Black-billed Cuckoo Conservation Plan for the California Ridge Wind Energy Project Champaign and Vermilion Counties, Illinois

Prepared for:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PROJECT APPLICANT:

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PROJECT NAME: California Ridge Wind Energy Project

COUNTY: Champaign and Vermilion Counties, Illinois

1.0 AREA TO BE AFFECTED

1.1 Project Location:

See Figure 1 – Project Location

Champaign County:
Township 20N, Range 14W, Sections 4 - 6, 8 & 9
Township 21N, Range 10E, Sections 25 & 26
Township 21N, Range 11E, Sections 30 & 31
Township 21N, Range 14W, Sections 19 - 21, 28 - 33

Vermilion County:
Township 20N, Range 12W, Sections 19 & 20
Township 20N, Range 13W, Sections 3 - 24
Township 20N, Range 14W, Sections 1 –-3, 10 - 15 & 24
Township 21N, Range 13W, Sections 29 - 32
Township 21N, Range 14W, Sections 25 - 27, 34 - 36

1.2 Project Description

The California Ridge Wind Energy Project (Project), located in Champaign and Vermilion Counties, Illinois (Figure 1), is owned by California Ridge Wind Energy LLC (CRWE), which is majority owned by TerraForm Power Inc. The Project consists of 134 1.6-megawatt (MW) wind turbines with a total nameplate capacity of 214.4 MW. The Project also includes an operations and maintenance (O&M) facility, a 34.5-kilovolt (kV)/138-kV substation, access roads, underground communications and power collection systems and a 138-kV overhead transmission line. CRWE has control of all the affected property (i.e., the facilities described above) through either ownership of the land or through lease agreements with the landowners.

The Project is approximately 11.0 miles [mi] across east to west and approximately 5.9 mi north to south. The closest towns to the Project are Royal (approximately one half mi to the southwest) and Collision (approximately one half mi to the northeast). Corn and soy bean production is the dominant land use in the Project area; trees are sparsely distributed and typically restricted to small clusters, generally associated with homes or small riparian areas. The Middle Fork Vermilion River is proximate to the eastern end of the Project and is approximately 1.5 mi from the nearest turbine at its closest point on the eastern end. The Project has been operational since December 2012. Appendix A contains photos of the Project area.

