percent) (Table 3). The remaining 90 species comprised 38.90 percent of the total number of birds observed.

The fall 2012 survey consisted of 23,665 avian individuals (69 different species) that were recorded during the 13 fixed-PC surveys (Table 2). The most frequently observed birds were Brewer's blackbird (*Euphagus cyanocephalus*), (69.97 percent of all birds observed), red-winged blackbird (14.56 percent) and European starling (4.34 percent) (Table 3). The remaining 66 species comprised 11.13 percent of the total birds observed.

3.3 AVIAN USE

Winter 2011-2012 overall mean bird use was 8.24 birds/20 min (Table 2). The overall mean use by non-raptors was 7.81 birds/20 min; the highest were Lapland longspur (5.76 birds/20 min), European starling (0.62 birds/20 min) and house sparrow (0.52 birds/20 min) (Table 2). The highest mean use at a point count was at PC #16 (approximately 26.00 birds/20 min) and observations at this point included high numbers of Lapland longspur (142 individuals) (Table 4).

Spring 2012 overall mean bird use was 79.67 birds/20 min (Table 2). The overall mean use by non-raptors was 78.81 birds/20 min; the highest were common grackle (28.52 birds/20 min), cliff swallow (12.91 birds/20 min) and red-winged blackbird (7.25 birds/20 min) (Table 2). The highest mean use at a

point count was at PC #2 (approximately 270.77 birds/20 min) and observations at this point included high numbers of common grackle (2,045 individuals) and cliff swallow (1,175 individuals) (Table 4).

Fall 2012 overall mean bird use was 260.07 birds/20 min (Table 2). The overall mean use by non-raptors was 259.45 birds/20 min; the highest mean use species were Brewer's blackbird (181.97 birds/20 min), red-winged blackbird (37.86 birds/20 min) and European starling (11.29 birds/20 min) (Table 2). The highest mean use at a point count was at PC #1 (1,298.46 birds/20 min) and observations at this point included high numbers of Brewer's blackbirds (1,550 individuals) (Table 4).

For the winter 2011-2012 species groups, overall mean use was highest for songbirds (7.31 birds/20 min) followed by gamebirds (0.45 birds/ 20 min) (Table 2).

For the summer 2012 species groups, overall mean use was highest for songbirds (69.43 birds/20 min) followed by gamebirds (4.30 birds/ 20 min) (Table 2).

For the fall 2012 species groups, overall mean use was highest for songbirds (246.38 birds/20 min) followed by waterfowl (5.07 birds/ 20 min) (Table 2).

Raptors are a group of special interest because of their propensity to fly at heights within a turbine RSA. Overall winter 2011-2012 mean use for raptors was 0.43 birds/20 min. Six raptor species were identified during the winter 2011-2012 PC surveys: golden eagle (*Aquila chrysaetos*) and rough-legged hawk (*Buteo lagopus*) (0.12 birds/20 min); northern harrier (*Circus cyaneus*) (0.10 birds/20 min); bald eagle (*Haliaeetus leucocephalus*) (0.05 birds/20 min); prairie falcon (*Falco mexicanus*) and snowy owl (*Bubo scandiacus*) (0.02 birds/20 min) (Table 2).

Overall spring 2012 mean use for raptors was 0.95 birds/20 min. Eight raptor species were identified during the PC survey. The top three observed were: red-tailed hawk (*Buteo jamaicensis*) (0.40 birds/20 min), northern harrier (0.26 birds/20 min) and turkey vulture (*Cathartes aura*) (0.12 birds/20 min) (Table 2).

Overall fall 2012 mean use for raptors was 0.62 birds/20 min. Eight raptor species were identified during the PC survey. The top three observed were: red-tailed hawk (0.43 birds/20 min), turkey vulture (0.07 birds/20 min) and northern harrier (0.04 birds/20 min) (Table 2).

3.4 FREQUENCY OF OCCURRENCE

The ring-necked pheasant was the most common species present (14.29 percent of all surveys) and was most widely distributed throughout the Campbell County Wind Farm project area in the winter 2011-2012 surveys (Tables 2 and 4). Other frequently occurring species included golden eagle (11.90 percent of all surveys), and rough-legged hawk (9.52 percent of all surveys) (Table 3).

Western meadowlark was the most common species present (97.80 percent of all surveys) and most widely distributed throughout the project area in the spring 2012 surveys (Tables 2 and 4). Other frequently occurring species included ring-necked pheasant (79.12 percent of all surveys), horned lark (65.93 percent of all surveys) and common grackle (56.04 percent of all surveys) (Table 3).

Western meadowlark was the most common species present (42.86 percent of all surveys) and most widely distributed throughout the project area in the fall 2012 surveys (Tables 2 and 4). Other frequently occurring species included mourning dove (*Zenaida macroura*) (38.46 percent of all surveys) and red-tailed hawk (34.07 percent of all surveys) (Table 3).

3.5 FLIGHT HEIGHT AND ENCOUNTER RATE

During the winter 2011-2012 avian use surveys 89.90 percent of all individuals observed were flying (Table 6). Flight height and flight direction data was recorded for most of the flying birds observed (Table 7a). Approximately 69.23 percent of flying raptor species flew below the RSA, 23.08 percent flew within the RSA, and 7.69 percent flew above the RSA. For all other species, approximately 78.19 percent flew below the RSA, 21.81 percent flew within the RSA, and 0.00 percent flew above the RSA (Table 5).

During winter 2011-2012 surveys, golden eagles had the highest raptor species encounter rate (0.05 birds flying within the RSA/20 min). This was followed by bald eagle (0.02 birds flying within the RSA/20 min) (Table 6).

Lapland longspur had the highest non-raptor winter 2011-2012 encounter rate (1.52 birds flying within the RSA/20 min), followed by sharp-tailed grouse (0.02 birds flying within the RSA/20 min) (Table 6).

During the spring 2012 avian use surveys, 79.99 percent of all individuals observed were flying (Table 6). Flight height and flight direction data was recorded for most of the flying birds (Table 7b). One hundred percent of flying raptor species flew below the RSA. For all other species, 99.30 percent flew below the RSA, 0.70 percent flew within the RSA, and 0.00 percent flew above the RSA (Table 5).

During spring 2012 surveys no raptors were observed flying within or above the RSA (Table 6).

Lapland longspur had the highest non-raptor spring 2012 encounter rate (0.44 birds flying within the RSA/20 min) (Table 6).

During the fall 2012 avian use surveys, 97.00 percent of all individuals observed were flying (Table 6). Flight height and flight direction data was recorded for most of the flying birds (Table 7c). Approximately 88.10 percent of flying raptor species flew below the RSA, 9.52 percent flew within the RSA, and 2.38 percent flew above the RSA. For all other species, 99.99 percent flew below the RSA, <0.01 percent flew within the RSA, and <0.01 percent flew above the RSA (Table 5).

During fall 2012 surveys, red-tailed hawk was the only raptor species with an encounter rate (0.04 birds flying within the RSA/20 min) (Table 6).

Eastern Kingbird (*Tyrannus tyrannus*) was the only non-raptor fall 2012 species with an encounter rate (0.01 birds flying within the RSA/20 min) (Table 6).

3.6 SENSITIVE SPECIES OBSERVATIONS

A total of twelve sensitive avian species of concern for South Dakota were recorded during the winter 2011-2012, spring 2012 and fall 2012 PC and incidental surveys (South Dakota Natural Heritage Program, 2012) (Tables 4 and 8). This included the great blue heron (*Ardea herodias*) (12 individuals),

bufflehead (*Bucephala albeola*) (8 individuals), hooded merganser (*Lophodytes cucullatus*) (1 individual), bald eagle (*Haliaeetus leucocephalus*) (2 individuals), sharp-shinned hawk (*Accipiter striatus*) (1 individual), Cooper's hawk (*Accipiter cooperii*) (2 individuals), broad-winged hawk (*Buteo platypterus*) (3 individuals), Swainson's hawk (*Buteo swainsoni*) (19 individuals), Ferruginous hawk (*Buteo regalis*) (8 individuals), golden eagle (*Aquila chrysaetos*) (5 individuals), merlin (*Falco columbarius*) (2 individuals) and prairie falcon (*Falco mexicanus*) (2 individuals). The golden and bald eagle are also legally protected under the Bald and Golden Eagle Protection Act (BGEPA 1940), while the others are protected under the Migratory Bird Treaty Act (MBTA 1919).

3.7 FLIGHT DIRECTION

Birds observed flying during the winter 2011-2012 surveys were generally flying in north, west and northwest directions (20.00 percent each). This was followed by northeast and south (15.00 percent each and southwest (10.00 percent) (Table 7a).

During the spring 2012 surveys, birds were generally flying in a southerly direction (73.71 percent). This was followed by west (11.14 percent), east (7.37 percent), north (6.65 percent), northwest (0.75 percent), southeast (0.21 percent), northeast (0.14 percent), and southwest (0.03 percent) (Table 7b).

During the fall 2012 surveys birds were generally flying in a southerly direction (43.13 percent). This was followed by east (22.94 percent), west (13.52 percent), southeast (12.46 percent), north (6.82 percent), northeast (0.96 percent), northwest (0.10 percent), and southwest (0.06 percent) (Table 7c).

3.8 INCIDENTAL SURVEYS

Cumulative incidental observations for all three surveys periods included 93 different species, which included 495 observations and 13,885 individuals (Table 8).

During the winter 2011-2012 incidental survey, staff documented 11 species and a total of 76 individuals over 6 survey periods (Table 8). Six species were detected during incidental surveys, but not during the winter 2011-2012 point count surveys, including American goldfinch (*Carduelis tristis*), blue jay (*Cyanocitta cristata*), black-capped chickadee (*Poecile atricapillus*), red-tailed hawk, sharp-shinned hawk (*Accipiter striatus*), and yellow shafted flicker (*Colaptes auratus*), (Table 8).

During the spring 2012 incidental survey, staff documented 74 species and a total of 2,525 individuals over 13 survey periods (Table 8). Twenty species were detected during incidental surveys, but not during the spring 2012 point count surveys, including American avocet (*Recurvirostra americana*), American wigeon (*Anas americana*), American coot (*Fulica americana*), bank swallow (*Riparia riparia*), blue grosbeak (*Passerina caerulea*), broad-winged hawk (*Buteo platypterus*), bufflehead (*Bucephala albeola*), Canada goose (*Branta canadensis*), Franklin's gull (*Leucophaeus pipixcan*), hooded merganser (*Lophodytes cucullatus*), house finch (*Haemorhous mexicanus*), lesser scaup (*Aythya affinis*), lesser yellowlegs (*Tringa flavipes*), merlin (*Falco columbarius*), redhead (*Aythya americana*), ring-necked phalarope (*Phalaropus lobatus*), ring-necked duck (*Aythya collaris*), short-eared owl (*Asio flammeus*), willet (*Tringa semipalmata*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*) (Table 8).

During the fall 2012 incidental survey, staff documented 48 species and a total of 11,315 individual birds over 13 survey periods (Table 8). Seventeen species were detected during incidental surveys, but not

during the fall 2012 point count surveys, including American coot , bank swallow, canvasback (*Aythya valisineria*), Cooper's hawk (*Accipiter cooperii*), gadwall (*Anas strepera*), grasshopper sparrow (*Ammodramus savannarum*), gray partridge (*Perdix perdix*), green-winged teal (*Anas carolinensis*), loggerhead shrike (*Lanius ludovicianus*), mountain bluebird (*Sialia currucoides*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), pie-billed grebe (*Podilymbus podiceps*), prairie falcon, redhead, ring-billed gull (*Larus delawarensis*), and short-eared owl (Table 8).

3.9 SHARP-TAILED GROUSE

Three sharp-tailed grouse leks were located within the survey area (Figure 2). All of the leks were located in native or tame pasture land in the 1-mile buffer area; none were within the project boundary. The survey area appeared to have areas that contained quality sharp-tailed grouse habitat, particularly in areas of contiguous grassland within the east and northeast portions of the project area and within the buffer area to the west and northwest of the project area. However, on a landscape-level, the habitat was fragmented with crop fields and lacked woody cover to support larger populations of sharp-tailed grouse. Lek number, date, number of birds present, habitat and GPS coordinates were recorded (Table 10).

3.10 RAPTOR NESTS

Eleven raptor nests were located within the survey area (Figure 2). Two species of nesting raptors were identified: red-tailed hawk and Swainson's hawk (Table 9). Nesting substrates were limited to trees or bushes associated with unoccupied and occupied farm yards. No cliff or bluff nesting substrate exists in the survey area. Prey base habitat appeared limited because of the fragmented landscape which consists mostly of agricultural land.

3.11 WHOOPING CRANES

No whooping cranes were sighted during the spring or fall 2012 survey. Three sandhill crane groups with a total of 130 individuals were observed during the spring and fall 2012 survey.

4.0 Discussion and Impact Assessment

4.1 RAPTOR USE AND ENCOUNTER RATE

During the winter 2011-2012 survey 18 individual raptors were observed for a mean use of 0.43 raptors/20 min; during the spring 2012 survey 86 individual raptors were observed for a mean use of 0.95 raptors/20 min; and during the fall 2012 survey 56 individual raptor observations were made for a mean use of 0.62 raptors/20 min (Table 2).

The overall raptor mean use rate at the Campbell County Wind Farm was 0.71 raptors/20 min (winter 2011-2012, spring 2012 and fall 2012). This rate was compared to a study of 37 other wind energy facilities that implemented similar protocols. The raptor annual mean use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind energy facilities, as summarized by Derby et al. 2010, a ranking of seasonal raptor mean use was developed: low (0-0.5 raptors/20 min. survey); low to moderate (0.5-1.0 raptors/20 min); moderate (1.0-2.0 raptors/20 min); high (2.0-3.0 raptors/20 min); and very high (> 3.0 raptors/20 min). Under this ranking, mean raptor use at the Campbell County Wind Farm is considered to be low to moderate.

Encounter rate analysis may also suggest which species may be at risk to become turbine casualties. The encounter rate is an index and only considers probability of exposure based on abundance, number of individuals flying, and flight height of each species within the RSA for turbines to be used at the wind-energy facility.

Raptor encounter rates at the Campbell County Wind Farm are considered low, with 0.07 individuals flying within the RSA/20 min during the winter 2011-2012 survey, 0.00 individuals flying within the RSA/20 min during the spring 2012 survey and 0.04 individuals flying within the RSA/20 min during the spring 2012 survey (Table 6). Approximately 6.4 percent of all raptor observations were within the RSA. The highest raptor encounter rate was golden eagle with 0.05 individuals flying within the RSA/20 min during the winter 2011-2012 survey. Red-tailed hawk was second with an encounter rate of 0.04 individuals flying within the RSA/20 min during the fall 2012 survey (Table 6). The winter 2011-2012, spring 2012, fall 2012 and annual raptor encounter rate is relatively low, and the percentage of raptor observations within the RSA during the surveys and the low to moderate annual mean use rate (raptors/20 minutes) indicates a low potential for mortality at the Campbell County Wind Farm.

High numbers of raptor fatalities have been documented at wind-energy facilities (e.g. Altamont Pass); however other studies at wind-energy facilities in the United States found that 3.2% of the total casualties were raptors (Erickson et al. 2001). Results from Altamont Pass in California suggest that species mortality is not all related to abundance (Orloff and Flanery 1992). Golden eagles, red-tailed hawks and American kestrels were casualties more often than predicted based on abundance. Based on species occurrence/abundance within the Campbell County Wind Farm, golden eagles and red-tailed hawks may constitute the highest proportion of potential raptor fatalities at Campbell County Wind Farm.

Raptor nest density within the Campbell County Wind Farm and within one mile of the project boundary was one nest per 4.0 square miles (Figure 2). Few raptor species that have been identified as nesting at wind energy facilities have been observed as fatalities at wind energy facilities (Derby et al. 2010); therefore, the relationship is low between the number of collision fatalities and raptor nests within or near project facilities. However, it is assumed that raptors nesting close to turbines would likely have a greater chance of being impacted from collision with turbines, though the data is not available at this time to determine the impact (Derby et al. 2010).

4.2 NON-RAPTOR USE AND ENCOUNTER RATE

Migratory bird species in the United States are protected by the Migratory Bird Treaty Act (MBTA). Passerine species have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001 and Erickson et al. 2002), often comprising more than 80% of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Passerines make up a large proportion of the birds observed during the avian surveys at the Campbell County Wind Farm and would be expected to make up the largest proportion of fatalities. Encounter rate indices for both winter 2011-2012 and spring 2012 PC surveys indicate that the Lapland longspur is likely to be exposed to collisions from wind turbines at the Campbell County Wind Farm (Table 6). There were other species that flew through the RSA during the PC surveys, but encounter rates were not high enough to warrant significant collision exposure (Table 6).

4.3 SHARP-TAILED GROUSE

The sharp-tailed grouse inhabits steppe, grassland and mixed grass habitats. Sharp-tailed grouse serve as indicators of grassland ecosystem health and provide recreational and aesthetic value. Three known sharp-tailed grouse leks were located within the surrounding area in 2010 and 2012; none of these leks were located within the project area.

Native prairie is used by sharp-tailed grouse for seasonal habitat needs such as lekking, nesting, brood rearing, and wintering. The area surrounding the lek site contains habitat for reproduction and year round survival of sharp-tailed grouse. Loss of native prairie may affect the availability of habitat for grouse lekking and reproduction. Concerns that sharp-tailed grouse may avoid lek activity and nesting near human-made structures have heightened this issue for siting wind farms (Pitman et al. 2005). Establishing new roads in areas of native prairie increases habitat fragmentation and could provide better access for nesting predators such as skunks, raccoons, coyotes and feral cats. Reproductive success could be reduced if native prairie areas are more accessible to predators. Turbine setbacks from leks and minimizing grouse habitat disturbance may reduce the direct and indirect effect of wind development on grouse.

South Dakota Game Fish and Parks (SDGFP) recommends a No Surface Occupancy (NSO) setback of 1.0 mile from leks in which no turbines should be constructed (Figure 2). They also recommend a timing limitation from March 1st to June 30th, within a distance of 2.0 miles, in order to protect leks and nests. No activity/construction within this buffer during this time is recommended. It is also recommended to avoid placing wind developments in large, contiguous blocks of grassland. Blocks are considered fragmented by any human-derived feature (e.g., agricultural uses, fences, transmission lines, roads, burned areas) that subdivides them. Maintaining habitat connectivity between leks is important

because both males and females use multiple leks throughout the breeding season. Setbacks from leks would help further minimize any potential displacement impacts to sharp-tailed grouse.

4.4 LISTED AND SENSITIVE SPECIES RISK

All sensitive species observed at the Campbell County Wind Farm are summarized in Section 3.6. No federally listed threatened, endangered or candidate species were observed at the Campbell County Wind Farm during this study. One state listed threatened/endangered species, the bald eagle, was observed during fixed-point surveys at the Campbell County Wind Farm.

The U.S. Fish & Wildlife Service (USFWS) has expressed concern over potential impacts to whooping cranes. The whooping crane migrates through South Dakota during spring and fall, within a corridor that is roughly 200-miles wide; the Campbell County Wind Farm falls within the center of the corridor where 75% of South Dakota's whooping crane reported sittings have been recorded (Figure 3). No whooping cranes were observed during the study, however several groups of sandhill cranes were observed during the spring and fall PC surveys which often travel with whooping cranes.

Whooping crane stopover habitat in South Dakota is variable, but can be described as wetlands (roosting areas) that are greater than ¼ acre in size with water depths in the range of five to eight inches with minimal surrounding vegetation. Harvested cereal grain fields in close proximity to wetlands are used for foraging by whooping cranes, however cranes will also forage in wetlands and other crops such as alfalfa. See the "Avian Survey-Campbell County Wind Farm" submitted January of 2011 for the whooping crane attractiveness of the Campbell County Wind Farm and surrounding area.

The probability of whooping crane collisions with turbines on the Campbell County Wind Farm is unknown. However, the sporadic nature of stopovers within the 2,500 mile long by 200-mile wide migration corridor, and the small size of the proposed Campbell County Wind Farm, the probability of whooping crane collisions is presumed to be low.

5.0 Conclusion

Differences in bird use were detected between the winter 2011-2012, spring 2012 and fall 2012 PC survey points. It appeared that birds were using specific areas of the Campbell County Wind Farm, especially point counts #1 and #2 in which large numbers of common grackles, cliff swallows and Brewer's blackbirds were observed. No strong associations with topographic features within the Campbell County Wind Farm were noted for raptors or other large avian species. No flyways or concentration areas were observed.

Based on research conducted at wind farms throughout the United States, raptor use at the Campbell County Wind Farm is generally lower than use levels recorded at other wind farms. To date, no relationships have been determined between overall use by other bird species, and fatality rates of those bird groups at wind farm facilities. Flight characteristics and foraging habits of some species may result in additional exposure for these species at the Campbell County Wind Farm. The surveys for this proposed wind farm did not address the impacts to nocturnal migrants. Generally, overall fatality rates for birds (including nocturnal migrants) at wind farm facilities in the Midwest portion of the United States have been relatively low and consistent. The range of overall bird fatality estimates at three Midwest wind farm facilities has ranged from 0.7 to 3.4 fatalities/MW/year (Derby, et al. 2010).

Wildlife and plants which are closely associated with grasslands, primarily native, may be affected by the potential construction and operation of this wind farm facility. Wildlife species may avoid these habitats during siting of turbines. Plants will be permanently removed by turbine placement and access road construction. No federally listed endangered, threatened, or candidate species were observed within the Campbell County Wind Farm. However, twelve sensitive state avian species of concern were recorded within the project area. These avian species are generally not associated with agricultural habitats and occur in grassland/native prairie, wetlands, or woodland habitats. The potential exists for these species to be temporarily or permanently displaced from these habitats.

The Campbell County Wind Farm is located within the center of the whooping crane migration corridor, and a similar species, sandhill crane, was documented to occur during both the spring and fall PC surveys. Adequate stop-over habitat exists for the whooping crane to use Campbell County Wind Farm.

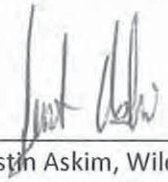
Sharp-tailed grouse were observed throughout the surveys, and three leks were located during the spring lekking season. South Dakota Game Fish and Parks (SDGFP) recommend avoiding placing turbines within 1.0 mile of sharp-tailed grouse leks and a construction timing limitation from March 1st to June 30th, for a distance of 2.0 miles from leks.

Direct mortality and/or injury from collisions with wind turbines and/or guy wires, temporary or permanent habitat loss, and displacement of birds from habitats near turbines are possible impacts to avian species from the construction and operation of the Campbell County Wind Farm (Drewitt and Langston 2006). In addition to mortality associated with wind farms, concerns have been raised that bird species may avoid areas near turbines after the wind farm is in operation (Drewitt and Langston 2006).

6.0 General and Signatures

The services performed by Wenck scientists for this project have been conducted in a manner consistent with the degree of care and technical skill appropriately exercised by professionals currently practicing in this area under similar time and budget constraints. Recommendations and findings contained in this report represent our professional judgment and are based upon available information and technically accepted practices at the present time and location. Other than this, no warranty is implied or expressed.

Wenck Wildlife Biologist Justin Askim prepared the report.



Justin Askim, Wildlife Biologist

12/26/2012
Date

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Table 1. Campbell County Wind Farm Point Count Dates	
Winter 2011-2012	
Survey Number	**Date**
1	12/14/2011
2	12/27/2011
3	1/9/2012
4	1/26/2012
5	2/8/2012
6	2/21/2012
Spring 2012	
Survey Number	**Date**
1	3/19/2012
2	3/28/2012
3	4/3/2012
4	4/10/2012
5	4/17/2012
6	4/24/2012
7	4/30/2012
8	5/8/2012
9	5/14/2012
10	5/21/2012
11	5/28/2012
12	6/5/2012
13	6/14/2012
Fall 2012	
Survey Number	**Date**
1	8/17/2012
2	8/23/2012
3	8/30/2012
4	9/5/2012
5	9/12/2012
6	9/18/2012
7	9/24/2012
8	10/2/2012
9	10/10/2012
10	10/16/2012
11	10/22/2012
12	10/30/2012
13	11/6/2012

Table 2. Campbell County Wind Farm Point Count Avian Species by Group

Species	Winter 2011-2012			Spring 2012			Fall 2012		
	Number of Birds	Number of Observations	Mean Use (# birds/20 min.)	Number of Birds	Number of Observations	Mean Use (# birds/20 min.)	Number of Birds	Number of Observations	Mean Use (# birds/20 min.)
Songbirds									
Alder Flycatcher	0	0	0.00	1	1	0.01	0	0	0.00
American Goldfinch	0	0	0.00	24	20	0.26	64	36	0.70
American Robin	0	0	0.00	27	22	0.30	114	17	1.25
American Tree Sparrow	7	1	0.17	13	5	0.14	9	4	0.10
Baltimore Oriole	0	0	0.00	2	2	0.02	0	0	0.00
Barn Swallow	0	0	0.00	38	24	0.42	58	26	0.64
Black-capped Chickadee	0	0	0.00	2	2	0.02	8	6	0.09
Blue Grosbeak	0	0	0.00	0	0	0.00	2	2	0.02
Blue-winged Warbler	0	0	0.00	1	1	0.01	0	0	0.00
Bobolink	0	0	0.00	44	14	0.48	6	1	0.07
Brewer's Blackbird	0	0	0.00	3	2	0.03	16,559	6	181.97
Brown Thrasher	0	0	0.00	34	24	0.37	5	3	0.05
Brown-headed Cowbird	0	0	0.00	118	38	1.30	1	1	0.01
Cedar Waxwing	0	0	0.00	335	5	3.68	0	0	0.00
Chestnut-collared Longspur	0	0	0.00	10	9	0.11	1	1	0.01
Chipping Sparrow	0	0	0.00	28	7	0.31	2	1	0.02
Clay-colored Sparrow	0	0	0.00	62	9	0.68	21	5	0.23
Cliff Swallow	0	0	0.00	1,175	5	12.91	2	2	0.02
Common Grackle	0	0	0.00	2,595	56	28.52	342	14	3.76
Common Yellowthroat	0	0	0.00	6	6	0.07	0	0	0.00
Dark-eyed Junco	0	0	0.00	9	3	0.10	151	15	1.66
Dickcissel	0	0	0.00	20	8	0.22	0	0	0.00
Eastern Bluebird	0	0	0.00	3	3	0.03	6	3	0.07
Eastern Kingbird	0	0	0.00	29	20	0.32	40	15	0.44
European Starling	26	1	0.62	295	24	3.24	1,027	25	11.29
Field Sparrow	0	0	0.00	0	0	0.00	4	2	0.04
Grasshopper Sparrow	0	0	0.00	1	1	0.01	0	0	0.00
Grays Catbird	0	0	0.00	1	1	0.01	1	1	0.01
Harris's Sparrow	0	0	0.00	4	2	0.04	14	5	0.15
Horned Lark	10	3	0.24	127	71	1.40	50	17	0.55
House Finch	0	0	0.00	0	0	0.00	7	2	0.08
House Sparrow	22	1	0.52	11	5	0.12	12	7	0.13
House Wren	0	0	0.00	27	20	0.30	1	1	0.01
Lapland Longspur	242	3	5.76	60	2	0.66	100	1	1.10
Lark Bunting	0	0	0.00	1	1	0.01	0	0	0.00
Lark Sparrow	0	0	0.00	2	2	0.02	16	4	0.18
Least Flycatcher	0	0	0.00	8	8	0.09	0	0	0.00
Loggerhead Shrike	0	0	0.00	2	2	0.02	0	0	0.00
Orchard Oriole	0	0	0.00	15	13	0.16	2	2	0.02
Pine Siskin	0	0	0.00	3	1	0.03	0	0	0.00
Red-eyed Vireo	0	0	0.00	1	1	0.01	0	0	0.00
Red-winged Blackbird	0	0	0.00	660	54	7.25	3,445	21	37.86
Ruby-crowned Kinglet	0	0	0.00	1	1	0.01	0	0	0.00
Savannah Sparrow	0	0	0.00	8	7	0.09	98	18	1.08
Say's Phoebe	0	0	0.00	9	9	0.10	3	3	0.03
Sedge Wren	0	0	0.00	5	4	0.05	0	0	0.00
Song Sparrow	0	0	0.00	20	20	0.22	11	8	0.12
Spotted Towhee	0	0	0.00	1	1	0.01	0	0	0.00
Swainson's Thrush	0	0	0.00	1	1	0.01	0	0	0.00
Tree Swallow	0	0	0.00	23	16	0.25	6	4	0.07
Vesper Sparrow	0	0	0.00	51	32	0.56	23	13	0.25
Warbling Vireo	0	0	0.00	14	12	0.15	0	0	0.00
Western Kingbird	0	0	0.00	36	24	0.40	42	11	0.46
Western Meadowlark	0	0	0.00	330	125	3.63	164	49	1.80
White-Crowned Sparrow	0	0	0.00	5	2	0.05	0	0	0.00
White-throated Sparrow	0	0	0.00	0	0	0.00	1	1	0.01
Willow Flycatcher	0	0	0.00	6	6	0.07	2	2	0.02
Yellow Warbler	0	0	0.00	11	9	0.12	0	0	0.00
Totals	**307**	**9**	**7.31**	**6,318**	**763**	**69.43**	**22,420**	**355**	**246.38**
Waterfowl									
Blue-winged Teal	0	0	0.00	57	15	0.63	6	2	0.07
Canada Goose	0	0	0.00	5	3	0.05	266	4	2.92
Cinnamon Teal	0	0	0.00	1	1	0.01	0	0	0.00
Gadwall	0	0	0.00	12	5	0.13	0	0	0.00
Green-winged Teal	0	0	0.00	7	3	0.08	0	0	0.00
Greater White-fronted Goose	0	0	0.00	0	0	0.00	150	1	1.65
Mallard	0	0	0.00	65	25	0.71	14	2	0.15
Northern Pintail	0	0	0.00	13	7	0.14	0	0	0.00
Northern Shoveler	0	0	0.00	17	5	0.19	0	0	0.00
Ruddy Duck	0	0	0.00	8	1	0.09	0	0	0.00
Wood Duck	0	0	0.00	14	7	0.15	25	5	0.27
Totals	**0**	**0**	**0.00**	**199**	**72**	**2.19**	**461**	**14**	**5.07**
Raptors/Vultures/Owls									
American Kestrel	0	0	0.00	1	1	0.01	3	3	0.03
Bald Eagle	2	2	0.05	0	0	0.00	0	0	0.00
Cooper's Hawk	0	0	0.00	1	1	0.01	0	0	0.00
Ferruginous Hawk	0	0	0.00	5	4	0.05	1	1	0.01
Golden Eagle	5	5	0.12	0	0	0.00	0	0	0.00
Great-horned Owl	0	0	0.00	2	2	0.02	1	1	0.01
Merlin	0	0	0.00	0	0	0.00	1	1	0.01
Northern Harrier	4	4	0.10	24	23	0.26	4	4	0.04
Prairie Falcon	1	1	0.02	0	0	0.00	0	0	0.00
Red-tailed Hawk	0	0	0.00	36	34	0.40	39	37	0.43
Rough-legged Hawk	5	5	0.12	0	0	0.00	0	0	0.00
Snowy Owl	1	1	0.02	0	0	0.00	0	0	0.00
Swainson's Hawk	0	0	0.00	6	4	0.07	1	1	0.01
Turkey Vulture	0	0	0.00	11	8	0.12	6	3	0.07
Totals	**18**	**18**	**0.43**	**86**	**77**	**0.95**	**56**	**51**	**0.62**
Sharebirds									
Killdeer	0	0	0.00	46	31	0.51	37	11	0.41
Marbled Godwit	0	0	0.00	3	2	0.03	0	0	0.00
Spotted Sandpiper	0	0	0.00	0	0	0.00	2	2	0.02
Upland Sandpiper	0	0	0.00	21	16	0.23	1	1	0.01
Wilson's Phalarope	0	0	0.00	2	2	0.02	0	0	0.00
Wilson's Snipe	0	0	0.00	3	3	0.03	0	0	0.00
Totals	**0**	**0**	**0.00**	**75**	**54**	**0.82**	**40**	**14**	**0.44**
Woodpeckers									
Downy Woodpecker	0	0	0.00	1	1	0.01	1	1	0.01
Harly Woodpecker	0	0	0.00	0	0	0.00	2	2	0.02
Northern Flicker	0	0	0.00	4	4	0.04	20	10	0.22
Red-headed Woodpecker	0	0	0.00	4	4	0.04	10	4	0.11
Yellow-shafted Flicker	0	0	0.00	11	10	0.12	0	0	0.00
Totals	**0**	**0**	**0.00**	**20**	**19**	**0.22**	**33**	**17**	**0.36**
Waterbirds									
Double-crested Cormorant	0	0	0.00	4	1	0.04	1	1	0.01
Great Blue Heron	0	0	0.00	2	2	0.02	5	5	0.05
Pied-billed Grebe	0	0	0.00	3	3	0.03	0	0	0.00
Totals	**0**	**0**	**0.00**	**9**	**6**	**0.10**	**6**	**6**	**0.07**
Crows and Allies									
American Crow	2	1	0.05	9	7	0.10	85	4	0.93
Black-billed Magpie	0	0	0.00	3	3	0.03	0	0	0.00
Blue Jay	0	0	0.00	11	11	0.12	18	12	0.20
Totals	**2**	**1**	**0.05**	**23**	**21**	**0.25**	**103**	**16**	**1.13**
Pigeons/Doves									
Mourning Dove	0	0	0.00	123	54	1.35	282	43	3.10
Rock Pigeon	0	0	0.00	3	2	0.03	12	2	0.13
Totals	**0**	**0**	**0.00**	**126**	**56**	**1.38**	**294**	**45**	**3.23**
Gamebirds									
Ring-necked Pheasant	18	7	0.43	391	85	4.30	119	40	1.31
Sharp-tailed Grouse	1	1	0.02	0	0	0.00	3	1	0.03
Totals	**19**	**8**	**0.45**	**391**	**85**	**4.30**	**122**	**41**	**1.34**
Cranes/Rails									
Sandhill Crane	0	0	0.00	1	1	0.01	129	2	1.42
Totals	**0**	**0**	**0.00**	**1**	**1**	**0.01**	**129**	**2**	**1.42**
Goatsuckers									
Common Nighthawk	0	0	0.00	1	1	0.01	1	1	0.01
Totals	**0**	**0**	**0.00**	**1**	**1**	**0.01**	**1**	**1**	**0.01**
Gulls/Terns									
Ring-billed Gull	0	0	0.00	1	1	0.01	1	1	0.01
Totals	**0**	**0**	**0.00**	**1**	**1**	**0.01**	**1**	**1**	**0.01**
Grand Totals	**346**	**36**	**8.24**	**7,250**	**1156**	**79.67**	**23,666**	**563**	**260.07**

Table 3. Campbell County Wind Farm Point Count Percent Composition and Frequency by Species Group

