2010 Fall Avian Survey

Cimarron Wind Energy Project – Phase I
Gray County, Kansas

Prepared for

CPV Cimarron Renewable Energy Company, LLC

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TETRA TECH EC, INC.

EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (Tetra Tech) was contracted by CPV Cimarron Renewable Energy, LLC (CPV) to undertake fall avian use surveys for the proposed Cimarron Wind Energy Project – Phase I (the Project) in Gray County, Kansas. The studies were conducted to identify potential avian impacts associated with building and operating the wind conversion facility. Birds have been identified as a group potentially at risk because of collisions with wind turbines and power lines and possible displacement due to the presence of the associated structures. Weekly surveys were performed at the Project from August 20 to November 19, 2010, which included the fall through early winter seasons. Fixed point count surveys (with an 800-meter [m] radius of observation) were conducted at 6 points distributed throughout the Project Area. The Project Area is defined as the approximately 13,097 acres of private land under lease with CPV for construction of the Project. These are the same point count locations within in the same Project Area previously studied for the 2010 Spring Avian Survey report.

Within the Project Area, a total 2,543 birds from 57 species and including 28 birds that could not be identified to species were observed. Overall mean bird use within the Project Area was 30.27 birds/20 minutes (min). Avian counts ranged from 0 to 337 birds/20 min count period.

Songbirds had the highest mean use out of all species groups observed (19.44 birds/20 min). The species with the highest mean use were the red-winged blackbird (6.74 birds/20 min), western meadowlark (3.98 birds/20 min), and horned lark (2.79 birds/20 min). The red-winged blackbird had a zero encounter rate within the rotor-swept area (RSA) of the intended turbines. Western meadowlark and horned lark had low fall encounter rates within the RSA; as a result, any mortality resulting from the Project, should it occur, is expected to be low during the fall season.

The Canada goose was the fourth most common bird species observed at the Project. The Canada goose had the highest encounter rate of 2.49 birds flying at RSA height/20 min. Canada goose mortality has been documented at other wind energy facilities with publicly available data. Fewer than 10 Canada goose fatalities have been reported at new generation wind farms and Canada goose seem generally able to avoid turbines. As a result, any mortality of Canada goose at the Project is anticipated to be low.

The Swainson's hawk was the most commonly observed raptor species during avian surveys. The Swainson's hawk had the second highest encounter rate at 1.57 birds flying at RSA height/20 min. Swainson's hawk fatalities have been documented at other wind farms with publicly available data. Over two-thirds of Swainson's hawk observations were made at point 5 on September 17 (120 individuals out of the 174 observed during the fall surveys). Field notes taken by the biologist on that day describe a tractor plowing the nearby fields and the Swainson's hawks hunting opportunistically behind the tractor either on the ground or in the air over the area. Foraging behind tractors could increase the potential for fatalities by Swainson's hawks at the Project. The northern harrier, red-tailed hawk, turkey vulture, American kestrel, sharp-shinned hawk, merlin, Cooper's hawk, rough-legged hawk, golden eagle, great horned owl, and ferruginous hawk were also observed at the Project but had low use values of 0.90 birds/20 min or less, which reduces the potential for fatalities to these species.

LISTED AND SENSITIVE SPECIES

Lesser prairie chickens were incidentally observed as the field biologist traveled between point count sites. The observations were in the northeast section outside of the Project Area close to survey points 5 and 6. This is the same area as described in the lek survey conducted in the spring 2010 avian survey. The lesser prairie chicken is a candidate species for listing as threatened by the United States Fish and Wildlife Service (USFWS). A petition brought to the Kansas Department of Wildlife and Parks is requesting that lesser prairie chicken be listed a state threatened species. A ruling is still pending.

One golden eagle was observed in the Project during the fall 2010 avian survey. No golden eagles were observed in the spring 2010 avian survey. However, the overall low encounter rates of golden eagles within the Project imply a low likelihood of turbine collisions. The golden eagle and bald eagle are protected by the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA prohibits the take of any bald or golden eagle, alive or dead, including any part, nest, or egg. Currently, take permits are not available under the BGEPA, but they are being considered as an option by the USFWS.

Table ES-1. Fall 2010 Avian Use Summary at the Cimarron Wind Energy Project – Phase I

Variable	Result	Details
Non-raptors		
Mean use	26.07 birds/20 min	
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	1	Canada goose
Federally listed[1] species observed within the Project Area	No	
State-listed species[2] within the Project Area	No	
Raptors		
Mean use	4.20 birds/20 min	
Number of species with high encounter rates (>1.0 birds at RSA height/20 min)	1	Swainson's hawk
Eagles observed within the Project Area	Yes (1 individual)	golden eagle
Eagles observed nesting within the Project Area	No	
Federally listed species observed within the Project Area	No	
State-listed species within the Project Area	No	
Habitat		
Native habitat likely to be affected by development	Yes	Prairie
Lakes (waterfowl attractant)	Yes	Playas
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Scattered throughout
Cliffs (raptor nesting and traveling)	No	
River (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	No	

[1]Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.
[2] State-listed species are protected Under the Kansas Nongame and Endangered Species Conservation Act of 1975.

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1.0 INTRODUCTION

1.1 WIND ENERGY AND BIRDS

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

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

In addition to mortality associated with wind farms, concerns have been raised that some bird species may avoid areas near turbines after the wind farm is in operation (Drewitt and Langston 2006). For example, at the Buffalo Ridge wind energy facility in Minnesota, densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines. It was suggested that the reduced density may be due to avoidance of the turbines, turbine noise and maintenance activities, and the reduced habitat quality due to the presence of access roads and large gravel pads surrounding the turbines (Leddy et al. 1999). Reduced abundance of grassland songbirds was found within 50 m of a turbine pad for a wind farm along the Washington and Oregon state border, but the investigators attributed displacement to the direct loss of habitat or reduced habitat quality and not the presence of the turbines (Erickson et al. 2004). None of these studies have addressed whether or not these avoidance effects are temporary (i.e., the birds may habituate to the presence of turbines over time) or permanent.

Finally, most native, migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported,

imported, transported, carried or received any migratory bird, part, nest, egg or product. Despite extensive liability provisions, the United States Fish and Wildlife Service (USFWS) has narrowly interpreted its permitting authority. "As currently written, USFWS's regulations establish a permitting scheme for a variety of intentional activities, such as hunting, falconry, certain import and export activities, depredation control, and scientific research. But there is no permitting scheme for the incidental take of migratory birds during otherwise lawful activities" (Beveridge 2005). There is no permitting framework (i.e., incidental take permits) that allows a wind company to protect itself from liability at wind facilities; however, the USFWS does not usually take action if good faith efforts have been made to minimize impacts. To date, no wind development company has been charged for violations of the MBTA.

1.2 STUDY AREA DESCRIPTION

CPV Cimarron Renewable Energy Company, LLC (CPV) is planning to develop a wind energy conversion facility in southwestern Kansas in Gray County (Figure 1). The Cimarron Wind Energy Project – Phase I (Project) is located on rural private lands under easement with CPV in Foote Township, an unincorporated portion of Gray County. CPV is committed to environmental due diligence and has contracted Tetra Tech EC, Inc. (Tetra Tech) to conduct fall avian surveys at the Project to quantify local avian use in the area and to identify potential avian impacts associated with building and/or operating the proposed facility.

The Project Area is approximately 13,097 acres of leased private lands and is located in the Western High Plains Ecoregion. The Western High Plains is comprised of smooth to slightly irregular plains having a high percentage of cropland. Buffalo grass (*Bouteola* spp.) prairies are the dominant natural vegetation in this region. Land use is predominantly dry-land farming of winter wheat, corn and sunflowers interspersed with cattle grazing. Playa wetlands of various sizes are mapped within or near the Project Area (Figure 1); however, most are shallow enough to have been converted into croplands. Only a few intermittent and perennial streams are present in the region, including Buckner Creek (intermittent), which passes through the eastern portion of the Project Area and the Arkansas River (perennial), located approximately 1.5 miles south of the Project Area. Buckner Creek was dry during the time of the survey. Much of the rest of the Project Area has drainages that, at the time of the survey, were also dry.

The State of Kansas has documented 469 bird species that are still known to occur in the state (KOS 2009). The state is situated within the Central Flyway, one of the main bird migratory routes (USFWS 2010a). The Central Flyway runs through the central portion of the United States and, as a consequence, the Project Area. In the fall, most birds travel southward from breeding grounds from as far away as Alaska via the central plains states in the United States to their wintering grounds in the southern United States to as far away as South America (USFWS 2010b).

2.0 METHODS

To evaluate avian risk at wind energy facilities, standardized protocols for pre-construction point counts have been established by Tetra Tech and were used in this study. This protocol is designed to be responsive to the level of effort recommended in the National Wind Coordinating Committee's Summary of Research Results and Priority Questions (NWCC 2010) and the USFWS's 2010 Wind Turbine Guidelines Advisory Committee Recommendations (USFWS

2010b). Data collected from these counts are used to identify species or species groups that may be at risk from project development and may provide additional information for micro-siting wind facilities to minimize impacts to birds. Results in this report are presented in terms of species groups, and highlight federally and state-listed species, and species of concern.