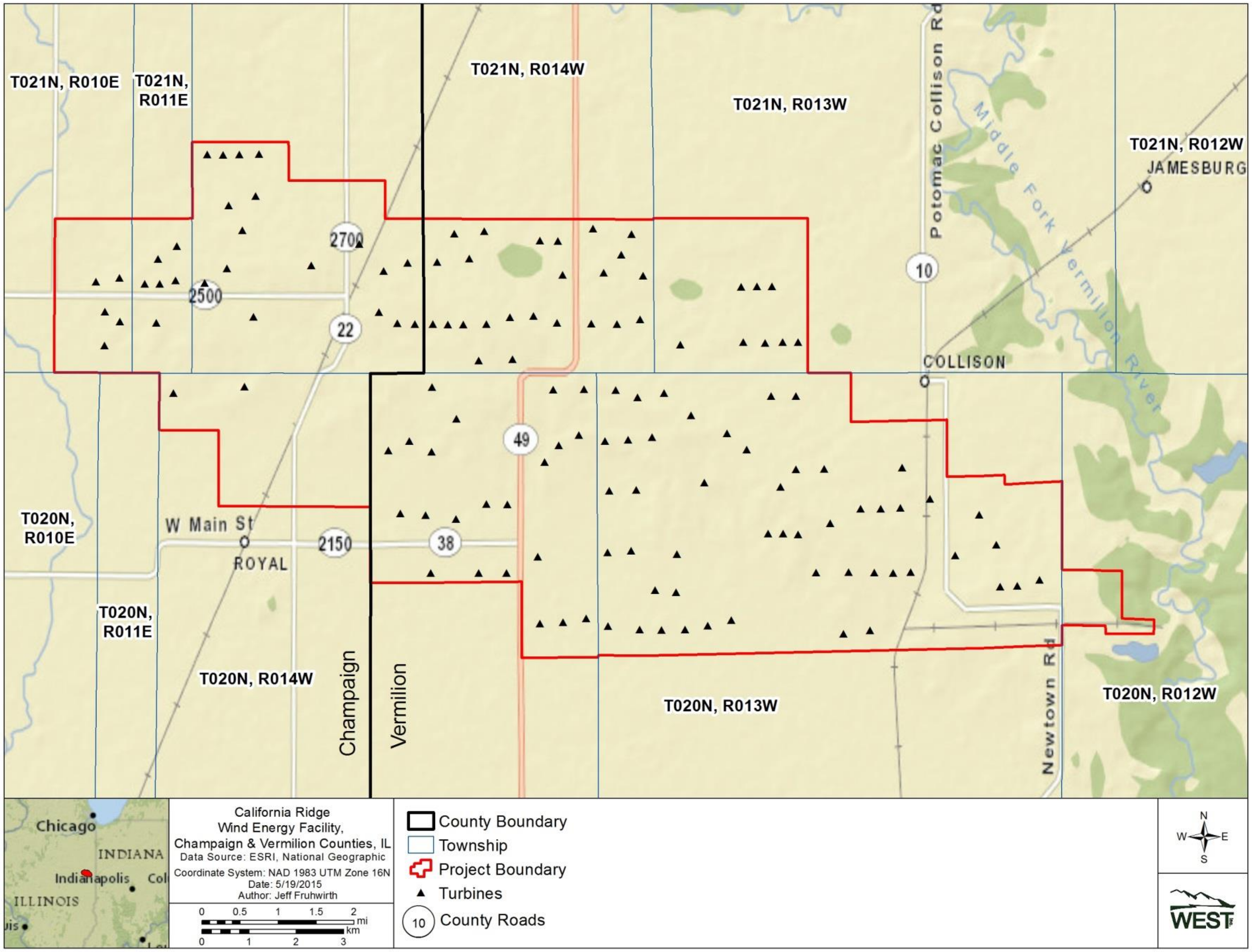

Figure 1. California Ridge Wind Energy Project

2.0 BIOLOGICAL DATA OF AFFECTED SPECIES

2.1 Black-Billed Cuckoo

2.1.1 Migration

The black-billed cuckoo (*Coccyzus erythropthalmus*) is a long-distance nocturnal migrant assumed to migrate over vast areas without stopping (Hughes 2001). The species engages in a short nomadic period after spring migration during which food resources are evaluated (Nolan and Thompson 1975). Individuals are commonly observed outside the breeding distribution of the species during this period (Hughes 2001). During fall migration, individuals are inconspicuous and do not typically migrate in large groups (Robbins 1991).

Generally, black-billed cuckoos begin to arrive on breeding grounds in the central United States (U.S.) from late April to early May, and the number of arrivals peaks during mid-May. Timing of migration can be highly irregular, and spring migrants can arrive as late as early June in the Midwestern U.S. (Hughes 2001) Much less is known about the timing of fall migration. Generally, migrants begin to depart breeding sites in the Midwest in late August, and peak departure occurs in late September or early October (Hughes 2001). Individuals are known to linger as late as October 31 in Illinois (Bohlen 1989) and November 13 in Ohio (Peterjohn 1989).

2.1.2 Breeding

Although no specific data are available for black-billed cuckoo, female yellow-billed cuckoo (*Coccyzus americanus*) appear to breed in their first year (Laymon 1998), and given that the species are closely related it is likely that female black-billed cuckoo follow the same pattern. The onset of black-billed cuckoo nesting has been correlated with the emergence of invertebrates, and timing of first clutch is variable as it is associated with food availability. Peak breeding activity has been related to peak numbers of annual cicadas and caterpillar emergence, and the delayed onset of nesting may result from the delayed emergence of caterpillars (Hughes 2001). Generally, nesting occurs in the Midwestern U.S. from late May to late June, but active nests have been recorded as late as mid-September (Eastman 1991). Eggs have been recorded in Illinois as early as May 7 and as late as July 20 (Bent 1940). Little is known about how often cuckoos raise two broods in a year, and black-billed cuckoos are generally assumed to raise one brood per year. Records of eggs in late summer are suspected to be late first broods associated with late-season emergence of prey populations (Pistorius 1985).