Species	Winter 2011-2012		Spring 2012		Fall 2012	
	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency
Songbirds						
Alder Flycatcher	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
American Goldfinch	0.00%	0.00%	0.33%	19.78%	0.27%	32.97%
American Robin	0.00%	0.00%	0.37%	24.18%	0.48%	17.58%
American Tree Sparrow	2.02%	2.38%	0.18%	5.49%	0.04%	4.40%
Baltimore Oriole	0.00%	0.00%	0.03%	2.20%	0.00%	0.00%
Barn Swallow	0.00%	0.00%	0.52%	24.18%	0.25%	21.98%
Black-capped Chickadee	0.00%	0.00%	0.03%	2.20%	0.03%	6.59%
Blue Grosbeak	0.00%	0.00%	0.00%	0.00%	0.01%	2.20%
Blue-winged Warbler	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Bobolink	0.00%	0.00%	0.61%	15.38%	0.03%	1.10%
Brewer's Blackbird	0.00%	0.00%	0.04%	2.20%	69.97%	6.59%
Brown Thrasher	0.00%	0.00%	0.47%	20.88%	0.02%	3.30%
Brown-headed Cowbird	0.00%	0.00%	1.63%	39.56%	0.00%	1.10%
Cedar Waxwing	0.00%	0.00%	4.62%	5.49%	0.00%	0.00%
Chestnut-collared Longspur	0.00%	0.00%	0.14%	8.79%	0.00%	1.10%
Chipping Sparrow	0.00%	0.00%	0.39%	7.69%	0.01%	1.10%
Clay-colored Sparrow	0.00%	0.00%	0.86%	9.89%	0.09%	5.49%
Cliff Swallow	0.00%	0.00%	16.21%	5.49%	0.01%	2.20%
Common Grackle	0.00%	0.00%	35.79%	56.04%	1.45%	13.19%
Common Yellowthroat	0.00%	0.00%	0.08%	5.49%	0.00%	0.00%
Dark-eyed Junco	0.00%	0.00%	0.12%	3.30%	0.64%	14.29%
Dickcissel	0.00%	0.00%	0.28%	6.59%	0.00%	0.00%
Eastern Bluebird	0.00%	0.00%	0.04%	3.30%	0.03%	3.30%
Eastern Kingbird	0.00%	0.00%	0.40%	18.68%	0.17%	13.19%
European Starling	7.51%	2.38%	4.07%	25.27%	4.34%	25.27%
Field Sparrow	0.00%	0.00%	0.00%	0.00%	0.02%	2.20%
Grasshopper Sparrow	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Grays Catbird	0.00%	0.00%	0.01%	1.10%	0.00%	1.10%
Harris's Sparrow	0.00%	0.00%	0.06%	2.20%	0.06%	3.30%
Horned Lark	2.89%	7.14%	1.75%	65.93%	0.21%	15.38%
House Finch	0.00%	0.00%	0.00%	0.00%	0.03%	2.20%
House Sparrow	6.36%	2.38%	0.15%	5.49%	0.05%	7.69%
House Wren	0.00%	0.00%	0.37%	20.88%	0.00%	1.10%
Lapland Longspur	69.94%	7.14%	0.83%	2.20%	0.42%	1.10%
Lark Bunting	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Lark Sparrow	0.00%	0.00%	0.03%	2.20%	0.07%	4.40%
Least Flycatcher	0.00%	0.00%	0.11%	8.79%	0.00%	0.00%
Loggerhead Shrike	0.00%	0.00%	0.03%	2.20%	0.00%	0.00%
Orchard Oriole	0.00%	0.00%	0.21%	12.09%	0.01%	2.20%
Pine Siskin	0.00%	0.00%	0.04%	1.10%	0.00%	0.00%
Red-eyed Vireo	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Red-winged Blackbird	0.00%	0.00%	9.10%	54.95%	14.56%	19.78%
Ruby-crowned Kinglet	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Savannah Sparrow	0.00%	0.00%	0.11%	7.69%	0.41%	17.58%
Say's Phoebe	0.00%	0.00%	0.12%	8.79%	0.01%	2.20%
Sedge Wren	0.00%	0.00%	0.07%	4.40%	0.00%	0.00%
Song Sparrow	0.00%	0.00%	0.28%	18.68%	0.05%	8.79%
Spotted Towhee	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Swainson's Thrush	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Tree Swallow	0.00%	0.00%	0.32%	17.58%	0.00%	0.00%
Vesper Sparrow	0.00%	0.00%	0.70%	30.77%	0.03%	4.40%
Warbling Vireo	0.00%	0.00%	0.19%	13.19%	0.10%	14.29%
Western Kingbird	0.00%	0.00%	0.50%	24.18%	0.18%	9.89%
Western Meadowlark	0.00%	0.00%	4.55%	97.80%	0.69%	42.86%
White-Crowned Sparrow	0.00%	0.00%	0.07%	2.20%	0.00%	0.00%
White-throated Sparrow	0.00%	0.00%	0.00%	0.00%	0.00%	1.10%
Willow Flycatcher	0.00%	0.00%	0.08%	4.40%	0.01%	2.20%
Yellow Warbler	0.00%	0.00%	0.15%	9.89%	0.00%	0.00%
Totals	**88.73%**		**87.14%**		**94.74%**	
Waterfowl						
Blue-winged Teal	0.00%	0.00%	0.79%	14.29%	0.03%	2.20%
Canada Goose	0.00%	0.00%	0.07%	3.30%	1.12%	4.40%
Cinnamon Teal	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Gadwall	0.00%	0.00%	0.17%	5.49%	0.00%	0.00%
Green-winged Teal	0.00%	0.00%	0.10%	3.30%	0.00%	0.00%
Greater White-fronted Goose	0.00%	0.00%	0.00%	0.00%	0.63%	1.10%
Mallard	0.00%	0.00%	0.90%	24.18%	0.06%	2.20%
Northern Pintail	0.00%	0.00%	0.18%	6.59%	0.00%	0.00%
Northern Shoveler	0.00%	0.00%	0.23%	5.49%	0.00%	0.00%
Ruddy Duck	0.00%	0.00%	0.11%	1.10%	0.00%	0.00%
Wood Duck	0.00%	0.00%	0.19%	7.69%	0.11%	5.49%
Totals	**0.00%**		**2.74%**		**1.95%**	
Raptors/Vultures/Owls						
American Kestrel	0.00%	0.00%	0.01%	1.10%	0.01%	3.30%
Bald Eagle	0.58%	4.76%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Ferruginous Hawk	0.00%	0.00%	0.07%	4.40%	0.00%	1.10%
Golden Eagle	1.45%	11.90%	0.00%	0.00%	0.00%	0.00%
Great-horned Owl	0.00%	0.00%	0.03%	2.20%	0.00%	1.10%
Merlin	0.00%	0.00%	0.00%	0.00%	0.00%	1.10%
Northern Harrier	1.16%	7.14%	0.33%	21.98%	0.02%	4.40%
Prairie Falcon	0.29%	2.38%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	0.00%	0.00%	0.50%	32.97%	0.16%	34.07%
Rough-legged Hawk	1.45%	9.52%	0.00%	0.00%	0.00%	0.00%
Snowy Owl	0.29%	2.38%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	0.00%	0.00%	0.08%	4.40%	0.00%	1.10%
Turkey Vulture	0.00%	0.00%	0.15%	7.69%	0.03%	3.30%
Totals	**5.20%**		**1.19%**		**0.24%**	
Shorebirds						
Killdeer	0.00%	0.00%	0.63%	32.97%	0.16%	8.79%
Marbled Godwit	0.00%	0.00%	0.04%	2.20%	0.00%	0.00%
Spotted Sandpiper	0.00%	0.00%	0.00%	0.00%	0.01%	2.20%
Upland Sandpiper	0.00%	0.00%	0.29%	14.29%	0.00%	1.10%
Wilson's Phalarope	0.00%	0.00%	0.03%	2.20%	0.00%	0.00%
Wilson's Snipe	0.00%	0.00%	0.04%	3.30%	0.00%	0.00%
Totals	**0.00%**		**1.03%**		**0.17%**	
Woodpeckers						
Downy Woodpecker	0.00%	0.00%	0.01%	1.10%	0.00%	1.10%
Hariy Woodpecker	0.00%	0.00%	0.00%	0.00%	0.01%	2.20%
Northern Flicker	0.00%	0.00%	0.06%	4.40%	0.08%	9.89%
Red-headed Woodpecker	0.00%	0.00%	0.06%	3.30%	0.04%	2.20%
Yellow-shafted Flicker	0.00%	0.00%	0.15%	10.99%	0.00%	0.00%
Totals	**0.00%**		**0.28%**		**0.14%**	
Waterbirds						
Double-crested Cormorant	0.00%	0.00%	0.06%	1.10%	0.00%	1.10%
Great Blue Heron	0.00%	0.00%	0.03%	2.20%	0.02%	4.40%
Pied-billed Grebe	0.00%	0.00%	0.04%	3.30%	0.00%	0.00%
Totals	**0.00%**		**0.12%**		**0.03%**	
Crows and Allies						
American Crow	0.58%	2.38%	0.12%	7.69%	0.36%	4.40%
Black-billed Magpie	0.00%	0.00%	0.04%	3.30%	0.00%	0.00%
Blue Jay	0.00%	0.00%	0.15%	10.99%	0.08%	12.09%
Totals	**0.58%**		**0.32%**		**0.44%**	
Pigeons/Doves						
Mourning Dove	0.00%	0.00%	1.70%	46.15%	1.19%	38.46%
Rock Pigeon	0.00%	0.00%	0.04%	2.20%	0.05%	2.20%
Totals	**0.00%**		**1.74%**		**1.24%**	
Gamebirds						
Ring-necked Pheasant	5.20%	14.29%	5.39%	79.12%	0.50%	32.97%
Sharp-tailed Grouse	0.29%	2.38%	0.00%	0.00%	0.01%	1.10%
Totals	**5.49%**		**5.39%**		**0.52%**	
Cranes/Rails						
Sandhill Crane	0.00%	0.00%	0.01%	1.10%	0.55%	2.20%
Totals	**0.00%**		**0.01%**		**0.55%**	
Goatsuckers						
Common Nighthawk	0.00%	0.00%	0.01%	1.10%	0.00%	1.10%
Totals	**0.00%**		**0.01%**		**0.00%**	
Gulls/Terns						
Ring-billed Gull	0.00%	0.00%	0.01%	1.10%	0.00%	0.00%
Totals	**0.00%**		**0.01%**		**0.00%**	
Grand Totals	**100.00%**		**100.00%**		**100.00%**	

Table 4. Avian Species Observed by Point Count at Campbell County Wind Farm

Species	Number of Birds	Number of Occurrences	Winter 2011-2012 Points							Spring 2012 Points							Fall 2012 Points						
			1	2	3	4	14	15	16	1	2	3	4	14	15	16	1	2	3	4	14	15	16
Songbirds																							
Alder Flycatcher	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
American Goldfinch	56	88	0	0	0	0	0	0	0	1	1	5	2	5	1	9	7	3	3	12	18	7	14
American Robin	39	141	0	0	0	0	0	0	0	3	1	5	3	7	1	7	1	1	17	27	16	0	52
American Tree Sparrow	10	29	0	0	0	0	0	0	7	10	0	0	1	0	0	2	0	0	0	4	0	0	5
Baltimore Oriole	2	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Barn Swallow	50	96	0	0	0	0	0	0	0	4	10	2	4	6	5	7	21	18	2	2	1	9	5
Black-capped Chickadee	8	10	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	5
Blue Grosbeak	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Blue-winged Warbler	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bobolink	15	50	0	0	0	0	0	0	0	3	11	2	27	0	1	0	0	0	6	0	0	0	0
Brewer's Blackbird	8	16,562	0	0	0	0	0	0	0	2	0	0	0	0	1	0	15,500	5	1,000	0	4	0	50
Brown Thrasher	27	39	0	0	0	0	0	0	0	12	0	12	0	2	1	2	0	0	0	0	0	1	2
Brown-headed Cowbird	39	119	0	0	0	0	0	0	0	31	20	7	22	3	17	18	1	0	0	0	0	0	0
Cedar Waxwing	5	335	0	0	0	0	0	0	0	0	0	2	0	0	0	333	0	0	0	0	0	0	0
Chestnut-collared Longspur	10	11	0	0	0	0	0	0	0	9	0	0	1	0	0	0	1	0	0	0	0	0	0
Chipping Sparrow	8	30	0	0	0	0	0	0	0	0	0	26	0	0	0	2	0	0	0	0	2	0	0
Clay-colored Sparrow	14	83	0	0	0	0	0	0	0	14	0	44	3	0	0	1	6	0	0	0	0	4	11
Cliff Swallow	7	1,377	0	0	0	0	0	0	0	0	1,375	0	0	0	0	0	0	2	0	0	0	0	0
Common Grackle	70	2,937	0	0	0	0	0	0	0	307	2,045	32	231	28	12	140	0	8	13	15	301	0	5
Common Yellowthroat	6	6	0	0	0	0	0	0	0	0	0	1	1	0	1	3	0	0	0	0	0	0	0
Dark-eyed Junco	18	160	0	0	0	0	0	0	0	2	0	0	0	0	0	7	0	119	0	6	9	5	12
Dickcissel	8	20	0	0	0	0	0	0	0	0	1	3	4	0	4	8	0	0	0	0	0	0	0
Eastern Bluebird	6	9	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	2	0	1
Eastern Kingbird	35	69	0	0	0	0	0	0	0	14	1	3	2	5	4	0	3	2	6	2	8	17	2
European Starling	51	1,374	26	0	0	0	0	0	0	43	39	17	100	31	5	60	462	81	323	2	102	57	0
Field Sparrow	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0
Grasshopper Sparrow	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Grays Catbird	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Harris's Sparrow	7	18	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	12	2	0	0
Horned Lark	94	197	9	0	1	0	0	0	0	19	8	20	4	19	30	27	1	2	18	0	5	21	3
House Finch	2	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2
House Sparrow	14	67	0	22	0	0	0	0	0	2	0	8	0	1	0	0	0	2	7	0	3	0	0
House Wren	21	28	0	0	0	0	0	0	0	0	1	8	5	8	0	5	0	0	0	0	0	0	1
Lapland Longspur	8	502	0	0	64	0	0	36	142	0	0	0	0	0	0	60	0	0	100	0	0	0	0
Lark Bunting	5	17	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	15	1
Lark Sparrow	2	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Least Flycatcher	8	8	0	0	0	0	0	0	0	0	0	1	0	3	0	4	0	0	0	0	0	0	0
Loggerhead Shrike	2	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Orchard Oriole	15	17	0	0	0	0	0	0	0	1	1	1	2	3	1	4	0	0	0	0	1	1	0
Pine Siskin	1	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-eyed Vireo	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Red-winged Blackbird	75	4,305	0	0	0	0	0	0	0	54	30	4	123	8	9	432	625	260	608	1,401	241	250	60
Ruby-crowned Kinglet	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Savannah Sparrow	25	106	0	0	0	0	0	0	0	6	1	1	0	0	0	0	29	22	0	11	21	11	4
Say's Phoebe	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	0	0	0	0	0	1
Sedge Wren	4	5	0	0	0	0	0	0	0	2	0	0	2	0	0	1	0	0	0	0	0	0	0
Song Sparrow	28	31	0	0	0	0	0	0	0	15	0	0	5	0	0	0	6	1	0	0	0	0	4
Spotted Towhee	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Swainson's Thrush	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Tree Swallow	20	29	0	0	0	0	0	0	0	2	4	4	9	1	0	3	0	0	0	2	4	0	0
Vesper Sparrow	45	74	0	0	0	0	0	0	0	24	0	1	4	6	6	10	3	0	0	12	4	14	1
Warbling Vireo	12	14	0	0	0	0	0	0	0	0	0	1	0	7	2	2	0	0	0	0	0	0	0
Western Kingbird	35	78	0	0	0	0	0	0	0	7	4	5	2	8	9	1	29	3	1	2	5	2	0
Western Meadowlark	174	494	0	0	0	0	0	0	0	72	55	53	45	28	44	35	65	12	32	4	34	16	1
White-Crowned Sparrow	2	5	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0
White-throated Sparrow	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Willow Flycatcher	8	8	0	0	0	0	0	0	0	1	0	0	2	0	0	1	1	0	0	0	0	0	1
Yellow Warbler	9	11	0	0	0	0	0	0	0	1	1	1	1	7	0	0	0	0	0	0	0	0	0
Waterfowl																							
Blue-winged Teal	17	63	0	0	0	0	0	0	0	30	8	0	19	0	0	0	0	4	0	2	0	0	0
Canada Goose	7	271	0	0	0	0	0	0	0	2	1	0	2	0	0	0	35	0	0	80	1	150	0
Cinnamon Teal	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gadwall	5	12	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Green-winged Teal	3	7	0	0	0	0	0	0	0	4	2	0	1	0	0	0	0	0	0	0	0	0	0
Greater White-fronted Goose	1	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	0
Mallard	27	79	0	0	0	0	0	0	0	25	16	0	19	0	0	5	2	0	0	12	0	0	0
Northern Pintail	7	13	0	0	0	0	0	0	0	0	9	0	4	0	0	0	0	0	0	0	0	0	0
Northern Shoveler	5	17	0	0	0	0	0	0	0	0	1	0	18	0	0	0	0	0	0	0	0	0	0
Ruddy Duck	1	8	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood Duck	12	39	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	10	0	15	0	0	0
Raptors/Vultures/Owls																							
American Kestrel	4	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0
Bald Eagle	4	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooper's Hawk	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ferruginous Hawk	5	6	0	0	0	0	0	0	0	1	0	2	2	0	0	0	1	0	0	0	0	0	0
Golden Eagle	10	10	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Great-horned Owl	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Merlin	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Northern Harrier	35	36	1	2	0	1	0	0	0	2	0	0	7	0	0	0	0	1	0	0	0	0	0
Prairie Falcon	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-tailed Hawk	71	75	0	0	0	0	0	0	0	2	1	2	13	3	3	10	2	8	2	9	8	4	6
Rough-legged Hawk	10	10	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snowy Owl	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swainson's Hawk	5	7	0	0	0	0	0	0	0	2	2	1	0	0	4	2	0	0	0	0	4	0	2
Turkey Vulture	11	17	0	0	0	0	0	0	0	2	2	1	0	0	4	2	0	0	0	0	1	0	0
Shorebirds																							
Killdeer	42	83	0	0	0	0	0	0	0	24	6	2	7	0	1	6	0	1	0	30	6	0	0
Marbled Godwit	2	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Spotted Sandpiper	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Upland Sandpiper	17	22	0	0	0	0	0	0	0	1	8	0	3	2	1	4	0	0	0	0	0	1	0
Wilson's Phalarope	2	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Wilson's Snipe	3	3	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
Woodpeckers																							
Downy Woodpecker	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Hairy Woodpecker	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Northern Flicker	14	24	0	0	0	0	0	0	0	0	1	2	0	1	0	0	9	2	6	0	3	0	0
Red-headed Woodpecker	8	14	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	10	0	0
Yellow-shafted Flicker	10	11	0	0	0	0	0	0	0	3	0	1	1	2	1	3	0	0	0	0	0	0	0
Waterbirds																							
Double-crested Cormorant	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0
Great Blue Heron	7	7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	2	0	1	0	0	0
Pied-billed Grebe	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Crows and Allies																							
American Crow	12	96	0	0	0	0	0	0	2	4	1	1	0	0	3	0	0	0	0	0	0	2	83
Black-billed Magpie	3	3	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0
Blue Jay	23	29	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	3	0	6	0	9
Pigeons/Doves																							
Mourning Dove	97	405	0	0	0	0	0	0	0	11	10	26	11	28	17	20	36	20	6	149	41	19	11
Rock Pigeon	4	15	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	10
Gamebirds																							
Ring-necked Pheasant	136	542	13	1	0	0	0	0	4	85	35	39	75	28	24	105	29	26	15	34	8	9	18
Sharp-tailed Grouse	3	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Cranes/Rails																							
Sandhill Crane	3	130	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	128	0	0	0
Goatsuckers																							
Common Nighthawk	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Gulls/Terns																							
Ring-billed Gull	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Totals	1,783	31,451	50	29	65	3	5	38	156	678	3,520	356	819	263	214	1,400	16,880	621	2,171	1,951	883	774	385
Mean Use			6.33	4.83	10.83	0.50	0.83	6.33	26.00	52.15	270.77	27.38	63.00	20.23	16.46	107.69	1,298.46	47.77	167.00	150.08	67.92	59.54	29.62

Table 5. Avian Flight Heights at Campbell County Wind Farm	Winter 2011-2012				Spring 2012				Fall 2012			
	Observation		Individuals		Observation		Individuals		Observation		Individuals	
	#	%	#	%	#	%	#	%	#	%	#	%
Non-Raptors												
Above RSA (>118.5m)	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.28%	1	0.00%
Below RSA (<41.4m)	10	83.33%	233	78.19%	456	99.78%	5,693	99.30%	361	99.45%	22,914	99.99%
Within RSA (≥41.5m and ≤118.5m)	2	16.67%	65	21.81%	1	0.22%	40	0.70%	1	0.28%	1	0.00%
Raptors/Vultures/Owls												
Above RSA (>118.5m)	1	7.69%	1	7.69%	0	0.00%	0	0.00%	1	2.50%	1	2.38%
Below RSA (<41.4m)	9	69.23%	9	69.23%	57	100.00%	66	100.00%	35	87.50%	37	88.10%
Within RSA (≥41.5m and ≤118.5m)	3	23.08%	3	23.08%	0	0.00%	0	0.00%	4	10.00%	4	9.52%

Table 6. Point Count Individuals and RSA at Campbell County Wind Farm

Species	Winter 2011-2012						Spring 2012						Spring 2013					
	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA
Songbirds																		
Alder Flycatcher	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
American Goldfinch	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.26	41.67%	100.00%	0.00%	0.00%	0.00	0.70	53.13%	100.00%	0.00%	0.00%
American Robin	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.30	48.15%	100.00%	0.00%	0.00%	0.00	1.25	75.44%	100.00%	0.00%	0.00%
American Tree Sparrow	0.00	0.17	0.00%	0.00%	0.00%	0.00%	0.00	0.14	92.31%	100.00%	0.00%	0.00%	0.00	0.10	100.00%	100.00%	0.00%	0.00%
Baltimore Oriole	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Barn Swallow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.42	94.74%	100.00%	0.00%	0.00%	0.00	0.64	94.83%	100.00%	0.00%	0.00%
Black-capped Chickadee	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.09	50.00%	100.00%	0.00%	0.00%
Blue Grosbeak	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	50.00%	100.00%	0.00%	0.00%
Blue-winged Warbler	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Bobolink	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.48	43.18%	100.00%	0.00%	0.00%	0.00	0.07	100.00%	100.00%	0.00%	0.00%
Brewer's Blackbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	181.97	99.70%	100.00%	0.00%	0.00%
Brown Thrasher	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.37	70.59%	100.00%	0.00%	0.00%	0.00	0.05	80.00%	100.00%	0.00%	0.00%
Brown-headed Cowbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	1.30	89.83%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Cedar Waxwing	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	3.68	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Chestnut-collared Longspur	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.11	40.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Chipping Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.31	89.29%	100.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Clay-colored Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.68	96.77%	100.00%	0.00%	0.00%	0.00	0.23	100.00%	100.00%	0.00%	0.00%
Cliff Swallow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	12.91	100.00%	100.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Common Grackle	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	28.52	97.46%	100.00%	0.00%	0.00%	0.00	3.76	98.83%	100.00%	0.00%	0.00%
Common Yellowthroat	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.07	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Dark-eyed Junco	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.10	88.89%	100.00%	0.00%	0.00%	0.00	1.66	97.35%	100.00%	0.00%	0.00%
Dickcissel	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.22	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.07	50.00%	100.00%	0.00%	0.00%
Eastern Kingbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.32	58.62%	100.00%	0.00%	0.00%	0.01	0.44	85.00%	97.06%	2.94%	0.00%
European Starling	0.00	0.62	100.00%	100.00%	0.00%	0.00%	0.00	3.24	81.69%	100.00%	0.00%	0.00%	0.00	11.29	69.62%	100.00%	0.00%	0.00%
Field Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%
Grasshopper Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Grays Catbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Harris's Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	0.00%	0.00%	0.00%	0.00%	0.00	0.15	50.00%	100.00%	0.00%	0.00%
Horned Lark	0.00	0.24	10.00%	100.00%	0.00%	0.00%	0.00	1.40	34.65%	100.00%	0.00%	0.00%	0.00	0.55	96.00%	100.00%	0.00%	0.00%
House Finch	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	28.57%	100.00%	0.00%	0.00%
House Sparrow	0.00	0.52	100.00%	100.00%	0.00%	0.00%	0.00	0.12	72.73%	100.00%	0.00%	0.00%	0.00	0.13	58.33%	100.00%	0.00%	0.00%
House Wren	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.30	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Lapland Longspur	1.52	5.76	100.00%	73.55%	26.45%	0.00%	0.44	0.66	100.00%	33.33%	66.67%	0.00%	0.00	1.10	100.00%	100.00%	0.00%	0.00%
Lark Bunting	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Lark Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	50.00%	100.00%	0.00%	0.00%	0.00	0.18	81.25%	100.00%	0.00%	0.00%
Least Flycatcher	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Loggerhead Shrike	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Orchard Oriole	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.16	40.00%	100.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Pine Siskin	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Red-eyed Vireo	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Red-winged Blackbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	7.25	99.09%	100.00%	0.00%	0.00%	0.00	37.86	99.97%	100.00%	0.00%	0.00%
Ruby-crowned Kinglet	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Savannah Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	50.00%	100.00%	0.00%	0.00%	0.00	1.08	95.92%	100.00%	0.00%	0.00%
Say's Phoebe	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.10	22.22%	100.00%	0.00%	0.00%	0.00	0.03	66.67%	100.00%	0.00%	0.00%
Sedge Wren	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Song Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.22	20.00%	100.00%	0.00%	0.00%	0.00	0.12	90.91%	100.00%	0.00%	0.00%
Spotted Towhee	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Swainson's Thrush	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Tree Swallow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.25	95.65%	100.00%	0.00%	0.00%	0.00	0.07	100.00%	100.00%	0.00%	0.00%
Vesper Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.56	37.25%	100.00%	0.00%	0.00%	0.00	0.25	100.00%	100.00%	0.00%	0.00%
Warbling Vireo	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Western Kingbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.40	86.11%	100.00%	0.00%	0.00%	0.00	0.46	97.62%	100.00%	0.00%	0.00%
Western Meadowlark	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	3.63	7.27%	100.00%	0.00%	0.00%	0.00	1.80	89.02%	100.00%	0.00%	0.00%
White-Crowned Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.05	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
White-throated Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Willow Flycatcher	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.07	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Yellow Warbler	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.12	18.18%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Waterfowl																		
Blue-winged Teal	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.63	26.32%	100.00%	0.00%	0.00%	0.00	0.07	66.67%	100.00%	0.00%	0.00%
Canada Goose	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.05	40.00%	100.00%	0.00%	0.00%	0.00	2.92	99.62%	100.00%	0.00%	0.00%
Cinnamon Teal	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Gadwall	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.13	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Green-winged Teal	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	85.71%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Greater White-fronted Goose	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	1.65	100.00%	100.00%	0.00%	0.00%
Mallard	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.71	44.62%	100.00%	0.00%	0.00%	0.00	0.15	14.29%	100.00%	0.00%	0.00%
Northern Pintail	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.14	23.08%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Northern Shoveler	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.19	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Ruddy Duck	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Wood Duck	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	0.00%	0.00%	0.00%	0.00%	0.00	0.27	16.00%	100.00%	0.00%	0.00%
Raptors/Vultures/Owls																		
American Kestrel	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Bald Eagle	0.02	0.05	100.00%	50.00%	50.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Ferruginous Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.05	80.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Golden Eagle	0.05	0.12	80.00%	25.00%	50.00%	25.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Great-horned Owl	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Merlin	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Northern Harrier	0.00	0.10	100.00%	100.00%	0.00%	0.00%	0.00	0.26	95.83%	100.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%
Prairie Falcon	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.40	55.56%	100.00%	0.00%	0.00%	0.04	0.43	74.36%	86.21%	13.79%	0.00%
Rough-legged Hawk	0.00	0.12	40.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Snowy Owl	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.07	83.33%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Turkey Vulture	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.12	100.00%	100.00%	0.00%	0.00%	0.00	0.07	33.33%	100.00%	0.00%	0.00%
Shorebirds																		
Killdeer	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.51	39.13%	100.00%	0.00%	0.00%	0.00	0.41	24.32%	100.00%	0.00%	0.00%
Marbled Godwit	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	66.67%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Spotted Sandpiper	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.23	33.33%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Wilson's Phalarope	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	50.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	33.33%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Woodpeckers																		
Downy Woodpecker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Hariy Woodpecker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Northern Flicker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%	0.00	0.22	75.00%	100.00%	0.00%	0.00%
Red-headed Woodpecker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	50.00%	100.00%	0.00%	0.00%	0.00	0.11	100.00%	100.00%	0.00%	0.00%
Yellow-shafted Flicker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.12	81.82%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Waterbirds																		
Double-crested Cormorant	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Great Blue Heron	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.05	80.00%	100.00%	0.00%	0.00%
Pied-billed Grebe	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Crows and Allies																		
American Crow	0.00	0.05	100.00%	100.00%	0.00%	0.00%	0.00	0.10	44.44%	100.00%	0.00%	0.00%	0.00	0.93	100.00%	100.00%	0.00%	0.00%
Black-billed Magpie	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Blue Jay	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.12	9.09%	100.00%	0.00%	0.00%	0.00	0.20	83.33%	100.00%	0.00%	0.00%
Pigeons/Doves																		
Mourning Dove	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	1.35	60.98%	100.00%	0.00%	0.00%	0.00	3.10	88.65%	100.00%	0.00%	0.00%
Rock Pigeon	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.13	100.00%	100.00%	0.00%	0.00%
Gamebirds																		
Ring-necked Pheasant	0.00	0.43	0.00%	100.00%	0.00%	0.00%	0.00	4.30	8.44%	100.00%	0.00%	0.00%	0.00	1.31	23.53%	100.00%	0.00%	0.00%
Sharp-tailed Grouse	0.02	0.02	100.00%	0.00%	100.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Cranes/Rails																		
Sandhill Crane	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	1.42	99.22%	100.00%	0.00%	0.00%
Goatsuckers																		
Common Nighthawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Gulls/Terns																		
Ring-billed Gull	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Totals	**1.62**	**8.24**	**89.88%**				**0.44**	**79.67**	**79.99%**				**0.05**	**260.05**	**97.00%**			

Table 7a. Point Count Observations and Flight Direction at Campbell County Wind Farm, Winter 2011-2012									
Species	Number Flying	Number of Observations	Percentage of Flights in Various Flight Directions						
			N	NE	E	SE	S	SW	W	NW
Songbirds										
American Tree Sparrow	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	26	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Lark	1	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
House Sparrow	22	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lapland Longspur	242	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls										
Bald Eagle	2	2	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%
Golden Eagle	4	5	25.00%	25.00%	0.00%	0.00%	25.00%	0.00%	25.00%	0.00%
Northern Harrier	4	4	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	50.00%	0.00%
Prairie Falcon	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Rough-legged Hawk	2	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	50.00%
Snowy Owl	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gamebirds										
Ring-necked Pheasant	4	7	0.00%	25.00%	0.00%	0.00%	0.00%	25.00%	0.00%	50.00%
Sharp Tailed Grouse	1	1	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Crows and Allies										
American Crow	2	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTALS	**311**	**36**	**20.00%**	**15.00%**	**0.00%**	**0.00%**	**15.00%**	**10.00%**	**20.00%**	**20.00%**

Table 7b. Point Count Observations and Flight Direction at Campbell County Wind Farm, Spring 2012

Species	Number Flying	Number of Observations	Percentage of Flights in Various Flight Directions							
			N	NE	E	SE	S	SW	W	NW
Songbirds										
Alder Flycatcher	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Goldfinch	10	20	10.00%	0.00%	10.00%	0.00%	10.00%	0.00%	20.00%	0.00%
American Robin	13	22	7.69%	0.00%	0.00%	0.00%	30.77%	0.00%	23.08%	0.00%
American Tree Sparrow	12	5	0.00%	0.00%	0.00%	0.00%	58.33%	0.00%	33.33%	0.00%
Baltimore Oriole	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Barn Swallow	36	24	36.11%	0.00%	0.00%	0.00%	27.78%	0.00%	33.33%	0.00%
Black-capped Chickadee	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged Warbler	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	19	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.53%	0.00%
Brewer's Blackbird	3	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%
Brown Thrasher	24	24	4.17%	0.00%	0.00%	0.00%	4.17%	0.00%	8.33%	0.00%
Brown-headed Cowbird	106	38	5.66%	0.00%	17.92%	0.00%	0.00%	0.00%	8.49%	0.00%
Cedar Waxwing	335	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.60%	0.00%
Chestnut-collared Longspur	4	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chipping Sparrow	25	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	60	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cliff Swallow	1175	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Grackle	2529	56	1.38%	0.00%	1.94%	0.08%	82.64%	0.00%	5.69%	0.71%
Common Yellowthroat	0	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dark-eyed Junco	8	3	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%
Dickcissel	0	8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	0	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	17	20	0.00%	0.00%	5.88%	0.00%	0.00%	0.00%	5.88%	0.00%
European Starling	241	24	0.00%	0.00%	0.41%	0.00%	2.49%	0.00%	6.22%	0.00%
Grasshopper Sparrow	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gray Catbird	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Harris's Sparrow	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Lark	44	71	4.55%	0.00%	2.27%	0.00%	4.55%	0.00%	4.55%	0.00%
House Sparrow	8	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
House Wren	0	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lapland Longspur	60	2	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%
Lark Bunting	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lark Sparrow	1	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	0	8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Loggerhead Shrike	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%
Orchard Oriole	6	13	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
Pine Siskin	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-eyed Vireo	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-winged Blackbird	654	54	6.88%	0.00%	11.16%	0.00%	0.00%	0.00%	7.19%	0.00%
Ruby-crowned Kinglet	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Savannah Sparrow	4	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Say's Phoebe	2	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sedge Wren	0	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	4	20	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spotted Towhee	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Thrush	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Tree Swallow	22	16	9.09%	0.00%	13.64%	0.00%	4.55%	0.00%	13.64%	0.00%
Vesper Sparrow	19	32	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Warbling Vireo	0	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Kingbird	31	24	0.00%	0.00%	0.00%	0.00%	9.68%	0.00%	3.23%	0.00%
Western Meadowlark	24	125	4.17%	0.00%	8.33%	0.00%	4.17%	0.00%	0.00%	0.00%
White-Crowned Sparrow	5	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	0	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	2	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waterfowl										
Blue-winged Teal	15	15	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	73.33%	0.00%
Canada Goose	2	3	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cinnamon Teal	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gadwall	0	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Green-winged Teal	6	3	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mallard	29	25	20.69%	0.00%	44.83%	0.00%	13.79%	0.00%	13.79%	0.00%
Northern Pintail	3	7	33.33%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Shoveler	0	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ruddy Duck	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wood Duck	0	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls										
American Kestrel	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Ferruginous Hawk	4	4	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%
Great-horned Owl	2	2	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	23	23	30.43%	4.35%	13.04%	0.00%	17.39%	0.00%	17.39%	8.70%
Red-tailed Hawk	20	34	20.00%	10.00%	0.00%	10.00%	0.00%	0.00%	20.00%	0.00%
Swainson's Hawk	5	4	40.00%	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%
Turkey Vulture	11	8	63.64%	0.00%	0.00%	0.00%	0.00%	9.09%	9.09%	18.18%
Shorebirds										
Killdeer	18	31	5.56%	0.00%	0.00%	11.11%	11.11%	0.00%	16.67%	0.00%
Marbled Godwit	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	7	16	28.57%	0.00%	14.29%	0.00%	0.00%	0.00%	14.29%	0.00%
Wilson's Phalarope	1	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	1	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Woodpeckers										
Downy Woodpecker	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	4	4	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%
Red-headed Woodpecker	2	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-shafted Flicker	9	10	11.11%	0.00%	11.11%	0.00%	0.00%	0.00%	44.44%	0.00%
Waterbirds										
Double-crested Cormorant	4	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	2	2	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%
Pied-billed Grebe	0	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Crows and Allies										
American Crow	4	7	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	50.00%	0.00%
Black-billed Magpie	3	3	33.33%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue Jay	1	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pigeons/Doves										
Mourning Dove	75	54	4.00%	0.00%	21.33%	0.00%	6.67%	0.00%	18.67%	0.00%
Rock Pigeon	3	2	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	66.67%	0.00%
Gamebirds										
Ring-necked Pheasant	33	85	3.03%	0.00%	45.45%	0.00%	12.12%	0.00%	0.00%	0.00%
Cranes/Rails										
Sandhill Crane	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Goatsuckers										
Common Nighthawk	1	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gulls/Terns										
Ring-billed Gull	1	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTALS	**5,799**	**1,156**	**6.65%**	**0.14%**	**7.37%**	**0.21%**	**73.71%**	**0.03%**	**11.14%**	**0.75%**

Table 7c. Point Count Observations and Flight Direction at Campbell County Wind Farm, Fall 2012