2.1 AVIAN SURVEYS

2.1.1 Fixed-point Surveys

An experienced field biologist conducted 20-minute (min) point count surveys at 6 locations within the Project Area to evaluate avian use, behavior, and species composition during fall migration (Figure 2). The biologist conducted weekly surveys from August 20 to November 19, 2010 (Table 1) which included the fall through early winter seasons. Tetra Tech distributed the survey locations throughout the Project Area and chose locations that maximized the 360-degree sight distance for the observer and covered a diversity of habitats.

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

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

Tetra Tech chose 20-min survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 min may lead to double-counting of songbirds (i.e., counting the same individual more than once) because individuals may appear and disappear from view. If double-counting of individuals occurs it is likely to be on a small scale due to the professional biologist's survey experience and accuracy of observations. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Large flocks, such as a group of 100 or more individuals, are accurately counted rapidly by focusing on "grouping into tens" and counting how many groups of tens can be made from the flock observed. Double-counting of birds is not problematic for this type of survey because the objective is to document avian activity in terms of number of birds noted per 20-min survey, not number of distinct individual birds (i.e., determine population size) present in the Project Area.

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

2.1.2 Incidental Observations

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

2.1.3 Listed Species Information

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

Kansas lists 59 wildlife species as endangered or threatened. State-listed endangered and threatened species in Kansas are protected by the Kansas Nongame and Endangered Species Conservation Act of 1975, which states that an action permit is required if any action is taken that will impact a state-listed threatened or endangered species (Kansas Statutes Annotated [KSA] 32-957-963 – Kansas Department of Wildlife and Parks [KDWP] 2010).

2.1.4 Data Quality Assurance/Quality Control

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

2.2 ANALYSIS

2.2.1 Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Tetra Tech defined raptors as vultures, hawks, eagles, falcons, and owls. As turkey vulture and vultures in general have a flight behavior that is similar to raptors and as they are often included as raptors

in other studies, Tetra Tech has included them with raptors for the purpose of our analyses. Non-raptors were defined as all other species groups.

2.2.2 Avian Use of the Project Area

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

2.2.3 Flight Behavior

Tetra Tech evaluated flight behavior by calculating the proportion of flying birds observed below, within, or above the height of the anticipated turbine rotor swept area (RSA). The turbine type currently being considered for the Project is the 2.3 megawatt (MW) Siemens SWT-2.3-101 (or equivalent); therefore, an 80-m hub height and 101-m rotor diameter was used to calculate the RSA. With these specifications, the estimated RSA was between 29.5 and 130.5 m above ground. If any of a bird's recorded flight heights fell within the upper or lower limits of the anticipated RSA, then for this study Tetra Tech considered that bird to have flown within the height of the anticipated RSA.

2.2.4 Encounter Rate

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

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

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

2.2.5 Mortality Risk

The highly regional nature of avian mean use across North America and the scarce data on avian mortality at wind farms in many parts of the continent contribute to uncertainty in predicting fatality rates (Arnett et al. 2007). To date, the most comprehensive source of regional information on avian fatality rates is the Avian and Bat Fact Sheet, which shows that estimated fatalities range from 14 birds/MW/year (yr) in Tennessee to 0 birds/MW/yr in Oklahoma (NWCC 2010). Based on the available data, raptor fatality rates generally are low at most wind energy developments with exceptions demonstrated at certain facilities in California with a predominance of older generation turbines (NWCC 2010). As a result of uncertainty in predicting fatality rates, Tetra Tech did not attempt to derive mortality estimates from mean use data. Rather, this report highlights species or groups that may experience mortality or displacement that could significantly affect local or regional populations, based on the data provided in this report and other information sources.

3.0 RESULTS

3.1 AVIAN USE AND FREQUENCY OF OCCURRENCE

The biologist surveyed 2,979 acres during point count surveys, covering 23 percent of the Project Area. The 6 point count locations were surveyed 14 times, resulting in 84 total 20-min surveys. None of the points were missed during the fall survey period. A total 2,543 birds were observed within the Project, 2,515 birds from 57 species and 28 birds that could not be identified to species during the 84 fixed-point count surveys (Table 2). Overall mean bird use within the Project was 30.27 birds/20 min. Avian counts ranged from 0 to 337 birds/20 min count period.

Overall mean use by non-raptors was 26.07 birds/20 min and, among species groups, mean use was highest for songbirds (19.44 birds/20 min; Table 2). Songbirds were observed in the majority of surveys and were widely distributed throughout the Project Area. The non-raptors with the highest mean use were the red-winged blackbird (6.74 birds/20 min, observed in 11.9 percent of all surveys), western meadowlark (3.98 birds/20 min; 57.1 percent of all surveys), and horned lark (2.79 birds/20 min; 45.2 percent - Table 2). Each of the other songbird species was detected during 10.7 percent or less of the surveys. In the songbird species group, red-winged blackbird accounted for 34.7 percent of all individuals observed in the group.

The group with the next highest mean use among non raptor groups was waterfowl (2.86 birds/20 min). Among waterfowl, Canada geese accounted for 87.1 percent and cackling geese accounted for 12.9 percent of all individuals observed in the group (Table 2). Among the remaining species groups, Pigeons/Doves and Gamebirds had the next highest mean use values of 1.67 birds/20 min and 1.08 birds/20 min, respectively.

Non-raptor mean use was highest on November 19 (89.00 birds/20 min) and October 22 (77.17 birds/20min; Figure 3). The species that most contributed to the high mean use on November 19 were the Canada goose (180 individuals), Lapland longspur (87 individuals), and European starlings (70 individuals). The species that most contributed to the high mean use on October 22 was the red-winged blackbird (110 individuals), western meadowlark (77 individuals), and horned lark (23 individuals). Mean use for non-raptors was highest at point 1 (49.29 birds/20 min) and observations at this point included red-winged blackbird (473 individuals) mourning

dove (79 individuals), and horned larks (49 individuals; Table 3; Figure 4). The habitat near point 1 is not unique within the Project as the nearby shallow playas had been converted to cropland.

Raptors are a group of special interest because of their propensity to fly at heights similar to a turbine RSA. Overall mean use for raptors was 4.20 birds/20 min (Table 2), and raptors were the second most frequently observed species group during the fall surveys. The raptors with the highest use were the Swainson's hawk (2.07 birds/20 min; 11.9 percent of all surveys), northern harrier (0.90 birds/20 min; 47.6 percent of all surveys), and red-tailed hawk (0.86 birds/20 min; 53.6 percent of all surveys). Mean use for each other raptor species (turkey vulture, American kestrel, sharp-shinned hawk, merlin, Cooper's hawk, rough-legged hawk, golden eagle, great horned owl, and ferruginous hawk) was 0.11 birds/20 min or lower.

Mean use by raptors was highest on September 17 (21.17 birds/20 min) and included 120 Swainson's hawks, 5 northern harriers, 3 red-tailed hawks, and 2 American kestrels (Figure 5). Mean use by raptors was 8.83 birds/20 min or less for all other survey dates. Mean use by raptors was highest at point count location 5 (Figure 6). Species observed at point 5 included 120 Swainson's hawks, 14 red-tailed hawks, 11 northern harriers, 2 sharp-shinned hawks, 1 Cooper's hawk, 1 rough legged hawk, and 1 great horned owl (Table 3). The majority of raptors observed at point 5 were 120 Swainson's hawks observed on September 17 (Table 3). During that day, at point 5, a farm tractor was tilling the nearby fields and the Swainson's hawks were observed hunting opportunistically behind the tractor either on the ground or in flight over the area. This phenomenon was also observed during the spring 2010 survey at the same point but with only 20 Swainson's hawks observed in the spring survey.

3.2 FLIGHT HEIGHT AND ENCOUNTER RATE

During fall avian use surveys, the biologist collected behavioral data for 100 percent of all birds observed during point count surveys. The biologist observed 92.1 percent of all birds flying and collected flight height data for 99.9 percent and flight direction for 10.6 percent of the birds observed in flight (those that were clearly moving through the area). Of non-raptor species observed flying, 74.0 percent flew below the height of the anticipated RSA, 22.8 percent flew at the height of the anticipated RSA, and 3.2 percent flew above the anticipated RSA (Table 4). Of raptor species observed flying, 37.2 percent flew below the height of the anticipated RSA, 61.2 percent flew at the height of the anticipated RSA, and 1.6 percent flew above the anticipated RSA. Data on flight direction are located in Appendix 1. Flight direction showed that most birds moving though the Project Area were flying in a southerly direction.

Canada goose and Swainson's hawk had the highest encounter rates (2.49 and 1.57 birds flying at RSA height/20 min respectively; Table 5). All other species had encounter rates of fewer than 0.94 birds flying at RSA height/20 min or less.