Clutch size for black-billed cuckoo is most often 2 to 3 eggs, rarely 4 or 5. Eggs are usually laid every second day, but intervals of 1 to 4 days have been reported. Because incubation begins after the first egg is laid, estimates of length of incubation are variable, and range from 10 to 14 days (Hughes 2001). Incubation that begins with the first egg also results in nestlings at different phases of development within the same nest. Most young depart the nest at 6 to 7 days but are unable to fly until approximately three weeks of age (Hughes 2001). During this stage, young climb through branches and run along the ground, and individuals have been found up to 1.3 mi away from the nest site before they were capable of flight (Sealy 1985). Because young are accompanied and fed by adults during this stage, fledging is estimated to occur at 21-24 days when young can fly (Sandilands 2010), although age at which juveniles are able to feed on their own is not known (Hughes 2001).

2.1.3 Post-Breeding Dispersal and Lifespan

After departure from the nest but before independence, parents may divide the brood to reduce competition from larger siblings (Sealy 1985), likely resulting in a relatively large area required for post-breeding dispersal of a given brood. After fledging, both adults and juveniles disperse widely in search of food (Sandilands 2010). The average lifespan of the black-billed cuckoo is not well documented; however, based on the small amount of data available from banded cuckoos, it is thought that they have relatively short lives, up to four or five years (Hughes 2010; de Magalhaes et al. 2005).

2.1.4 Population Status

The black-billed cuckoo experienced population declines throughout North America during the twentieth century, particularly during the 1980s and 1990s (Hughes 2001). From 1966-2012, populations in the U.S. as reported in the North American Breeding Bird Survey declined by 3.0 percent per year (95.0% CI = 2.2 – 10.5% per year; n = 1,303 routes; Sauer et al. 2014). Trends for Illinois were similar, declining by 4.1% per year (95.0% CI = 1.3 – 6.7% per year; n = 58 routes; Sauer et al. 2014).

Local abundance may be highly variable from year to year. Because cuckoo populations have been correlated with irruptions of cicadas (Nolan and Thompson 1975) and caterpillars (Jauvin and Bombardier 1996), there can be large increases in local populations from immigration during insect irruptions. Thus, black-billed cuckoo may become locally common in areas where, in most years, it is rare. The nomadic nature of the black-billed cuckoo, even during the breeding season, can result in population estimates that fluctuate annually (Sandilands 2010). Thus, long-term trends provide the best insight into population dynamics for this species.

Black-billed cuckoos were considered a common summer resident in northern Illinois in the early 1900s, but the population has declined since then due to loss of nesting habitat, such as orchards and hedgerows (Kleen et al. 2004). Breeding bird survey data indicate the species has always been more common in northern Illinois, with decreasing abundance observed in southern Illinois. The species is currently considered an uncommon migrant and summer resident in Illinois, with lower abundance occurring in southern Illinois (Kleen et al. 2004; Figure 2). As of 2013, there are estimated to be approximately 870,000 black-billed cuckoo breeding in North America, with approximately 410,000 breeding in the U.S., and approximately 5,000 breeding in Illinois (Blancher et al. 2013).