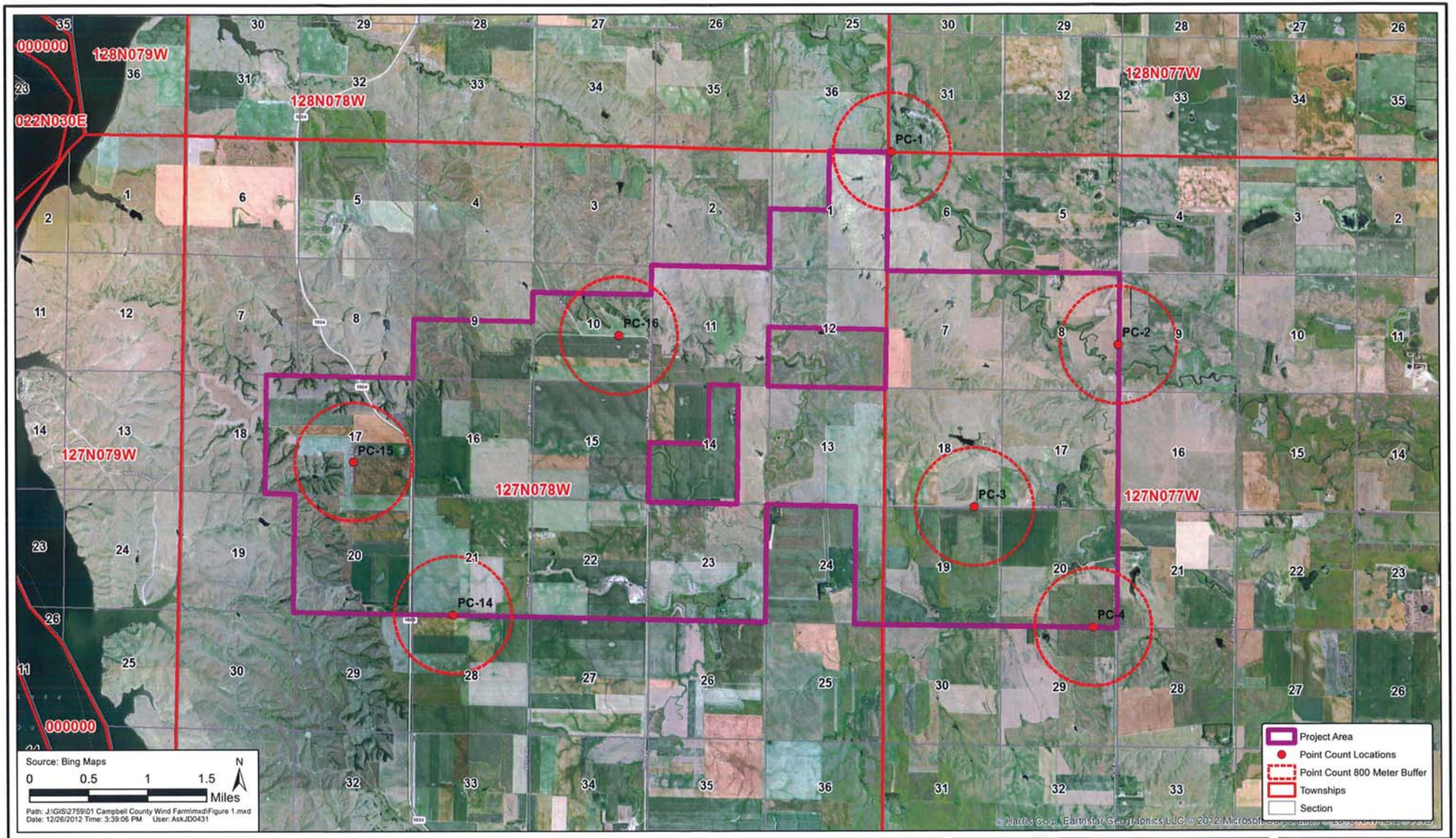
Species	Number Flying	Number of Observations	Percentage of Flights in Various Flight Directions							
			N	NE	E	SE	S	SW	W	NW
Songbirds										
American Goldfinch	34	36	0.00%	0.00%	0.00%	0.00%	8.82%	0.00%	50.00%	0.00%
American Robin	86	17	0.00%	0.00%	1.16%	0.00%	20.93%	0.00%	9.30%	0.00%
American Tree Sparrow	9	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Barn Swallow	55	26	25.45%	0.00%	9.09%	0.00%	18.18%	0.00%	27.27%	0.00%
Black-capped Chickadee	4	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue Grosbeak	1	2	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Bobolink	6	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Brewer's Blackbird	16,509	6	0.00%	0.00%	3.03%	0.00%	0.03%	0.00%	0.00%	0.00%
Brown Thrasher	4	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Brown-headed Cowbird	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chestnut-collared Longspur	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Chipping Sparrow	2	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	21	5	0.00%	0.00%	0.00%	0.00%	9.52%	0.00%	0.00%	0.00%
Cliff Swallow	2	2	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Grackle	338	14	2.37%	0.00%	0.30%	1.18%	0.89%	0.00%	1.78%	0.30%
Dark-eyed Junco	147	15	0.00%	0.00%	0.00%	0.00%	50.34%	0.00%	0.00%	0.00%
Eastern Bluebird	3	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	34	15	2.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	715	25	0.00%	3.64%	0.00%	41.96%	1.40%	0.00%	23.78%	0.00%
Field Sparrow	4	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grays Catbird	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Harris's Sparrow	7	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Lark	48	17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
House Finch	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
House Sparrow	7	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
House Wren	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lapland Longspur	100	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Lark Sparrow	13	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Orchard Oriole	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-winged Blackbird	3,444	21	4.36%	0.00%	0.00%	0.03%	19.60%	0.00%	0.29%	0.00%
Savannah Sparrow	94	18	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.26%	0.00%
Say's Phoebe	2	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	10	8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%	0.00%
Tree Swallow	6	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vesper Sparrow	23	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Kingbird	41	11	0.00%	0.00%	0.00%	0.00%	17.07%	0.00%	0.00%	0.00%
Western Meadowlark	146	49	11.64%	0.00%	0.00%	0.00%	0.00%	0.00%	9.59%	0.00%
White-throated Sparrow	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waterfowl										
Blue-winged Teal	4	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Canada Goose	265	4	0.00%	0.00%	13.21%	0.00%	86.79%	0.00%	0.00%	0.00%
Greater White-fronted Goose	150	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mallard	2	2	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wood Duck	4	5	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls										
American Kestrel	3	3	33.33%	0.00%	33.33%	0.00%	0.00%	0.00%	33.33%	0.00%
Ferruginous Hawk	1	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great-horned Owl	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Merlin	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	4	4	25.00%	0.00%	25.00%	0.00%	25.00%	0.00%	25.00%	0.00%
Red-tailed Hawk	29	37	20.69%	0.00%	10.34%	6.90%	31.03%	6.90%	10.34%	6.90%
Swainson's Hawk	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Turkey Vulture	2	3	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Shorebirds										
Killdeer	9	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%
Spotted Sandpiper	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Woodpeckers										
Downy Woodpecker	1	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hariy Woodpecker	2	2	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	50.00%	0.00%
Northern Flicker	15	10	6.67%	0.00%	6.67%	13.33%	6.67%	0.00%	13.33%	0.00%
Red-headed Woodpecker	10	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waterbirds										
Double-crested Cormorant	1	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	4	5	0.00%	0.00%	25.00%	0.00%	25.00%	0.00%	50.00%	0.00%
Crows and Allies										
American Crow	85	4	0.00%	0.00%	0.00%	94.12%	2.35%	0.00%	3.53%	0.00%
Blue Jay	15	12	6.67%	20.00%	0.00%	0.00%	20.00%	0.00%	6.67%	0.00%
Pigeons/Doves										
Mourning Dove	250	43	0.80%	0.00%	2.40%	0.00%	23.20%	0.00%	60.40%	0.00%
Rock Pigeon	12	2	83.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gamebirds										
Ring-necked Pheasant	28	40	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%
Sharp-tailed Grouse	3	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Cranes/Rails										
Sandhill Crane	128	2	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Goatsuckers										
Common Nighthawk	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
TOTALS	**22,956**	**562**	**6.82%**	**0.96%**	**22.94%**	**12.46%**	**43.13%**	**0.06%**	**13.52%**	**0.10%**

Table 8. Campbell County Wind Farm Incidental Observations

Species	Winter 2011-2012		Spring 2012		Fall 2012		TOTALS	
	Observations	Individuals	Observations	Individuals	Observations	Individuals	Observations	Individuals
Alder Flycatcher	0	0	1	1	0	0	1	1
American Avocet	0	0	2	3	0	0	2	3
American Coot	0	0	0	0	1	1	1	1
American Crow	1	2	2	3	3	9	6	14
American Goldfinch	1	12	0	0	0	0	1	12
American Kestrel	0	0	17	19	7	8	24	27
American Tree Sparrow	0	0	1	4	2	8	3	12
American Wigeon	0	0	7	13	0	0	7	13
Ammerican Coot	0	0	2	2	0	0	2	2
Bank Swallow	0	0	3	18	2	13	5	31
Barn Swallow	0	0	3	9	2	4	5	13
Black-billed Magpie	0	0	1	1	0	0	1	1
Blue Grosbeak	0	0	1	1	0	0	1	1
Blue Jay	4	24	2	2	0	0	6	26
Black-capped Chickadee	1	1	0	0	0	0	1	1
Blue-winged Teal	0	0	15	72	8	47	23	119
Blue-winged Warbler	0	0	1	1	0	0	1	1
Bobolink	0	0	0	0	1	5	1	5
Brewer's Blackbird	0	0	3	252	3	3,300	6	3,552
Broad-winged Hawk	0	0	1	3	0	0	1	3
Bufflehead	0	0	3	8	0	0	3	8
Canada Goose	0	0	2	19	0	0	2	19
Canvasback	0	0	0	0	1	2	1	2
Cedar Waxwing	0	0	1	1	0	0	1	1
Chestnut-collared Longspur	0	0	3	4	0	0	3	4
Clay-colored Sparrow	0	0	1	1	0	0	1	1
Cliff Swallow	0	0	5	1,250	0	0	5	1,250
Common Grackle	0	0	3	280	2	1,540	5	1,820
Common Yellowthroat	0	0	1	1	0	0	1	1
Cooper's Hawk	0	0	0	0	1	1	1	1
Dark-eyed Junco	0	0	1	4	1	6	2	10
Dickcissel	0	0	5	13	0	0	5	13
Double-crested Cormorant	0	0	2	6	0	0	2	6
European Starling	0	0	0	0	3	550	3	550
Ferruginous Hawk	0	0	1	1	1	1	2	2
Franklin's Gull	0	0	3	53	0	0	3	53
Gadwall	0	0	10	23	5	28	15	51
Grasshopper Sparrow	0	0	2	2	1	2	3	4
Gray Partridge	0	0	0	0	1	2	1	2
Great Blue Heron	0	0	3	3	2	2	5	5
Great-horned Owl	0	0	6	9	1	1	7	10
Green-winged Teal	0	0	1	2	2	3	3	5
Harris's Sparrow	0	0	1	1	4	21	5	22
Hooded Merganser	0	0	1	1	0	0	1	1
Horned Lark	9	16	0	0	2	26	11	42
House Finch	0	0	1	1	0	0	1	1
House Sparrow	0	0	2	11	2	11	4	22
House Wren	0	0	1	1	0	0	1	1
Lapland Longspur	0	0	1	2	0	0	1	2
Lark Sparrow	0	0	1	1	1	6	2	7
Lesser Scaup	0	0	3	11	0	0	3	11
Lesser Yellowlegs	0	0	1	6	0	0	1	6
Loggerhead Shrike	0	0	11	12	1	2	12	14
Mallard	0	0	20	54	2	6	22	60
Marbled Godwit	0	0	2	2	0	0	2	2
Merlin	0	0	1	1	0	0	1	1
Mountain Bluebird	0	0	0	0	1	1	1	1
Mourning Dove	0	0	0	0	3	190	3	190
Northern Flicker	0	0	0	0	4	6	4	6
Northern Harrier	0	0	31	32	2	2	33	34
Northern Pintail	0	0	10	18	1	1	11	19
Northern Shoveler	0	0	7	21	1	3	8	24
Pied-billed Grebe	0	0	6	6	7	50	13	56
Prairie Falcon	0	0	0	0	1	1	1	1
Redhead	0	0	1	2	6	38	7	40
Red-necked Phalarope	0	0	1	1	0	0	1	1
Red-tailed Hawk	1	1	20	20	44	48	65	69
Red-winged Blackbird	0	0	1	50	16	5,229	17	5,279
Ring-billed Gull	0	0	2	4	1	2	3	6
Ring-necked Duck	0	0	1	1	0	0	1	1
Ring-necked Pheasant	0	0	1	50	2	80	3	130
Rock Pigeon	0	0	4	50	2	33	6	83
Ruby-crowned Kinglet	0	0	1	1	0	0	1	1
Rough-legged Hawk	2	2	0	0	0	0	2	2
Savannah Sparrow	0	0	2	3	1	2	3	5
Say's Phoebe	0	0	5	5	1	1	6	6
Sharp-tailed Grouse	3	15	0	0	3	9	6	24
Sharp-shinned Hawk	1	1	0	0	0	0	1	1
Short-eared Owl	0	0	1	1	1	1	2	2
Snowy Owl	1	1	0	0	0	0	1	1
Swainson's Hawk	0	0	8	10	2	2	10	12
Tundra Swan	0	0	0	0	0	0	0	0
Turkey Vulture	0	0	3	9	3	10	6	19
Upland Sandpiper	0	0	2	10	0	0	2	10
Vesper Sparrow	0	0	0	0	1	1	1	1
Warbling Vireo	0	0	1	1	0	0	1	1
Western Kingbird	0	0	1	1	0	0	1	1
Willet	0	0	4	4	0	0	4	4
Wilson's Phalarope	0	0	6	20	0	0	6	20
Wilson's Snipe	0	0	2	3	0	0	2	3
Wood Duck	0	0	1	2	0	0	1	2
Yellow-headed Blackbird	0	0	2	11	0	0	2	11
Yellow-shafted Flicker	1	1	1	1	0	0	2	2
Totals	**25**	**76**	**286**	**2,525**	**165**	**11,315**	**465**	**13,885**

Table 9. Raptor Nest Observations at Campbell County Wind Farm				
Raptor Nest Number	**Species**	**Activity**	**Lat**	**Long**
1	Swainson's Hawk	Inactive	45.79916011	-100.2039864
2	Red-tailed Hawk	Active	45.80605092	-100.2764625
3	Red-tailed Hawk	Inactive	45.81246727	-100.1837823
4	Red-tailed Hawk	Active	45.79927381	-100.2462607
5	Red-tailed Hawk	Inactive	45.79857987	-100.2988624
6	Red-tailed Hawk	Inactive	45.78346464	-100.2703123
7	Red-tailed Hawk	Active	45.79503927	-100.1875049
8	Red-tailed Hawk	Inactive	45.8177952	-100.1786046
9	Red-tailed Hawk	Inactive	45.81279426	-100.1973169
10	Red-tailed Hawk	Active	45.83409427	-100.1836162
11	Red-tailed Hawk	Active	45.83040345	-100.2542095

Table 10. Sharp-tailed Grouse Lek Observations at Campbell County Wind Farm					
Lek Number	**Date**	**Number of Birds Observed**	**Habitat**	**Lat**	**Long**
1	5/14/2010 4/9/2012 4/17/2012	6 1 1	Grassland/Alfalfa	45.790497	-100.177643
2	4/9/2012 4/17/2012	1 5	Grassland	45.812489	-100.339138
3	4/9/2012 4/17/2012 4/24/2012	22 10 17	Grassland	45.842823	-100.279962



Fagen Engineering, LLC

Campbell County Wind Farm-Campbell County, South Dakota
Project Boundary and Point Count Locations

Wenck
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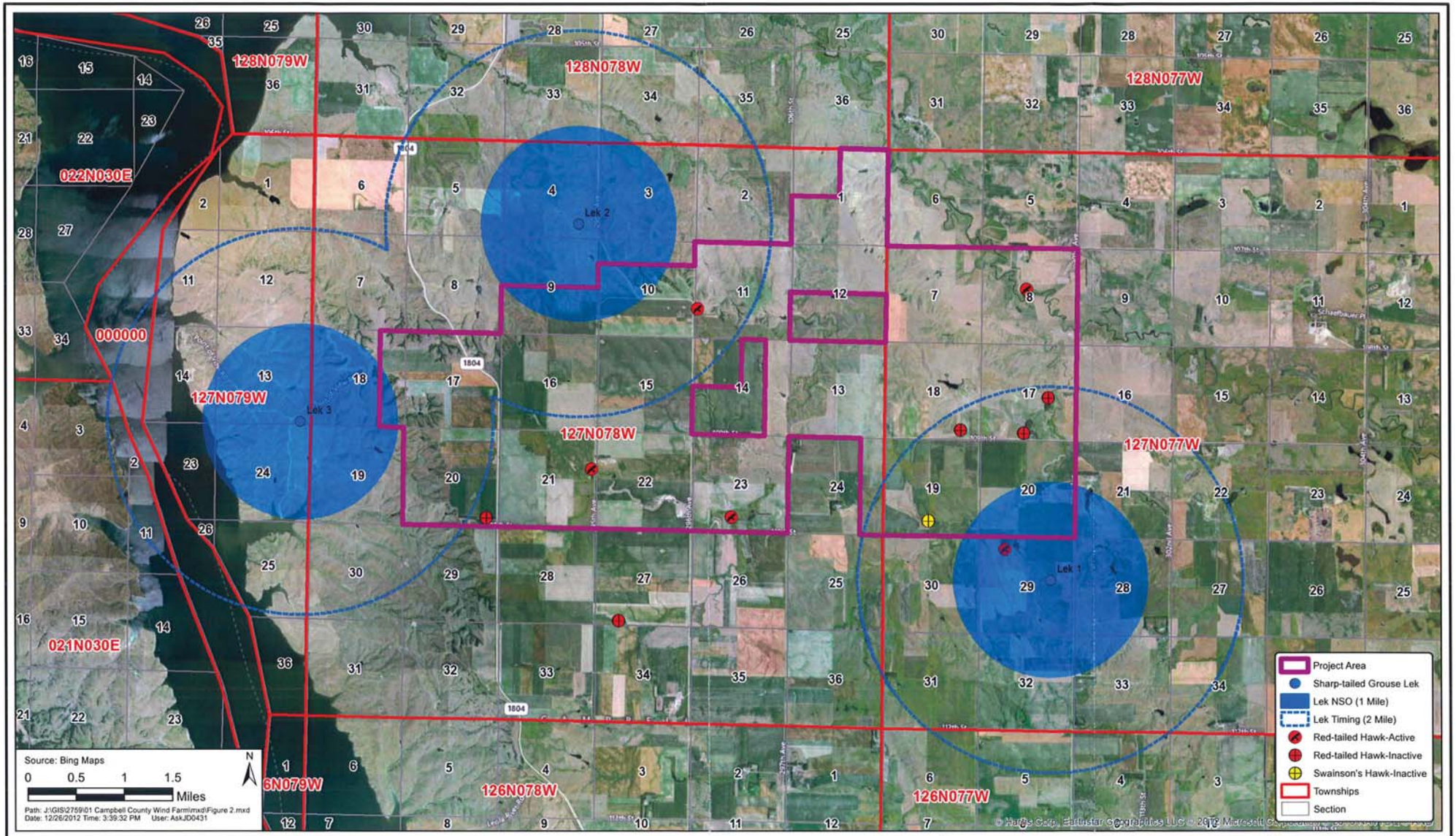
www.wenck.com
301 1st Street NE Suite 202
Mandan, ND 58554-3370
701-751-3370

DEC 2012

FIGURE 1



Fagen Engineering, LLC

Campbell County Wind Farm-Campbell County, South Dakota
Raptor Nest and Sharp-tailed Grouse Lek Locations

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www.wenck.com
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Mandan, ND 58554-3370
701-751-3370

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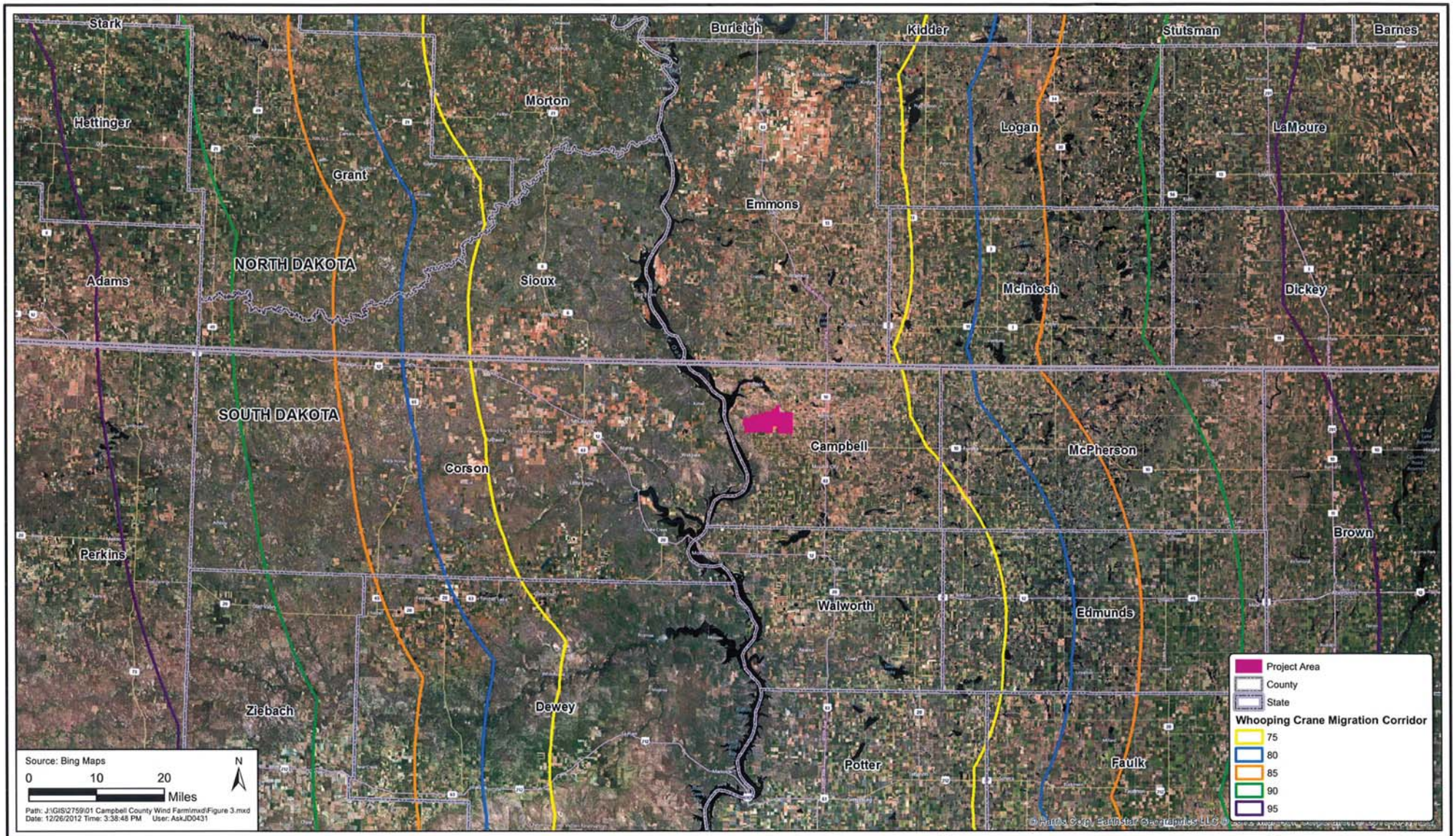
FIGURE 2



Fagen Engineering, LLC

Campbell County Wind Farm-Campbell County, South Dakota
Whooping Crane Migration Corridor

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
301 1st Street NE Suite 202
Mandan, ND 58554-3370
701-751-3370

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FIGURE 3

Avian Survey
Campbell County Wind Farm

Campbell County, South Dakota

January 2011

Prepared for:
Dave Plagge
Environmental Coordinator
Fagen Engineering, LLC.
180 8th Avenue
Granite Falls, MN 56241

Prepared by:
WPC, Inc.
PO Box 1401
Bismarck, ND 58504

Campbell County Wind Farm

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1.0 INTRODUCTION

Dakota Plains Energy, Inc. is planning to develop a wind energy facility in Campbell County, South Dakota. The Campbell County Wind Farm (CCWF) is located on private land in north central South Dakota, 5 miles west of Herreid, SD (Figure 1). Western Plains Consulting (WPC) was contracted by Fagen Engineering Inc. to conduct a variety of wildlife surveys at the proposed facility location.

This data from this report will be used to identify wildlife species or species groups of concern that may be at a higher mortality risk and/or displacement from wind farm development. Data in this report are presented in species groupings, and highlight federally listed species, state listed species, and other species of concern.

1.1 Diurnal Fixed-Point and Incidental Avian Use Surveys

Spring and fall are migration periods for non-resident avian species. During the spring, birds are moving north from wintering grounds to summer breeding grounds. In the fall, birds are moving south to wintering grounds. Spring and fall are prime time periods to conduct avian surveys on potential wind farm areas to observe migratory species and resident species.

Avian surveys focus on inventory and monitoring with specific objectives that include: 1) an inventory of all the bird species in a specific project area; 2) determining the relative abundance of species; and 3) monitoring seasonal changes in species composition and relative abundance (Whitworth et al. 2007). Diurnal fixed-point surveys are one of the most common methods used to determine avian composition and abundance. Point counts not only focus on visual cues but also on auditory cues to give the observer an advantage in rough terrain. For some species, vocal cues may be the only reliable means of detection; for example, most counts of secretive rails in heavily vegetated marshes have relied on vocal cues for determining their presence and abundance (Whitworth et al. 2007).

Incidental avian surveys are used to determine bird distribution and composition between point count locations. Larger birds, such as game birds, raptors, and waterfowl, large flocks of smaller birds, and birds that are a rarity in the area are commonly recorded during incidental surveys.

1.2 Sharp-tailed Grouse

Male sharp-tailed grouse congregate at historical/communal leks in the spring to compete for breeding opportunities. Both sexes return to their natal breeding grounds yearly for their entire life. Leks are typically found in areas with low vegetative growth on a hill, knoll or other point of high visibility. Fidelity to these locations is extremely high for sharp-tailed grouse. Sharp-tailed grouse require nesting habitat within close proximity the lek that is comprised of dense or residual vegetative cover to conceal and protect their nest from predators (Vodehnal and Haufler 2007).

Due to the fact that sharp-tailed grouse typically fly low to the ground, mortality from a turbine collision is low. Fences and power lines, however, may be a significant cause of direct mortality by collision (Bidwell et al. 2003). Disturbance of nesting prairie grouse may occur from the construction of turbines, turbine noise, and physical movement of turbines during operation (Robel et al. 2004). Loss of habitat and fragmentation related to wind energy development may affect local prairie grouse populations by decreasing the area of habitat available for nesting and brood-rearing and by increasing predation (Pittman et al. 2005). Therefore, federal and state wildlife agencies are concerned about the placement of turbines in areas with known prairie grouse populations. Turbine setbacks from leks and minimizing grouse habitat disturbance may reduce the direct and indirect effect of wind development on grouse.

1.3 Whooping Cranes

The whooping crane (*Grus americana*) is a federally listed endangered species. Whooping crane injury or death caused by any wind energy project feature would be considered "take" under the Endangered Species Act. Avoidance of habitat by the cranes due to the construction and operation of turbines can be considered habitat loss and 'take" under ESA.

It is unknown how whooping cranes would respond to the presence of wind turbines. Avoidance of wind farms by whooping cranes may reduce the probability of collision, but could amount to loss of stopover habitat. The construction and operation of wind turbines could result in direct mortality from collision with the turbines or by avoidance of habitat in areas where turbines are located.

Power lines located in the vicinity of foraging or roosting habitat pose a threat to whooping cranes due to individual birds often flying at low altitudes (33 to 49 feet above ground) when moving among foraging and roosting sites (Canadian Wildlife Service and United States Fish and Wildlife Service 2005, Stehn and Wassenich 2006). Since 1956, at least 46 whooping cranes have been killed or seriously injured as a result of collisions with power lines (Stehn and Wassenich 2006).

1.4 Raptor Nests

Raptors spend much of their time hunting and soaring within elevation ranges that correspond to the wind turbine rotor-sweep-area (RSA), making them susceptible to turbine blades (Erickson et al. 2002). Because raptors are long-lived species with low reproduction rates, potential population impacts from significant collision-related facilities are of concern (Erickson et al. 2002). Although specific studies are lacking, adults and recently fledged young could be at risk of collision with turbines because of their increased use of the areas near nest sites. Adult raptors often fly near nest sites during the breeding season to attend to young and deliver prey. After young raptors fledge, fledglings often spend significant amounts of time flying and roosting near nest locations until they become capable flyers and hunters. Additionally, construction activities near active nests during the breeding season may potentially result in disturbance or abandonment of nest sites.

2.0 METHODS

2.1 Diurnal Fixed-point and Incidental Avian Use Surveys

Fixed-point Surveys

Avian point count surveys were conducted in the spring and fall, 2010 to capture both migration periods. Survey data was used to evaluate avian use, behavior, and species composition during fall and spring migration at the CCWF. Diurnal fixed-point count surveys were conducted for 20 minutes at 16 circular plots (Figure 2). Point counts (PC) were selected in diverse habitats and at locations with the best possible view shed (Appendix I). Spring surveys were conducted weekly between March 31 and June 20, 2010, and fall surveys between August 17 and November 2, 2010 (Table 1).

All observations within the 800-meter radius circle at each PC were recorded. Any observation outside the 800-meter-radius was considered an incidental observation. The time duration of each PC survey was 20 minutes during which all audio and visual observations were recorded. Surveys were conducted weekly by one observer. Surveys were conducted during all daylight hours of the day and survey schedules were rotated to ensure each PC was surveyed at various times of the day each week. Data was recorded for each observation, including species, number of individuals, time, and height above ground, behavior, and flight direction. Flight heights and distances from the observer were estimated by an experienced field ornithologist by using a range finder and topographic maps.

The data collected provides results that can be used to potentially project the effects of wind turbines at CCWF on avian species. This survey protocol allows an estimate of the avian use throughout the day and captures a variety of bird species. Songbirds are most active in the morning during the breeding season and can be difficult to detect during the afternoon, whereas raptors become more active several hours after sunrise when the sunlight heats the air and creates thermals, which individuals use for soaring.

Twenty-minute (20) survey periods provide adequate time to detect both raptors and non-raptors. Double counting may occur during the 20 minute survey because individuals may appear and disappear from view. 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-minutes, not number of distinct individual birds.

The ability to detect all species within the 800-meter survey varies among species and potentially not all individuals within the 800-meter survey were counted. This variation in detectability results in an overestimate of mean use in conspicuous species and an underestimate of mean use in reclusive species (Thompson 2002). Birds not easily identifiable due to low light conditions and distance were identified to the lowest taxonomic level possible.

Incidental Observations

Incidental observations included observations that occurred while traveling between PC locations, pre-and post-PC survey, and outside the 800-meter radius circular plot. These observations were recorded but not used in the formal analysis. Incidental observations are presented in Table 8.

Species Groupings

The data is presented in two primary groups of interest: raptors and non-raptors. Raptors were defined as vultures, hawks, eagles, falcons, and owls. Non-raptors were defined as all other avian species.

Mean Avian Use

Mean use was calculated by dividing the total number of birds per species observed by the total number of surveys conducted. Mean use was also calculated for each individual point count location to determine if there are areas with a higher mean use than other areas. The number of observations is also presented, this information helps depict whether a high mean use is driven by a single observation.

Flight Behavior

Flight behavior was evaluated by calculating the proportion of flying birds that were observed flying below, within, or above the turbine RSA. Dakota Plains Energy, Inc. is proposing GE 1.5 MW turbines; these turbines have a hub height of 80 meters with a 77 meter diameter RSA. Therefore, a RSA between 41.5 and 118.5 meters above the ground was used in the analysis.

Encounter Rate

The encounter rate is the rate in which a species was observed flying through the RSA during the avian point count surveys at CCWF and suggests potential mortality risk from flight height behavior.

To estimate the rate at which a species flies through the RSA, the following equation was applied to every species observed in the CCWF:

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

- A is the mean use of birds/20 minutes for a given species.
- P_f is the proportion of all activity observations for a given species that were flying
- P_t is the proportion flying observations that were within the turbine RSA

2.2 Sharp-tailed Grouse

Sharp-tailed grouse surveys were conducted in early April through early May 2010, from ½ hour before sunrise to two hours after sunrise. Peak attendance by females on leks typically occurs from April 15 to 25, but these dates vary by up to a week depending on weather conditions (Schroeder and Robb 1993). Listening stops were made throughout the project area to identify lek locations. Sharp-tailed grouse males may be heard at a distance of up to 0.50 mile. Listening stops were not conducted if winds exceeded 10 miles per hour (mph) or during precipitation events. After a lek was located, the birds were observed and the number of males and females were counted. Lek locations were documented using Global Positioning System (GPS) coordinates. Given the sensitive nature of this species, and the fact that females may be nesting near the lek, disturbance to breeding prairie grouse was kept to a minimum.

2.3 Whooping Cranes

Sandhill/Whooping crane surveys were conducted between early April and the end of April 2010 and again from early October to early November 2010 when the highest numbers of cranes are expected to occur in the project area (USFWS 2007). Ground searches were conducted throughout the day starting ½ hour before sunrise and ending at sunset. Sandhill/Whooping crane surveys were conducted by driving a vehicle along the roads within the vicinity of the project area. Stops were made at good vantage points and the biologist glassed and listened for the presence of cranes. On calm mornings sandhill cranes may be heard at a distance of 2.5 miles (Tacha et al. 1992). Each stop consisted of listening and using binoculars and/or spotting scopes to scan the surrounding terrain to visually identify sandhill and/or whooping cranes. Listening stops were conducted but not limited to established avian point count locations. Stops were not conducted during excessively harsh weather conditions.

Determination of the Attractiveness of the CCWF to Whooping Cranes

A landscape scale analysis to assess the potential occurrence of and risk to whooping cranes was conducted by evaluating the wetland/agricultural landscape features at CCWF and surrounding area. The potential risk to the whooping crane is related to the potential for the cranes to occur on the ground. The analysis involved: 1) determining the acreage of wetlands on the CCWF, 2) comparing the proportion of the CCWF in wetlands to the proportion of wetlands within a 10-mile-wide buffer zone around the CCWF, and 3) determining the proportion of land cover on the CCWF within 1 km (0.62 miles) of an agricultural field. The proportion of the CCWF containing a wetland-agricultural matrix and within a 10-mile buffer zone of the CCWF was indentified in order to assess the relative attractiveness of the CCWF to whooping cranes.

The United States Department of Agriculture (USDA) National Land Cover Dataset (NLCD) data for North Dakota and South Dakota was used to determine the total acreage of wetlands of any size within the CCWF and within 10 miles in each direction of the CCWF (Figure 4). The percentage of total acreage of the CCWF that was comprised of wetlands and the percentage of the total acreage of a 10-mile-wide buffer zone around the CCWF that was wetlands were

calculated and compared to determine whether the CCWF contained more wetlands than the surrounding area (Tetra Tech 2008).

2.4 Raptor Nests

A raptor nest survey was conducted to locate raptor nests and determine nest activity status and the species using those nests. The initial surveys were conducted in early April, before trees leaf out, to locate nests and to identify early breeding species. The project area was surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations were documented with GPS coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data were recorded for each nest. An additional visit was conducted in May 2010 to document the activity status of nests located during the initial survey and identify nesting attempts by late nesting raptors such as Swainson's hawks. Raptors may use nests intermittently among years as well as re-nest after a nest failure; therefore, early and late-season nest surveys allow for a more accurate summary of breeding raptors.

3.0 RESULTS (Spring and Fall 2010)

3.1 Campbell County Wind Farm

Of the approximately 20,120 acres that comprise the CCWF, approximately 7,900 acres were surveyed during PC surveys, covering 26.3 percent of the total area. Eleven point count locations were partially outside the CCWF (Figure 2). The spring and fall 2010 surveys were conducted 12 times, each season at 16 PC locations, which resulted in a total of 192, 20-minute spring 2010 surveys and 192 20-minute fall 2010 surveys (Table 1).

3.2 Species Composition

The spring 2010 survey consisted of 13,337 avian individuals (83 different species) that were recorded during the 192 fixed-PC surveys (Table 2). The most frequently observed birds were unidentified blackbird *(Icteridae)* (34.56 percent of all birds observed), red-winged blackbird *(Agelaius phoeniceus)* (13.59 percent), Franklin's gull *(Larus pipixcan)* (7.81 percent) and ring-necked pheasant (*Phasianus colchicus),* (5.59 percent), (Table 3). The remaining 79 species comprised 38.45 percent of the total number of birds observed.

The fall 2010 survey consisted of 8,698 avian inividuals (75 different species) that were recorded during the 192 fixed PC surveys (Table 2). The most frequently observed birds were unidentified blackbirds, (36.80 percent of all birds observed), brewer's blackbird (*Euphagus cyanocephalus)* (23.35 percent), western meadowlark (*Sturnella neglecta* (8.93 percent) and ring-necked pheasant (4.61 percent) (Table 3). The remaining 71 species comprised 26.31 percent of the total birds observed.

3.3 Avian Use

Spring 2010 overall mean bird use within the CCWF was 69.46 birds/20 min (Table 4a). The overall mean use by non-raptors was 68.76 birds/20 min; the highest were unidentified blackbirds (24.01 birds/20 min), red-winged blackbird (9.44 birds/20 min), Franklin's gull (5.42 birds/20 min) and ring-necked pheasant (3.88 birds/20 min) (Table 2). Mean use for non-raptors was the highest at PC #7 (approximately 26.43 birds/20 min) and observations at this point included high numbers of unidentified blackbird's (4,445 individuals) and Franklin's gull (331 individuals) (Table 4a).

Fall 2010 overall mean bird use within the CCWF was 45.30 birds/20 min (Table 4b). The overall mean use by non-raptors was 44.88 birds/20 min; the highest mean use species were unidentified blackbird (16.67 birds/20 min), Brewer's blackbird (10.58 birds/20 min), western meadowlark (4.05 birds/20 min) and ring-necked pheasant (2.09 birds/20 min) (Table 2). Mean use for non-raptors was the highest at PC #12 (11.56 birds/20 min) and observations at this point included high numbers of Brewer's blackbird (2,013 individuals) and rock pigeon (72 individuals) (Table 4b).

Among spring 2010 species groups, overall mean use was highest for songbirds (52.44 birds/20 min) and included unidentified blackbird (24.01 birds/20 min), red-winged blackbird (9.44 birds/ 20 min), western meadowlark (3.47 birds/20 min), and horned lark *Eremophila alpestris* (3.17 birds/20 min). Gulls/terns had the second highest mean use (5.55 birds/20 min).

For fall 2010 species groups, overall mean use was highest for songbirds (37.03 birds/20 min) and included unidentified blackbird (16.67 birds/20 min), Brewer's blackbird (10.58 birds/20 min), western meadowlark (4.05 birds/20 min) and unidentified sparrow (*Emberizidae*) (3.17 birds/20 min). Game birds had the second highest mean use (2.33 birds/20 min).