3.3 INCIDENTAL OBSERVATIONS

The biologist documented 37 species as incidental observations (Table 6). These included 17 species that were not detected during fall point count surveys. These were (in alphabetical order) - American wigeon, buff-breasted sandpiper, burrowing owl, eastern bluebird, gadwall, great blue heron, greater white-fronted goose, green-winged teal, lesser prairie-chicken, mallard,

northern shoveler, prairie falcon, red-headed woodpecker, ring-necked duck, short-eared owl, upland sandpiper, and white-faced ibis.

4.0 DISCUSSION

4.1 NON-RAPTOR USE AND ENCOUNTER RATE

The bird community of the Project was comprised primarily of species commonly found in row-crop agriculture and grasslands. The red-winged blackbird, western meadowlark, and horned lark were the most common species and inhabit agricultural and grasslands that can be found throughout the Project. Mortality of red-winged blackbirds, western meadow larks, and horned larks has been observed at other wind facilities (Johnson and Erikson 2010). All observations of red-winged blackbirds in flight in the Project Area were below the anticipated RSA. Western meadowlark and horned lark had low encounter rates (0.05 and 0.91 birds flying at RSA height/20 min respectively). As a result, any mortality of western meadowlark and horned lark in the Project Area is anticipated to be low.

The Canada goose was the fourth most common bird species observed at the Project. However, all the observations were of large flocks at survey points 3, 4, and 5 flying in a southerly direction. The Canada goose had the highest encounter rate of 2.49 birds flying at RSA height/20 min. Canada goose mortality has been documented at other wind energy facilities but with fewer than 10 fatalities reported at new generation wind farms (Jain et al. 2007, Johnson and Erikson 2010), Canada geese generally appear able to avoid turbines. As a result, any mortality of Canada goose in the Project Area is anticipated to be low.

4.2 PALMER DROUGHT SUITABILITY INDEX REVIEW

The Project's location is within the prairie pothole region and the Project does have intermittent streams and playas present that were dry during the fall 2010 survey. According to the Palmer Drought Suitability Index for southwest Kansas the fall 2010 (August to November) season was in a mild drought (NOAA 2010). Looking at patterns of precipitation for the past ten years in the region show the previous 2009 fall season was a mild wet spell. Additionally, the region has experienced flood-like conditions in previous fall seasons. These flood conditions may contribute to higher use of the Project by birds such as waterfowl, waterbirds, and shorebird species groups should the surface waters such as the playas were to become full based on the findings that avian diversity and species richness was significantly positively correlated with the area inundated with water (Rivers et al. 2001).

4.3 RAPTOR USE AND ENCOUNTER RATE

Erickson (2007) looked at raptor mean use plotted against raptor mortality for 11 operating windfarms in the United States and showed that when raptor use is low (as defined as <1.0 birds/20 min) raptor mortality appears to be low (0 - 0.14 MW/yr). Overall fall raptor use at the Project was 4.20 birds/20 min, suggesting a moderate probability of negative interactions with turbines.

The Swainson's hawk was the most commonly observed raptor species during avian surveys. The Swainson's hawk had the second highest encounter rate at 1.57 birds flying at RSA height/20 min. Swainson's hawk fatalities have been documented at other wind farms with publicly available data (Gritski et al. 2009, Jeffrey et al. 2009a, Johnson and Erickson 2010). Over two-thirds of the Swainson's hawks observed were at point 5 on September 17 (120 individuals of a total of 174). Field notes taken from the biologist on that day describe a tractor

plowing the nearby fields with the Swainson's hawks observed hunting opportunistically behind the tractor either on the ground or in the air over the area. This type of behavior may increase the potential for negative turbine interactions by Swainson's hawks in the Project Area.

The Northern harrier, red-tailed hawk, turkey vulture, American kestrel, sharp-shinned hawk, merlin, Cooper's hawk, rough legged hawk, golden eagle, great horned owl, and ferruginous hawk were also observed in the Project Area but with low use values of 0.90 birds/20 min or less (Table 2), thereby minimizing the potential for fatalities of these species.

4.4 LISTED AND SENSITIVE SPECIES

During avian use surveys, one golden eagle was observed in the Project at point 6. The golden eagle is a slow-reproducing, long-lived species and, as a result, local populations may be sensitive to small changes in adult survival; hence, even a few fatalities could have local population implications (Kochert et al. 2002). However, the overall low encounter rates of golden eagles within the Project imply a low likelihood of turbine collisions. Results from post-construction monitoring studies, primarily at older generation wind farms suggest that golden eagles are vulnerable to mortality from turbine collisions (Insignia 2009, Johnson and Erikson 2010).

The golden eagle and bald eagle are protected by the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA prohibits the take of any bald or golden eagle, alive or dead, including any part, nest, or egg. "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" a bald or golden eagle. "Disturb" means to agitate or bother an eagle to a degree that causes, or is likely to cause, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Currently, the final rule allowing for take permits is in effect; however, permits for take under this rule have not been authorized due to the lack of implementing guidelines. In the absence of permits, the USFWS is recommending that project proponents consult with them to discuss if an Avian Protection Plan will mitigate the risk to the eagles. CPV is implementing an Avian and Bat Protection Plan as part of the consultation under Section 7 of the ESA between Tennessee Valley Authority (TVA), who serves as the lead federal agency, and USFWS on the Project.

Lesser prairie chickens (federal candidate) were observed as incidental observations during the fall point count surveys. All of the sightings were in the same areas as described in the lek surveys in the 2010 Spring Avian Survey report which fell outside of the Project Area (Tetra Tech 2010).

No other federally listed or state-listed species were observed during avian surveys.

4.5 COMPARISON OF SPRING AND FALL 2010 SURVEYS

Spring avian surveys counted 5,963 birds from 57 species while the fall surveys had 2,543 birds from 57 species including 28 unidentified species. Both the spring and fall surveys had a total of 84 surveys completed with none of the points being missed. Overall mean use in the spring was higher at 70.99 birds/20 min compared to the 30.27 birds/20 min in the fall. Songbirds had the highest mean use in both the spring and the fall with red-winged blackbirds and western

meadowlarks being the most commonly observed birds in both seasons. Raptors were the group with the second highest mean use among species groups in the fall at 4.20 birds/20 min compared to the spring where cranes/rails (mostly sandhill cranes) ranked second among species groups at 25.06 birds/20 min and raptors ranked fifth among species groups at 1.02 bird/20 min in the spring. The northern harrier and Swainson's hawk were the most common raptor in both the spring and the fall surveys. Swainson's hawks were confirmed to be breeding in the Project Area during the spring raptor nest survey. Flocks of Swainson's hawks were also observed to be migrating through the Project Area during both seasons as evident from the hunting behavior around a tractor that was actively plowing up a field.

4.6 PROJECT CONCLUSIONS

The bird community of the Project was comprised primarily of birds that inhabit row-crop agriculture and grasslands. The red-winged blackbird, western meadowlark, and horned lark were the most common species and can be found throughout the Project. The red-winged blackbird, western meadowlark and horned lark were the most common species observed in the Project Area. Red-winged blackbird, western meadowlark, and horned lark fatalities have been reported at other wind energy facilities (Johnson and Erikson 2010). All observations of red-winged blackbird in flight were below the anticipated RSA. The western meadowlark and horned lark had low encounter rates. As a result any fatalities that occur in the Project Area are expected to be low. Nocturnal migrants (e.g., some songbirds) may pass through the Project and would not be detected by the survey methods used in this study if the birds did not stop over within the Project Area. However, mortality of nocturnal migrants at the Project is not expected to have population-level implications because less than 0.01 percent of nocturnal migrants that fly through wind farms are killed (Erickson 2007).

The species with the highest encounter rate was the Canada goose. Canada goose fatalities have been reported at other wind energy facilities. However, fewer than 10 individual fatalities of Canada geese have been reported at new generation wind energy facilities and Canada geese (as well as other waterfowl) generally appear able to avoid turbines. As a result Canada goose and probably waterfowl fatalities at the Project are expected to be low, especially given the general lack (except at point 6) of open water that could attract water-associated birds.

Overall raptor use at the Project was 4.20 birds/20 min, suggesting a moderate probability of negative interactions with turbines. Raptor mortality appears to be low when raptor use is low, as defined by Erickson (2007) as <1.0 birds/20 min. The raptor species with the highest encounter rate was the Swainson's hawk. Most (two-thirds of) Swainson's hawk observations were made at point 5 on September 17 (120 individuals). Field notes taken from the biologist on that day describe a tractor plowing the nearby fields with the Swainson's hawks observed hunting opportunistically behind the tractor either on the ground or in the air over the area. This type of behavior may increase the potential for negative turbine interactions by Swainson's hawks at the Project. The northern harrier, red-tailed hawk, turkey vulture, American kestrel, sharp-shinned hawk, merlin, Cooper's hawk, rough-legged hawk, great horned owl, and ferruginous hawk were also observed at the Project but with low use values of 0.90 birds/20 min or less, thereby minimizing the potential for fatalities of these species. One golden eagle was observed at point 6. No golden eagles were observed during the spring 2010 avian survey and therefore may be a rare migrant or vagrant. Golden eagles are protected by the BGEPA. Consultation with the USFWS and additional consideration of golden eagle use of the site may help further reduce risk of

turbine collisions. CPV will support TVA's consultation under Section 7 of the ESA with USFWS on the Project.