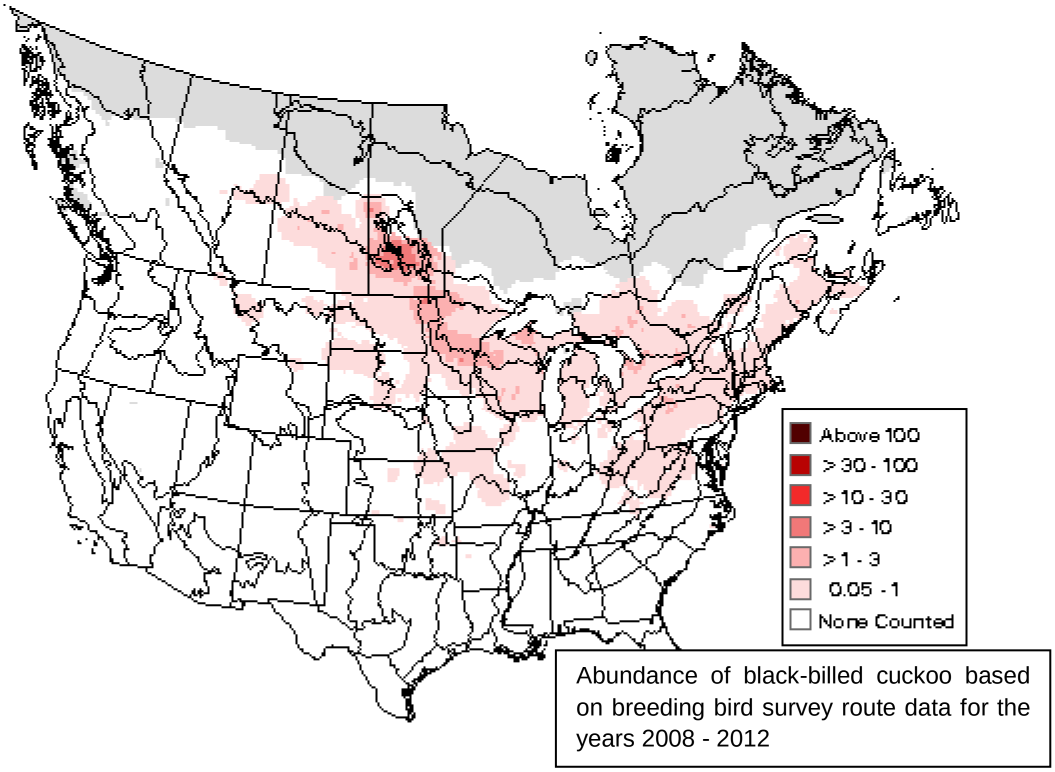

Figure 2. Black-billed Cuckoo Summer Distribution – Breeding Bird Survey Data

Raw breeding bird survey (BBS) data from 1985 - 2014 (Sauer et al. 2015) was reviewed to determine if areas of concentrated black-billed cuckoo records during the breeding season exist and if BBS routes near the Bishop Hill Project contain black-billed cuckoo observations. The BBS uses established routes on public roads resulting in a long-term bird survey throughout the U.S., Canada and Mexico.

Statewide, a total of 204 black-billed cuckoo detections were recorded on 2,295 survey routes during the analysis period and consistent with the known episodic population cycle of black-billed cuckoo for an average of 0.09 black-billed cuckoo/route (Table 1). Over the most recent five years of data (2009 - 2014), 12 black-billed cuckoo were recorded over 503 survey routes for an average of 0.02 black-billed cuckoo/route. During the most recent five years, black-billed cuckoo were detected on a total of eight unique survey routes, and black-billed cuckoo were not detected on the same survey route more than once in the five-year period (Figure 3). All routes with black-billed cuckoo detections over the most recent five years were located towards the western boundary of the state near the Mississippi and Illinois Rivers.

Table 1. Black-billed cuckoo observations by route for Illinois 1985 - 2014.

Route number	Year	Count
1	1985	2
	1986	1
	1989	3
	1990	2
	1991	1
	1992	1
2	1987	2
	1989	1
	1990	3
	1993	1
	2002	2
	2006	1
	2007	2
3	1991	1
	1998	1
	2008	3
4	1993	1
5	1991	1
7	1986	2
	1989	1
8	1985	2
	1986	1
	1988	2
	1989	2
	1990	2
	1992	1
	1993	1
	1994	1
	2013	3
9	1990	2
10	1986	1
	1988	6
	1989	1
	1990	1
	1994	1
	1995	4
	1997	1
	2004	1
11	1990	1
	1991	1
13	1992	1
14	1990	1
	1997	1
16	1990	1
17	1990	1
18	1988	1
	1989	1
	1991	1
19	1986	1
	1991	1
22	1997	1
	2003	1
23	1985	1
24	1989	1
	1991	1
	1992	1
	2010	1
25	1987	1
	1989	3
	1993	2
	1994	1
	1995	1
	1999	1
	2003	2
	2004	1
	2005	1
	2007	1
	2014	2
27	1994	2
	1997	2
33	1986	1
34	2007	2
35	1985	1
	1992	2
	1994	5
	1998	1
37	1992	1
	1994	1
	1996	1
38	1986	1
	1988	2
	1991	3
	1992	3
	1995	1
	1996	2
	1997	1
	1998	3
	1999	1
	2001	3
	2002	1
	2003	5
	2004	1
	2008	1
	2011	2
40	1993	1
41	2003	3
	2004	2
	2011	1
44	1999	1
45	2001	1
46	1991	1
	2004	1
	2006	1
	2007	1
48	1988	2
51	2003	1
	2007	1
52	1993	1
58	1985	1
	1992	1
60	1986	1
	1989	1
	1996	1
62	1985	1
	1986	1
66	1993	2
	2005	2
	2008	2
74	2007	1
75	1998	1
	2002	2
	2004	2
	2007	1
	2011	1
77	2000	1
	2001	1
	2003	1
301	2004	1
	2008	1
302	2002	1
	2003	2
	2006	2
	2007	3
	2008	1
	2009	1
304	2010	1