Raptors are a group of special interest avian species because of their propensity to fly at heights within a turbine RSA. Overall spring 2010 mean use for raptors was 0.70 birds/20 min. Eleven raptor species were identified during the spring PC survey: red-tailed hawk (*Buteo jamaicensis*) (0.30 birds/20 min), northern harrier (*Circus cyaneus*) (0.17 birds/20 min); turkey vulture (*Carthartes aura*), American kestrel (*Falco sparverius*), Swainson's hawk (*Buteo swainsoni*) and burrowing owl (*Athene cunicularia*) each had a mean use of 0.05 birds/20 min; and golden eagle (*Aquila chrysaetos*), merlin (*Falco columbarius*), bald eagle (*Haliaeetus leucocephalus*), Cooper's hawk (*Accipiter cooperii*) and great-horned owl (*Bubo virginianus*) each had a mean use of 0.05 birds/20 min (Table 2).

Overall fall 2010 mean use for raptors was 0.40 birds/20 min. Ten raptor species were identified during the PC survey: northern harrier (0.14 birds/20 min), red-tailed hawk (0.13 birds/20 min), turkey vulture (0.06 birds/20 min), American kestrel (0.03 birds/20 min), Swainson's hawk, golden eagle, Cooper's hawk, unidentified buteo (*Buteo* sp.), rough-legged hawk (*Buteo lagopus*), sharp-shinned hawk (*Accipiter striatus*) each had a mean use of 0.01 birds/20 min (Table 2).

3.4 Frequency of Occurrence

The ring-necked pheasant was the most common species present (92.19 percent of all surveys) and was most widely distributed throughout CCWF in the spring 2010 surveys (Table 4a). Other frequently occurring species included western meadowlark (91.15 percent of all surveys), horned lark (78.65 percent of all surveys), red-winged blackbird (73.44 percent of all surveys), brown-headed blackbird (*Molothrus ater*) (48.96 percent of all surveys) and mourning dove (*Zenaida macroura*) (46.88 percent of all surveys) (Table 3).

Western meadowlark was the most common species present (44.79 percent of all surveys) and most widely distributed throughout CCWF (Table 4b) in the fall 2010 surveys. Other frequently occurring species included ring-necked pheasant (40.63 percent of all surveys), mourning dove (32.29 percent of all surveys), horned lark (30.21 percent of all surveys), and American goldfinch (*Carduelis tristis*) (22.40 percent) (Table 3).

3.5 Flight Height and Encounter Rate

During the spring 2010 avian use surveys 80.69 percent of all individuals observed were flying (Table 6a). Flight height and flight direction data was recorded for 100 percent of flying birds (Table 7a). Approximately 44.34 percent of flying raptor species flew below the RSA, 52.83 percent flew within the RSA, and 2.83 percent flew above the RSA. For all other species, approximately 65.76 percent flew below the RSA, 31.74 percent flew within the RSA, and 2.51 percent flew above the RSA (Table 5).

During spring 2010, red-tailed hawks had the highest raptor species encounter rate (0.16 birds flying within the RSA/20 min), this was followed by turkey vulture (0.05 birds flying within the RSA/20 min), American kestrel (0.03 birds flying within the RSA/20 min), northern harrier (0.03 birds flying within the RSA/20 min), Swainson's hawk (0.02 birds flying within the RSA/20 min), and golden eagle (0.01 birds flying within the RSA/20 min) (Table 6a).

Unidentified blackbird had the highest non-raptor spring 2010 encounter rate (5.13 birds flying within the RSA/20 min), followed by Franklin's gull (4.15 birds flying within the RSA/20 min), and barn swallow (*Hirundo rustica*) (2.09 birds flying within the RSA/20 min) (Table 6a).

During the fall 2010 avian use surveys, 94.92 percent of all individuals observed were flying (Table 6b) Flight height and flight direction data was recorded for 100 percent of flying birds (Table 7b). Approximately 35.71 percent of flying raptor species flew below the RSA, 57.14 percent flew within the RSA, and 7.14 percent flew above the RSA. For all other species, approximately 50.26 percent flew below the RSA, 42.23 percent flew within the RSA, and 7.51 percent flew above the RSA (Table 5).

During fall 2010, red-tailed hawks had the highest raptor species encounter rate (0.09 birds flying within the RSA/20 min), turkey vulture (0.05 birds flying within the RSA/20 min), northern harrier (0.05 birds flying within the RSA/20 min), rough-legged hawk (0.01 birds flying within the RSA/20 min), sharp-shined hawk (0.01 birds flying within the RSA/20 min), Cooper's

hawk (0.01 birds flying within the RSA/20 min), Swainson's hawk (0.01 birds flying within the RSA/20 min), and golden eagle (0.01 birds flying within the RSA/20 min.) (Table 6b).

Unidentified blackbird had the highest non-raptor fall 2010 encounter rate (13.96 birds flying within the RSA/20 min). This was followed by Franklin's gull (1.18 birds flying within the RSA/20 min), unidentified sparrow (1.04 birds flying within the RSA/20 min), and western meadowlark (0.62 birds flying within the RSA/20 min) (Table 6b).

3.6 Sensitive Species Observations

A total of 11 sensitive species were recorded during the spring and fall 2010 PC and incidental surveys. This included a state endangered species, peregrine falcon (*Falco peregrinis;* one individual), and a state threatened species, bald eagle (one individual). Nine (9) state sensitive species were also observed at the CCWF, bobolink (*Dolichonyx orysivorus;*199 individuals), marbled godwit (*Limosa fedoa;* 23 individuals), Swainson's hawk (11 individuals), burrowing owl (nine individuals), dicksissel (*Spiza americana;* six individuals), golden eagle (three individuals), Loggerhead shrike (*Lanius ludovicianus;* two individuals), and long-billed curlew (*Numenius americanus;* two individuals). Additionally, both bald eagles and golden eagles are protected under the Bald and Golden Eagle Protection Act.

3.7 Flight Direction

Birds observed flying during the spring 2010 surveys were generally flying in a southerly direction (36.28 percent). This was followed by variable directions (19.77 percent), northwest (10.43 percent), north (10.92 percent), southeast (9.71 percent), east (4.08 percent), west (3.55 percent), northeast (3.35 percent), and southwest (1.90 percent) (Table 7a).

Birds during the fall 2010 surveys were observed flying in a southerly direction (66.67 percent). This was followed by directions of southeast (8.26 percent), variable directions (6.43 percent), east (4.80 percent), north (4.54 percent), west (4.53 percent), northeast (2.43 percent), northwest (1.89 percent), and southwest (0.45 percent) (Table 7b).

3.8 Incidental Surveys

During the spring 2010 incidental survey, staff documented 26 species and a total of 1,529 individuals over 12 survey periods (Table 8). European starling (*Sturnus vulgaris*) was the most commonly recorded species during the incidental surveys within the CCWF (633 individuals). This was followed by red-winged blackbird (436 individuals), and Franklin's gull (126 individuals). Two species, blue jay (*Cyanocitta cristata*) and common tern (*Sterna hirundo*), were detected during incidental surveys, but not during spring 2010 point count surveys (Table 8).

During the fall 2010 incidental survey, staff documented 14 species and a total of 90 birds over 12 survey periods (Table 8). Red-tailed hawk was the most commonly recorded species during

the incidental surveys within the CCWF (32 individuals). This was followed by American crow (*Corvus caurinus*) (12 individuals), northern harrier (10 individuals) and Swainson's hawk (9 individuals). Four species including bald eagle, northern pintail (*Anas acuta*), burrowing owl and peregrine falcon (*Falco peregrines*) were detected during incidental surveys, but not during fall 2010 point count surveys (Table 8).

3.9 Sharp-tailed Grouse Leks

One (1) sharp-tailed grouse lek was located during the spring 2010 survey (Figure 3). Lek number, date, sex and number of birds present, habitat and GPS coordinates were recorded (Table 10). The lek was visited twice during the spring lekking season. The lek was located in at T127N-R077W-Section 29, S ½ of the NE ¼. Five (5) males and 1 female sharp-tailed grouse were observed.

3.10 Whooping Crane

No whooping cranes were sighted during the spring or fall 2010 survey. Two (2) sandhill crane groups with a total of 153 individuals were observed during the spring 2010 survey. Five (5) sandhill crane groups with a total of 110 individuals were observed during the fall 2010 survey.

Attractiveness of the CCWF to Whooping Cranes

The CCWF and the 10-mile buffer zone were analyzed for total acres, total acres of wetlands and total acres of agricultural land (Figure 4). The CCWF is 20,120 acres in size and consists of 3,733 acres of agricultural land (18.5 percent), 276 acres of wetlands (1.4 percent), and 18,328 acres of wetland-agricultural matrix (91.1 percent) (Figure 4). The 10-mile buffer zone is 392,060 acres and it consists of 61,106 acres of agricultural land (15.6 percent), 14,306 acres of wetlands (3.7 percent), and 280,960 acres of wetland-agricultural matrix (71.7 percent) (Figure 4).

The analysis suggests that 91.1 percent of the CCWF contains ideal habitat for whooping cranes, while 71.7 percent of the 10-mile buffer contains ideal habitat. The red hatched areas in Figure 4 indicate the areas that are not ideal habitat for sandhill and/or whooping cranes for foraging and loafing on the CCWF and 10-mile buffer zone.

3.11 Raptor Nests

Seventeen (17) raptor nests were observed and mapped within CCWF (Figure 3). Fifteen of the nests were red-tailed hawk (eleven active, four inactive), one unknown (inactive) and one Swainson's hawk active (Table 9). See below for nest locations:

- Nest 1 Swainson's hawk Active SE ¼ SW ¼ 127-077-19
- Nest 2 Red-tailed hawk Active SE ¼ SW ¼ 127-077-32
- Nest 3 Red-tailed hawk Active SE ¼ NE ¼ 127-078-21

• Nest 4	Red-tailed hawk	Active	SE ¼ SW ¼ 127-077-17
• Nest 5	Red-tailed hawk	Active	NE ¼ SE ¼ 126-078-3
• Nest 6	Red-tailed hawk	Active	SE ¼ SW ¼ 127-078-23
• Nest 7	Red-tailed hawk	Active	SE ¼ SE ¼ 127-078-20
• Nest 8	Red-tailed hawk	Inactive	SW ¼ SW ¼ 127-078-27
• Nest 9	Red-tailed hawk	Inactive	SW ¼ NE ¼ 127-078-34
• Nest 10	Unknown	Inactive	NW ¼ SE ¼ 126-078-2
• Nest 11	Red-tailed hawk	Active	SW ¼ NW ¼ 127-077-31
• Nest 12	Red-tailed hawk	Inactive	SE ¼ SW ¼ 126-077-18
• Nest 13	Red-tailed hawk	Inactive	SW ¼ SW ¼ 127-077-33
• Nest 14	Red-tailed hawk	Active	NE ¼ NW ¼ 127-077-29
• Nest 15	Red-tailed hawk	Active	NW ¼ SE ¼ 127-077-17
• Nest 16	Red-tailed hawk	Active	SW ¼ NE ¼ 126-078-2
• Nest 17	Red-tailed hawk	Active	SE ¼ SE ¼ 127-077-18

4.0 DISCUSSION AND IMPACT ASSESSMENT

4.1 Raptor Use and Encounter Rate

During the spring 2010 survey 135 individual raptors were observed for a mean use of 0.70 raptors/20 min, compared to the fall 2010 survey where 77 raptor observations were made for a mean use of 0.40 raptors/20 min (Table 2).

The raptor annual mean use rate at CCWF of 0.55 raptors/20 min (combining spring and fall values) was compared with 37 other wind energy facilities that implemented similar protocols. The raptor annual mean use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind energy facilities, as summarized by Derby et al. 2010, a ranking of seasonal raptor mean use was developed: low (0-0.5 raptors/20 min. survey); low to moderate (0.5-1.0 raptors/20 min); moderate (1.0-2.0 raptors/20 min); high (2.0-3.0 raptors/20 min); and very high (> 3.0 raptors/20 min). Under this ranking, mean raptor use at the CCWF is considered to be low to moderate. The annual raptor use at CCWF would rank 11th compared to 37 other wind-energy facilities (Derby et al. 2010).

Raptor encounter rates of 0.29 individuals flying within the RSA/20 min during the spring 2010 survey and 0.21 individuals flying within the RSA/20 min during the fall 2010 survey was low at CCWF (Tables 6a and 6b). Fifty-three (53) percent of all raptor observations were within the RSA. The spring and fall 2010 surveys altogether, had an annual raptor encounter rate of 0.25 flying within the RSA/20 min. The highest raptor encounter rate was red-tailed hawk with 0.16 individuals (spring) flying within the RSA/20 min. Turkey vultures were second with a encounter rate of 0.05 individuals (spring and fall) flying within the RSA/20 min (Table 6a and 6b). The spring and fall and annual raptor encounter rate calculated is relatively low, however the percentage of raptor observations within the RSA during the spring and fall surveys and the low to moderate annual mean use rate (raptors/20 minutes) shows potential for mortality at CCWF.

High numbers of raptor fatalities have been documented at wind-energy facilities (e.g. Alamont Pass), however other studies at wind-energy facilities in the United States suggest that 3.2% of the total casualties were raptors (Erickson et al. 2001). Results from Alamont Pass in California suggest that species mortality is not all related to abundance (Orloff and Flanery 1992). Golden eagles, red-tailed hawks and American kestrels were casualties more often than predicted based on abundance. Based on species occurrence/abundance within CCWF, red-tailed hawk and turkey vultures may constitute the highest proportion of raptor fatalities at CCWF.

Encounter rate analysis may also determine which species might become turbine casualties. The encounter rate is an index and only considers probability of exposure based on abundance, number of individuals flying, and flight height of each species within the RSA for turbines to be used at the wind-energy facility. The encounter rate index is relative to the observations of species during the surveys and within the study area and cannot be extrapolated to the species that may use CCWF in the future. The encounter rate index from this study does not take into consideration behavior (e.g. foraging, courtship), habitat use, and turbine avoidance differences between species. At CCWF, the raptor species with the highest encounter rate indices were red-tailed hawk and turkey vulture.

Raptor nest density within CCWF and within one mile of the boundary of CCWF was 0.54 nests per square mile (Figure 4). Few raptor species that have been identified as nesting at wind energy facilities have been observed as fatalities at wind-energy facilities (Derby et al. 2010), therefore, the relationship is very low between the number of collision fatalities and raptor nests within or near project facilities, however, it is assumed that raptors nesting close to turbines would likely have a greater chance of being impacted from collision with turbines, but the data is not available at this time to determine the impact (Derby et al. 2010).

4.2 Non-Raptor Use and Encounter Rate

Migratory bird species in the United States are protected by the Migratory Bird Treaty Act (MBTA). Passerine species have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001 and Erickson et al. 2002), often comprising more than 80% of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Passerines make up a large proportion of the birds observed during the spring and fall 2010 avian surveys at CCWF and would be expected to make up the largest proportion of fatalities at the CCWF. Encounter rate indices for both spring and fall PC surveys indicate that unidentified blackbirds and Franklin's gulls are likely to be exposed to collisions from wind turbines at CCWF (Tables 6a & 6b). There were other passerine and waterfowl species that flew through the RSA during spring and fall PC surveys, but encounter rates are not high enough to warrant significant collision exposure (Tables 6a & 6b).

4.3 Sharp-tailed Grouse

The sharp-tailed grouse inhabits steppe, grassland and mixed grass habitats. Sharp-tailed grouse require grasslands with residual cover for nesting and utilize agricultural areas seasonally for food. Males congregate on communal display grounds called leks, which are often located on a

knoll or ridge, beginning in early spring and extending into June. Sharp-tailed grouse serve as indicators of grassland ecosystem health and provide recreational and aesthetic value (SDGFP 2008). One known sharp-tailed grouse lek was located within the project area in 2010, however there are landlocked areas within the project area that were not surveyed. Potential lek surveys in the spring of 2011 may find additional leks in these native prairie areas.

Native prairie is used by sharp-tailed grouse for seasonal habitat needs such as lekking, nesting, brood rearing, and wintering. The area surrounding the lek site contains habitat for reproduction and year round survival of sharp-tailed grouse. Loss of native prairie may affect the availability of habitat for grouse lekking and reproduction. Concerns that sharp-tailed grouse may avoid nesting near human-made structures have heightened this issue for siting wind farms (Pitman et al. 2005). Establishing new roads in areas of native prairie increases habitat fragmentation and could provide better access for nesting predators such as skunks, raccoons, coyotes and feral cats. These animals are predators of sharp-tailed grouse nests and reproductive success could be reduced if native prairie areas are more accessible to predators.

South Dakota Game Fish and Parks (SDGFP) does not mandate specific distances turbines should be constructed from leks, but does recommend avoidance of construction and maintenance activities (including mowing) during the ground nesting bird breeding season (April to July). Although the SDGFP does not mandate specific distances turbines should be constructed from leks, it is recommended that no turbines be constructed within ¼-mile of the lek (Figure 3). Setbacks from leks would help further minimize any potential displacement impacts to sharp-tailed grouse.

4.4 Listed and Sensitive Species Risk

All sensitive species observed at the CCWF are summarized in Section 3.6. No federally listed threatened, endangered or candidate species were observed at the CCWF during this study. One state threatened species, bald eagle, was observed during fixed-point surveys at the CCWF (one observation). A state endangered species, peregrine falcon, was also observed during incidental surveys at the CCWF (one observation). The bald eagle is also legally protected under the Bald and Golden Eagle Protection Act (BGEPA 1940), while the others are further protected under the Migratory Bird Treaty Act (MBTA 1919).

The U.S. Fish & Wildlife Service (USFWS) and the SDGFP have expressed concern over potential impacts to whooping cranes that are being considered within the migration corridor of whooping cranes, such as the CCWF. The whooping crane migrates through South Dakota during spring and fall, within a corridor that is roughly 200-miles wide; the CCWF falls within the center of the corridor where 75% of South Dakota's whooping crane reported sittings have been recorded (Figure 5). No whooping cranes were observed during the study, however several groups of sandhill cranes were observed during the spring and fall PC surveys.

Whooping crane stopover habitat in South Dakota is variable, but can be described as wetlands (roosting areas) that are greater than ¼ acre in size with water depths in the range of five to eight inches with minimal surrounding vegetation. Harvested cereal grain fields in close proximity to the wetlands are used for foraging by whooping cranes, however cranes will forage in wetlands

and other crops such as alfalfa. The wetland density and wetland-agricultural analyses indicate that stop-over habitat is available on the CCWF and within a 10-mile vicinity of CCWF. The presence of stop-over habitat within the 10-mile vicinity of CCWF minimizes the impact of potential lost habitat if whooping cranes avoid the wind farm, due to availability of adequate surrounding habitat.

The probability of whooping crane collisions with turbines on the CCWF is unknown. However, due to the small number of whooping cranes, the sporadic nature of stopovers within the 2,500 mile long by 200-mile wide migration corridor, the small size of the proposed CCWF, the probability of whooping crane collision is presumed low.

4.5 Potential Impacts to Avian Species – Direct and Indirect Effects

Direct mortality and/or injury from collisions with wind turbines and/or guy wires, temporary or permanent habitat loss, and displacement of birds from habitats near turbines are possible impacts to avian species from the construction and operation of the CCWF (Drewitt and Langston 2006). In addition to mortality associated with wind farms, concerns have been raised that bird species may avoid areas near turbines after the wind farm is in operation (Drewitt and Langston 2006).

5.0 CONCLUSIONS AND RECOMMENDATIONS

Differences in bird use were detected between spring and fall PC survey points, though it does not appear that birds were disproportionally using specific areas of the CCWF. No strong association with topographic features within the CCWF was noted for raptors or other large avian species. No flyways or concentration areas were observed.

Based on research conducted at wind farms throughout the United States, raptor use at CCWF is generally lower than use levels recorded at other wind farms. To date, no relationships have been determined between overall use by other bird species, and fatality rates of those bird groups at wind farm facilities. Flight characteristics and foraging habits of some species may result in additional exposure for these species at CCWF. The surveys for this proposed wind farm did not address the impacts to nocturnal migrants. Generally, overall fatality rates for birds (including nocturnal migrants) at wind farm facilities in the Midwest portion of the United States have been relatively low and consistent. The range of overall bird fatality estimates at three Midwest wind farm facilities has ranged from 0.7 to 3.4 fatalities/MW/year (Derby, et al. 2010).

Approximately 60% of the CCWF is grassland (native and tame) habitat. Wildlife and plants which are closely associated with grasslands, primarily native, may be affected by the potential construction and operation of this wind farm facility. Wildlife species may avoid these habitats during siting of turbines and plants will be permanently removed by turbine placement and access road construction. No federally listed endangered, threatened, or candidate species were located within the CCWF. However, 11 sensitive state avian species of concern were recorded within the project area. These avian species are generally not associated with agricultural

habitats and occur in grassland/native prairie, wetlands, or woodland habitats. The potential exists for these species to be temporarily or permanently displaced from these habitats.

The CCWF is located within the whooping crane migration corridor, and a similar species, sandhill crane, was documented to occur during both the spring and fall PC surveys. Adequate stop-over habitat exists for the whooping crane to use CCWF, but to what extent is not known.

Sharp-tailed grouse were observed both during the spring and fall PC surveys, and one lek was located during the spring lekking season. Additional lekking and reproductive habitat is present within the CCWF. A more comprehensive sharp-tailed grouse lek survey is recommended to determine the extent of sharp-tailed grouse use of CCWF.

6.0 GENERAL AND SIGNATURES

The services performed by WPC scientists for this project have been conducted in a manner consistent with the degree of care and technical skill appropriately exercised by professionals currently practicing in this area under similar time and budget constraints. Recommendations and findings contained in this report represent our professional judgment and are based upon available information and technically accepted practices at the present time and location. Other than this, no warranty is implied or expressed.

WPC, Inc. Wildlife Biologist and Project Manager, Justin Askim and Certified Wildlife Biologist, John W. Schulz, prepared the report. Wildlife Biologist and Project Manager, Daniel Ackerman completed the fieldwork.

Justin Askim, Wildlife Biologist

Project Manager

1/11/11

Date

Daniel Ackerman, Wildlife Biologist

Project Manager

1/11/2011

Date

John W, Schulz, Certified Wildlife Biologist

01/11/11

Date

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8.0 ACRONYMS AND ABBREVIATIONS

ac	Acre
BGEPA	Bald and Golden Eagle Protection Act
CCWF	Campbell County Wind Farm
ESA	Endangered Species Act
ha	hectare
M	meter
MBTA	Migratory Bird Treaty Act
Mph	miles per hour
NAIP	National Imagery Program
NLCD	National Land Cover Dataset
PC	Point Count
RSA	Rotor Sweep Area
SDGFP	South Dakota Game Fish and Parks
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WPC	Western Plains Consulting

Tables

Table 1. CCWF PC Dates, Spring 2010 and Fall 2010	
Spring 2010	
Survey Number	**Date**
1	3/31-4/1/2010
2	4/8-4/9/2010
3	4/15-4/16/2010
4	4/22-4/23/2010
5	4/29-4/30/2010
6	5/3-5/4/2010
7	5/13-14/2010
8	5/21/2010
9	5/26/2010
10	6/1/2010
11	6/9/2010
12	6/20/2010
Fall 2010	
Survey Number	**Date**
1	8/17-18/2010
2	8/23/2010
3	8/31/2010
4	9/7/2010
5	9/13/2010
6	9/20/2010
7	9/28-29/2010
8	10/4/2010
9	10/12-13/2010
10	10/18/2010
11	10/25/2010
12	11/2/2010

Table 2. CCWF Point Count Avian Species by Group, Spring 2010 and Fall 2010

Species	Spring 2010			Fall 2010		
	Number of Birds	Number of Observations	Mean Use (# birds/20 min.)	Number of Birds	Number of Observations	Mean Use (# birds/20 min.)
Songbirds						
Western Meadowlark	687	349	3.47	777	142	4.05
Horned Lark	609	271	3.17	183	75	0.95
Savannah Sparrow	15	15	0.08	0	0	0.00
Chestnut-collared Longspur	2	1	0.01	0	0	0.00
Vesper Sparrow	135	80	0.70	23	5	0.12
Brown-headed Cowbird	582	209	3.03	44	2	0.23
Barn Swallow	462	90	2.41	71	33	0.37
Tree Swallow	2	1	0.01	19	4	0.10
Grasshopper Sparrow	38	27	0.17	1	1	0.01
American Robin	72	41	0.38	87	16	0.45
Common Grackle	280	87	1.46	0	0	0.00
Western Kingbird	48	30	0.25	19	15	0.10
Eastern Kingbird	51	28	0.27	80	33	0.42
Gray Catbird	4	3	0.02	0	0	0.00
Loggerhead Shrike	1	1	0.01	1	1	0.01
Red-winged Blackbird	1,812	284	9.44	3	2	0.02
House Sparrow	3	3	0.02	1	1	0.01
European Starling	13	7	0.07	127	9	0.66
Field Sparrow	28	17	0.15	12	8	0.06
Unidentified Blackbird	4,609	7	24.01	3,201	17	16.67
American Tree Sparrow	9	6	0.05	3	2	0.02
Unidentified Warbler	12	7	0.06	1	1	0.01
White-Crowned Sparrow	1	1	0.01	5	3	0.03
Bobolink	197	85	1.03	2	2	0.01
Yellow-headed Blackbird	23	15	0.12	4	1	0.02
Clay-colored Sparrow	20	14	0.10	14	2	0.07
Bank Swallow	312	15	1.68	7	1	0.04
Brown Thrasher	12	9	0.06	3	3	0.02
Swainson's Thrush	1	2	0.01	0	0	0.00
Chipping Sparrow	12	10	0.06	4	3	0.02
Baltimore Oriole	1	1	0.01	0	0	0.00
Pine Grosbeak	1	1	0.01	0	0	0.00
Orchard Oriole	3	2	0.02	0	0	0.00
Red-eyed Vireo	3	3	0.02	0	0	0.00
Least Flycatcher	6	4	0.03	0	0	0.00
Northern Rough-winged Swallow	3	2	0.02	0	0	0.00
Song Sparrow	3	3	0.02	0	0	0.00
American Goldfinch	5	3	0.03	0	0	0.00
Marsh Wren	1	1	0.01	0	0	0.00
Eastern Bluebird	1	1	0.01	0	0	0.00
Cliff Swallow	1	1	0.01	0	0	0.00
Yellow-breasted Chat	1	1	0.01	0	0	0.00
Yellow-rumped Warbler	0	0	0.00	1	1	0.01
Brewer's blackbird	0	0	0.00	2,031	4	10.58
Snow Bunting	0	0	0.00	19	1	0.10
Red-eyed Vireo	0	0	0.00	1	1	0.01
Least Flycatcher	0	0	0.00	5	3	0.03
Song Sparrow	0	0	0.00	1	1	0.01
American Goldfinch	0	0	0.00	107	52	0.56
Dickcissel	0	0	0.00	4	2	0.02
Unidentified Sparrow	0	0	0.00	228	20	1.19
Blue Grosbeak	0	0	0.00	1	1	0.01
Yellow-breasted Chat	0	0	0.00	2	2	0.01
Bullock's Oriole	0	0	0.00	2	1	0.01
Ruby-crowned Kinglet	0	0	0.00	1	1	0.01
Brown Creeper	0	0	0.00	1	1	0.01
Dark-eyed Junco	0	0	0.00	13	3	0.07
Totals	**10,067**	**1,678**	**52.44**	**7,109**	**476**	**37.03**
Raptors/Vultures/Owls						
Golden Eagle	2	2	0.01	1	1	0.01
Red-tailed Hawk	58	54	0.30	25	23	0.13
Northern Harrier	33	33	0.17	27	25	0.14
American Kestrel	10	9	0.05	6	4	0.03
Merlin	1	1	0.01	0	0	0.00
Turkey Vulture	10	6	0.05	12	11	0.06
Swainson's Hawk	9	7	0.05	2	2	0.01
Great-horned Owl	1	1	0.01	0	0	0.00
Burrowing Owl	9	6	0.05	0	0	0.00
Unidentified Buteo	0	0	0.00	1	1	0.01
Sharp-shinned Hawk	0	0	0.00	1	1	0.01
Rough-legged Hawk	0	0	0.00	1	1	0.01
Bald Eagle	1	1	0.01	0	0	0.00
Cooper's Hawk	1	1	0.01	1	1	0.01
Totals	**135**	**121**	**0.70**	**77**	**70**	**0.40**
Waterfowl						
Canada Goose	19	9	0.10	20	2	0.10
Ring-necked Duck	10	1	0.05	0	0	0.00
Mallard	189	93	0.98	36	2	0.19
Wood Duck	1	1	0.01	0	0	0.00
Northern Pintail	69	20	0.36	0	0	0.00
Redhead	4	1	0.02	0	0	0.00
Blue-winged teal	20	9	0.10	2	1	0.01
Northern Shoveler	18	8	0.09	0	0	0.00
Gadwell	10	5	0.05	0	0	0.00
Totals	**340**	**147**	**1.77**	**58**	**5**	**0.30**
Shorebirds						
Killdeer	181	82	0.94	8	6	0.04
Wilson's Snipe	7	6	0.04	0	0	0.00
Upland Sandpiper	161	98	0.84	1	1	0.01
Willet	5	4	0.03	0	0	0.00
Marbled Godwit	24	14	0.13	0	0	0.00
Long-billed Curlew	0	0	0.00	2	1	0.01
Baird's Sandpiper	4	1	0.02	0	0	0.00
Wilson's Phalerope	2	1	0.01	0	0	0.00
Totals	**384**	**206**	**2.01**	**11**	**8**	**0.06**
Gamebirds						
Wild Turkey	4	4	0.02	1	1	0.01
Ring-necked Pheasant	745	477	3.88	401	159	2.09
Gray Partridge	0	0	0.00	33	3	0.17
Sharp Tailed Grouse	1	1	0.01	12	5	0.06
Totals	**750**	**482**	**3.91**	**447**	**168**	**2.33**
Pigeons/Doves						
Mourning Dove	302	176	2.57	234	121	1.22
Rock Pigeon	53	24	0.28	96	17	0.50
Eurasian Collared Dove	2	1	0.01	0	0	0.00
Totals	**357**	**201**	**1.86**	**330**	**138**	**1.72**
Gulls/Terns						
Ring-billed Gull	25	9	0.13	0	0	0.00
Franklin's Gull	1,041	19	5.42	234	4	1.22
Totals	**1,066**	**28**	**5.55**	**234**	**4**	**1.22**
Woodpeckers and Allies						
Yellow-shafted Flicker	19	15	0.10	4	4	0.02
Northern Flicker	0	0	0.00	16	11	0.08
Red-headed Woodpecker	0	0	0.00	1	1	0.01
Unidentified Woodpecker	1	1	0.01	0	0	0.00
Totals	**20**	**16**	**0.11**	**21**	**16**	**0.11**
Goatsuckers						
Common Nighthawk	1	1	0.01	1	1	0.01
Totals	**1**	**1**	**0.01**	**1**	**1**	**0.01**
Crows and Allies						
American Crow	61	28	0.32	26	14	0.14
Black-billed Magpie	0	0	0.00	1	1	0.01
Blue Jay	0	0	0.00	17	13	0.09
Totals	**61**	**28**	**0.32**	**44**	**28**	**0.23**
Waterbirds						
Great Blue Heron	3	3	0.02	3	3	0.02
Double-crested Cormorant	0	0	0.00	251	2	1.31
Cattle Egret	0	0	0.00	1	1	0.01
Great Egret	0	0	0.00	1	1	0.01
Totals	**3**	**3**	**0.02**	**256**	**7**	**1.33**
Cranes/Rallidae						
Sandhill Crane	153	2	0.80	110	5	0.57
Totals	**153**	**2**	**0.80**	**110**	**5**	**0.57**
Grand Totals	**13,337**	**2,913**	**69.46**	**8,698**	**926**	**45.30**

Table 3. CCWF Point Count Percent Composition and Frequency by Species Group, Spring 2010 and Fall 2010

Species	Spring 2010		Fall 2010	
	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency
Songbirds				
American Goldfinch	0.04%	1.56%	0.00%	0.00%
American Goldfinch	0.00%	0.00%	1.28%	22.40%
American Robin	0.54%	17.71%	1.00%	7.81%
American Tree Sparrow	0.07%	2.60%	0.08%	1.04%
Baltimore Oriole	0.01%	0.52%	0.00%	0.00%
Bank Swallow	2.41%	7.29%	0.08%	0.52%
Barn Swallow	3.46%	10.94%	0.82%	11.98%
Blue Grosbeak	0.00%	0.00%	0.01%	0.52%
Bobolink	1.48%	29.17%	0.02%	1.04%
Brewer's blackbird	0.00%	0.00%	23.35%	1.56%
Brown Creeper	0.00%	0.00%	0.01%	0.52%
Brown Thrasher	0.09%	4.69%	0.03%	1.56%
Brown-headed Cowbird	4.56%	48.96%	0.51%	1.04%
Bullock's Oriole	0.00%	0.00%	0.02%	0.52%
Chestnut-collared Longspur	0.01%	0.52%	0.00%	0.00%
Chipping Sparrow	0.09%	5.21%	0.05%	1.56%
Clay-colored Sparrow	0.15%	6.77%	0.16%	1.04%
Cliff Swallow	0.01%	0.52%	0.00%	0.00%
Common Grackle	2.10%	31.25%	0.00%	0.00%
Dark-eyed Junco	0.00%	0.00%	0.15%	1.56%
Dickcissel	0.00%	0.00%	0.03%	1.04%
Eastern Bluebird	0.01%	0.52%	0.00%	0.00%
Eastern Kingbird	0.38%	10.94%	0.92%	13.54%
European Starling	0.10%	3.65%	1.46%	3.65%
Field Sparrow	0.21%	8.33%	0.14%	4.17%
Grasshopper Sparrow	0.25%	12.50%	0.01%	0.52%
Grey Catbird	0.03%	1.56%	0.00%	0.00%
Horned Lark	4.57%	78.65%	2.10%	30.21%
House Sparrow	0.02%	1.56%	0.01%	0.52%
Least Flycatcher	0.04%	2.08%	0.06%	1.56%
Loggerhead Shrike	0.01%	0.52%	0.01%	0.52%
Marsh Wren	0.01%	0.52%	0.00%	0.00%
Northern Rough-winged Swallow	0.02%	1.04%	0.00%	0.00%
Orchard Oriole	0.02%	1.04%	0.00%	0.00%
Pine Grosbeak	0.01%	0.52%	0.00%	0.00%
Red-eyed Vireo	0.02%	1.56%	0.00%	0.00%
Red-eyed Vireo	0.00%	0.00%	0.01%	0.52%
Red-winged Blackbird	13.59%	73.44%	0.08%	1.04%
Ruby-crowned Kinglet	0.00%	0.00%	0.01%	0.52%
Savannah Sparrow	0.11%	7.29%	0.00%	0.00%
Snow Bunting	0.00%	0.00%	0.22%	0.52%
Song Sparrow	0.02%	1.56%	0.00%	0.00%
Song Sparrow	0.00%	0.00%	0.01%	0.52%
Swainson's Thrush	0.01%	1.04%	0.00%	0.00%
Tree Swallow	0.01%	0.52%	0.22%	2.08%
Unidentified Blackbird	34.58%	3.65%	36.80%	6.77%
Unidentified Sparrow	0.00%	0.00%	2.62%	7.29%
Unidentified Warbler	0.09%	3.65%	0.01%	0.52%
Vesper Sparrow	1.01%	30.21%	0.26%	2.60%
Western Kingbird	0.36%	11.98%	0.22%	6.25%
Western Meadowlark	5.00%	91.15%	8.93%	44.79%
White-Crowned Sparrow	0.01%	0.52%	0.06%	1.56%
Yellow-breasted Chat	0.00%	0.00%	0.02%	1.04%
Yellow-breasted Chat	0.01%	0.52%	0.00%	0.00%
Yellow-headed Blackbird	0.17%	7.81%	0.05%	0.52%
Yellow-rumped Warbler	0.00%	0.00%	0.01%	0.52%
Totals	**75.48%**		**81.73%**	
Raptors/Vultures/Owls				
Golden Eagle	0.01%	1.04%	0.01%	0.52%
Red-tailed Hawk	0.43%	13.96%	0.29%	10.42%
Northern Harrier	0.25%	16.67%	0.31%	11.46%
American Kestrel	0.07%	4.17%	0.07%	2.08%
Merlin	0.01%	0.52%	0.00%	0.00%
Turkey Vulture	0.07%	3.13%	0.14%	5.73%
Swainson's Hawk	0.07%	3.65%	0.02%	1.04%
Great-horned Owl	0.01%	0.52%	0.00%	0.00%
Burrowing Owl	0.07%	3.13%	0.00%	0.00%
Unidentified Buteo	0.00%	0.00%	0.01%	0.52%
Sharp-shinned Hawk	0.00%	0.00%	0.01%	0.52%
Rough-legged Hawk	0.00%	0.00%	0.01%	0.52%
Bald Eagle	0.01%	0.52%	0.00%	0.00%
Cooper's Hawk	0.01%	0.52%	0.01%	0.52%
Totals	**1.01%**		**0.01%**	
Waterfowl				
Canada Goose	0.14%	4.17%	0.23%	1.04%
Ring-necked Duck	0.07%	0.52%	0.00%	0.00%
Mallard	1.42%	31.25%	0.41%	1.04%
Wood Duck	0.01%	0.52%	0.00%	0.00%
Northern Pintail	0.52%	7.29%	0.00%	0.00%
Redhead	0.03%	0.52%	0.00%	0.00%
Blue-winged teal	0.15%	3.65%	0.02%	0.52%
Northern Shoveler	0.13%	4.17%	0.00%	0.00%
Gadwell	0.07%	2.60%	0.00%	0.00%
Totals	**2.55%**		**0.67%**	
Shorebirds				
Killdeer	1.36%	30.73%	0.09%	2.60%
Wilson's Snipe	0.06%	3.13%	0.00%	0.00%
Upland Sandpiper	1.21%	34.90%	0.01%	0.52%
Willet	0.04%	2.08%	0.00%	0.00%
Marbled Godwit	0.18%	6.25%	0.00%	0.00%
Long-billed Curlew	0.00%	0.00%	0.02%	0.52%
Baird's Sandpiper	0.03%	0.52%	0.00%	0.00%
Wilson's Phalarope	0.01%	0.52%	0.00%	0.00%
Totals	**2.88%**		**0.13%**	
Gamebirds				
Wild Turkey	0.08%	2.08%	0.01%	0.52%
Ring-necked Pheasant	5.59%	92.19%	4.61%	40.63%
Gray Partridge	0.00%	0.00%	0.14%	2.60%
Sharp Tailed Grouse	0.01%	0.52%	0.38%	1.56%
Totals	**5.62%**		**5.14%**	
Pigeons/Doves				
Mourning Dove	2.26%	46.88%	2.69%	32.29%
Rock Pigeon	0.40%	11.98%	1.10%	7.29%
Eurasian Collared Dove	0.01%	0.52%	0.00%	0.00%
Totals	**2.68%**		**3.79%**	
Gulls/Terns				
Ring-billed Gull	0.19%	2.60%	0.00%	0.00%
Franklin's Gull	7.81%	4.17%	2.69%	1.04%
Totals	**7.99%**		**2.69%**	
Woodpeckers and Allies				
Yellow-shafted Flicker	0.14%	7.29%	0.05%	2.08%
Northern Flicker	0.00%	0.00%	0.18%	4.69%
Red-headed Woodpecker	0.00%	0.00%	0.01%	0.52%
Unidentified Woodpecker	0.01%	0.52%	0.00%	0.00%
Totals	**0.15%**		**0.24%**	
Goatsuckers and Allies				
Common Nighthawk	0.01%	0.52%	0.01%	0.52%
Totals	**0.01%**		**0.01%**	
Crows and Allies				
American Crow	0.46%	11.98%	0.30%	6.77%
Black-billed Magpie	0.00%	0.00%	0.01%	0.52%
Blue Jay	0.00%	0.00%	0.20%	6.77%
Totals	**0.46%**		**0.51%**	
Waterbirds				
Great Blue Heron	0.02%	1.56%	0.03%	1.56%
Double-crested Cormorant	0.00%	0.00%	2.89%	1.04%
Cattle Egret	0.00%	0.00%	0.01%	0.52%
Great Egret	0.00%	0.00%	0.01%	0.52%
Totals	**0.02%**		**2.94%**	
Cranes/Rails				
Sandhill Crane	1.15%	1.04%	1.26%	2.60%
Totals	**1.15%**		**1.26%**	
Grand Totals	**100.00%**		**100.00%**	