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TABLES

Table 1. Fall 2010 point count survey dates at the Cimarron Wind Energy Project-Phase I.

Survey number	Date(s)
1	8/20
2	8/27
3	9/3
4	9/10
5	9/17
6	9/24
7	10/1
8	10/8
9	10/15
10	10/22
11	10/30
12	11/5
13	11/12
14	11/19

Table 2. Avian species, by species grouping, observed during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
Songbirds								
red-winged blackbird	1	566	13	6.74	(0.00-13.58)	11.9	34.7%	22.3%
western meadowlark	2	334	71	3.98	(2.31-5.65)	57.1	20.5%	13.1%
horned lark	3	234	49	2.79	(1.76-3.82)	45.2	14.3%	9.2%
Lapland longspur	7	107	9	1.27	(0.32-2.22)	9.5	6.6%	4.2%
European starling	10	75	3	0.89	(0.00-2.26)	3.6	4.6%	2.9%
brown-headed cowbird	13	58	3	0.69	(0.00-1.59)	3.6	3.6%	2.3%
cliff swallow	14	57	4	0.68	(0.00-1.80)	1.2	3.5%	2.2%
American crow	15	43	5	0.51	(0.00-1.13)	4.8	2.6%	1.7%
unidentified sparrow	17	28	6	0.33	(0.00-0.68)	4.8	1.7%	1.1%
American tree sparrow	18	22	4	0.26	(0.00-0.57)	3.6	1.3%	0.9%
barn swallow	19	18	10	0.21	(0.07-0.35)	10.7	1.1%	0.7%
lark bunting	20	10	4	0.12	(0.00-0.26)	3.6	0.6%	0.4%
dark-eyed junco	20	10	3	0.12	(0.00-0.26)	2.4	0.6%	0.4%
clay-colored sparrow	20	10	2	0.12	(0.00-0.32)	1.2	0.6%	0.4%
savannah sparrow	25	8	5	0.10	(0.00-0.21)	3.6	0.5%	0.3%
chipping sparrow	28	6	2	0.07	(0.00-0.17)	2.4	0.4%	0.2%
yellow-headed blackbird	29	5	1	0.06	(0.00-0.16)	1.2	0.3%	0.2%
white-crowned sparrow	29	5	3	0.06	(0.00-0.12)	3.6	0.3%	0.2%
lark sparrow	29	5	2	0.06	(0.00-0.16)	1.2	0.3%	0.2%
house sparrow	29	5	2	0.06	(0.00-0.13)	2.4	0.3%	0.2%
chestnut-collared longspur	34	4	2	0.05	(0.00-0.11)	2.4	0.2%	0.2%
orange-crowned warbler	35	3	2	0.04	(0.00-0.08)	2.4	0.2%	0.1%
eastern kingbird	35	3	2	0.04	(0.00-0.10)	1.2	0.2%	0.1%
western kingbird	38	2	1	0.02	(0.00-0.06)	1.2	0.1%	0.1%
vesper sparrow	38	2	2	0.02	(0.00-0.05)	2.4	0.1%	0.1%
house finch	38	2	1	0.02	(0.00-0.06)	1.2	0.1%	0.1%
dickcissel	38	2	1	0.02	(0.00-0.06)	1.2	0.1%	0.1%
blue jay	38	2	2	0.02	(0.00-0.05)	2.4	0.1%	0.1%
Wilson's warbler	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
Say's phoebe	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%

Table 2. Avian species, by species grouping, observed during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
northern shrike	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
northern mockingbird	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
loggerhead shrike	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
American pipit	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
American goldfinch	45	1	1	0.01	(0.00-0.03)	1.2	0.1%	0.0%
Group Total		**1633**	**221**	**19.44**	(11.34-27.54)	**86.9**		**64.2%**
Raptors								
Swainson's hawk	5	174	16	2.07	(0.00-4.51)	11.9	49.3%	6.8%
northern harrier	9	76	65	0.90	(0.67-1.13)	47.6	21.5%	3.0%
red-tailed hawk	11	72	57	0.86	(0.67-1.05)	53.6	20.4%	2.8%
turkey vulture	24	9	8	0.11	(0.03-0.19)	7.1	2.5%	0.4%
American kestrel	25	8	8	0.10	(0.05-0.15)	9.5	2.3%	0.3%
sharp-shinned hawk	29	5	5	0.06	(0.01-0.11)	4.8	1.4%	0.2%
merlin	35	3	3	0.04	(0.01-0.07)	3.6	0.8%	0.1%
Cooper's hawk	38	2	2	0.02	(0.00-0.05)	2.4	0.6%	0.1%
rough-legged hawk	45	1	1	0.01	(0.00-0.03)	1.2	0.3%	0.0%
golden eagle	45	1	1	0.01	(0.00-0.03)	1.2	0.3%	0.0%
great horned owl	45	1	1	0.01	(0.00-0.03)	1.2	0.3%	0.0%
ferruginous hawk	45	1	1	0.01	(0.00-0.03)	1.2	0.3%	0.0%
Group Total		**353**	**168**	**4.20**	(1.75-6.65)	**86.9**		**13.9%**
Waterfowl								
Canada goose	4	209	4	2.49	(0.25-4.73)	4.8	87.1%	8.2%
cackling goose	16	31	2	0.37	(0.00-0.96)	2.4	12.9%	1.2%
Group Total		**240**	**6**	**2.86**	(0.13-5.59)	**4.8**		**9.4%**
Pigeons/Doves								
mourning dove	6	138	40	1.64	(0.51-2.77)	31.0	98.6%	5.4%
Eurasian collared-dove	38	2	2	0.02	(0.00-0.05)	2.4	1.4%	0.1%
Group Total		**140**	**42**	**1.67**	(0.54-2.80)	**32.1**		**5.5%**
Gamebirds								
ring-necked pheasant	8	91	34	1.08	(0.53-1.63)	27.4	100.0%	3.6%
Group Total		**91**	**34**	**1.08**	(0.53-1.63)	**27.4**		**3.6%**

Table 2. Avian species, by species grouping, observed during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
Cranes/Rails								
sandhill crane	12	65	1	0.77	(0.00-2.04)	1.2	100.0%	2.6%
Group Total		**65**	**1**	**0.77**	(0.00-2.04)	**1.2**		**2.6%**
Woodpeckers								
northern flicker	20	10	8	0.12	(0.02-0.22)	6.0	83.3%	0.4%
hairy woodpecker	45	1	1	0.01	(0.00-0.03)	1.2	8.3%	0.0%
downy woodpecker	45	1	1	0.01	(0.00-0.03)	1.2	8.3%	0.0%
Group Total		**12**	**10**	**0.14**	(0.03-0.25)	**7.1**		**0.5%**
Waterbirds								
killdeer	25	8	5	0.10	(0.02-0.18)	6.0	100.0%	0.3%
Group Total		**8**	**5**	**0.10**	(0.02-0.18)	**6.0**		**0.3%**
Goatsuckers								
common nighthawk	45	1	1	0.01	(0.00-0.03)	1.2	100.0%	0.0%
Group Total		**1**	**1**	**0.01**	(0.00-0.03)	**1.2**		**0.0%**
Grand Total		**2543**	**488**	**30.27**	(20.80-39.75)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Number of Birds	Number of Obs.	Points					
			1	2	3	4	5	6
red-winged blackbird	566	13	473	0	1	0	92	0
western meadowlark	334	71	37	35	130	34	37	61
horned lark	234	49	49	27	21	25	27	85
Canada goose	209	4	0	0	30	90	89	0
Swainson's hawk	174	16	38	3	11	2	120	0
mourning dove	138	40	79	5	10	8	30	6
Lapland longspur	107	9	20	13	40	10	10	14
ring-necked pheasant	91	34	1	2	20	46	11	11
northern harrier	76	65	4	21	11	6	11	23
European starling	75	3	0	0	75	0	0	0
red-tailed hawk	72	57	20	8	10	13	14	7
sandhill crane	65	1	0	0	0	0	0	65
brown-headed cowbird	58	3	13	0	45	0	0	0
cliff swallow	57	4	0	0	0	0	0	57
American crow	43	5	0	0	11	30	2	0
cackling goose	31	2	0	0	0	30	1	0
unidentified sparrow	28	6	0	0	0	1	25	2
American tree sparrow	22	4	0	0	0	3	15	4
barn swallow	18	10	3	0	2	1	11	1
northern flicker	10	8	0	0	4	2	4	0
lark bunting	10	4	0	0	0	1	7	2
dark-eyed junco	10	3	0	0	0	10	0	0
clay-colored sparrow	10	2	0	0	0	10	0	0
turkey vulture	9	8	0	0	4	0	5	0
savannah sparrow	8	5	2	0	0	1	0	5
killdeer	8	5	2	0	3	0	3	0
American kestrel	8	8	4	0	4	0	0	0
chipping sparrow	6	2	0	0	0	5	1	0
yellow-headed blackbird	5	1	5	0	0	0	0	0
white-crowned sparrow	5	3	0	0	3	0	2	0
sharp-shinned hawk	5	5	0	1	2	0	2	0
lark sparrow	5	2	0	0	5	0	0	0
house sparrow	5	2	3	0	0	0	2	0
chestnut-collared longspur	4	2	2	0	0	0	2	0
orange-crowned warbler	3	2	0	0	3	0	0	0
merlin	3	3	1	1	0	0	0	1
eastern kingbird	3	2	0	0	0	0	3	0
western kingbird	2	1	0	0	2	0	0	0
vesper sparrow	2	2	0	0	1	1	0	0
house finch	2	1	0	0	2	0	0	0