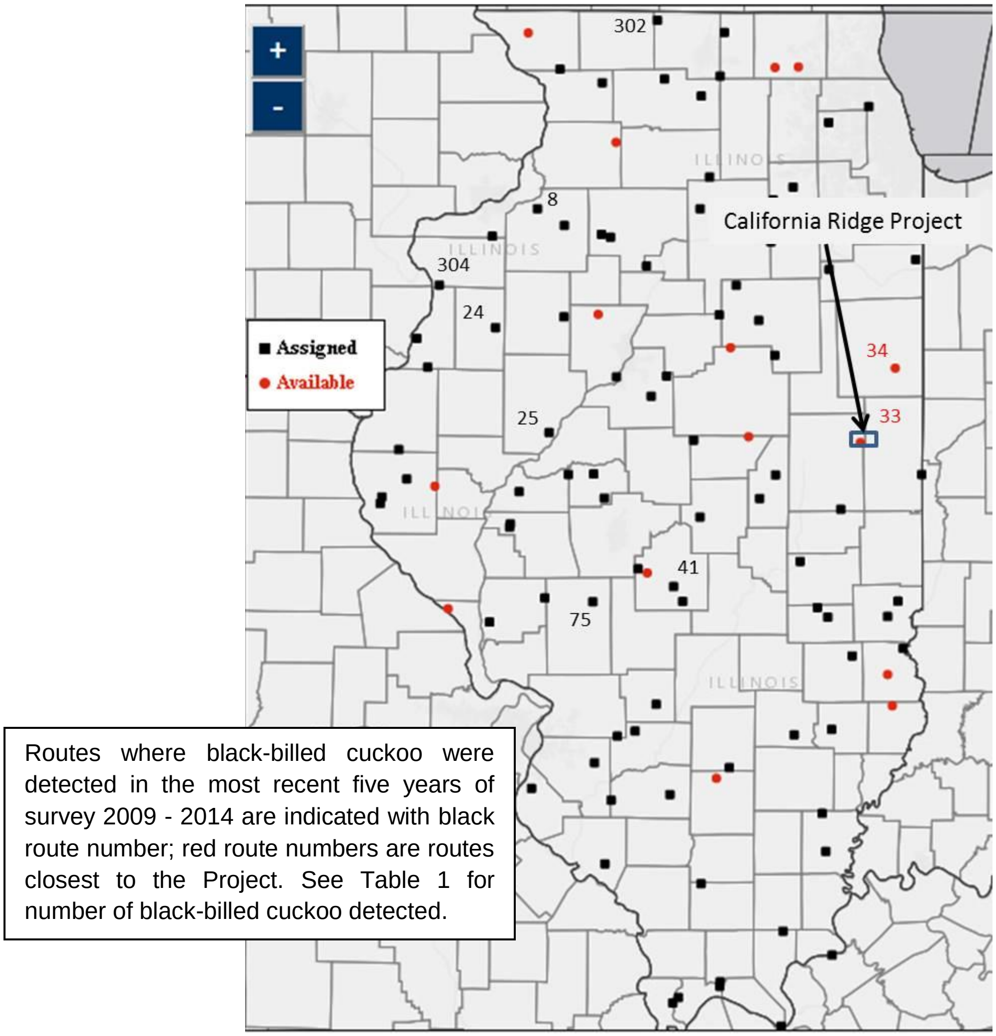

Figure 3. BBS route locations in Illinois, designated as either available (not currently surveyed) or currently assigned for survey.

The Dailey BBS route (number 33) runs through the Project area; one black-billed cuckoo was recorded in 1986, and the route was discontinued after 2005. The Milford route (number 34) is located approximately 25 mi north of the Project area, and two black-billed cuckoo were recorded in 2007.