Table 4a. Avian Species Observed by Point Count at CCWF, Spring 2010

Species	Number of Birds	Number of Occurrences	Points															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Western Meadowlark	667	349	74	71	58	45	43	34	23	32	26	44	55	23	27	30	42	40
Horned Lark	609	271	28	10	25	17	21	21	84	20	39	30	35	39	78	42	71	49
Savannah Sparrow	15	15	0	1	2	1	1	4	0	0	0	4	2	0	0	0	0	0
Chestnut-collared Longspur	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Vesper Sparrow	135	80	4	0	6	3	3	14	9	0	8	5	15	17	6	30	6	9
Brown-headed Cowbird	582	209	68	51	35	33	32	60	20	61	11	28	53	23	9	46	30	22
Barn Swallow	462	30	50	367	0	5	1	2	0	10	7	2	4	0	1	0	0	13
Tree Swallow	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grasshopper Sparrow	33	27	0	1	5	5	2	6	0	0	3	4	2	0	0	3	1	1
American Robin	72	41	1	0	0	0	6	5	0	0	3	3	12	23	8	8	3	0
Common Grackle	280	87	27	11	3	8	36	3	0	5	5	26	91	30	4	17	2	12
Western Kingbird	48	30	1	1	2	0	7	2	1	0	3	2	5	8	2	3	4	7
Eastern Kingbird	51	28	13	1	5	0	1	8	0	3	2	15	1	2	0	0	0	0
Gray Catbird	4	3	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0
Loggerhead Shrike	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Red-winged Blackbird	1,812	284	52	83	139	57	25	24	28	46	16	85	841	81	46	42	40	207
House Sparrow	3	3	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
European Starling	13	7	0	0	1	0	1	1	0	0	0	0	4	0	2	3	0	1
Field Sparrow	28	17	0	0	1	0	3	2	1	1	0	0	14	0	5	0	0	1
Unidentified Blackbird	4,609	7	0	0	0	0	0	0	4,445	0	40	0	49	0	0	0	0	75
American Tree Sparrow	9	6	0	0	4	0	1	0	0	0	0	2	2	0	0	0	0	0
Unidentified Warbler	12	7	0	0	0	0	3	2	0	0	1	0	2	0	1	0	0	3
White-Crowned Sparrow	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Bobolink	197	85	14	16	10	37	10	24	4	31	5	14	6	5	8	4	4	5
Yellow-headed Blackbird	23	15	3	5	2	2	0	0	0	2	1	1	0	0	0	0	7	0
Clay-colored Sparrow	20	14	2	0	4	2	0	1	0	2	1	0	0	3	0	1	2	2
Bank Swallow	322	15	6	298	0	0	0	0	0	2	2	6	1	1	4	0	2	0
Brown Thrasher	12	9	0	0	0	0	0	3	0	1	1	3	0	2	0	2	0	0
Swainson's Thrush	2	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Chipping Sparrow	12	10	0	0	1	0	0	0	1	0	2	0	0	1	3	1	3	0
Baltimore Oriole	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pine Grosbeak	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Orchard Oriole	3	2	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
Red-eyed Vireo	3	3	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0
Least Flycatcher	6	4	0	0	0	0	0	0	1	0	0	2	0	0	0	3	0	0
Northern Rough-winged Swallow	3	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Song Sparrow	3	3	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0
American Goldfinch	5	3	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3
Marsh Wren	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Bluebird	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cliff Swallow	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow-breasted Chat	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Golden Eagle	2	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Red-tailed Hawk	58	54	3	3	5	11	5	3	3	5	2	1	1	4	3	2	3	4
Northern Harrier	33	33	1	2	1	4	0	3	1	3	3	2	0	1	1	4	5	2
American Kestrel	10	9	1	1	1	2	1	2	0	1	0	0	1	0	0	0	0	0
Merlin	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Turkey Vulture	10	6	0	0	0	0	2	2	0	0	0	0	0	1	0	5	0	0
Swainson's Hawk	9	7	0	0	3	1	0	0	1	0	1	0	0	0	1	0	2	0
Great-horned Owl	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Burrowing Owl	9	6	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bald Eagle	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Cooper's Hawk	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Canada Goose	19	9	2	9	2	2	0	0	0	0	2	0	0	0	2	0	0	0
Ring-necked Duck	10	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallard	189	93	18	23	5	11	2	12	21	11	14	1	5	2	20	17	11	16
Wood Duck	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Pintail	69	20	1	34	0	5	4	0	0	0	0	0	8	0	3	0	12	2
Redhead	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Blue-winged teal	20	9	1	12	0	0	0	0	2	0	0	0	0	0	0	0	5	0
Northern Shoveler	18	8	10	3	0	0	0	0	3	0	0	0	0	0	0	2	0	0
Gadwell	10	5	0	2	0	0	0	0	4	2	0	2	0	0	0	0	0	0
Wilson's Snipe	7	6	0	0	1	1	0	2	0	0	1	0	0	0	0	0	1	1
Killdeer	181	82	41	20	3	4	4	10	11	0	6	2	13	8	25	10	17	7
Upland Sandpiper	161	98	22	18	1	10	2	9	11	2	0	11	7	7	10	21	17	13
Willet	5	4	0	3	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Marbled Godwit	24	14	2	12	2	0	0	3	0	0	0	0	0	1	0	0	1	3
Baird's Sandpiper	4	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Wilson's Phalarope	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Mourning Dove	302	176	9	2	18	3	21	7	11	3	35	26	38	74	10	22	11	12
Rock Pigeon	53	24	0	0	0	0	4	0	6	0	14	4	6	10	0	8	0	1
Eurasian Collared Dove	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Wild Turkey	4	4	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0
Ring-necked Pheasant	745	477	28	34	55	42	50	81	43	49	52	74	49	26	36	35	29	62
Sharp Tailed Grouse	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ring-billed Gull	25	9	1	18	2	0	0	0	0	0	0	0	3	1	0	0	0	0
Franklin's Gull	1,041	19	7	4	0	0	0	0	331	11	432	166	0	0	0	0	0	90
Yellow-shafted Flicker	19	15	0	1	2	0	3	1	0	0	0	0	2	5	3	0	2	0
Unidentified Woodpecker	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Common Nighthawk	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandhill Crane	153	2	0	0	0	0	0	0	0	0	0	0	0	85	68	0	0	0
American Crow	61	28	1	3	2	0	2	3	8	0	6	31	0	0	0	4	0	1
Great Blue Heron	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	**13,337**	**2,913**	**520**	**1,122**	**412**	**311**	**301**	**358**	**5,075**	**305**	**747**	**598**	**1,330**	**486**	**395**	**369**	**341**	**667**
Mean Use	**69.46**		**2.71**	**5.84**	**2.15**	**1.62**	**1.57**	**1.86**	**26.43**	**1.59**	**3.89**	**3.11**	**6.93**	**2.53**	**2.06**	**1.92**	**1.78**	**3.47**

Table 4b. Avian Species Observed by Point Count at CCWF, Fall 2010

Species	Number of Birds	Number of Occurrences	Points															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Western Meadowlark	777	142	55	29	290	13	37	109	10	7	22	7	56	38	28	24	35	17
Horned Lark	183	75	5	6	15	2	8	9	8	9	10	8	15	6	13	8	41	20
Vesper Sparrow	23	5	20	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Brown-headed Cowbird	44	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	1
Barn Swallow	71	33	16	9	4	6	0	4	5	3	6	2	10	0	4	0	2	0
Tree Swallow	19	4	0	9	0	0	0	0	1	0	9	0	0	0	0	0	0	0
Grasshopper Sparrow	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Yellow-rumped Warbler	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
American Robin	87	16	3	1	0	0	27	14	6	18	0	6	5	7	0	0	0	0
Brewer's blackbird	2,031	4	0	0	0	0	0	16	0	0	0	0	2	2,013	0	0	0	0
Western Kingbird	19	15	2	3	0	1	0	1	0	0	5	0	0	1	0	4	0	2
Eastern Kingbird	80	33	6	1	0	2	5	3	0	6	8	3	2	6	1	24	9	4
Loggerhead Shrike	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Snow Bunting	19	1	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0
Red-winged Blackbird	3	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
House Sparrow	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
European Starling	127	9	5	0	0	0	0	38	1	0	1	0	65	17	0	0	0	0
Field Sparrow	12	8	2	0	0	0	0	1	1	0	4	0	0	2	0	0	2	0
Unidentified Blackbird	3,201	17	1,003	2,000	0	0	1	0	3	80	0	0	0	0	25	52	37	0
American Tree Sparrow	3	2	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Unidentified Warbler	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
White-Crowned Sparrow	5	3	3	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Bobolink	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Yellow-headed Blackbird	4	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Clay-colored Sparrow	14	2	0	0	0	0	0	13	1	0	0	0	0	0	0	0	0	0
Bank Swallow	7	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Thrasher	3	3	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
Chipping Sparrow	4	3	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0
Red-eyed Vireo	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Least Flycatcher	5	3	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Song Sparrow	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
American Goldfinch	107	52	19	10	5	5	21	5	1	1	8	6	15	1	2	1	1	6
Dickcissel	4	2	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Unidentified Sparrow	228	20	0	0	8	1	3	2	11	3	190	1	1	0	7	0	1	0
Blue Grosbeak	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Yellow-breasted Chat	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Bullock's Oriole	2	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Ruby-crowned Kinglet	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Brown Creeper	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dark-eyed Junco	13	3	0	0	0	0	7	0	0	0	0	6	0	0	0	0	0	0
Golden Eagle	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Red-tailed Hawk	25	23	4	4	1	4	2	2	1	1	1	0	3	1	0	0	1	0
Northern Harrier	27	25	2	6	0	0	1	0	7	3	0	0	0	3	1	0	3	1
American Kestrel	6	4	0	0	0	0	2	1	0	0	0	0	0	2	0	1	0	0
Turkey Vulture	12	11	0	0	0	1	0	0	0	0	1	0	1	1	1	4	1	2
Swainson's Hawk	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Cooper's Hawk	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Unidentified Buteo	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sharp-shinned Hawk	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rough-legged Hawk	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wild Turkey	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ring-necked Pheasant	401	159	10	16	24	6	17	19	4	44	18	35	149	11	15	18	3	12
Sharp Tailed Grouse	12	5	0	0	0	1	0	0	1	3	0	1	0	0	0	0	6	0
Gray Partridge	33	3	0	0	0	0	0	0	2	0	0	0	31	0	0	0	0	0
Great Blue Heron	3	3	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Double-crested Cormorant	251	2	0	1	0	0	0	250	0	0	0	0	0	0	0	0	0	0
Cattle Egret	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Egret	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow-shafted Flicker	4	4	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0
Northern Flicker	16	11	1	0	0	0	4	0	1	0	2	1	1	6	0	0	0	0
Red-headed Woodpecker	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Canada Goose	20	2	0	0	0	0	0	0	0	0	19	1	0	0	0	0	0	0
Mallard	36	2	0	0	0	0	0	9	0	0	0	0	0	0	0	27	0	0
Blue-winged teal	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killdeer	8	6	5	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Upland Sandpiper	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Long-billed Curlew	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
American Crow	26	14	0	1	0	0	0	1	7	2	1	0	5	0	5	2	0	2
Blue Jay	17	13	1	0	0	0	2	0	0	0	3	1	3	2	0	1	2	2
Black-billed Magpie	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mourning Dove	234	121	15	25	5	7	16	11	10	1	13	6	21	28	11	6	48	11
Rock Pigeon	96	17	0	0	0	0	11	0	1	0	5	0	1	72	0	6	0	0
Franklin's Gull	234	4	8	0	226	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Nighthawk	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Sandhill Crane	110	5	1	1	0	105	0	0	0	0	0	0	0	0	0	0	3	0
Totals	**8,698**	**926**	**1,202**	**2,133**	**578**	**156**	**178**	**517**	**105**	**184**	**336**	**88**	**387**	**2,220**	**115**	**178**	**240**	**81**
Mean Use	**45.30**		**6.26**	**11.11**	**3.01**	**0.81**	**0.93**	**2.69**	**0.55**	**0.96**	**1.75**	**0.46**	**2.02**	**11.56**	**0.60**	**0.93**	**1.25**	**0.42**

Table 5. Avian Flight Heights at CCWF, Spring 2010 and Fall 2010	**Spring 2010**				**Fall 2010**			
	Observation		**Individuals**		**Observation**		**Individuals**	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Non-Raptors								
Above RSA (>118.5m)	7	0.40%	267	2.51%	8	1.32%	615	7.51%
Below RSA (<41m)	1,443	83.46%	7,007	65.76%	526	87.09%	4,114	50.26%
Within RSA (between 41.5m and 118.5m)	279	16.14%	4,583	31.74%	70	11.59%	3,457	42.23%
Raptors/Vultures/Owls								
Above RSA (>118.5m)	3	3.16%	3	2.83%	4	6.35%	5	7.14%
Below RSA (<41m)	44	46.32%	47	44.34%	23	36.51%	25	35.71%
Within RSA (between 41.5m and 118.5m)	48	50.53%	56	52.83%	36	57.14%	40	57.14%

Table 6a. Point Count Individuals and RSA at CCWF, Spring 2010						
Species	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA
Western Meadowlark	0.01	3.47	69.87%	99.79%	0.21%	0.00%
Horned Lark	0.06	3.17	89.16%	97.97%	2.03%	0.00%
Savannah Sparrow	0.00	0.08	20.00%	100.00%	0.00%	0.00%
Chestnut-collared Longspur	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Vesper Sparrow	0.01	0.70	25.93%	94.29%	5.71%	0.00%
Brown-headed Cowbird	0.30	3.03	90.38%	89.16%	10.84%	0.00%
Barn Swallow	2.09	2.41	100.00%	12.99%	87.01%	0.00%
Tree Swallow	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Grasshopper Sparrow	0.01	0.17	3.03%	0.00%	100.00%	0.00%
American Robin	0.00	0.38	59.72%	100.00%	0.00%	0.00%
Common Grackle	0.25	1.46	92.14%	81.40%	18.60%	0.00%
Western Kingbird	0.01	0.25	93.75%	97.78%	2.22%	0.00%
Eastern Kingbird	0.02	0.27	100.00%	92.16%	7.84%	0.00%
Gray Catbird	0.00	0.02	25.00%	100.00%	0.00%	0.00%
Loggerhead Shrike	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Red-winged Blackbird	1.61	9.44	46.25%	63.13%	36.87%	0.00%
House Sparrow	0.00	0.02	33.33%	100.00%	0.00%	0.00%
European Starling	0.00	0.07	92.31%	100.00%	0.00%	0.00%
Field Sparrow	0.00	0.15	17.86%	100.00%	0.00%	0.00%
Unidentified Blackbird	5.13	24.01	99.57%	78.54%	21.46%	0.00%
American Tree Sparrow	0.00	0.05	88.89%	100.00%	0.00%	0.00%
Unidentified Warbler	0.00	0.06	25.00%	100.00%	0.00%	0.00%
White-Crowned Sparrow	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Bobolink	0.08	1.03	85.79%	91.12%	8.88%	0.00%
Yellow-headed Blackbird	0.02	0.12	86.96%	80.00%	20.00%	0.00%
Clay-colored Sparrow	0.00	0.10	25.00%	100.00%	0.00%	0.00%
Bank Swallow	1.42	1.68	100.00%	15.22%	84.78%	0.00%
Brown Thrasher	0.00	0.06	75.00%	100.00%	0.00%	0.00%
Swainson's Thrush	0.01	0.01	100.00%	50.00%	50.00%	0.00%
Chipping Sparrow	0.00	0.06	16.67%	100.00%	0.00%	0.00%
Baltimore Oriole	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Pine Grosbeak	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Orchard Oriole	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Red-eyed Vireo	0.00	0.02	33.33%	100.00%	0.00%	0.00%
Least Flycatcher	0.02	0.03	100.00%	50.00%	50.00%	0.00%
Northern Rough-winged Swallow	0.01	0.02	100.00%	33.33%	66.67%	0.00%
Song Sparrow	0.00	0.02	33.33%	100.00%	0.00%	0.00%
American Goldfinch	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Marsh Wren	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Eastern Bluebird	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Cliff Swallow	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Yellow-breasted Chat	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Golden Eagle	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Red-tailed Hawk	0.16	0.30	67.24%	15.38%	76.92%	7.69%
Northern Harrier	0.03	0.17	90.91%	83.33%	16.67%	0.00%
American Kestrel	0.03	0.05	90.00%	44.44%	55.56%	0.00%
Merlin	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Turkey Vulture	0.05	0.05	100.00%	0.00%	100.00%	0.00%
Swainson's Hawk	0.02	0.05	55.56%	20.00%	80.00%	0.00%
Great-horned Owl	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Burrowing Owl	0.00	0.05	88.89%	100.00%	0.00%	0.00%
Bald Eagle	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Canada Goose	0.03	0.10	84.21%	62.50%	37.50%	0.00%
Ring-necked Duck	0.00	0.05	100.00%	100.00%	0.00%	0.00%
Mallard	0.65	0.98	90.48%	25.15%	72.51%	2.34%
Wood Duck	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Northern Pintail	0.21	0.36	94.20%	36.92%	63.08%	0.00%
Redhead	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Blue-winged teal	0.04	0.10	65.00%	46.15%	53.85%	0.00%
Northern Shoveler	0.06	0.09	88.89%	31.25%	68.75%	0.00%
Gadwell	0.04	0.05	90.00%	0.00%	100.00%	0.00%
Killdeer	0.05	0.94	91.16%	94.55%	5.45%	0.00%
Wilson's Snipe	0.01	0.04	14.29%	0.00%	100.00%	0.00%
Upland Sandpiper	0.03	0.84	47.20%	92.11%	7.89%	0.00%
Willet	0.01	0.03	40.00%	0.00%	100.00%	0.00%
Marbled Godwit	0.05	0.13	66.67%	37.50%	62.50%	0.00%
Baird's Sandpiper	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Wilson's Phalarope	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Mourning Dove	0.21	1.57	76.49%	82.25%	17.75%	0.00%
Rock Pigeon	0.13	0.28	88.68%	46.81%	53.19%	0.00%
Eurasian Collared Dove	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Wild Turkey	0.00	0.02	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	0.00	3.88	10.34%	100.00%	0.00%	0.00%
Sharp Tailed Grouse	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	0.02	0.13	100.00%	84.00%	16.00%	0.00%
Franklin's Gull	4.15	5.42	99.90%	0.87%	76.54%	22.60%
Yellow-shafted Flicker	0.00	0.10	57.89%	100.00%	0.00%	0.00%
Unidentified Woodpecker	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Common Nighthawk	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Sandhill Crane	0.80	0.80	100.00%	0.00%	100.00%	0.00%
Great Blue Heron	0.01	0.02	100.00%	66.67%	33.33%	0.00%
American Crow	0.09	0.32	83.61%	11.76%	33.33%	54.90%
Totals	17.90	69.46	80.69%			

Table 6b. Point Count Individuals and RSA at CCWF, Fall 2010						
Species	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA
Western Meadowlark	0.62	4.05	94.47%	83.79%	16.21%	0.00%
Horned Lark	0.02	0.95	84.70%	98.06%	1.94%	0.00%
Vesper Sparrow	0.00	0.12	78.26%	100.00%	0.00%	0.00%
Brown-headed Cowbird	0.00	0.23	100.00%	100.00%	0.00%	0.00%
Barn Swallow	0.12	0.37	100.00%	67.61%	32.39%	0.00%
Tree Swallow	0.05	0.10	100.00%	52.63%	47.37%	0.00%
Grasshopper Sparrow	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Yellow-rumped Warbler	0.00	0.01	100.00%	100.00%	0.00%	0.00%
American Robin	0.04	0.45	100.00%	91.95%	8.05%	0.00%
Brewer's blackbird	0.15	10.58	100.00%	98.57%	1.43%	0.00%
Western Kingbird	0.00	0.10	84.21%	100.00%	0.00%	0.00%
Eastern Kingbird	0.04	0.42	86.25%	89.86%	10.14%	0.00%
Loggerhead Shrike	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Snow Bunting	0.10	0.10	100.00%	0.00%	100.00%	0.00%
Red-winged Blackbird	0.00	0.02	0.00%	0.00%	0.00%	0.00%
House Sparrow	0.00	0.01	100.00%	100.00%	0.00%	0.00%
European Starling	0.02	0.66	97.64%	96.77%	3.23%	0.00%
Field Sparrow	0.00	0.06	83.33%	100.00%	0.00%	0.00%
Unidentified Blackbird	13.96	16.67	100.00%	9.09%	83.72%	7.19%
American Tree Sparrow	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Unidentified Warbler	0.00	0.01	0.00%	0.00%	0.00%	0.00%
White-Crowned Sparrow	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Bobolink	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Yellow-headed Blackbird	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Clay-colored Sparrow	0.00	0.07	100.00%	100.00%	0.00%	0.00%
Bank Swallow	0.00	0.04	100.00%	100.00%	0.00%	0.00%
Brown Thrasher	0.00	0.02	100.00%	100.00%	0.00%	0.00%
Chipping Sparrow	0.00	0.02	50.00%	100.00%	0.00%	0.00%
Red-eyed Vireo	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Song Sparrow	0.00	0.01	0.00%	0.00%	0.00%	0.00%
American Goldfinch	0.03	0.56	90.65%	93.81%	6.19%	0.00%
Dickcissel	0.00	0.02	50.00%	100.00%	0.00%	0.00%
Unidentified Sparrow	1.04	1.19	100.00%	12.28%	87.72%	0.00%
Blue Grosbeak	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Yellow-breasted Chat	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Bullock's Oriole	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Ruby-crowned Kinglet	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Brown Creeper	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Dark-eyed Junco	0.00	0.07	100.00%	100.00%	0.00%	0.00%
Golden Eagle	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Red-tailed Hawk	0.09	0.13	88.00%	13.64%	77.27%	9.09%
Northern Harrier	0.05	0.14	100.00%	66.67%	33.33%	0.00%
American Kestrel	0.00	0.03	66.67%	100.00%	0.00%	0.00%
Turkey Vulture	0.05	0.06	100.00%	0.00%	75.00%	25.00%
Swainson's Hawk	0.01	0.01	50.00%	0.00%	100.00%	0.00%
Cooper's Hawk	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Unidentified Buteo	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Sharp-shinned Hawk	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Rough-legged Hawk	0.01	0.01	100.00%	0.00%	100.00%	0.00%
Wild Turkey	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	0.00	2.09	44.64%	100.00%	0.00%	0.00%
Sharp Tailed Grouse	0.00	0.06	91.67%	100.00%	0.00%	0.00%
Gray Partridge	0.00	0.17	66.67%	100.00%	0.00%	0.00%
Great Blue Heron	0.01	0.02	66.67%	0.00%	100.00%	0.00%
Double-crested Cormorant	0.00	1.31	99.60%	0.00%	0.00%	100.00%
Cattle Egret	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Great Egret	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Yellow-shafted Flicker	0.00	0.02	75.00%	100.00%	0.00%	0.00%
Northern Flicker	0.00	0.08	62.50%	100.00%	0.00%	0.00%
Red-headed Woodpecker	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Canada Goose	0.10	0.10	95.00%	0.00%	100.00%	0.00%
Mallard	0.19	0.19	100.00%	0.00%	100.00%	0.00%
Blue-winged teal	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Killdeer	0.00	0.04	87.50%	100.00%	0.00%	0.00%
Upland Sandpiper	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Long-billed Curlew	0.00	0.01	0.00%	0.00%	0.00%	0.00%
American Crow	0.02	0.14	50.00%	76.92%	23.08%	0.00%
Black-billed Magpie	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Blue Jay	0.00	0.09	5.88%	100.00%	0.00%	0.00%
Mourning Dove	0.10	1.22	84.62%	90.40%	9.60%	0.00%
Rock Pigeon	0.24	0.50	100.00%	32.29%	47.92%	19.79%
Franklin's Gull	1.18	1.22	100.00%	0.00%	96.58%	3.42%
Common Nighthawk	0.00	0.01	100.00%	100.00%	0.00%	0.00%
Sandhill Crane	0.00	0.57	98.18%	0.00%	0.00%	100.00%
Totals	**18.21**	**45.30**	**94.92%**			

Table 7a. Point Count Observations and Flight Direction at CCWF, Spring 2010											
Species	Number Flying	Number of Observations	Percentage of Flights in Various Flight Directions								
			N	NE	E	SE	S	SW	W	NW	Var
Western Meadowlark	466	349	12.23%	4.29%	8.80%	1.93%	5.15%	0.64%	4.29%	2.36%	60.30%
Horned Lark	543	271	20.44%	3.31%	9.21%	4.24%	6.45%	0.18%	6.63%	3.50%	46.04%
Savannah Sparrow	3	15	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	66.67%
Chestnut-collared Longspur	2	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vesper Sparrow	35	80	0.00%	5.71%	17.14%	0.00%	14.29%	2.86%	2.86%	0.00%	57.14%
Brown-headed Cowbird	526	209	13.50%	5.32%	7.41%	4.56%	13.31%	4.18%	7.22%	7.03%	37.45%
Barn Swallow	462	30	0.00%	0.00%	0.65%	1.08%	2.60%	0.00%	0.43%	0.00%	95.24%
Tree Swallow	2	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	1	27	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
American Robin	43	41	13.95%	2.33%	4.65%	2.33%	9.30%	6.98%	18.60%	4.65%	37.21%
Common Grackle	258	87	20.93%	14.34%	8.53%	2.33%	7.75%	3.10%	12.40%	6.98%	23.64%
Western Kingbird	45	30	6.67%	0.00%	4.44%	4.44%	20.00%	0.00%	11.11%	4.44%	48.89%
Eastern Kingbird	51	28	3.92%	0.00%	3.92%	13.73%	5.88%	0.00%	27.45%	1.96%	43.14%
Gray Catbird	1	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Loggerhead Shrike	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Red-winged Blackbird	838	284	19.33%	5.13%	15.51%	3.10%	6.21%	2.27%	10.38%	17.66%	20.41%
House Sparrow	1	3	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	12	7	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	16.67%	33.33%
Field Sparrow	5	17	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	60.00%
Unidentified Blackbird	4,589	7	0.00%	1.63%	0.00%	18.52%	76.27%	2.07%	0.00%	0.87%	0.63%
American Tree Sparrow	8	6	0.00%	0.00%	0.00%	0.00%	50.00%	12.50%	0.00%	12.50%	25.00%
Unidentified Warbler	3	7	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
White-Crowned Sparrow	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Bobolink	169	85	3.55%	0.00%	9.47%	5.92%	5.92%	1.18%	4.73%	0.59%	68.64%
Yellow-headed Blackbird	20	15	5.00%	0.00%	5.00%	0.00%	5.00%	0.00%	15.00%	55.00%	15.00%
Clay-colored Sparrow	5	14	60.00%	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%
Bank Swallow	322	15	0.00%	0.00%	0.00%	0.62%	0.31%	0.62%	1.86%	0.62%	95.96%
Brown Thrasher	9	9	0.00%	0.00%	0.00%	33.33%	11.11%	0.00%	0.00%	0.00%	55.56%
Swainson's Thrush	2	2	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%
Chipping Sparrow	2	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	50.00%
Baltimore Oriole	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Pine Grosbeak	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Orchard Oriole	3	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Red-eyed Vireo	1	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Least Flycatcher	6	4	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%
Northern Rough-winged Swallow	3	2	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Song Sparrow	1	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
American Goldfinch	5	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Marsh Wren	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Cliff Swallow	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Yellow-breasted Chat	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Golden Eagle	2	2	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%
Red-tailed Hawk	39	54	12.82%	7.69%	15.38%	12.82%	12.82%	5.13%	5.13%	17.95%	10.26%
Northern Harrier	30	33	10.00%	10.00%	10.00%	6.67%	6.67%	0.00%	23.33%	23.33%	10.00%
American Kestrel	9	9	22.22%	0.00%	11.11%	0.00%	44.44%	11.11%	11.11%	0.00%	0.00%
Merlin	1	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Turkey Vulture	10	6	0.00%	0.00%	40.00%	20.00%	0.00%	0.00%	40.00%	0.00%	0.00%
Swainson's Hawk	5	7	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	60.00%	20.00%	0.00%
Great-horned Owl	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Burrowing Owl	8	6	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	75.00%
Bald Eagle	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	1	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	16	9	12.50%	25.00%	0.00%	25.00%	0.00%	12.50%	12.50%	12.50%	0.00%
Ring-necked Duck	10	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Mallard	171	93	18.13%	8.77%	13.45%	8.19%	15.20%	2.92%	11.70%	19.30%	2.34%
Wood Duck	1	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Northern Pintail	65	20	16.92%	44.62%	10.77%	10.77%	7.69%	6.15%	3.08%	0.00%	0.00%
Redhead	4	1	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged teal	13	9	53.85%	0.00%	30.77%	0.00%	15.38%	0.00%	0.00%	0.00%	0.00%
Northern Shoveler	16	8	0.00%	0.00%	25.00%	0.00%	56.25%	0.00%	6.25%	12.50%	0.00%
Gadwell	8	5	0.00%	25.00%	0.00%	0.00%	0.00%	25.00%	0.00%	25.00%	25.00%
Killdeer	165	82	18.18%	9.70%	9.09%	0.61%	3.64%	1.21%	4.85%	7.88%	44.85%
Wilson's Snipe	1	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Upland Sandpiper	76	98	30.26%	1.32%	5.26%	1.32%	5.26%	2.63%	6.56%	2.63%	44.74%
Willet	2	4	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marbled Godwit	16	14	25.00%	6.25%	20.00%	0.00%	12.50%	0.00%	12.50%	18.75%	0.00%
Baird's Sandpiper	4	1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Phalarope	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mourning Dove	231	176	16.02%	10.82%	15.58%	6.93%	11.69%	8.66%	8.23%	13.85%	8.23%
Rock Pigeon	47	24	12.77%	0.00%	8.51%	21.28%	12.77%	0.00%	2.13%	27.66%	14.89%
Eurasian Collared Dove	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	0	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	77	477	10.39%	9.09%	2.60%	11.69%	25.97%	7.79%	9.09%	23.38%	0.00%
Sharp Tailed Grouse	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	25	9	20.00%	56.00%	0.00%	0.00%	12.00%	0.00%	0.00%	12.00%	0.00%
Franklin's Gull	1,040	19	41.44%	0.67%	0.00%	0.10%	0.00%	0.00%	0.00%	57.79%	0.00%
Yellow-shafted Flicker	11	15	18.18%	45.45%	0.00%	0.00%	36.36%	0.00%	0.00%	0.00%	0.00%
Unidentified Woodpecker	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Nighthawk	1	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sandhill Crane	153	2	44.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	55.56%	0.00%
Great Blue Heron	3	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	33.33%	0.00%
American Crow	51	28	15.69%	1.96%	9.80%	3.92%	7.84%	0.00%	58.82%	1.96%	0.00%
TOTALS	10,762	2,913	10.92%	3.35%	4.08%	9.71%	36.28%	1.90%	3.55%	10.43%	19.77%

Table 7b. Point Count Observations and Flight Direction at CCWF, Fall 2010											
Species	Number Flying	Number of Observations	Percentage of Flights in Various Flight Directions								
			N	NE	E	SE	S	SW	W	NW	Var
Western Meadowlark	734	142	10.35%	0.82%	4.50%	3.81%	59.54%	0.00%	3.27%	4.09%	13.62%
Horned Lark	155	75	3.87%	0.65%	14.84%	3.23%	30.32%	0.00%	7.74%	3.87%	35.48%
Vesper Sparrow	18	5	0.00%	5.56%	0.00%	0.00%	94.44%	0.00%	0.00%	0.00%	0.00%
Brown-headed Cowbird	44	2	0.00%	2.27%	0.00%	0.00%	0.00%	0.00%	97.73%	0.00%	0.00%
Barn Swallow	71	33	8.45%	1.41%	9.86%	2.82%	1.41%	4.23%	18.31%	4.23%	49.30%
Tree Swallow	19	4	0.00%	0.00%	0.00%	47.37%	0.00%	5.26%	42.11%	0.00%	5.26%
Grasshopper Sparrow	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-rumped Warbler	1	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Robin	87	16	0.00%	0.00%	4.60%	5.75%	29.89%	1.15%	0.00%	1.15%	57.47%
Brewer's blackbird	2,031	4	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Western Kingbird	16	15	37.50%	6.25%	6.25%	0.00%	0.00%	0.00%	18.75%	0.00%	31.25%
Eastern Kingbird	69	33	11.59%	0.00%	10.14%	0.00%	8.70%	0.00%	5.80%	0.00%	63.77%
Loggerhead Shrike	1	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snow Bunting	19	1	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Red-winged Blackbird	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
House Sparrow	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
European Starling	124	9	66.13%	0.00%	0.81%	0.00%	0.00%	0.00%	5.65%	26.61%	0.81%
Field Sparrow	10	8	0.00%	0.00%	20.00%	0.00%	50.00%	0.00%	20.00%	10.00%	0.00%
Unidentified Blackbird	3,201	17	0.25%	0.00%	7.40%	0.78%	86.82%	0.00%	0.00%	1.03%	3.72%
American Tree Sparrow	3	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Unidentified Warbler	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
White-Crowned Sparrow	5	3	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.00%
Bobolink	2	2	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	50.00%
Yellow-headed Blackbird	4	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	14	2	0.00%	0.00%	92.86%	7.14%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank Swallow	7	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Brown Thrasher	3	3	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	33.33%
Chipping Sparrow	2	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Red-eyed Vireo	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	5	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%	0.00%	40.00%
Song Sparrow	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Goldfinch	97	52	26.80%	5.15%	14.43%	7.22%	9.28%	1.03%	26.80%	6.19%	3.09%
Dickcissel	2	2	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Sparrow	228	20	0.00%	0.00%	4.39%	86.40%	3.95%	0.00%	0.88%	2.19%	2.19%
Blue Grosbeak	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Yellow-breasted Chat	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bullock's Oriole	2	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Ruby-crowned Kinglet	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Brown Creeper	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Dark-eyed Junco	13	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Golden Eagle	1	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	22	23	4.55%	9.09%	4.55%	4.55%	18.18%	0.00%	9.09%	13.64%	36.36%
Northern Harrier	27	25	7.41%	0.00%	11.11%	11.11%	7.41%	11.11%	22.22%	7.41%	22.22%
American Kestrel	4	4	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Turkey Vulture	12	11	8.33%	16.67%	0.00%	8.33%	8.33%	0.00%	8.33%	0.00%	50.00%
Swainson's Hawk	1	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Cooper's Hawk	1	1	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Buteo	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sharp-shinned Hawk	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Rough-legged Hawk	1	1	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	179	159	57.54%	6.15%	2.79%	0.00%	13.97%	0.00%	14.53%	1.12%	3.91%
Sharp Tailed Grouse	11	5	9.09%	0.00%	0.00%	63.64%	0.00%	0.00%	27.27%	0.00%	0.00%
Gray Partridge	22	3	0.00%	9.09%	0.00%	0.00%	90.91%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	2	3	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Double-crested Cormorant	250	2	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cattle Egret	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Egret	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Yellow-shafted Flicker	3	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	33.33%
Northern Flicker	10	11	10.00%	0.00%	0.00%	50.00%	30.00%	0.00%	0.00%	0.00%	10.00%
Red-headed Woodpecker	1	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	19	2	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Mallard	36	2	0.00%	75.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%
Blue-winged teal	2	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	7	6	14.29%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	0.00%	57.14%
Upland Sandpiper	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Long-billed Curlew	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Crow	13	14	46.15%	0.00%	0.00%	23.08%	7.69%	0.00%	0.00%	0.00%	23.08%
Black-billed Magpie	1	1	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue Jay	1	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Mourning Dove	198	121	19.19%	4.04%	6.57%	3.54%	14.14%	9.09%	29.80%	3.03%	10.61%
Rock Pigeon	96	17	0.00%	3.13%	0.00%	25.00%	3.13%	0.00%	26.04%	26.04%	16.67%
Franklin's Gull	234	4	0.00%	53.42%	3.42%	0.00%	0.00%	0.00%	43.16%	0.00%	0.00%
Common Nighthawk	1	1	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sandhill Crane	108	5	0.00%	0.00%	0.00%	90.74%	9.26%	0.00%	0.00%	0.00%	0.00%
TOTALS	**8,256**	**926**	**4.54%**	**2.43%**	**4.80%**	**8.26%**	**66.67%**	**0.45%**	**4.53%**	**1.89%**	**6.43%**