Table 3. Avian species observed by point during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Number of Birds	Number of Obs.	Points					
			1	2	3	4	5	6
Eurasian collared-dove	2	2	1	0	1	0	0	0
dickcissel	2	1	0	0	0	0	2	0
Cooper's hawk	2	2	0	0	0	1	1	0
blue jay	2	2	0	0	2	0	0	0
Wilson's warbler	1	1	0	0	1	0	0	0
Say's phoebe	1	1	0	0	0	0	1	0
rough-legged hawk	1	1	0	0	0	0	1	0
northern shrike	1	1	0	0	1	0	0	0
northern mockingbird	1	1	0	0	0	0	1	0
loggerhead shrike	1	1	0	0	0	1	0	0
hairy woodpecker	1	1	0	0	0	0	1	0
golden eagle	1	1	0	0	0	0	0	1
great horned owl	1	1	0	0	0	0	1	0
ferruginous hawk	1	1	0	0	1	0	0	0
downy woodpecker	1	1	0	0	1	0	0	0
common nighthawk	1	1	0	0	1	0	0	0
American pipit	1	1	0	0	1	0	0	0
American goldfinch	1	1	0	0	1	0	0	0
Grand Total	**2543**	**488**	**757**	**116**	**460**	**331**	**534**	**345**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

		Birds	
		Number	**Percentage**
Non-raptors			
	Above RSA height (>130.5m)	65	3.2%
	At RSA height (29.5m–130.5m)	463	22.8%
	Below RSA height (<29.5m)	1506	74.0%
Raptors			
	Above RSA height (>130.5m)	5	1.6%
	At RSA height (29.5m–130.5m)	186	61.2%
	Below RSA height (<29.5m)	113	37.2%

[1] Includes only flying birds with flight height data

[2]These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
Canada goose	2.49	2.49 (0.25 - 4.73)	100.0	0.0	100.0	0.0
Swainson's hawk	1.57	2.07 (0.00 - 4.51)	78.2	2.2	97.1	0.7
Lapland longspur	0.94	1.27 (0.32 - 2.22)	100.0	0.0	73.8	26.2
horned lark	0.91	2.79 (1.76 - 3.82)	94.0	0.0	34.5	65.5
American crow	0.46	0.51 (0.00 - 1.13)	93.0	0.0	97.5	2.5
cackling goose	0.37	0.37 (0.00 - 0.96)	100.0	0.0	100.0	0.0
red-tailed hawk	0.36	0.86 (0.67 - 1.05)	88.9	0.0	46.9	53.1
cliff swallow	0.24	0.68 (0.00 - 1.80)	100.0	0.0	35.1	64.9
northern harrier	0.13	0.90 (0.67 - 1.13)	98.7	0.0	14.7	85.3
turkey vulture	0.10	0.11 (0.03 - 0.19)	100.0	11.1	88.9	0.0
western meadowlark	0.05	3.98 (2.31 - 5.65)	88.0	0.0	1.4	98.6
chestnut-collared longspur	0.03	0.05 (0.00 - 0.11)	100.0	0.0	50.0	50.0
sharp-shinned hawk	0.02	0.06 (0.01 - 0.11)	100.0	20.0	40.0	40.0
mourning dove	0.01	1.64 (0.51 - 2.77)	91.3	0.0	0.8	99.2
barn swallow	0.01	0.21 (0.07 - 0.35)	100.0	0.0	5.6	94.4
golden eagle	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
ferruginous hawk	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
common nighthawk	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
Cooper's hawk	0.01	0.02 (0.00 - 0.05)	100.0	0.0	50.0	50.0
yellow-headed blackbird	0.00	0.06 (0.00 - 0.16)	0.0	0.0	0.0	0.0
Wilson's warbler	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
western kingbird	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
white-crowned sparrow	0.00	0.06 (0.00 - 0.12)	100.0	0.0	0.0	100.0
vesper sparrow	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
unidentified sparrow	0.00	0.33 (0.00 - 0.68)	96.4	0.0	0.0	100.0
savannah sparrow	0.00	0.10 (0.00 - 0.21)	87.5	0.0	0.0	100.0
Say's phoebe	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
sandhill crane	0.00	0.77 (0.00 - 2.04)	100.0	100.0	0.0	0.0
red-winged blackbird	0.00	6.74 (0.00 - 13.58)	98.4	0.0	0.0	100.0
ring-necked pheasant	0.00	1.08 (0.53 - 1.63)	42.9	0.0	0.0	100.0
rough-legged hawk	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
orange-crowned warbler	0.00	0.04 (0.00 - 0.08)	66.7	0.0	0.0	100.0
northern shrike	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
northern mockingbird	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern flicker	0.00	0.12 (0.02 - 0.22)	70.0	0.0	0.0	100.0
merlin	0.00	0.04 (0.01 - 0.07)	100.0	0.0	0.0	100.0
loggerhead shrike	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
lark sparrow	0.00	0.06 (0.00 - 0.16)	100.0	0.0	0.0	100.0
lark bunting	0.00	0.12 (0.00 - 0.26)	100.0	0.0	0.0	100.0
killdeer	0.00	0.10 (0.02 - 0.18)	62.5	0.0	0.0	100.0
house sparrow	0.00	0.06 (0.00 - 0.13)	100.0	0.0	0.0	100.0
house finch	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
great horned owl	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
European starling	0.00	0.89 (0.00 - 2.26)	94.7	0.0	0.0	100.0
Eurasian collared-dove	0.00	0.02 (0.00 - 0.05)	50.0	0.0	0.0	100.0
eastern kingbird	0.00	0.04 (0.00 - 0.10)	100.0	0.0	0.0	100.0
downy woodpecker	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
dickcissel	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
dark-eyed junco	0.00	0.12 (0.00 - 0.26)	100.0	0.0	0.0	100.0
chipping sparrow	0.00	0.07 (0.00 - 0.17)	100.0	0.0	0.0	100.0
clay-colored sparrow	0.00	0.12 (0.00 - 0.32)	100.0	0.0	0.0	100.0
blue jay	0.00	0.02 (0.00 - 0.05)	50.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.69 (0.00 - 1.59)	100.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
American tree sparrow	0.00	0.26 (0.00 - 0.57)	100.0	0.0	0.0	100.0
American pipit	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.10 (0.05 - 0.15)	75.0	0.0	0.0	100.0
American goldfinch	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0

[1]These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

Table 6. Incidental observations of birds during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species
American kestrel
American wigeon
buff-breasted sandpiper
burrowing owl
Canada goose
Cooper's hawk
dickcissel
eastern bluebird
ferruginous hawk
gadwall
great blue heron
great horned owl
greater white-fronted goose
green-winged teal
horned lark
killdeer
Lapland longspur
lark bunting
lesser prairie-chicken
loggerhead shrike
mallard
merlin
northern harrier
northern shoveler
prairie falcon
red-headed woodpecker
rough-legged hawk
ring-necked duck
red-tailed hawk
sandhill crane
Say's phoebe
short-eared owl
sharp-shinned hawk
Swainson’s hawk
unidentified grouse
upland sandpiper
white-faced ibis