In summary, breeding black-billed cuckoos are uncommon in Illinois evidenced by a state-wide rate of 0.09 black-billed cuckoo/route from 1985 - 2014. More recent data from 2009 - 2014 shows a lower rate of 0.02 black-billed cuckoo/route. Based on the route-level analysis for the Project, black-billed cuckoo should be considered unlikely to occur as breeders on the BBS routes associated with the Project. The BBS is limited to roadside surveys on public roads, so uncommon species with specific habitat requirements may not be appropriately represented by the BBS.

2.1.5 Habitat Requirements

Spencer (1943) studied six black-billed cuckoo nests and found nesting habitat ranged from an 'open wooded area' (two nests) to second growth forest and thickets (four nests). Additional information on breeding habitat preferences is provided in breeding bird atlases, which provide important information on bird distributions but typically contain incidental information rather than study results (Hughes 2001). During the breeding season, black-billed cuckoos use a wide range of habitats but are most commonly associated with forest edges, fencerows, riparian areas and shrublands (Spencer 1943, Hughes 2001). Kleen et al. (2004) describes the species as more likely to utilize the "older, more wooded side of woodland edges" and is "less likely to be found near suburbia than the yellow-billed cuckoo." Trends in habitat use across breeding bird atlas records suggest that black-billed cuckoos will nest in habitat associated with water or marshy areas and use trees that typically form thickets such as willow, alder, birch and beech (Hughes 2001). Black-billed cuckoos will also nest in open woodlands that have branches to support nests as low as 2 to 3 feet (ft) above ground (Hughes 2001). Little is known about the territorial behavior of the black-billed cuckoo (Hughes 2001), but Freeman and Merriam (1986) hypothesized that home range size is 5 to 12 acres. Little is known about habitat use during migration, it is assumed to be similar to breeding habitat (Hughes 2001).

2.1.6 Species Status in the Project Area

2.1.6.1 Pre-Construction Surveys

Black-billed cuckoo were not detected at the Project area during pre-construction avian surveys, which were conducted between March 2009 and February 2010 (see Appendix C for pre-construction survey reports).

Fixed-point bird use surveys were conducted within the Project area by WEST from March 12, 2009 through February 15, 2010 (Good et al. 2010). Surveys were conducted weekly during the spring and fall migration seasons and monthly during the winter, to estimate the seasonal, spatial and temporal use of the Project area by birds, particularly raptors. No surveys were conducted during the summer due to the predominance of agriculture in the Project boundary. Twenty-four survey events were conducted; 15 survey points, distributed throughout the Project area, were sampled for a period of 20 minutes during each survey event. Three hundred and sixty 20-minute fixed-point surveys were conducted: 180 in spring, 120 in fall and 60 in winter. Results of these surveys are summarized below.

Forty-eight species were observed during all fixed-point surveys, with an average species richness of 0.67 large bird species/2,625-ft plot/20-minute survey and 1.66 small bird species/328-ft plot/20-minute survey. The total number of species was greater in the spring (45 species) and fall (30) than in the winter (12). Three passerine species, European starling (*Sturnus vulagris*), brown-headed cowbird (*Molothrus ater*) and red-winged blackbird (*Agelaius phoeniceus*) composed 44 percent of all bird observations.

A total of 5,325 bird observations comprised of 1,469 separate groups was recorded during the surveys. Overall, use by large bird species was higher during the spring and fall (3.40 and 2.43 birds/2,625-ft plot /20-minute survey, respectively) than during the winter (1.05 birds/2,625-ft plot /20-minute survey; Table 3.3). Small bird use followed a similar pattern, with higher use in the spring and fall (9.10 and 10.53 birds/328-ft plot /20-minute survey, respectively) than in the winter (4.58 birds/328-ft plot /20-minute survey).

Four sensitive species were recorded during fixed-point bird use surveys. Three upland sandpipers (*Bartramia longicauda*), a state-endangered species (DNR 2009) and a federal species of concern (USFWS 2008), were observed within the Project area. Ten northern harriers (*Circus cyaneus*) and one osprey (*Pandion haliaetus*), also both Illinois state-endangered species (DNR 2009), were recorded during fixed-point surveys. In addition, 283 American golden plovers (*Pluvialis dominica*) were observed in eight groups. While this species is not federally listed, it is a species of concern on the federal priority species lists (USFWS 2004). The number of state-endangered species observations may represent repeated observations of the same individual in some cases. No black-billed cuckoo were observed.