Table 8. CCWF Incidental Observations, Spring 2010 and Fall 2010				
Species	Spring 2010		Fall 2010	
	Observations	Individuals	Observations	Individuals
Red-tailed Hawk	44	52	31	32
Unidentified Hawk	1	1	0	0
Sharp-tailed Grouse	3	3	1	1
American Kestrel	12	12	5	5
Bald Eagle	5	5	1	1
Canada Goose	3	85	0	0
Red-winged Blackbird	4	436	0	0
Great-horned Owl	1	2	0	0
Northern Harrier	14	15	8	10
Northern Pintail	1	8	1	1
Swainson's Hawk	5	7	7	9
Franklin's Gull	5	126	1	1
Northern Shoveler	1	10	0	0
Mallard	1	1	0	0
Marbled Godwit	1	2	0	0
Blue Jay	1	2	0	0
Turkey Vulture	5	8	3	9
European Starling	4	633	0	0
Common Grackle	1	39	0	0
Horned Lark	1	2	0	0
Unidentified Blackbirds	3	68	0	0
Barn Swallow	1	3	0	0
Great Blue Heron	1	1	1	1
Common Tern	1	4	0	0
Burrowing Owl	1	2	2	4
American Crow	1	2	3	12
Cooper's Hawk	0	0	3	3
Peregrine Falcon	0	0	1	1
Totals	**121**	**1,529**	**68**	**90**

Table 9. Raptor Nest Observations at CCWF				
Raptor Nest Number	**Date**	**Species**	**Activity**	**Raptor Nest Location (NAD 83 UTM14)**
1	5/4/2010	Swainson's Hawk	Active	14T 0406436 5072438
2	4/8/2010	Red-tailed Hawk	Active	14T 0408011 5069264
3	4/8/2010	Red-tailed Hawk	Active	14T 0400816 5073291
4	4/8/2010	Red-tailed Hawk	Active	14T 0408028 5073893
5	4/15/2010	Red-tailed Hawk	Active	14T 402341 5068092
6	4/16/2010	Red-tailed Hawk	Active	14T 403151 5072501
7	4/22/2010	Red-tailed Hawk	Active	14T 399062 5072489
8	4/23/2010	Red-tailed Hawk	Inactive	14T 401254 5070774
9	4/22/2010	Red-tailed Hawk	Inactive	14T 401804 5069869
10	4/23/2010	Unknown	Inactive	14T 403586 5068048
11	4/22/2010	Red-tailed Hawk	Active	14T 405803 5069878
12	4/22/2010	Red-tailed Hawk	Inactive	14T 406113 5064222
13	4/22/2010	Red-tailed Hawk	Inactive	14T 408980 5069152
14	4/22/2010	Red-tailed Hawk	Active	14T 407710 5071961
15	4/22/2010	Red-tailed Hawk	Active	14T 408439 5074479
16	4/23/2010	Red-tailed Hawk	Active	14T 403288 5068324
17	5/3/2010	Red-tailed Hawk	Active	14T 406977 5073945

Table 10. Sharp-tailed Grouse Lek Observations at CCWF, Spring 2010						
Lek Number	**Date**	**Total Number of Birds Observed**			**Habitat**	**Lek Location (NAD 83 UTM14)**
		Males	**Female**	**Unknown**		
1	5/14/2010	5	1	0	Grassland/Alfalfa	14T 408469 5071445

Figures

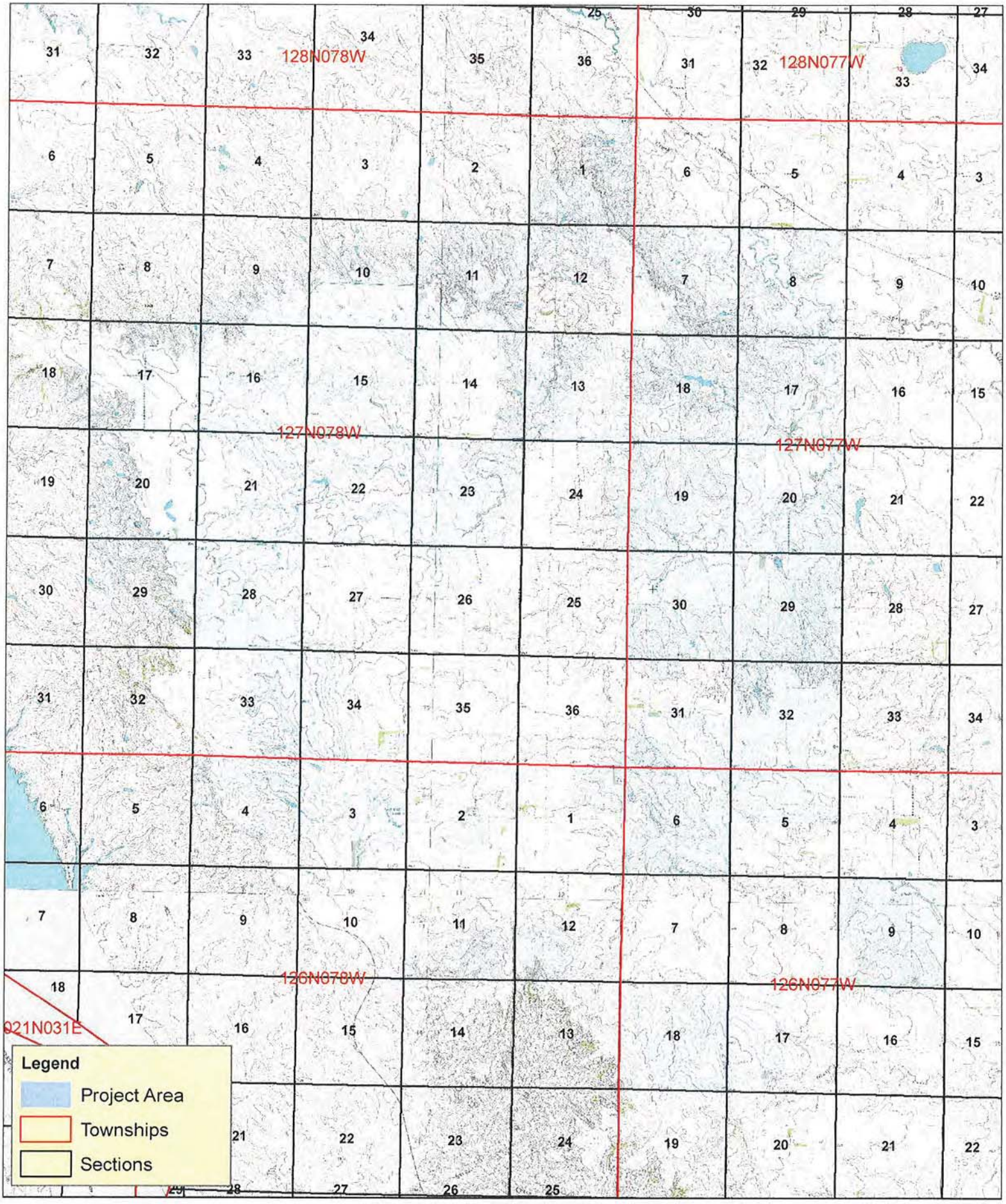

Figure 1. Campbell County Wind Farm Boundary
Fagen Engineering Inc.
Campbell County, South Dakota

1:72,000
WPC Project 211-01-JA/DA
Sources: USGS topo map

N

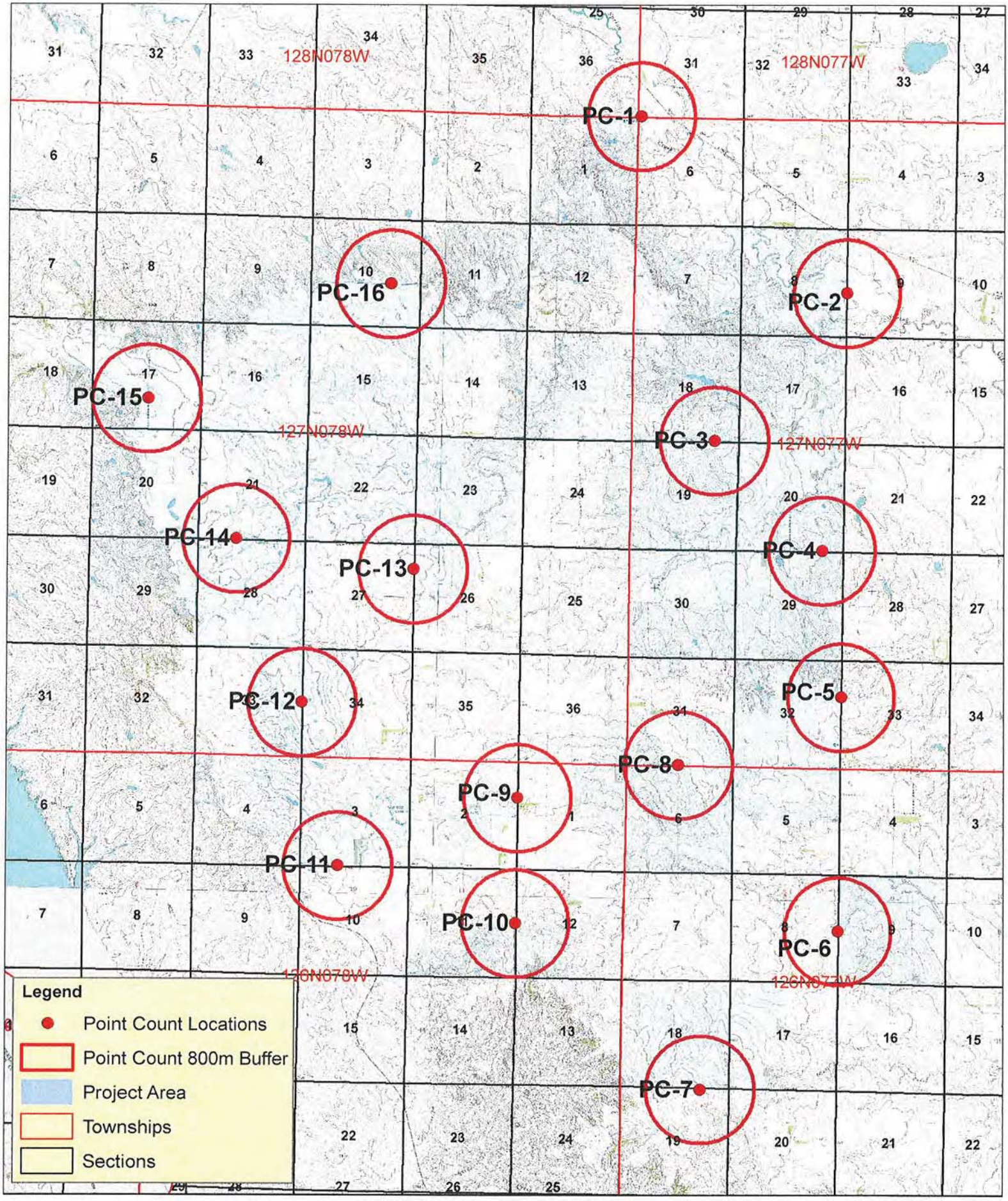

Figure 2. Campbell County Wind Farm Boundary and Point Count Locations
Fagen Engineering Inc.
Campbell County, South Dakota

1:72,000

N

WPC Project 211-01-JA/DA
Sources: USGS topo map

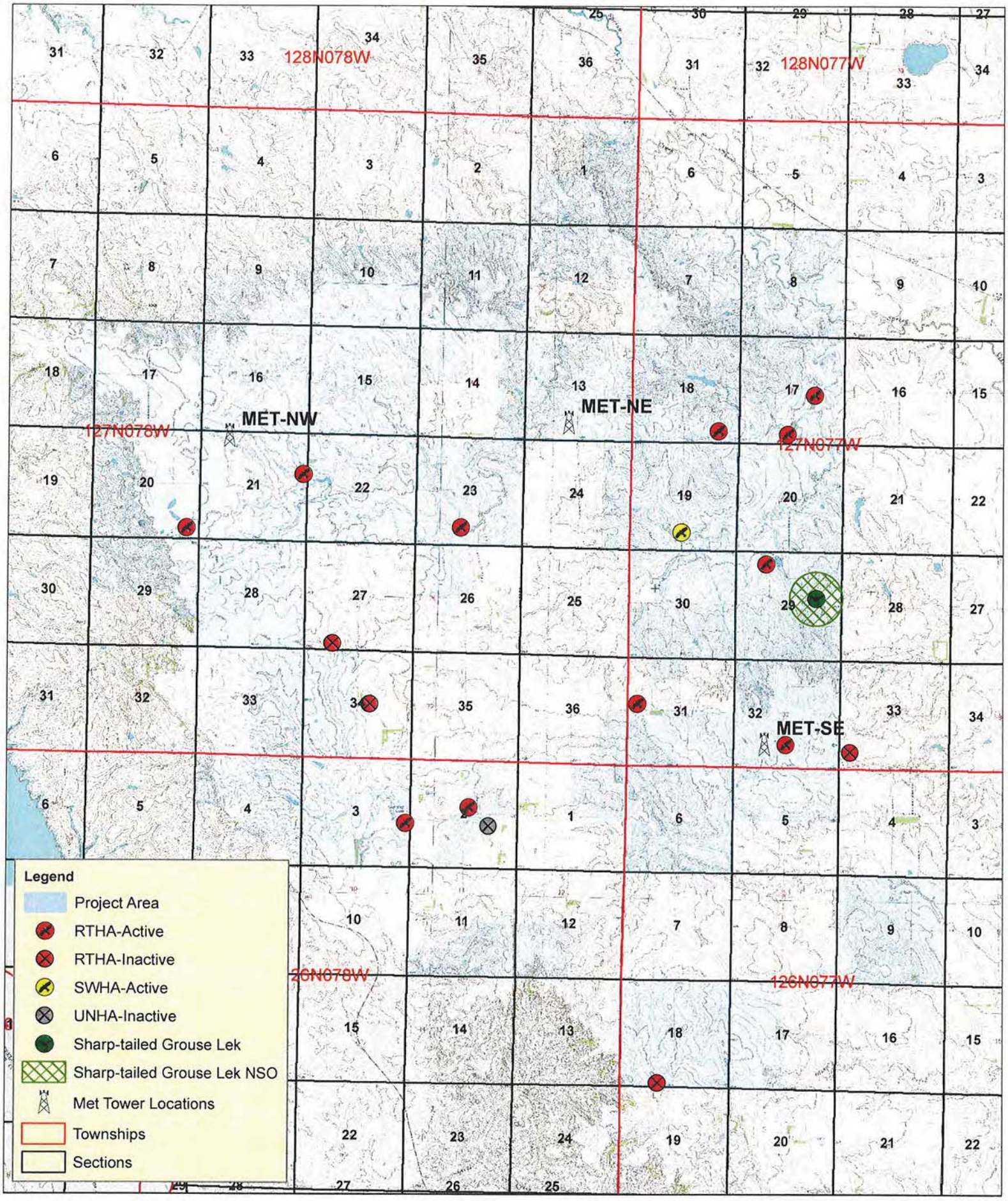

Figure 3. Raptor Nest and Lek Locations at Campbell County Wind Farm
Fagen Engineering Inc.
Campbell County, South Dakota

1:72,000

N

WPC Project 211-01-JA/DA
Sources: USGS topo map

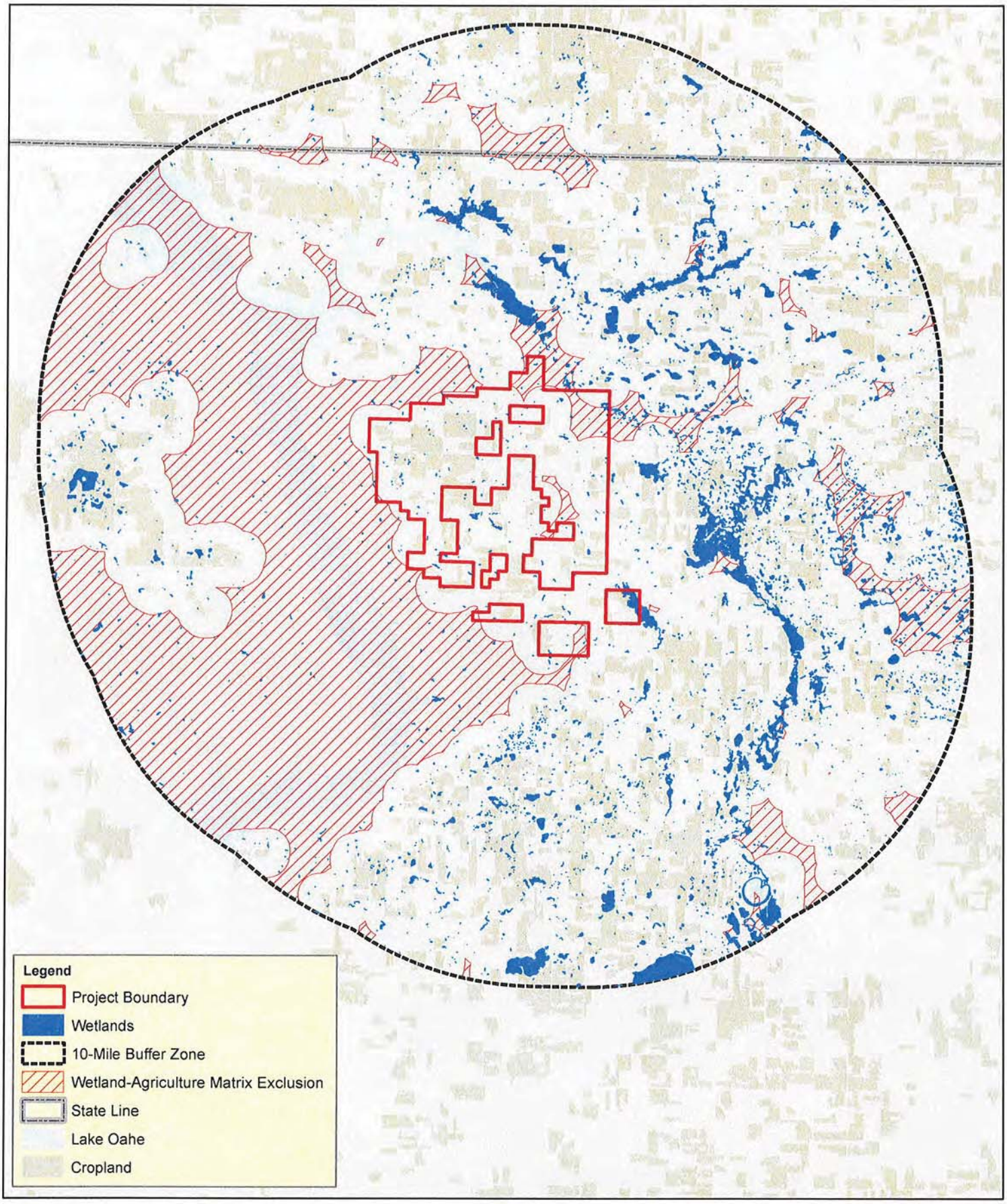

Figure 4. Project Area and 10-Mile Buffer Wetland-Agricultural Matrix
Fagen Engineering Inc.
Campbell County, South Dakota

1:235,000

WPC Project 211-01-JA/DA
Sources: USGS topo map

N

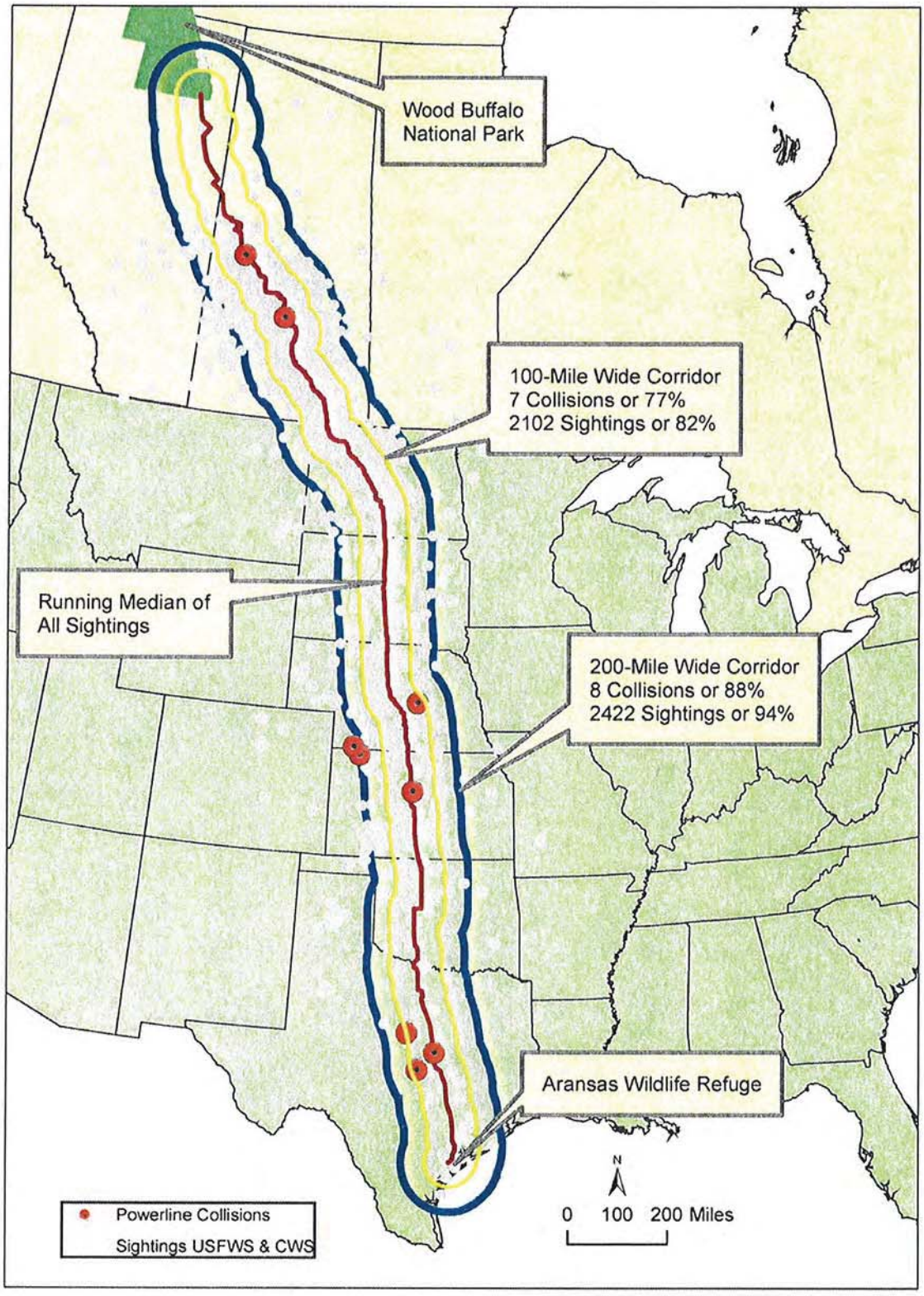

Figure 5. Whooping Crane Migration Distribution and Sightings

Appendix I

Appendix I. Point Count Photos

Photo 1: Point Count 1 looking east.

Photo 2: Point Count 1 looking north.

Photo 3: Point Count 1 looking west.

Photo 4: Point Count 1 looking south.

Photo 5: Point Count 2 looking east.

Photo 6: Point Count 2 looking north.

Photo 7: Point Count 2 looking west.

Photo 8: Point Count 2 looking south.

Photo 9: Point Count 3 looking east.

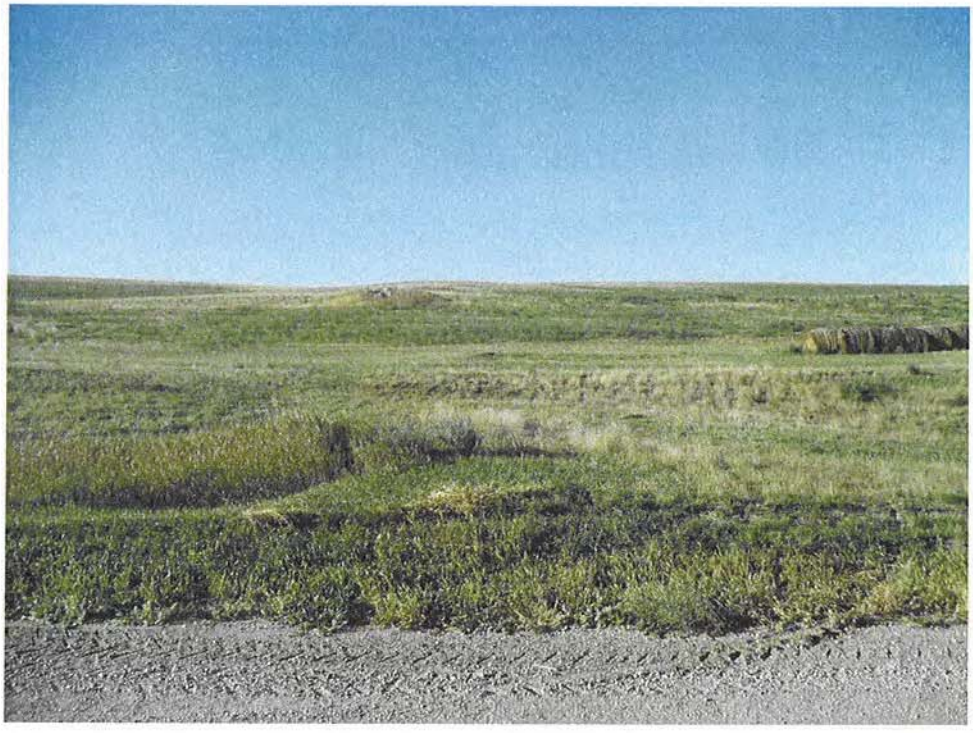

Photo 10: Point Count 3 looking north.

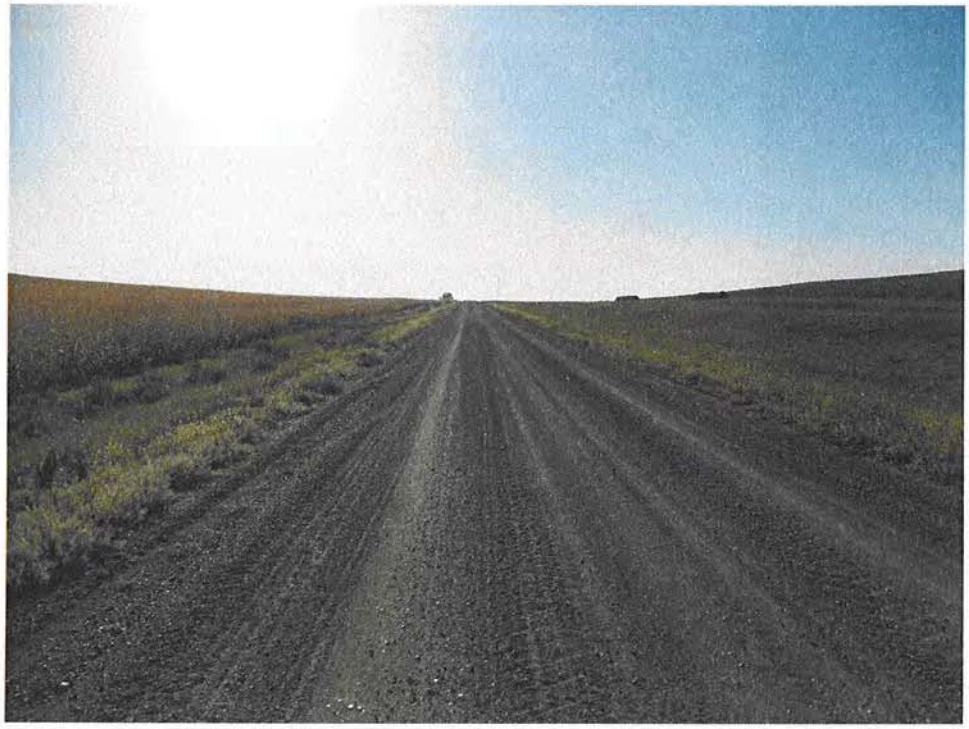

Photo 11: Point Count 3 looking west.

Photo 12: Point Count 3 looking south.

Photo 13: Point Count 4 looking east.

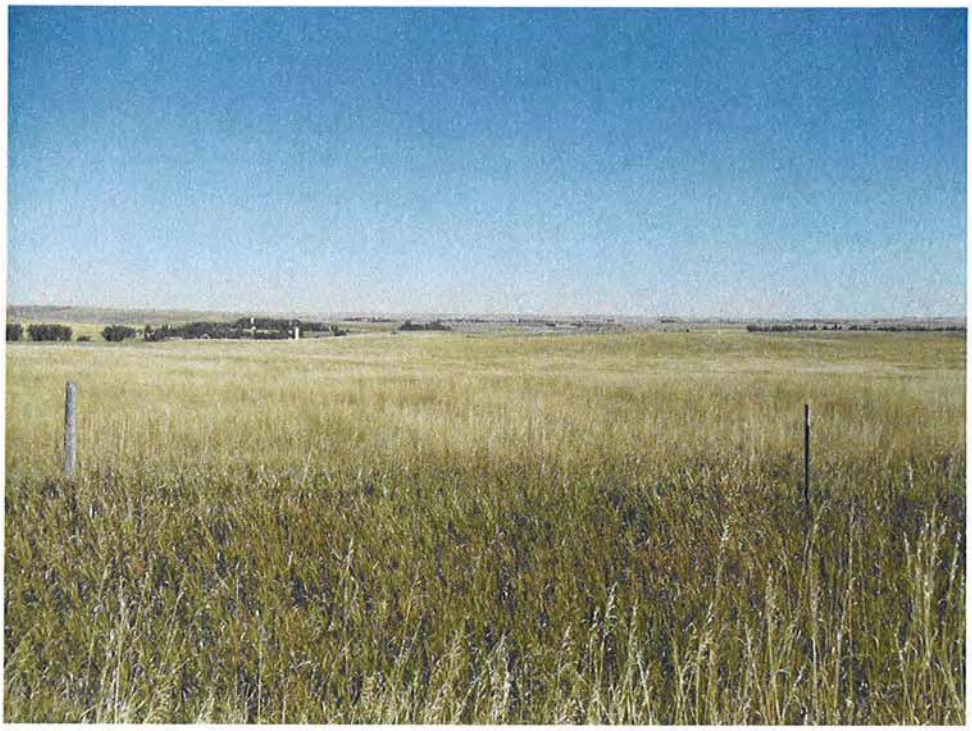

Photo 14: Point Count 4 looking north.

Photo 15: Point Count 4 looking west.

Photo 16: Point Count 4 looking south.

Photo 17: Point Count 5 looking east.

Photo 18: Point Count 5 looking north.

Photo 19: Point Count 5 looking west.

Photo 20: Point Count 5 looking south.

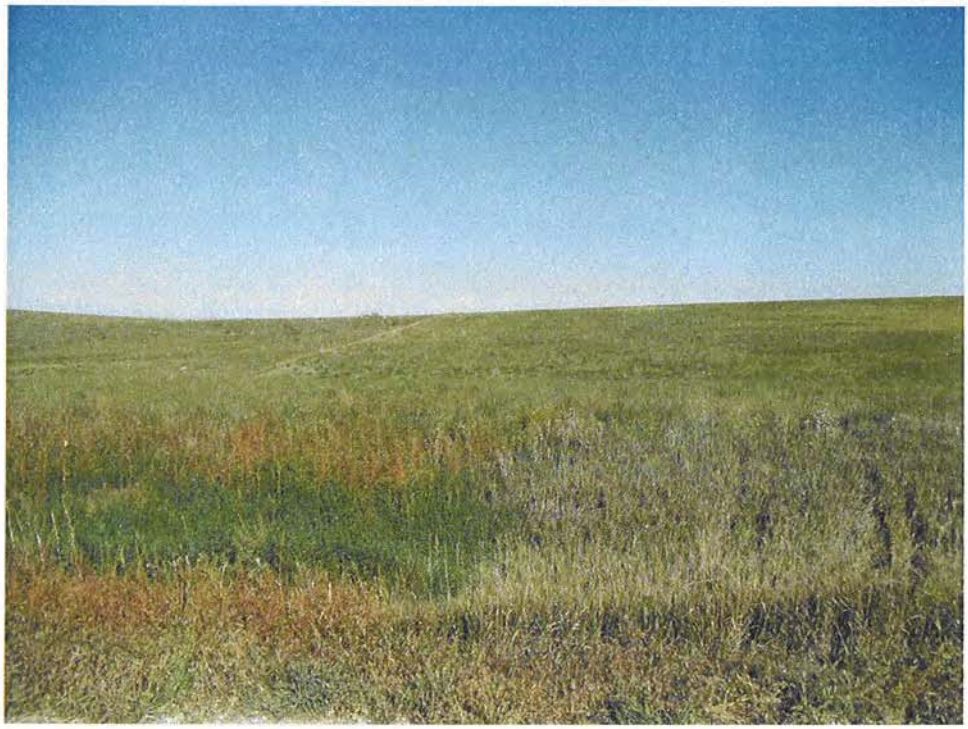

Photo 21: Point Count 6 looking east.

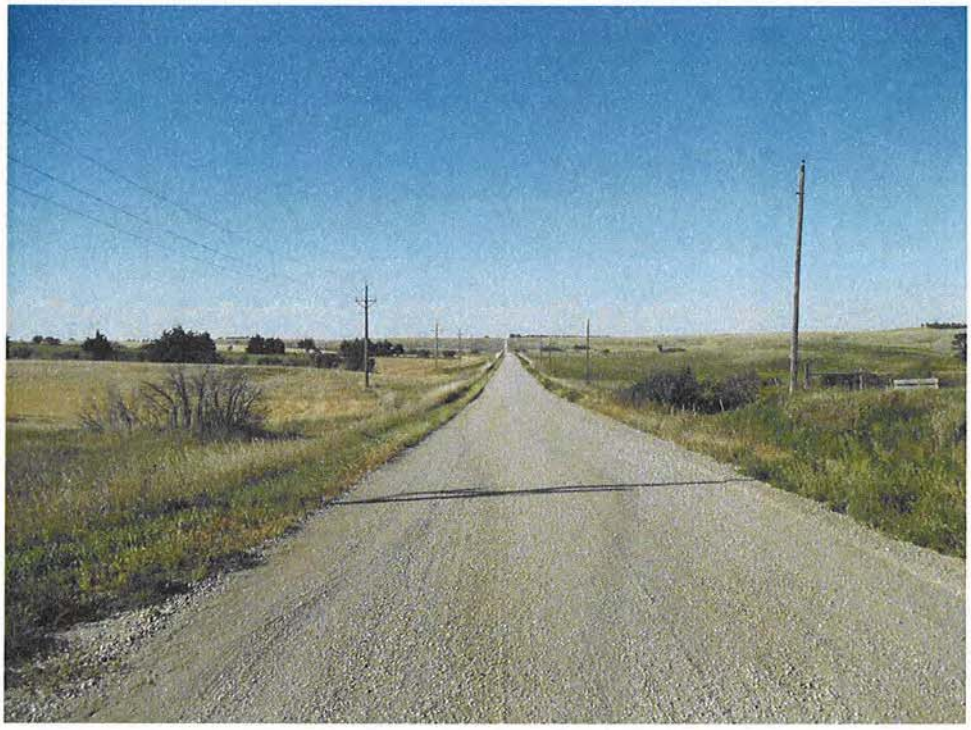

Photo 22: Point Count 6 looking north.