FIGURES

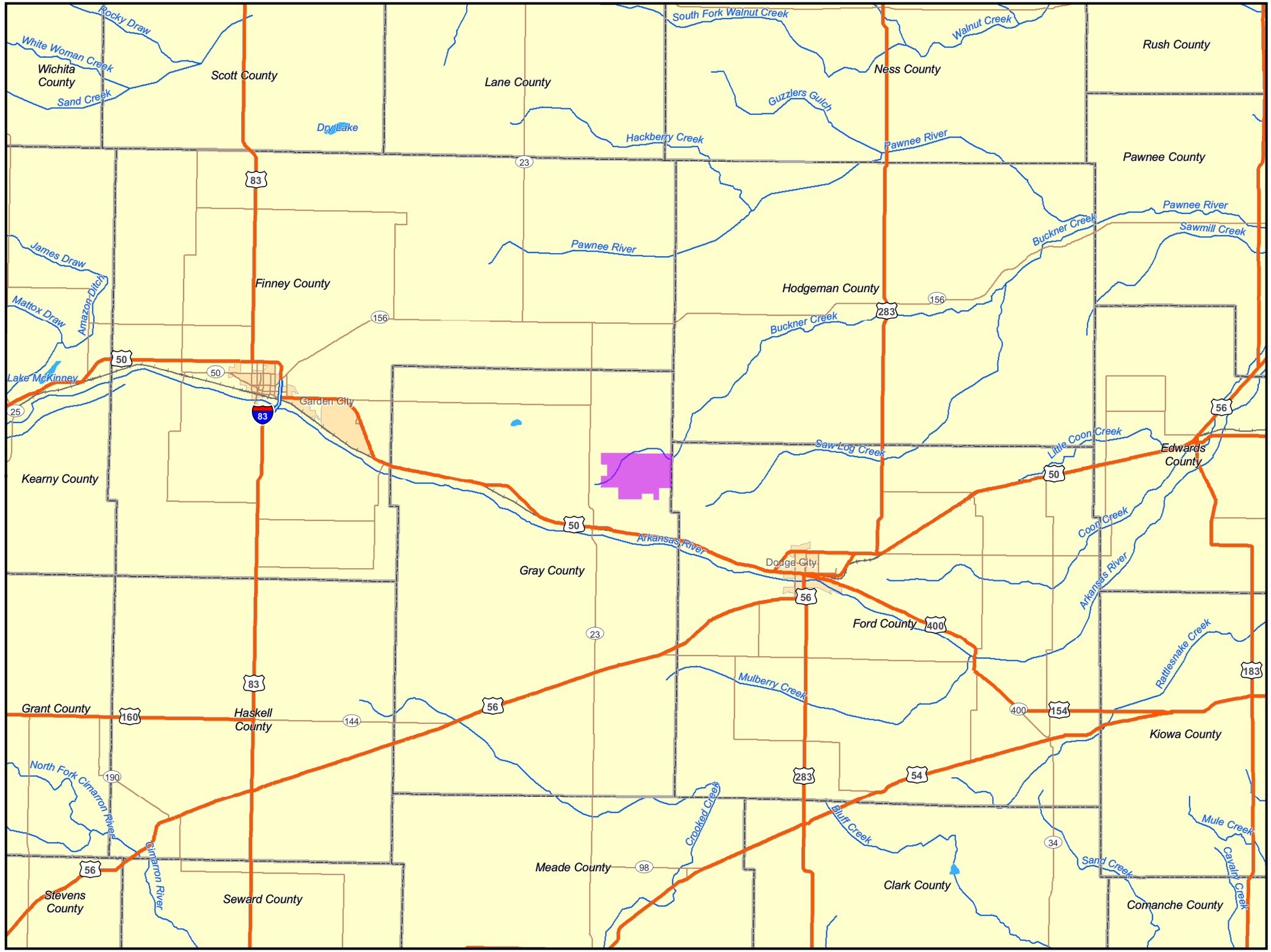


Figure 1

Vicinity Map

Cimarron Wind Energy Project-Phase I

Gray County, KS

- Project Area (6-28-2010)
- County Boundary
- River/Stream
- Lake/Pond
- Interstate Highway
- Federal Highway
- State Highway

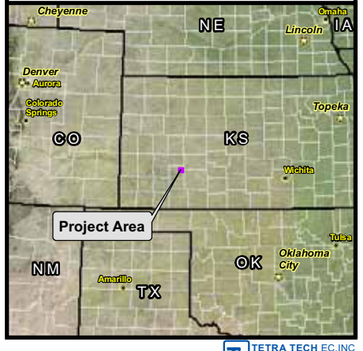
N W E S

1:500,000

NAD 1983 UTM 14

0 2 4 6 8 10

Miles



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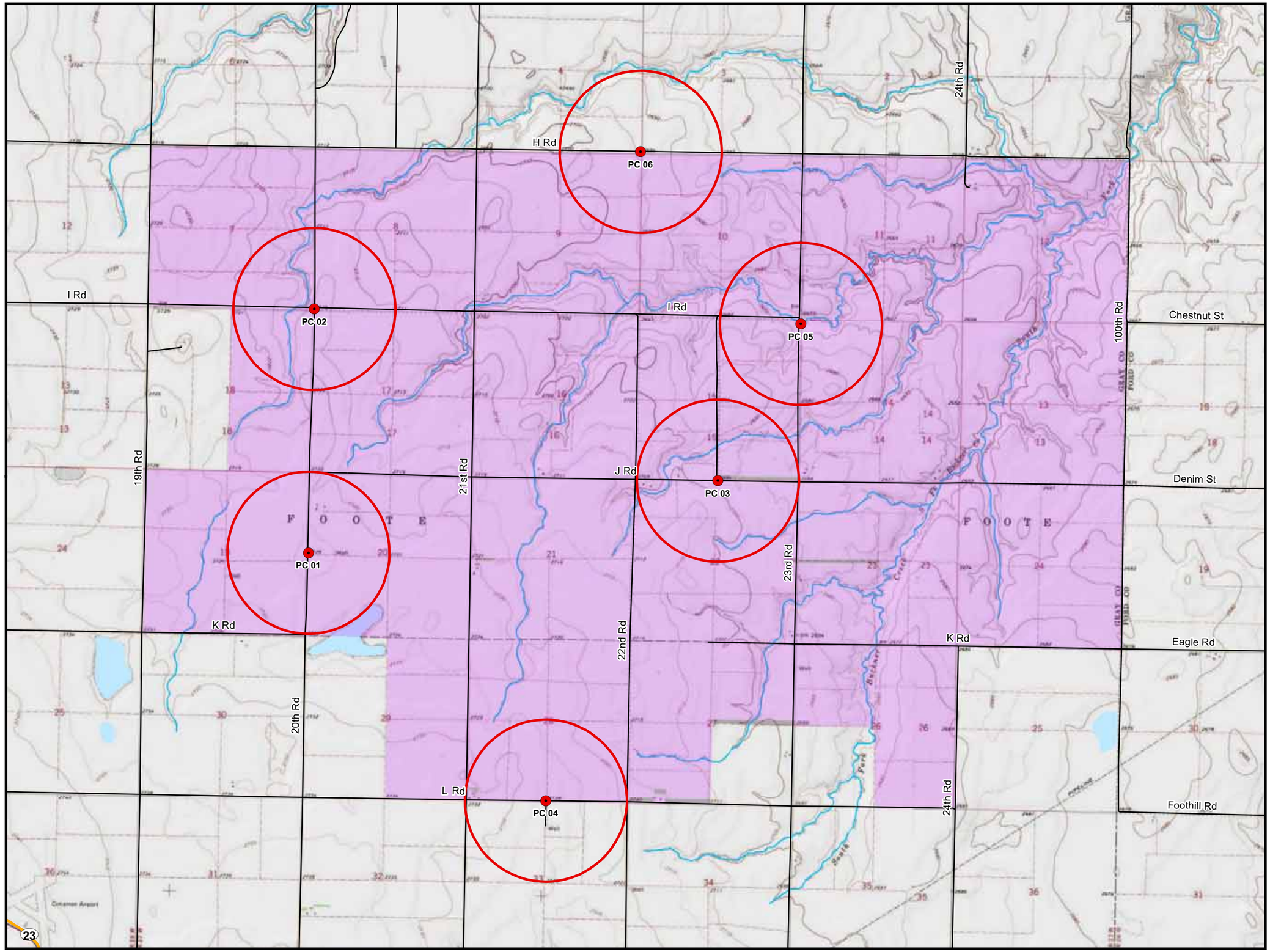

Figure 2

Point Count Location Map (Fall 2010)

Cimarron Wind Energy Project-Phase I

Gray County, KS

- Avian Survey Point
- Avian Survey Point 800-m Radius
- PC# Point Count Number
- Project Area (6-28-2010)
- River/Stream
- Lake/Pond
- State Highway
- Local Road