Photo 23: Point Count 6 looking west.

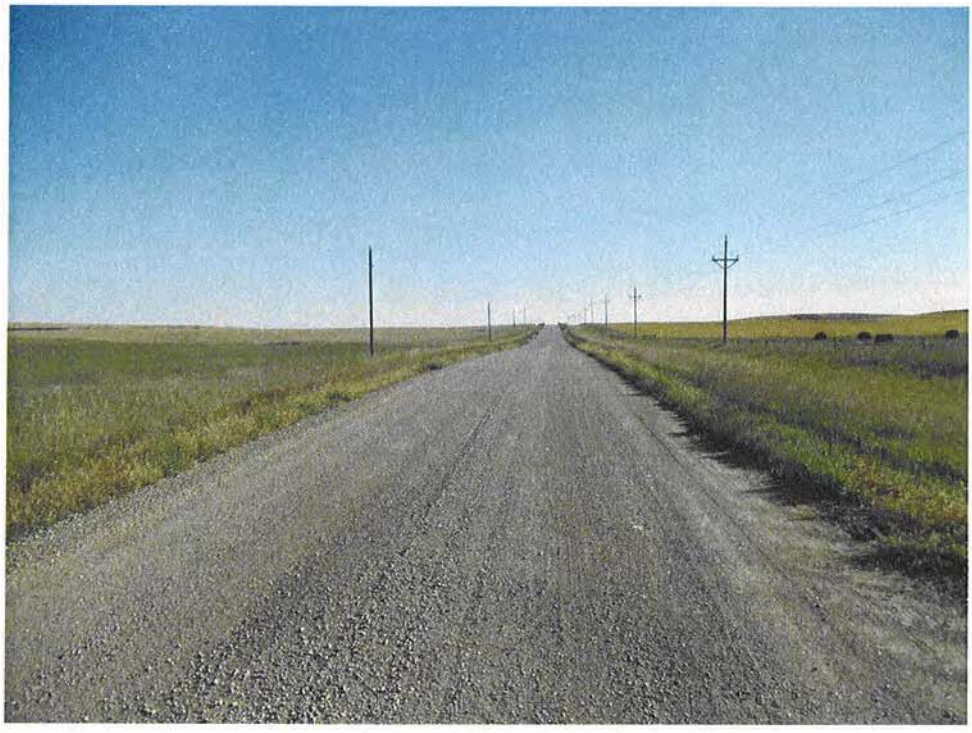

Photo 24: Point Count 6 looking south.

Photo 25: Point Count 7 looking east.

Photo 26: Point Count 7 looking north.

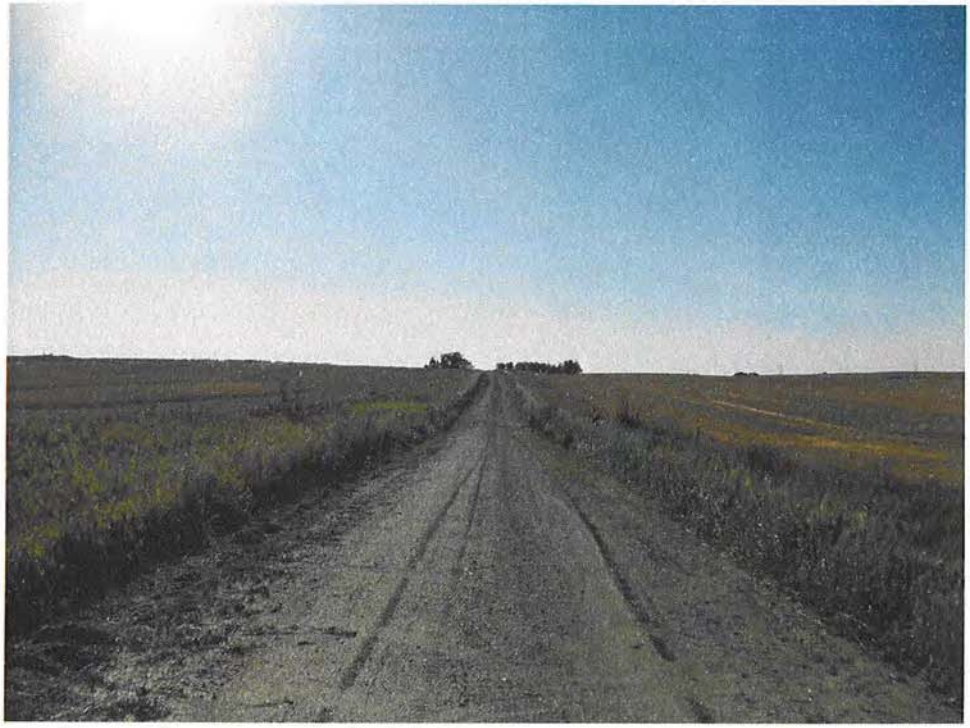

Photo 27: Point Count 7 looking west.

Photo 28: Point Count 7 looking south.

Photo 29: Point Count 8 looking east.

Photo 30: Point Count 8 looking north.

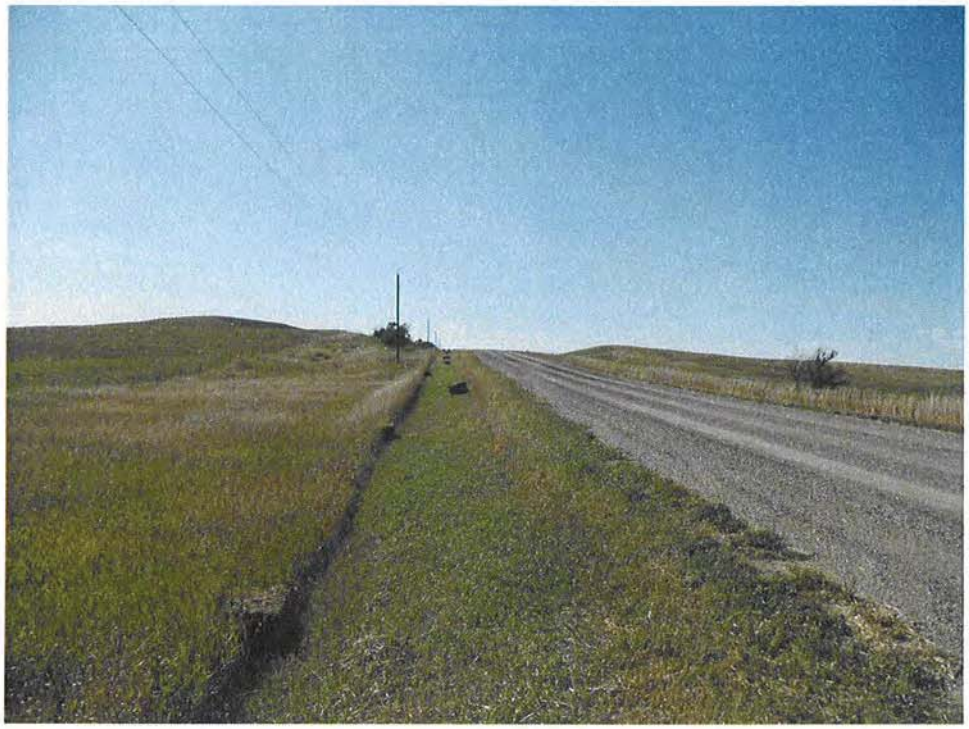

Photo 31: Point Count 8 looking west.

Photo 32: Point Count 8 looking south.

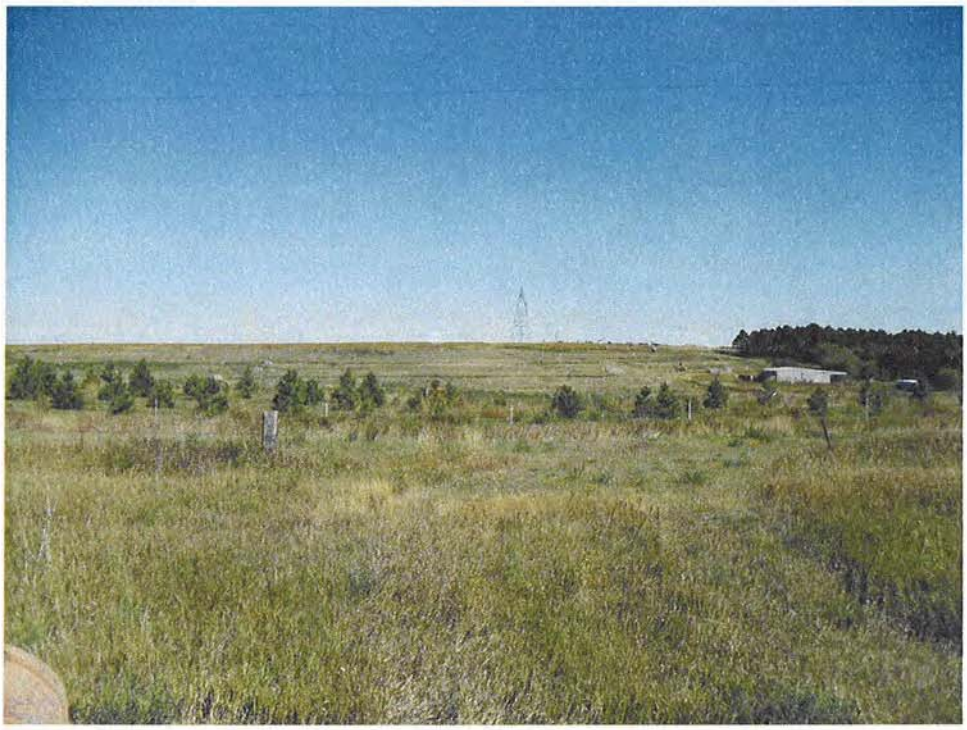

Photo 33: Point Count 9 looking east.

Photo 34: Point Count 9 looking north.

Photo 35: Point Count 9 looking west.

Photo 36: Point Count 9 looking south.

Photo 37: Point Count 10 looking east.

Photo 38: Point Count 10 looking north.

Photo 39: Point Count 10 looking west.

Photo 40: Point Count 10 looking south.

Photo 41: Point Count 11 looking east.

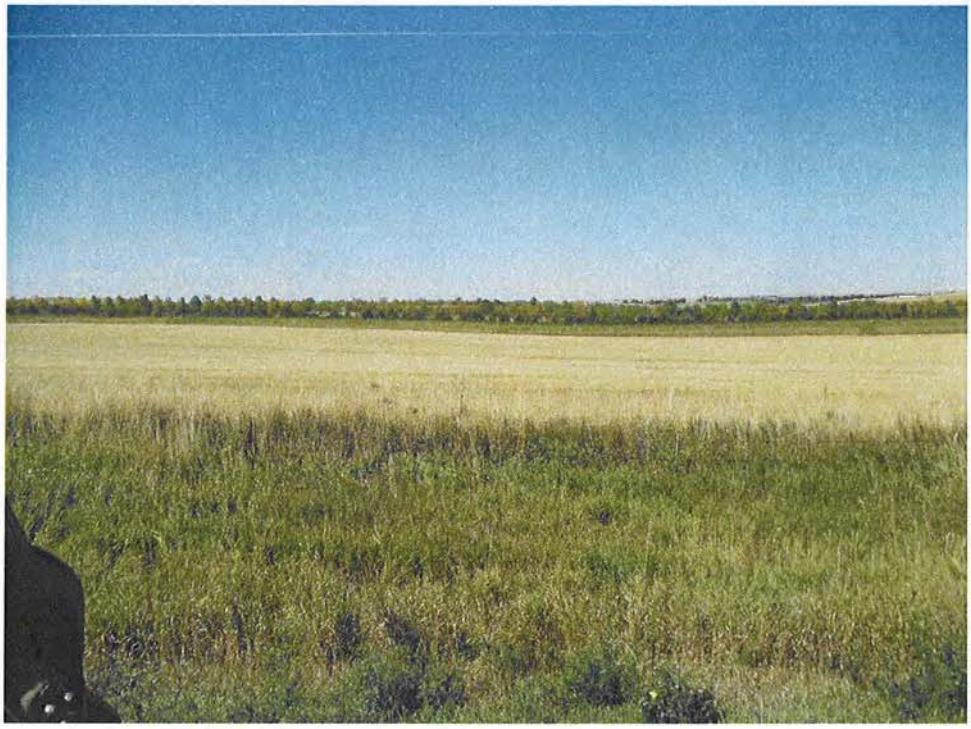

Photo 42: Point Count 11 looking north.

Photo 43: Point Count 11 looking west.

Photo 44: Point Count 11 looking south.

Photo 45: Point Count 12 looking east.

Photo 46: Point Count 12 looking north.

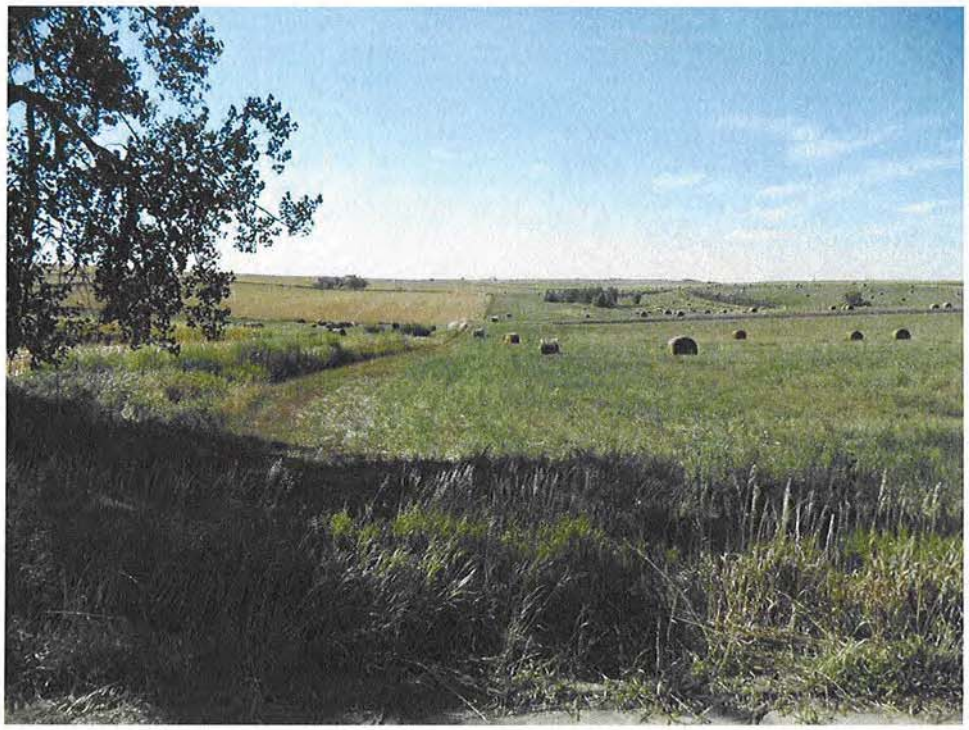

Photo 47: Point Count 12 looking west.

Photo 48: Point Count 12 looking south.

Photo 49: Point Count 13 looking east.

Photo 50: Point Count 13 looking north.

Photo 51: Point Count 13 looking west.

Photo 52: Point Count 13 looking south.

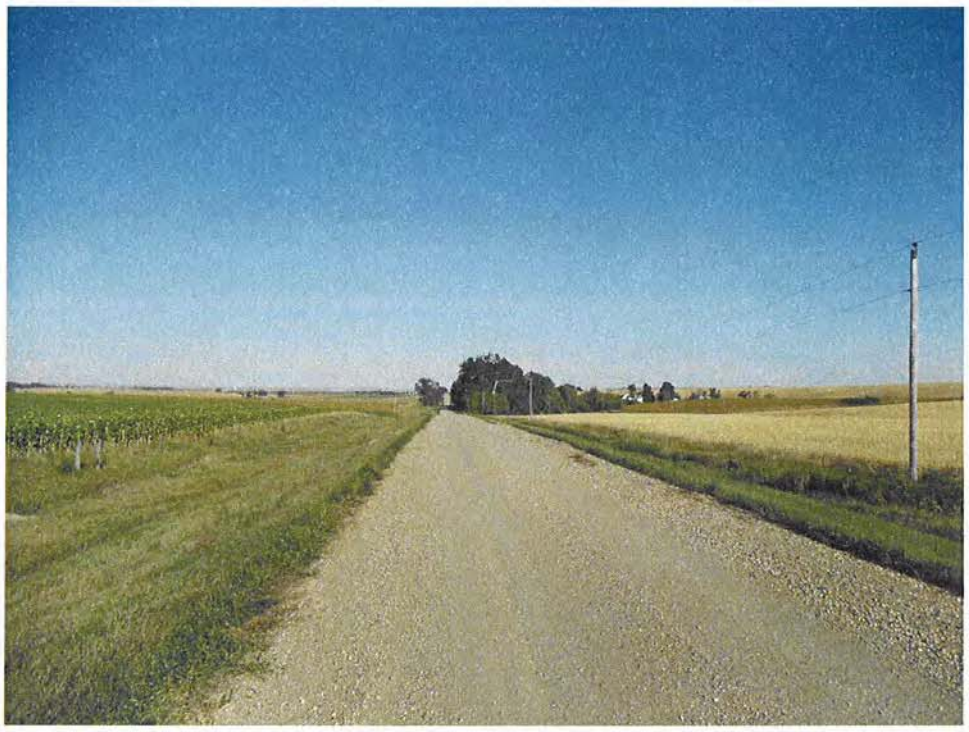

Photo 53: Point Count 14 looking east.

Photo 54: Point Count 14 looking north.

Photo 55: Point Count 14 looking west.

Photo 56: Point Count 14 looking south.

Photo 57: Point Count 15 looking east.

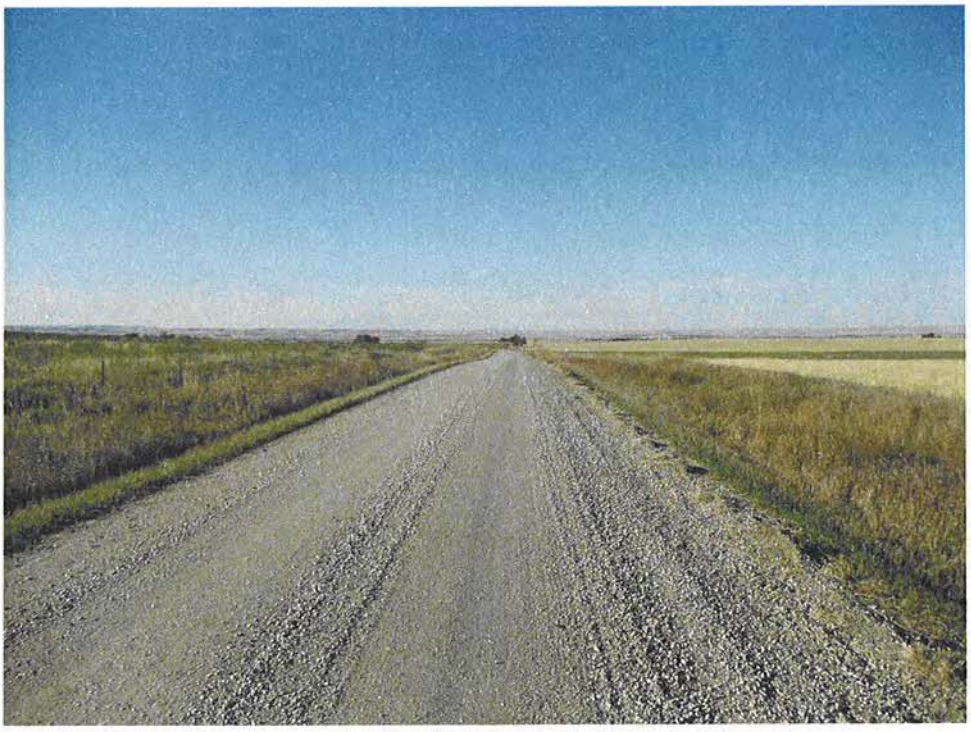

Photo 58: Point Count 15 looking north.

Photo 59: Point Count 15 looking west.

Photo 60: Point Count 15 looking south.

Photo 61: Point Count 16 looking east.

Photo 62: Point Count 16 looking north.

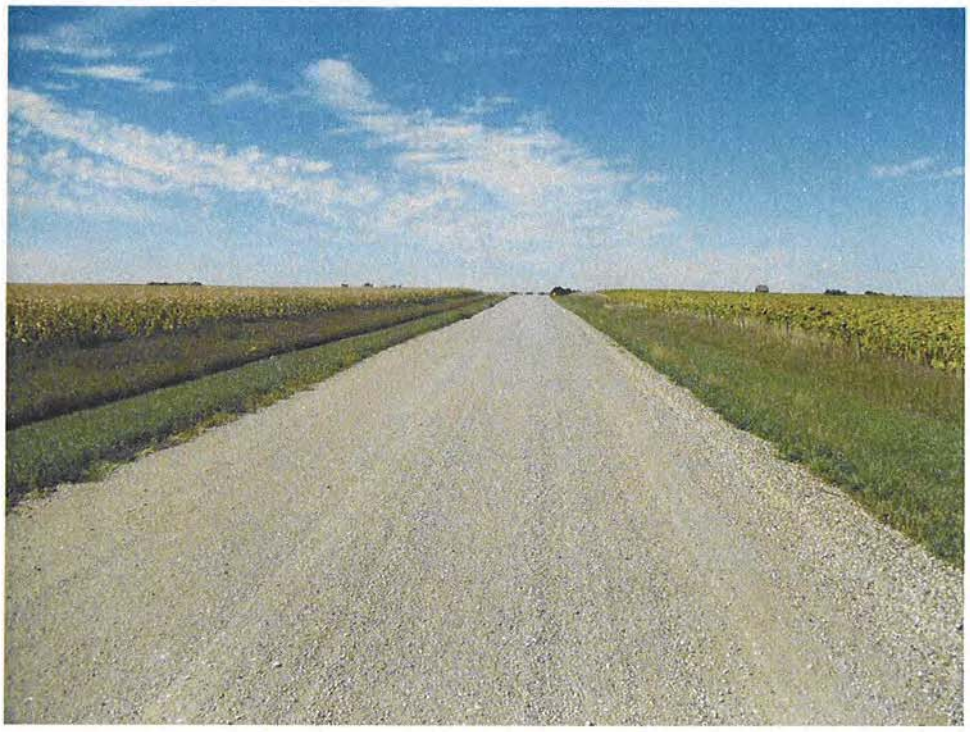

Photo 63: Point Count 16 looking west.

Photo 64: Point Count 16 looking south.

BAT ACOUSTIC STUDIES FOR THE CAMPBELL COUNTY WIND FARM
SOUTH DAKOTA

August 18 - October 24, 2010

Prepared for:

Western Plains Consulting, Inc.
Bismarck, ND

Project Owner:
Dakota Plains Energy
Aberdeen, SD

Prepared by:

Eco-Tech Consultants, Inc.
Jeffersonville, Indiana

January, 2011

ETC ECOLOGICAL
Eco-Tech Consultants, Inc.

EXECUTIVE SUMMARY

Eco-Tech Consultants, Inc. (ETC) initiated surveys in August 2010 designed to assess bat use within the proposed Campbell County Wind Farm, South Dakota. Acoustic surveys for bats using Anabat® SD-2 ultrasonic detectors at two MET towers at 2 m and 45 m microphone heights were conducted from August 18 to October 24, 2010. The objective of the surveys was to estimate the seasonal and spatial use of the study area by bats, as well as to estimate total bat activity, defined here as number of bat passes. In total, 379 bat passes were recorded during 264 detector nights. Averaging bat passes across locations, we detected a mean of 1.4 bat passes per detector-night, with a range of 0 to 59 total passes per night.

Total bat activity peaked in late August and no passes were recorded after October 11. Bat activity appears to have come predominately from low frequency (<30 kHz) bats (72% of passes). This species group is comprised of big brown bats, hoary bats and silver-haired bats. Bats with echolocation calls in the <30 kHz range, especially silver-haired and hoary bats, have comprised the majority of fatalities at other wind power projects. Passes by medium frequency (MF) and high-frequency (HF) bats totaled 11% and 16% respectively. Red bats, whose calls typically are 30-40 kHz, have predominated fatalities at some eastern wind energy projects. This species appears to have a limited presence within the project area.

The mean number of bat passes per detector per night was compared to existing data at other wind energy facilities from the region where both bat activity and mortality levels have been measured. The level of bat activity documented at the Campbell County Wind Farm was lower than all other published results. Assuming that the general relationship between bat activity and bat mortality observed at these sites is broadly applicable to other locations, we expect that levels of turbine-related bat mortality at the Campbell County Wind Farm will be on the lower end of the spectrum, and on par with others from the region. Assuming that activity patterns by bats are relatively consistent from year to year, we expect most fatalities to occur from mid- August to mid-September.

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FIGURES

PHOTOGRAPHS

1. INTRODUCTION

Western Plains Consulting, Inc. (WPC) contracted Eco-Tech Consultants, Inc (ETC) to conduct acoustic studies for fall migrating bats for the proposed Dakota Plains Energy's Campbell County Wind Farm (CCWF), South Dakota. ETC was requested to affix passive high/low acoustic monitoring systems at two existing meteorological towers already present at the development site. WPC biologists assisted ETC with the collection of data and maintenance of the monitoring systems.

While still in the initial design phases, CCWF ultimately has the potential for power production on the order of 300+ MW, from currently-held leases across 17,000 acres. At this time we are not aware of the turbine size or type to be employed by the developer. Generally, most modern turbines are capable of generating 1.5-2.5 MW of electricity, and reach 100 m (328 ft) or more into the sky. The construction of the CCWF is scheduled to commence in the fall of 2012.

As the nation's installed capacity of wind-energy has increased, so have concerns about the impacts to the birds and bats that sometimes collide with the turbines. As a result, both pre- and post-operations surveys for bats are recommended for most new wind-energy facilities. The purpose of this report is to summarize and describe the results of pre-construction bat acoustic surveys during the fall of 2010. This period coincides with the migration of certain bat species known to be the predominant fatalities of wind power projects across the nation. The intent is to highlight any items of biological interest and to describe levels of bat activity in the context of similar studies conducted regionally and nationally.

2. STUDY AREA

The Campbell County Wind Farm, located in north central South Dakota, will encompass 17,000 acres across three ridges just east (>4 km) of the Missouri River and south of Pollock, SD (Figure 1). The project is located in the USEPA Level IV Ecoregion described as the Southern Missouri Coteau Slope of the Northwestern Plains (Bryce et al. 1998). This ecoregion has level to rolling uplands sloping westward to the Missouri River. Elevation ranges from 1400-2200 m asl.

Grain croplands dominate the land-use. Soils are derived from loess and Wisconsin glacial till and are suited for the production of sunflowers, wheat, millet, barley, and some corn. Natural vegetation is comprised of western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), big bluestem (*Andropogon gerardii*), and needle and thread (*Hesperostipa comata*). Stream drainages are typically cleared, but may support small pockets of willows (*Salix* sp.), green ash (*Fraxinus pennsylvanica*), and elm (*Ulmus* sp.)

This ecoregion has a mean annual precipitation total of 19-21 in. Mean July minimum and maximum temperatures are 64 and 89°F, and there are typically 130-150 frost free days. The site is located on the western edge of the Central Time Zone. On September 1 sunset occurred at 20:22 (twilight 20:53) and sunrise was 07:01 (twilight 06:30).

The Missouri River to the west of the site exists as a large reservoir, Lake Oahe, and is impounded just north of Pierre, SD by Oahe Dam. Tributaries leading to the reservoir are heavily incised and are frequently dry.

3. METHODS

3.1. Bat Acoustic Survey

The objective of the acoustic survey was to estimate the seasonal and spatial use of the CCWF by bats. Bats were surveyed using Anabat SD2™ detectors (Titley Electronics Pty Ltd., NSW, Australia). Acoustic detectors are a recommended method to index and compare habitat use by bats. The use of this technology for calculating an index to bat impacts has been used at several wind-energy facilities (Kunz et al. *2007a),* and is an economically feasible bat risk assessment tool (Arnett 2007). Anabat detectors record echolocation calls with a broadband microphone. The echolocation sounds are then translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16, which is appropriate for all species of bats in South Dakota, was used for the study.

Bat activity was surveyed using 4 detectors from August 18 to October 24, 2010, a period corresponding to likely fall bat migration at this site, and which corresponds to the period when the majority of bat fatalities have been recorded at other wind energy projects (Arnett et al. 2008). Two meteorological towers were chosen to conduct acoustic monitoring. Each tower was positioned along ridge tops within cleared agriculture fields. At the time of sampling, the NW tower was a cleared fallow field while the SE tower was planted with corn. At each tower, Anabat detectors were established at 2m (low mic) and at 45m (high mic). This spacing along each tower was essential to sample air space from the vicinity of the presumed rotor-swept region of a turbine (>30m) and additional air space just over the existing surface vegetation (Kunz et al. 2007a).

Anabat detector loggers were placed inside plastic weather-tight containers and connected to the microphones via a coaxial cable. The microphones were encased in a Bat-Hat weatherproof housing systems (EME Systems, Berkeley, California). A 45° PVC elbow with the opening positioned parallel to the ground was employed to protect the electronics from moisture. The high mic was raised with a mounted pulley system, and the low mic was affixed directly to the met tower using hose clamps. All acoustic equipment was powered by 12V 12Ah closed cell batteries (Photos 1-6).

All units were programmed to turn on each night an approximate half-hour before sunset and turn off approximately a half-hour after sunrise. Calls were recorded to a compact flash memory card with large storage capacity. Bat echolocation detectors also detect other ultrasonic sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. Maintenance visits were conducted approximately every week to collect data cards and replace depleted 12V batteries.

3.2. Data Analysis

Potential call files were extracted from data files using CFCread© software (www.hoarybat.com, Version 4.3.18). The default settings for CFCread© were used during this file extraction process, as these settings are recommended for the calls that are characteristic of eastern bats. This software screens all data recorded by the bat detector and extracts call files using a filter. Using the default settings for this initial screen also ensures comparability between data sets. Settings used by the filter include a max TBC (time between calls) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter is and the more noise files and poor quality call sequences are retained within the data set. The units of activity were number of bat passes (Hayes, 1997). A pass was defined as a continuous series of greater than or equal to two call pulses produced by an individual bat with no pauses between call pulses of less than one second (White and Gehrt 2001, Gannon et al. 2003). In this report, the terms bat pass and bat sequence are used interchangeably.

Following extraction of files, each data set was further filtered in AnalookW© (www.hoarybat.com, Version 3.8g) to remove/reduce extraneous environmental and insect noise specific to a certain frequency range. With each filter run, files not passing filters were visually inspected for missed bat calls and moved by hand to the appropriate directory. Bat calls typically include a series of pulses characteristic of normal flight or prey location ("search phase" calls) and capture periods (feeding "buzzes"). In contrast, static typically forms a diffuse band of dots at either a constant frequency or widely varying frequency, caused by wind, vibration, or other interference.

The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector nights. Because of the inherent difficulty in identifying bat calls to the species level with passive monitoring methods, all recorded bat calls were classified by their characteristic frequency range and taxonomic group (species guild). We chose to use three species guilds for bats known from the South Dakota region (Table 1). They include high-frequency calls (>40 kHz), which are generally given by small bats (*e.g.*, *Myotis* sp.); medium-frequency (30-40 kHz) which are comprised of the red bat [*Lasiurus borealis*] and evening bat [*Nyctisceius humeralis*]; or low-frequency (<30 kHz), which are generally given by

the largest bats (*e.g.*, silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*], hoary bat [*Lasiurus cinereus*]). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis.

Once all of the call files were identified and categorized in appropriate guilds, nightly tallies of detected calls were compiled. Mean detection rates (number of passes/detector-night) for the entire sampling period were calculated for each detector and for all detectors combined. It is important to note that detection rates indicate only the number of calls detected and do not necessarily reflect the number of individual bats in an area. For example, a single individual can produce one or many call files recorded by the bat detector, but the bat detector cannot differentiate between individuals of the same species producing those calls. The results of the acoustic monitoring survey are most applicable for determining bat activity patterns and probable species composition of migrant individuals and the local bat community. The magnitude of the community and the number of migrants occurring within the study area is not accurately measurable with the acoustic methods. Although, intuitively, if a specific detector records a high number of call sequences, it is likely that the level of activity near that detector is higher.

Additional analysis was conducted to assess potential associations between bat activity levels and environmental variables such as wind speed and temperature. This data was obtained from anemometry equipment affixed to the MET towers and is represented as a nightly mean of measurements obtained every ten minutes from approximately sundown to sunup throughout the survey period.

4. RESULTS

4.1. Acoustic Survey

Bat activity was monitored at two MET tower locations on a total of 264 nights during the 272-night sampling period (4 detectors for 68 nights), and resulted in the collection of 379 bat passes (Table 2, Figure 2). Averaging across stations, we detected 1.4 bat passes per night. Overall, passes by low frequency bats (LF: 72%) outnumbered passes by medium frequency (MF: 11%) and high frequency bats (HF: 16%) (Figure 3). We additionally recorded 204,693 files that were characterized as noise, with the sources primarily coming from insects, rain, wind, birds, and mechanical equipment.

In all, acoustic equipment was operational 97% of the monitoring period, with 3.88 detectors, on average, operating on any given night (range: 3-4). Failures occurred at SE02 (Southeast MET tower, 2m mic) for 6 nights because of a blown fuse and at SE45 for two nights due to an insufficiently charged battery.

4.2. Spatial Variation

Bat activity varied considerably between stations (Figures 4-6). Approximately 80% of all calls recorded from the two locations came from the NW MET tower. Bat activity was greater at the 2 m height than the 45 m height, with 62% of all calls coming from the low mics.

LF bats at the NW tower (2 m and 45 m combined) comprised 58% of the total calls recorded in the study area (Figure 5). LF was the only group with activity levels greater than one pass per detector night (1.46 at NW45 and 1.76 at NW02) at any given detector location. All others were 0.65 passes per night or less (Table 2).

We did not observe a sunstantial relationship between species groups and the vertical sampling profile. The relative proportion of LF, MF, and HF bat calls was nearly equal at 2 m and 45 m heights, with a maximum proportional separation no greater than 10%.

4.3. Temporal Variation

Bat activity was variable on any given night, but there was a general trend toward a peak in activity in late August (Figure 2). Bat activity was highest (22 total passes per night) during the week of August 25. Overall bat activity declined substantially in the following weeks, particularly after mid-September, influenced perhaps by decreasing temperatures and increasing wind speeds. Only 6 bat passes were recorded in October, with no bat passes occurring after October 11. Bat activity was positively correlated with temperature over the course of the study (Figure 7), but the relationship displayed weak correlation (R^2 = 0.27) (Figure 8)

Bat activity in relation to wind speed was examined during the primary activity period of August 18 to August 31. In general a trend was observed with activity being negatively correlated to wind speed (Figure 9), but the relationship was not strong (R^2 = 0.18) (Figure 10). The three peak activity nights occurred when mean nightly wind speed was below 7 m/s, and very low activity nights did occur when wind speed were elevated (8.8-14.5 m/s).

Activity by HF, MF and LF species, while differing in magnitude, showed similar relative activity levels by date. In all three guilds, the week of August 25th represented the peak of weekly activity for the entire study period (Figure 2). Interestingly, the night of August 28th in particular was the peak night for all three groups (42 LF, 6 MF, and 11 HF passes). This night was nearly the last night with temperatures above 20°C. It was preceded by three nights around 16°C (Figure 7). Following this cool stretch, August 28th was the first night with wind speeds under 7 m/s. For the study period, nightly temperature averaged 13.1°C, and nightly wind speed averaged 7.9 m/s (Figures 7 and 9).

5. DISCUSSION

To date, monitoring studies of wind projects in the eastern U.S. suggest that migratory tree-roosting species (hoary, red and silver-haired bats) comprise almost 75% of reported bats killed, and the majority of fatalities occur during the post-breeding or fall migration season (roughly August and September) (Arnett et al. 2008, Johnson et al. 2003, Kunz et al. *2007b)*. A few studies of wind projects across the east have recorded both bat mortality and Anabat detections per night (Kunz et al. 2007b). The number of bat calls per night as determined from bat detectors shows a rough correlation with bat mortality. This allows for some qualitative comparison of risk across regions. However, extrapolation of these trends to other sites must be done cautiously because effort, timing of sampling, species recorded, and detector settings (equipment and locations) all vary among studies (Kunz et al. *2007b).* Nonetheless, our best available estimate of potential mortality levels at a proposed wind project involves evaluation of our on-site bat acoustic data in terms of activity levels, seasonal variation and species composition, and topographic features of the project area.

Bat activity within the CCWF (1.4 bat passes per detector-night) was lower than all published observations from region-similar facilities in Minnesota (2.1 passes/nt), Wyoming (2.2 passes/nt), and Iowa (34.9 passes/nt) (Kunz et al. 2007b). Based on the presumed relationship between pre-construction bat activity and post-construction fatalities, we expect that bat mortality rates at CCWF will be minimal in the context of published observations from other facilities.

We are not aware of any large, known bat colonies or other landscape features that are likely to attract large numbers of bats in the vicinity of the project. Activity was low at the NW MET tower and very low at the SE tower. Both towers are located in large agricultural and grassland landscapes with only small woodlots and forested riparian zones scattered throughout. There are no substantial travel corridors or north/south broad migration corridors running through the site. The Missouri River (Lake Oahe) does provide such a corridor to the west, however it is 5.5 km from the nearest MET tower and the habitat is sparse between these features.

The vertical distribution of recorded calls was not wholly reflective of trends observed for other acoustic monitoring studies (Arnett et al. 2006). Typically LF calls are concentrated at the high mic stations while MF and HF occur at the lower ones. We observed a fairly uniform distribution among species groups at both the high and low locations. At all locations and elevations, LF bats showed the highest levels of activity.

All species groups showed relatively consistent activity in mid-August, a peak in late August, and then a gradual decline into mid-September. By the beginning of October bat activity was sporadic but never more than a few bats observed on any given night.

Fatality studies of bats at wind projects in the US have shown a peak in mortality in August and September and generally lower mortality earlier in the summer (Johnson 2005, Arnett et al. 2008). While the survey efforts vary, the studies that combine Anabat surveys and fatality

surveys show a general association between the timing of increased bat call rates and timing of mortality, with both call rates and mortality peaking during the fall (Kunz et al. *2007b).* Based on the available data, it is expected that bat mortality at the CCWF will follow the same temporal patterns seen at other sites, but the risk for elevated mortality is low.

As has been observed in other studies (Arnett et al. 2005, Kunz et al. 2007a), bat activity is frequently negatively correlated with wind speed. In particular, wind speeds greater than 6 m/s tend to inhibit bats flying above canopy or in the open. Data collected at CCWF seems to support this hypothesis.

Based on the observed activity of species groups at the CCWF and the known bat distributions from central South Dakota east of the Missouri River, we can make some assumptions about the species assemblage in the vicinity and the likelihood of post-construction mortality. With the higher level of activity from the LF group, hoary bats and silver-haired bats are the species most likely to be at risk during fall migration periods. Both of these species are tree-roosting bats and undertake continental scale migrations in spring and autumn (Cryan 2003). Both are known to be substantial components of the observed bat strikes from wind turbine blades. The big brown bat, also from the LF group, is likely a more-permanent summer resident. While big brown bats have been recorded in post-construction studies, they are less probable to incur high levels of mortality as other LF bats. Red bats from the MF group are also tree-roosting migratory bats known as a species often struck by turbine blades. Their abundance/activity, however, appears to be low at this site. HF Myotis are present at the site during the summer and fall, but their numbers appear to very low and therefore the probability of strike is also low.

6. CONCLUSION

In general, bat activity in the Campbell County Wind Farm during the fall survey period is similar to other acoustic studies throughout the region. The LF group represented the majority of calls that were identifiable, followed by the MF and HF groups. There was an observed association with temperature and wind speed patterns. Overall, bat detection rates were on the lower end of the scale when compared to projects across the Eastern U.S., and the risk for post-construction bat mortality is relatively low.

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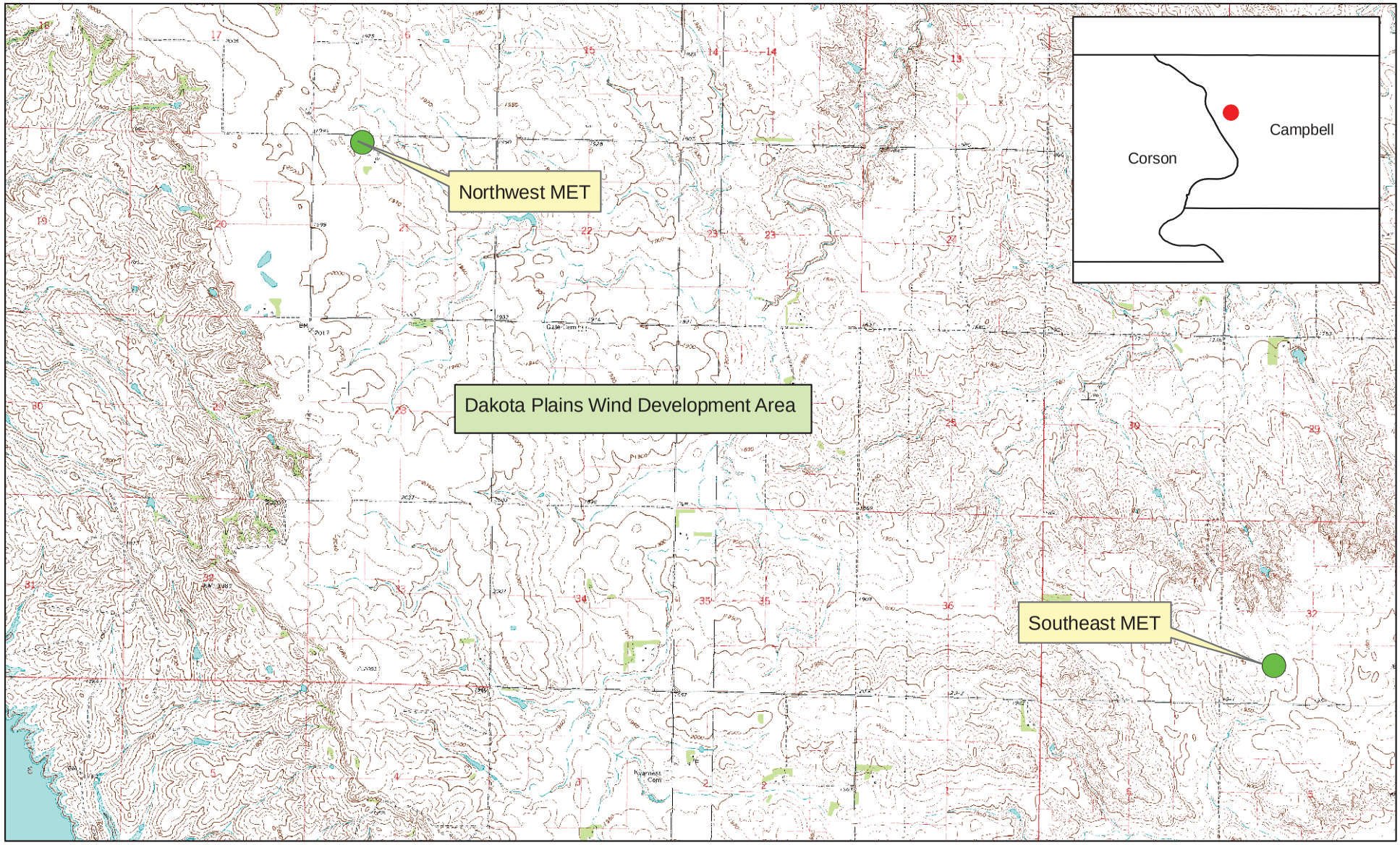
Table 1. Bat species with the potential to occur within the project area (South Dakota Bat Working Group Website 2009), sorted by call frequency.

Common Name	Scientific Name
High-frequency (> 40 kHz)	
little brown bat	*Myotis lucifugus*
northern long-eared bat	*Myotis septentrionalis*
eastern pipistrelle	*Perimyotis subflavus*
Mid-frequency (30-40 kHz)	
eastern red bat[1]	*Lasiurus borealis*
evening bat	*Nycticeius humeralis*
Low-frequency (< 30 kHz)	
big brown bat	*Eptesicus fuscus*
silver-haired bat	*Lasionycteris noctivagans*
hoary bat[1]	*Lasiurus cinereus*

1 = long-distance migrant

Table 2. Results of acoustic bat surveys conducted at the Campbell County Wind Farm, SD, August 18-Octbober 24, 2010, separated by call frequency (HF = high frequency, MF = mid frequency, LF = low frequency).

Station	MET Tower	Height (m)	LF	MF	HF	Total Bat Files	Noise Files	Total Files	Detector Nights	Passes/ Night
NW02	NW	45	120	27	44	191	72,065	72,256	68	2.81
NW45	NW	45	99	5	7	111	15,484	15,595	68	1.63
SE02	SE	2	29	7	7	43	45,171	45,214	62	0.69
SE45	SE	2	26	4	4	34	71,973	72,007	66	0.52
			274	43	62	379	204,693	205,072	264	1.41



N

1:48,000

Dakota Plains
Campbell County, SD

0 315 630 1,260 1,890 2,520 Meters

Imagery Source: USGS Pollock SE

FIGURE 1

PROJECT LOCATION MAP

ETC ECOLOGICAL
Eco-Tech Consultants, Inc.

Drawn by: PLD	Print Date: 12/30/10
Prepared For: WPC	
ETC File: JV2010012	

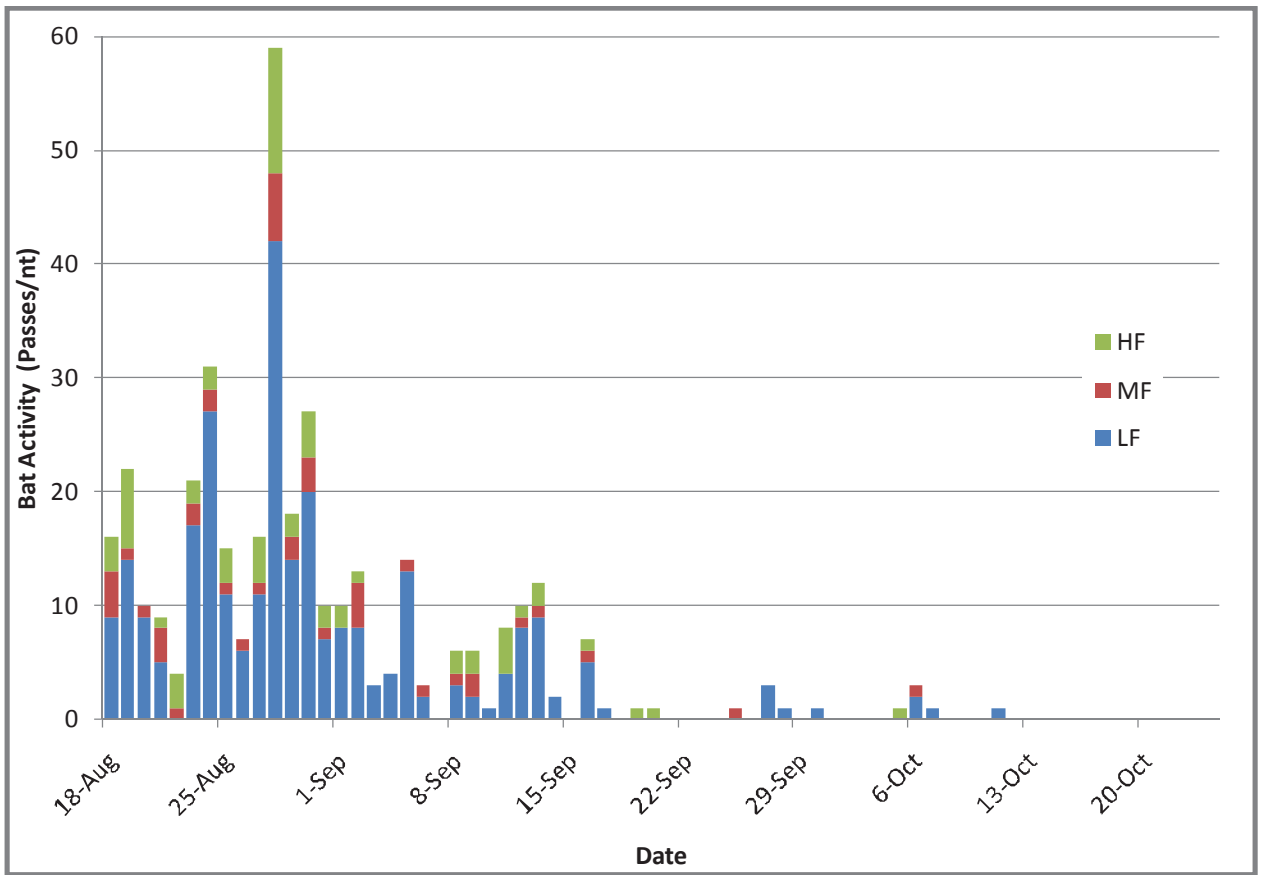


Figure 2. Total nightly bat activity between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota. Passes per night are comprised of acoustic recordings from four monitoring stations at two MET towers (2m, 45m).

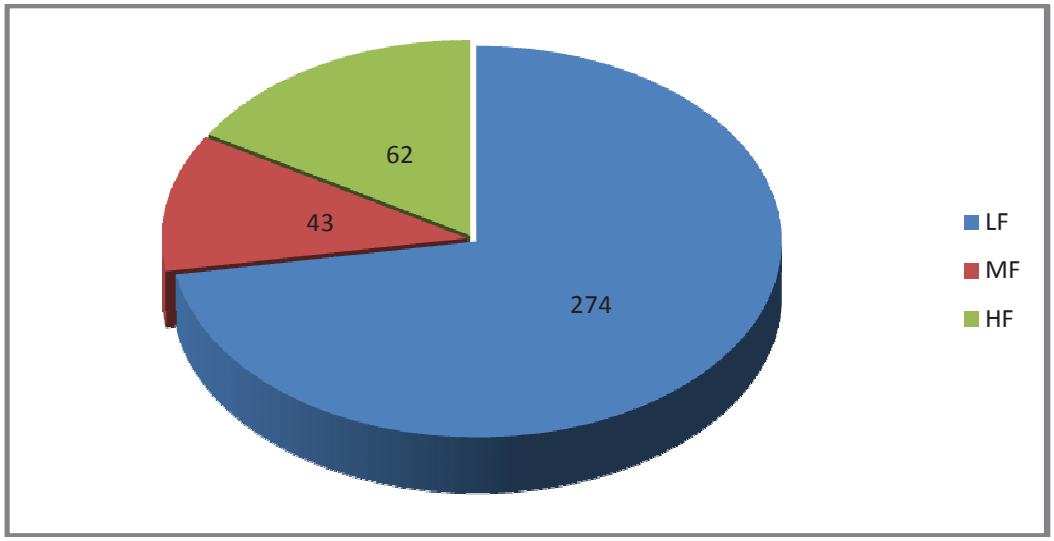


Figure 3. Proportion of high, medium, and low-frequency bats passes recording between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

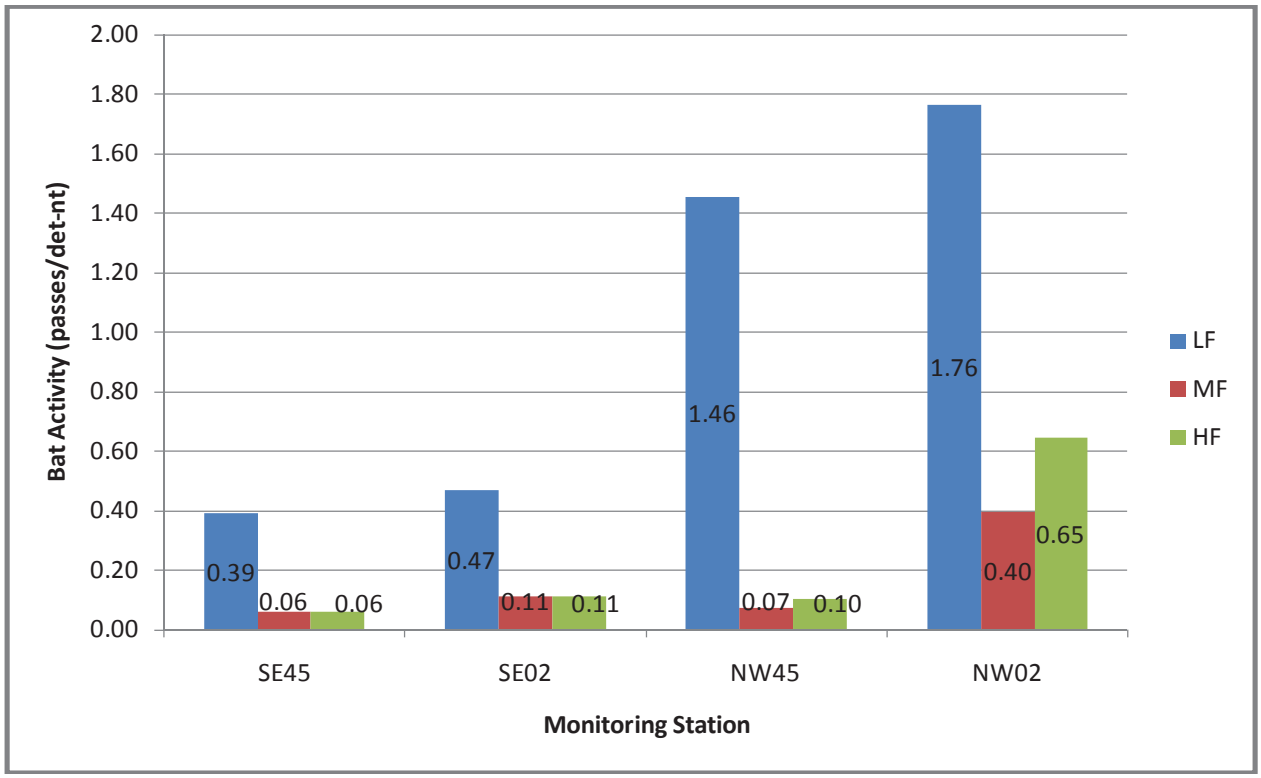


Figure 4. Number of bat passes per detector night for each monitoring station between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota. Average across all stations is 1.4 bat passes per night.

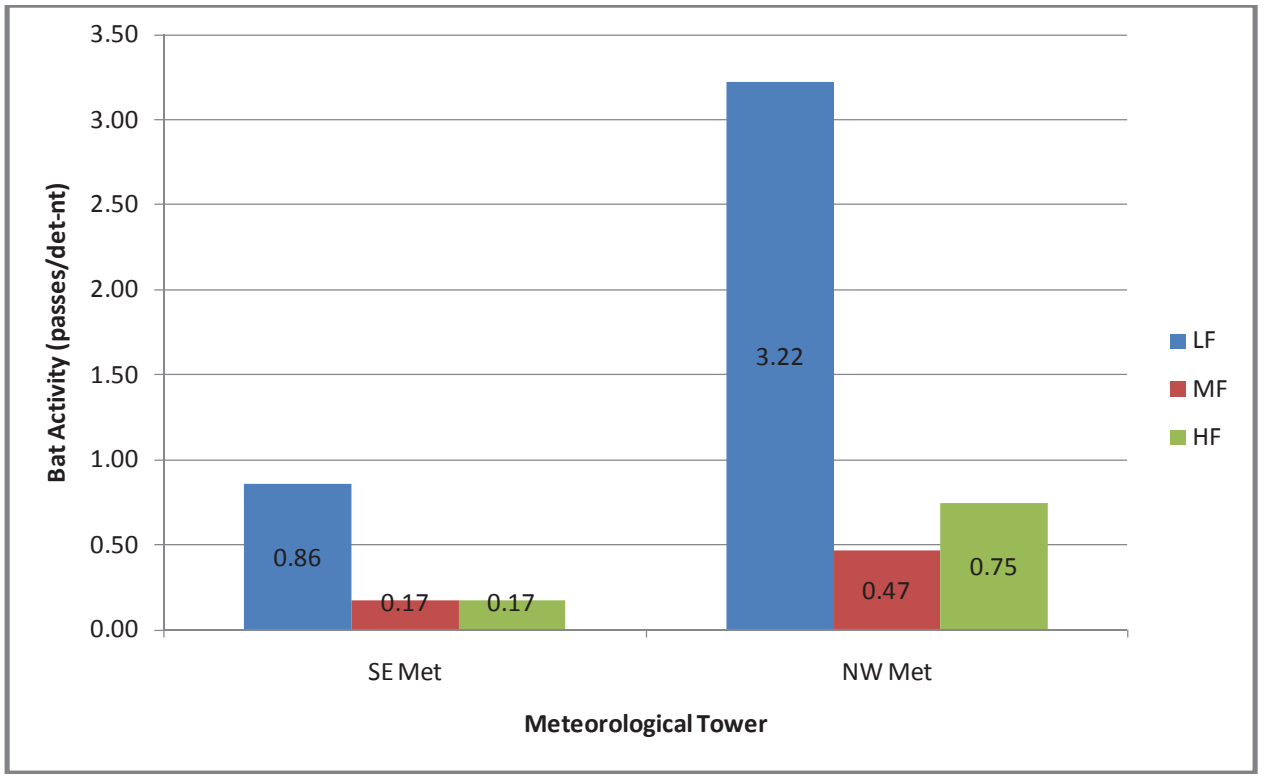


Figure 5. Number of bat passes per detector night by MET tower between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

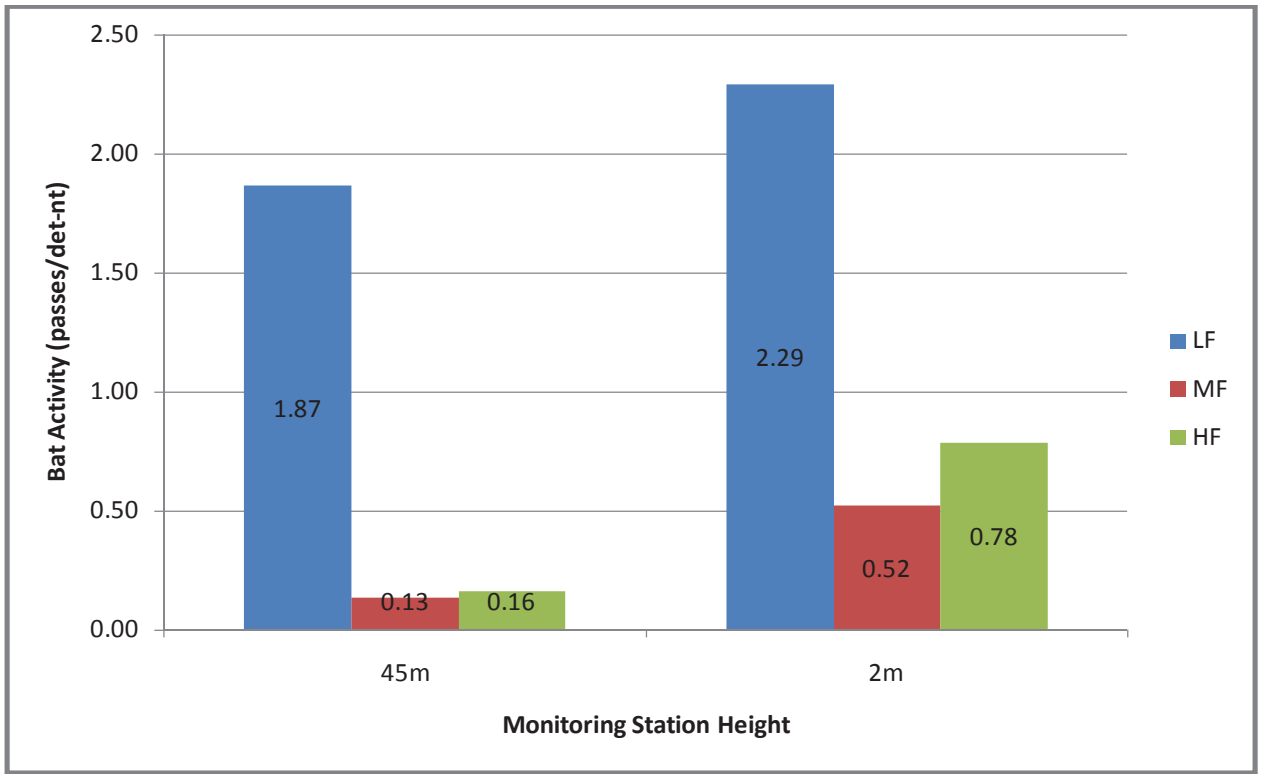


Figure 6. Number of bat passes per detector night at 2m and 45 vertical strata between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

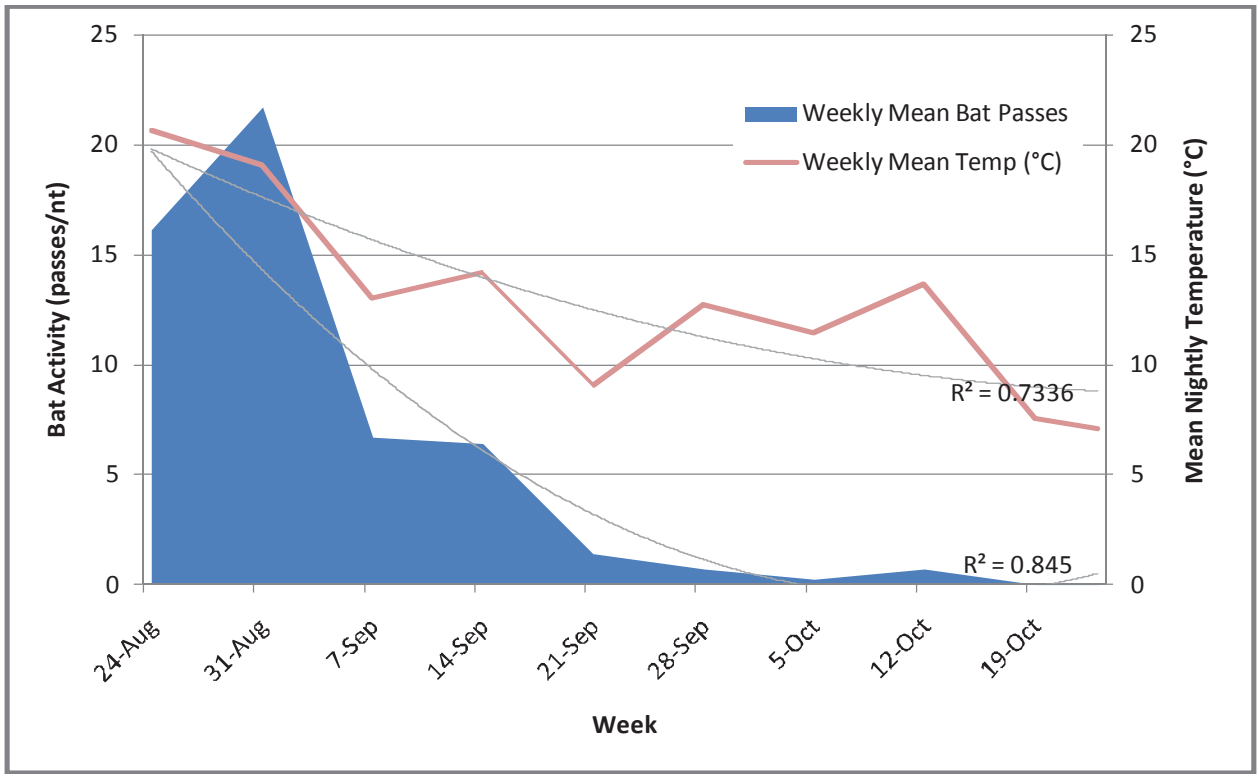


Figure 7. Weekly mean bat passes per night and weekly mean nightly temperature between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

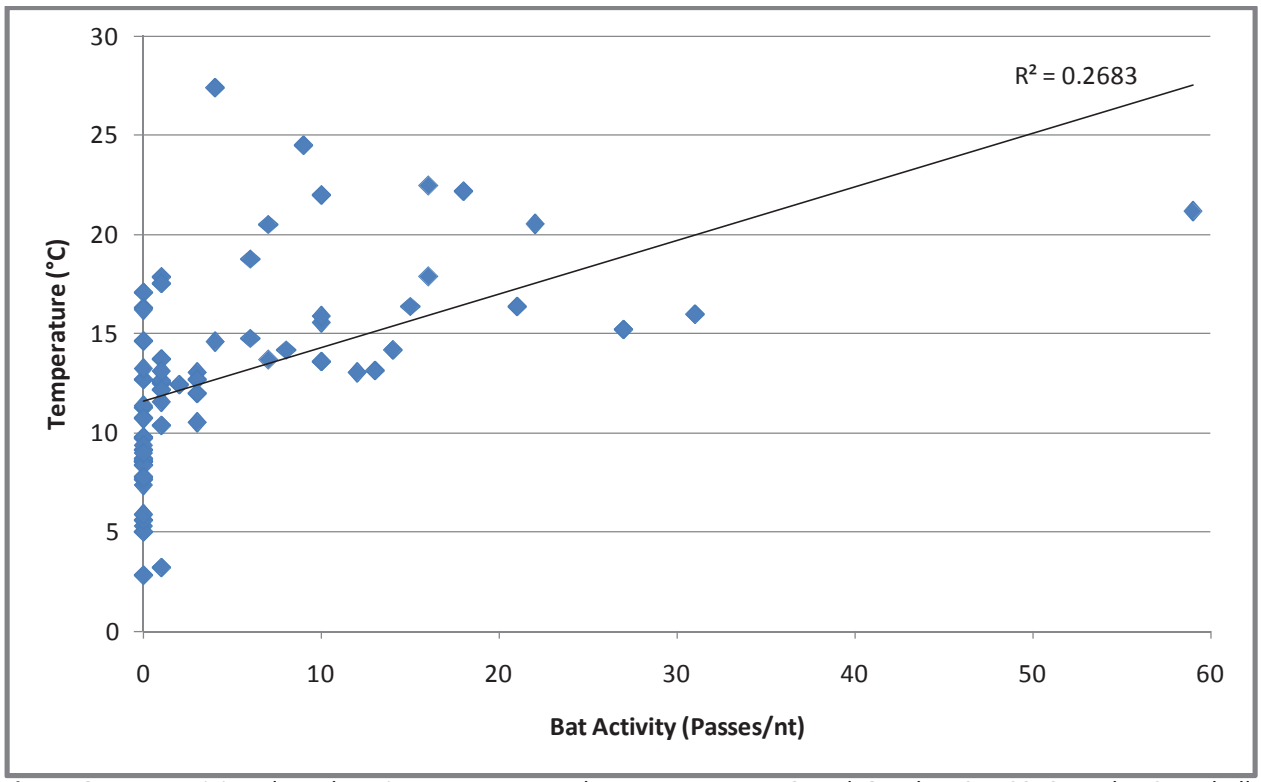


Figure 8. Bat activity plotted against temperature between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

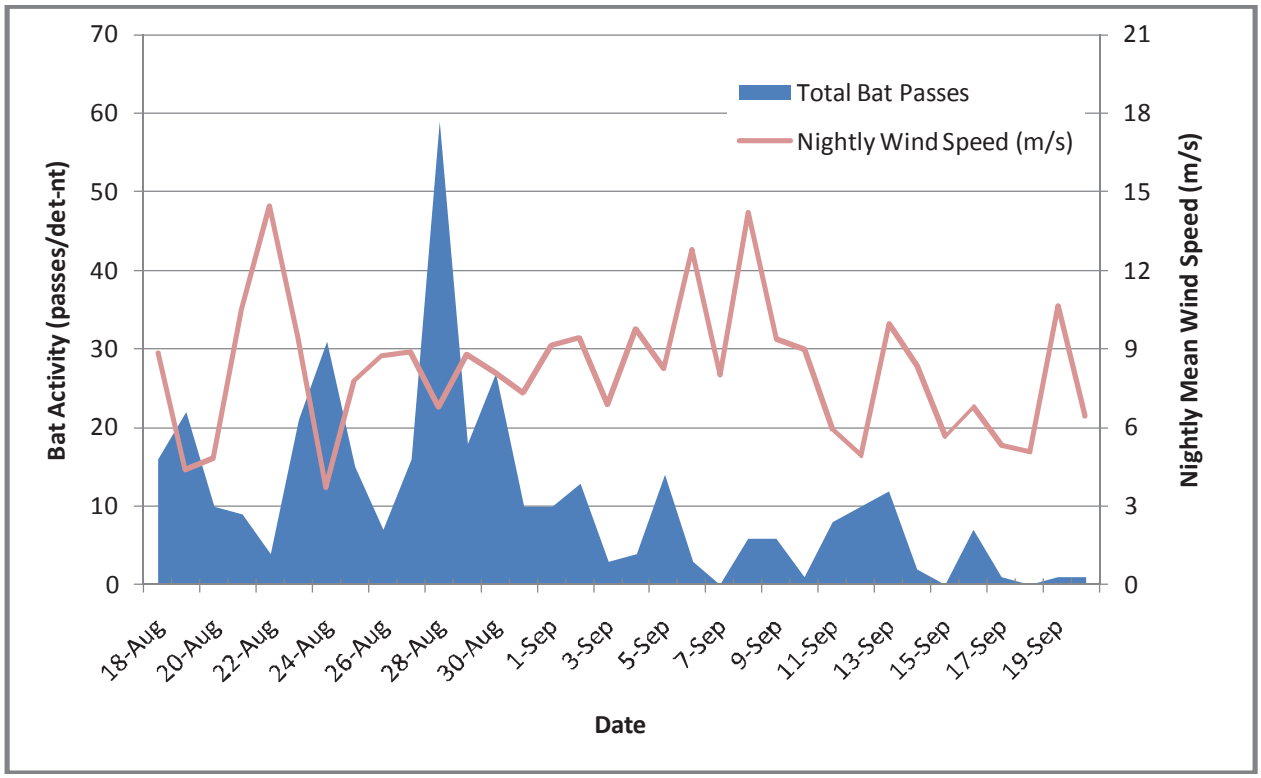


Figure 9. Mean bat passes per night and nightly wind speed between August 18 and October 19, 2010 at the Campbell County Wind Farm, South Dakota.

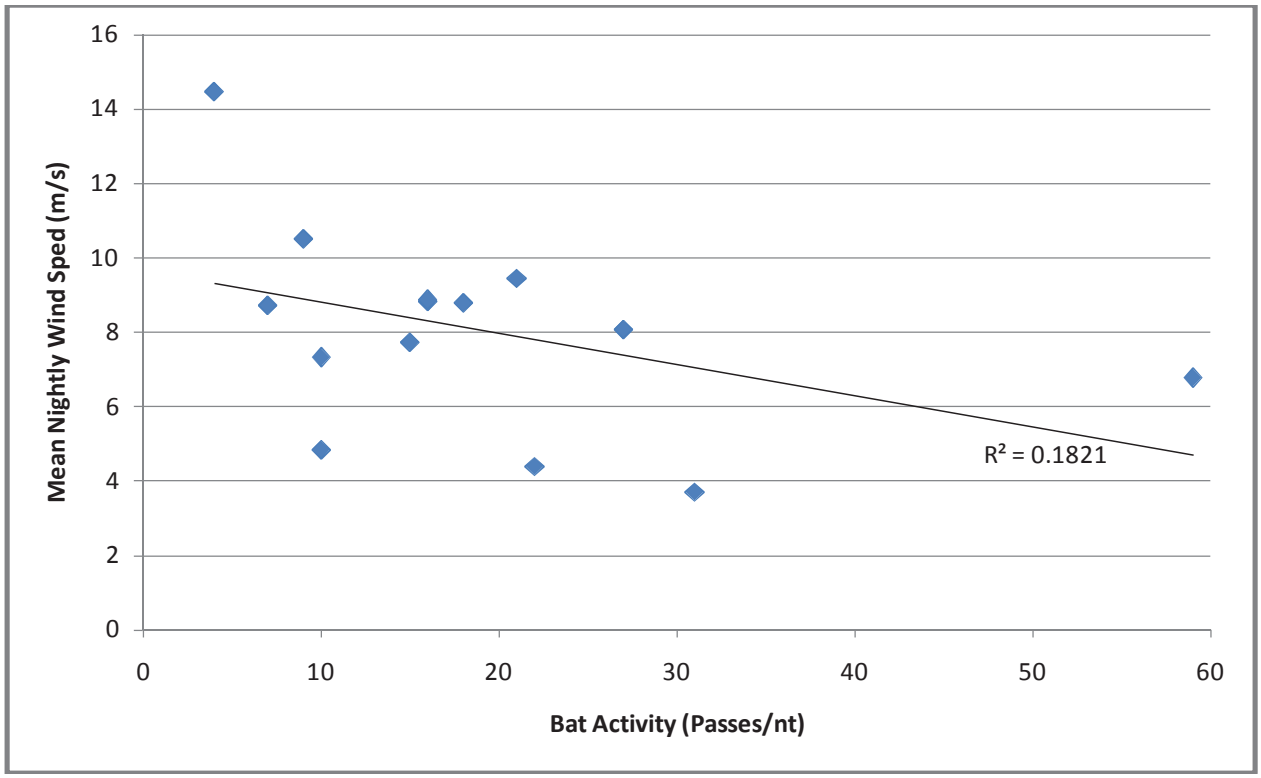


Figure 10. Bat activity plotted against mean nightly wind speed between August 18 and October 24, 2010 at the Campbell County Wind Farm, South Dakota.

Photo 1. WPC and ETC staff raising 45m microphone on MET tower

Photo 2. ETC design weatherproof housing for 2m and 45m Anabat systems

Photo 3. Low microphone (2m) set-up.

Photo 4. Anabat housing at base of MET tower.

Photo 5. High microphone (45m) being raised to pulley bracket.

Photo 6. Campbell County MET tower