N W E S

1:36,000

NAD 1983 UTM 14

Last Modified: 11-30-2010

0 0.25 0.5 0.75 1 Miles

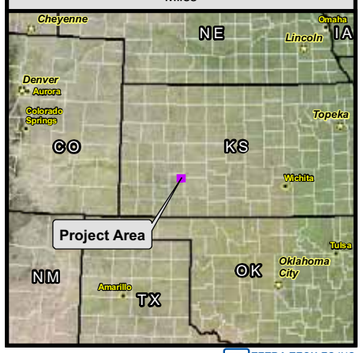

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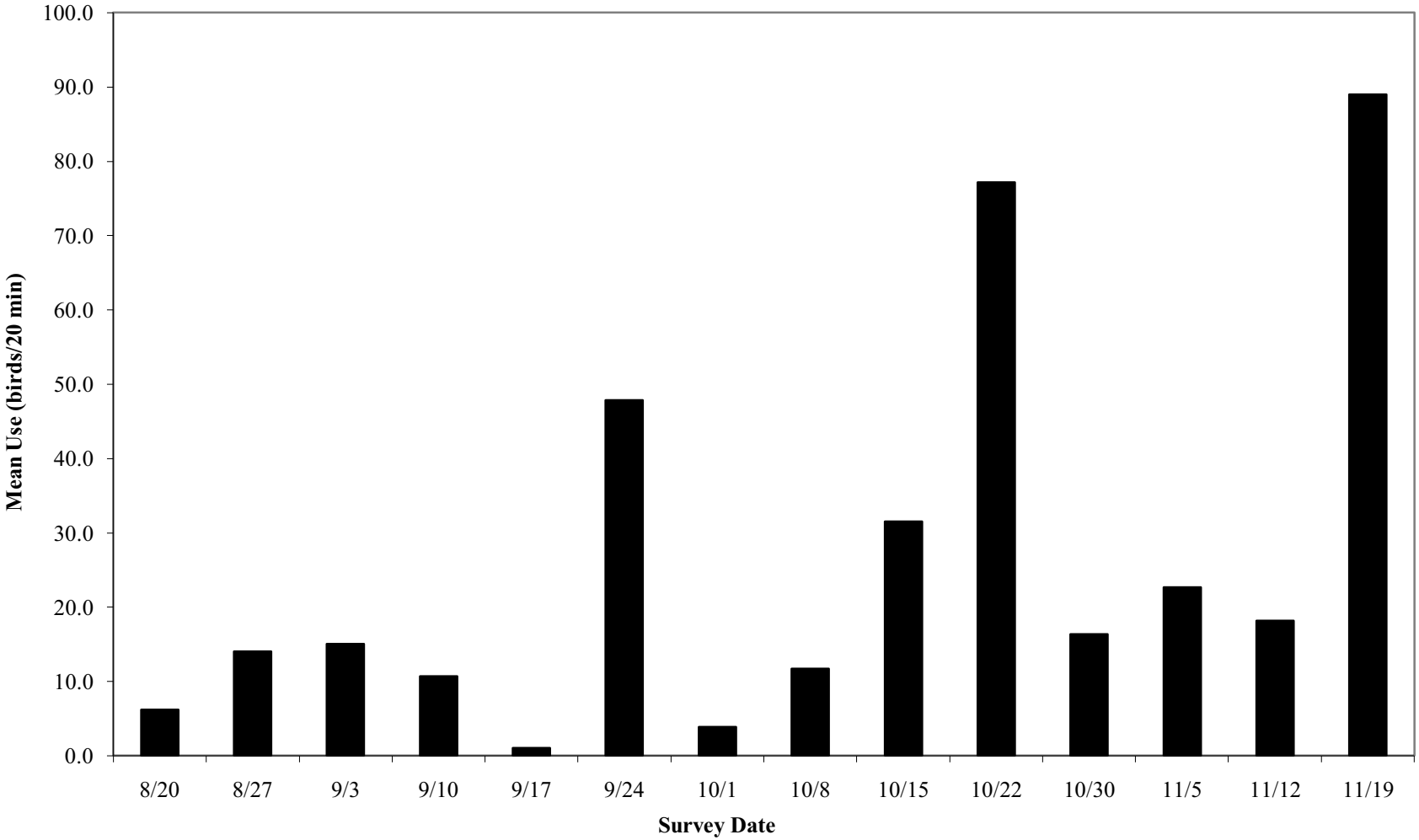
Figure 3. Non-raptor mean use by survey date in Fall 2010 at the Cimarrron Wind Energy Project-Phase I



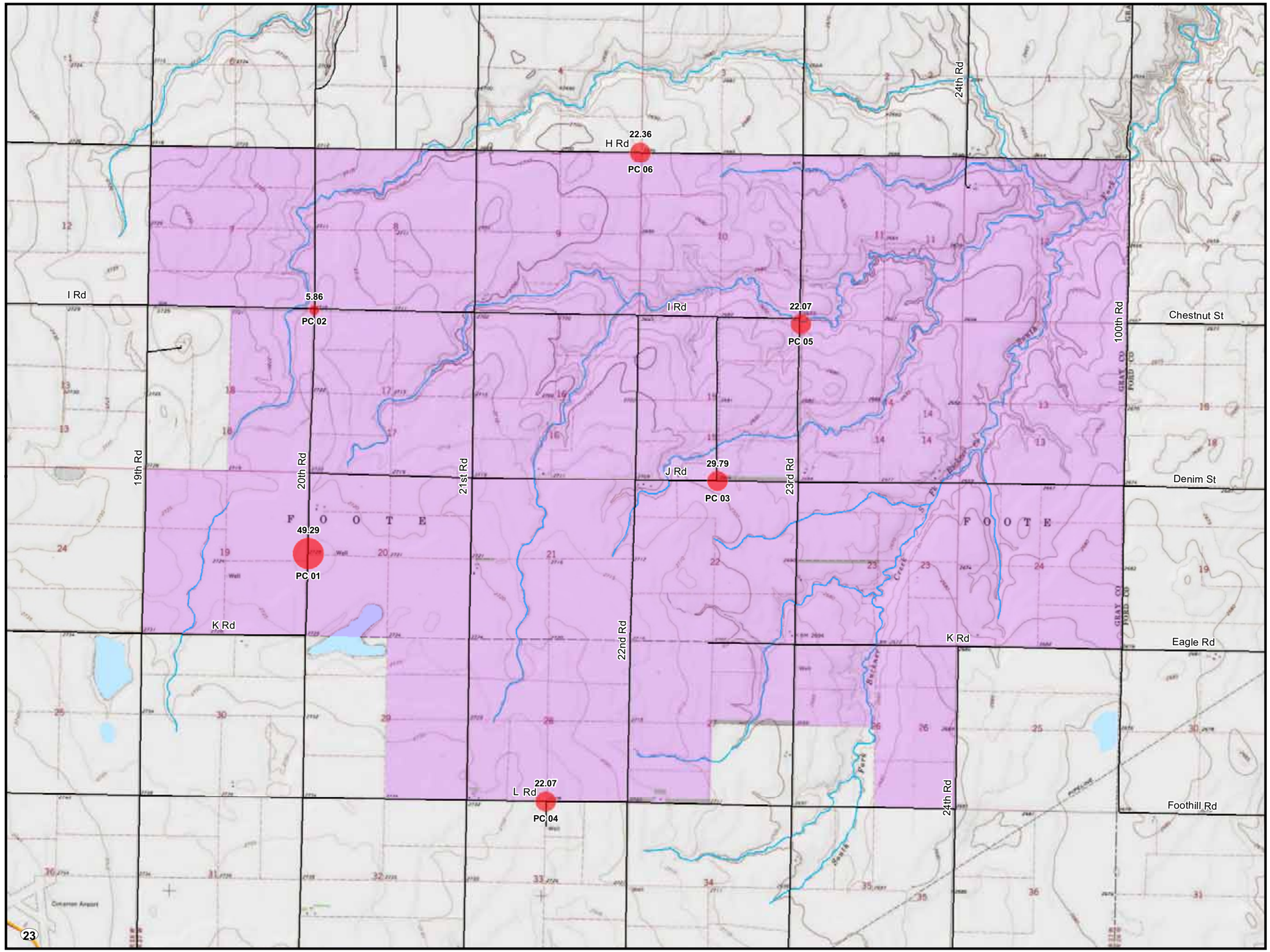


Figure 4

Non-raptor Mean Use by Point Count Location (Fall 2010)

Cimarron Wind Energy Project-Phase I

Gray County, KS

Non-Raptors per 20 Minutes

- 0.01 - 10.00
- 10.01 - 20.00
- 20.01 - 30.00
- 30.01 - 40.00
- > 40.01

\# Mean Use Value

PC# Point Count Number

- Project Area (6-28-2010)
- River/Stream
- Lake/Pond
- State Highway
- Local Road

N W E S

1:36,000

NAD 1983 UTM 14

Last Modified: 11-30-2010

0 0.25 0.5 0.75 1

Miles

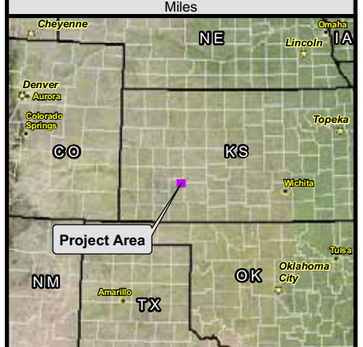


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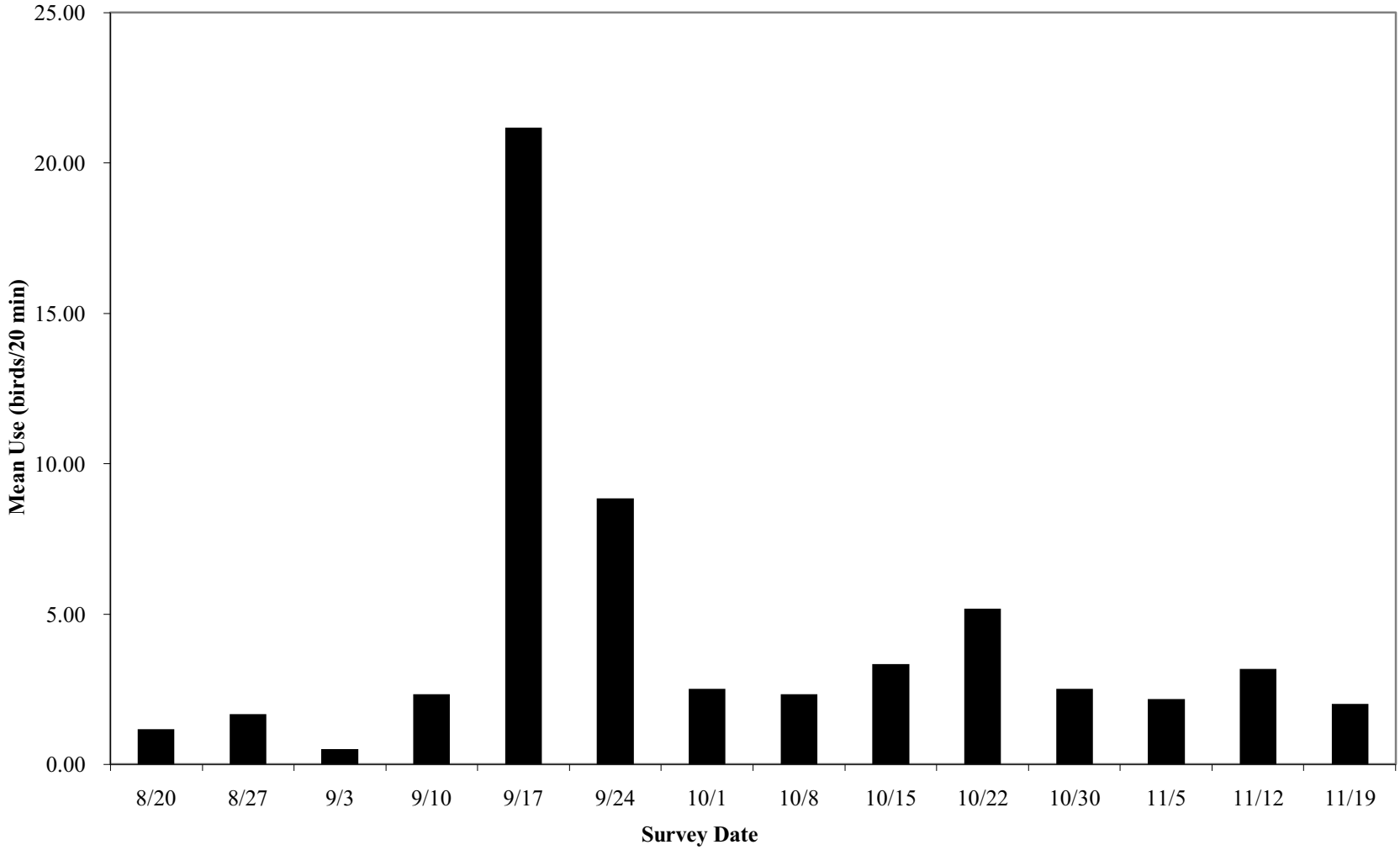
Figure 5. Raptor mean use by survey date in Fall 2010 at the Cimarron Wind Energy Project-Phase I.



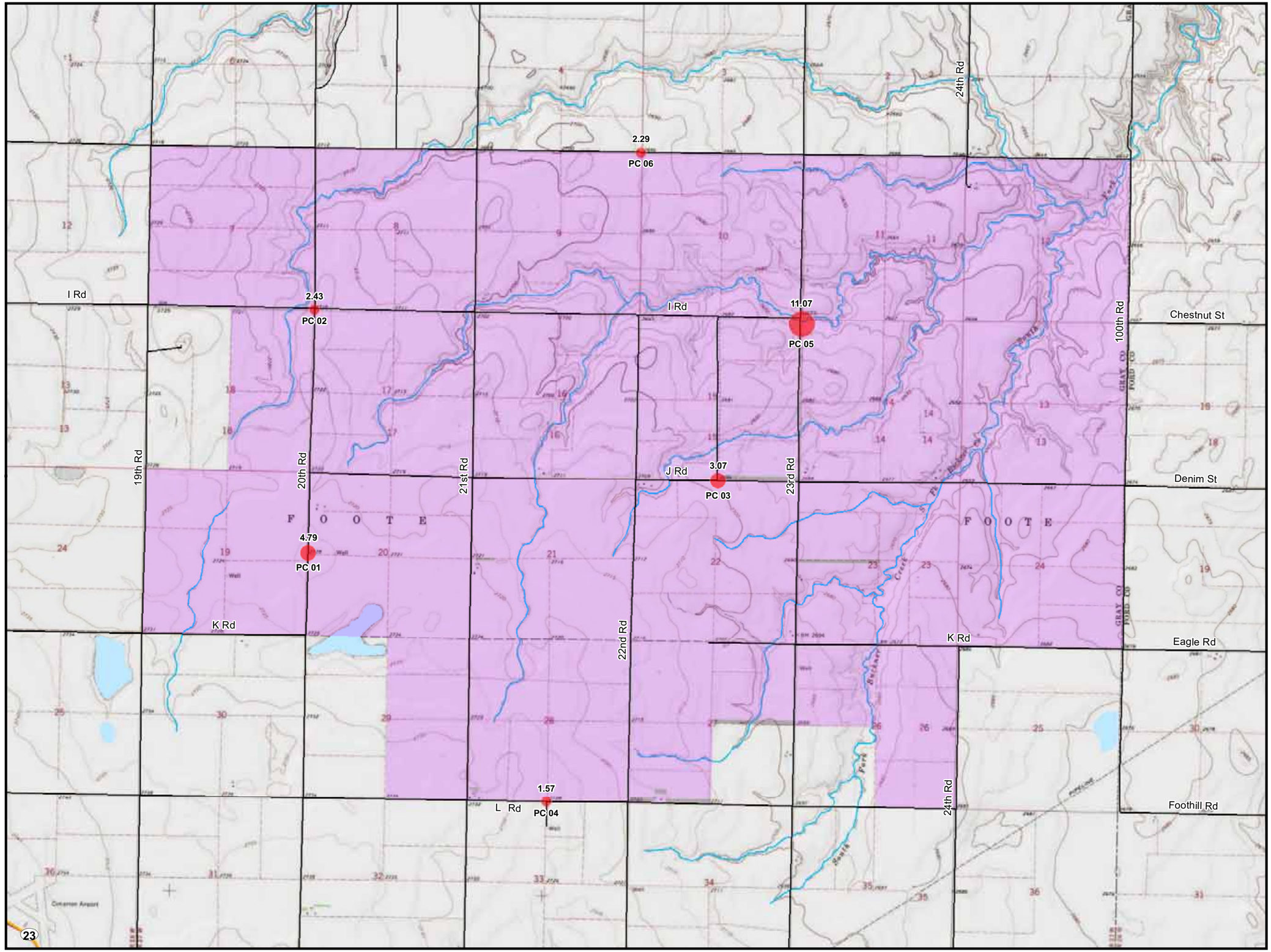


Figure 6

Raptor Mean Use by Point Count Location (Fall 2010)

Cimarron Wind Energy Project-Phase I

Gray County, KS

Raptors per 20 Minutes

- 0.01 - 3.00
- 3.01 - 6.00
- 6.01 - 9.00
- > 12.00

\# Mean Use Value

PC# Point Count Number

- Project Area (6-28-2010)
- River/Stream
- Lake/Pond
- State Highway
- Local Road

N W E S

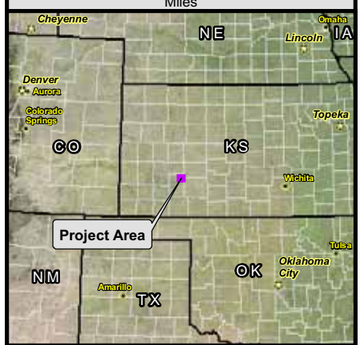
1:36,000

NAD 1983 UTM 14

Last Modified: 11-30-2010

0 0.25 0.5 0.75 1

Miles



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APPENDICES

Appendix 1. Flight directions of birds observed during Fall 2010 point count surveys at the Cimarron Wind Energy Project-Phase I.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
Canada goose	209	4	0.0	0.0	0.0	28.7	57.4	13.9	0.0	0.0	0.0
cackling goose	31	2	0.0	0.0	0.0	3.2	96.8	0.0	0.0	0.0	0.0
red-tailed hawk	2	2	50.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0
American crow	2	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
turkey vulture	1	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
sharp-shinned hawk	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
ferruginous hawk	1	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Cooper's hawk	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Grand Total	**248**	**13**	**0.4**	**0.0**	**0.0**	**24.6**	**61.7**	**13.3**	**0.0**	**0.0**	**0.0**

[1] Includes only flying birds with flight directions