<u>Pre-construction Nest Surveys</u>

All native habitats, including wooded habitat, directly impacted by construction activities during the breeding season were surveyed for nests by a trained biologist prior to construction. No black-billed cuckoo nests were detected in these surveys.

2.1.6.2 Black-billed Cuckoo Habitat Evaluation

Aerial imagery was examined and areas of woody vegetation were placed into three categories: woodlot, shelterbelt (shrubs) and shelterbelt (trees) based on the size of the patch, the configuration of the patch (linear versus non-linear) and color of the vegetation. The habitat map was used to guide a site visit in December 2014 to evaluate the Project for potential black-billed cuckoo breeding habitat. Patches of woody vegetation with a dense understory of branches at the patch edge as low as 2 to 3 ft above the ground were considered potential black-billed cuckoo breeding habitat. Per Hughes (2001) and Kleen et al. (2004), any habitat that would be difficult to walk through was considered potential black-billed cuckoo breeding habitat.

The Project occurs in the Central Corn Belt Plains Level III Ecoregion, which consists of flat to rolling plains that have largely been converted to cropland (90.2% of the habitat in the California Ridge Project). The Project consists of limited black-billed cuckoo breeding habitat with only scattered shelterbelts (less than 2% of habitat) in the Project area; large woodlots are not found within the boundary (Figure 1; California Ridge Wind Energy LLC 2011). There are approximately 635 acres of potential black-billed cuckoo habitat (1.9%) within the approximately 33,524 acre Project boundary, consisting of approximately 73 acres of shrubland (mostly shelterbelts), approximately 266 acres of shelterbelt trees and approximately 296 acres of woodlots (see Table 3 in Section 4.4). Therefore, the Project area should be considered poor black-billed cuckoo breeding habitat with limited availability for stopover. Within one mi east of the Project, the Middle Fork Vermilion River corridor contains suitable breeding habitat and is a unique feature of the primarily agricultural landscape near the Project. Several conservation areas including Kennekuk Cove County Park, Windfall Prairie Nature Preserve and Horseshoe Bottom Nature Preserve could serve as potential breeding habitat for black-billed cuckoos.

2.1.6.3 Black-billed Cuckoo Carcass Detections and Correlates of Risk

During multiple years of post-construction monitoring, three black-billed cuckoo carcasses were detected at the Project (Table 2; Figure 4; Appendix D).

To understand if risk could be identified for black-billed cuckoos based on information from carcass detections, the spatial (i.e., location) and temporal (i.e., timing) information associated with carcasses in the context of life history and habitat preferences of black-billed cuckoo was examined. As only three carcasses were detected, limited inference can be drawn regarding spatial and temporal correlates of risk. The carcasses detected were not at turbines near shelterbelts (Table 2). Collisions of nocturnal migrants with towers are hypothesized to be influenced by the type of lighting on the structure and weather conditions, specifically the presence of fog or low clouds (Bevanger 1994, Shire et al. 2000, Gehring et al. 2009). Comparing the fatality rate of birds near lighted and non-lighted turbines indicates that the red blinking lights on lighted wind turbines do not create a strong attractant (Kerlinger et al. 2010). Rain, thunderstorms or fog did not occur overnight during the estimated dates when the carcasses occurred (Table 2). Thus, the carcass discoveries were not likely related to inclement weather events typically associated with bird collision risk at structures.

Table 2. Information for post-construction monitoring and black-billed cuckoo carcasses at California Ridge Wind Energy Project

Survey time period	Number and Date of Black-billed Cuckoo Found	Turbine Number	Age	Habitat at Turbine (≤328 ft)	Weather During Night of Estimated Occurrence
Spring 2013	None	NA	NA	NA	NA
Fall 2013	September 15, 2013	96	Adult	Agriculture	Clear, Sept 14
Spring 2014	None	NA	NA	NA	NA
Fall 2014	July 29, 2014 - incidental find	19	Adult	Agriculture	Clear, July 25
Fall 2015	September 16, 2015	109	Juvenile	Agriculture	Clear, September 15

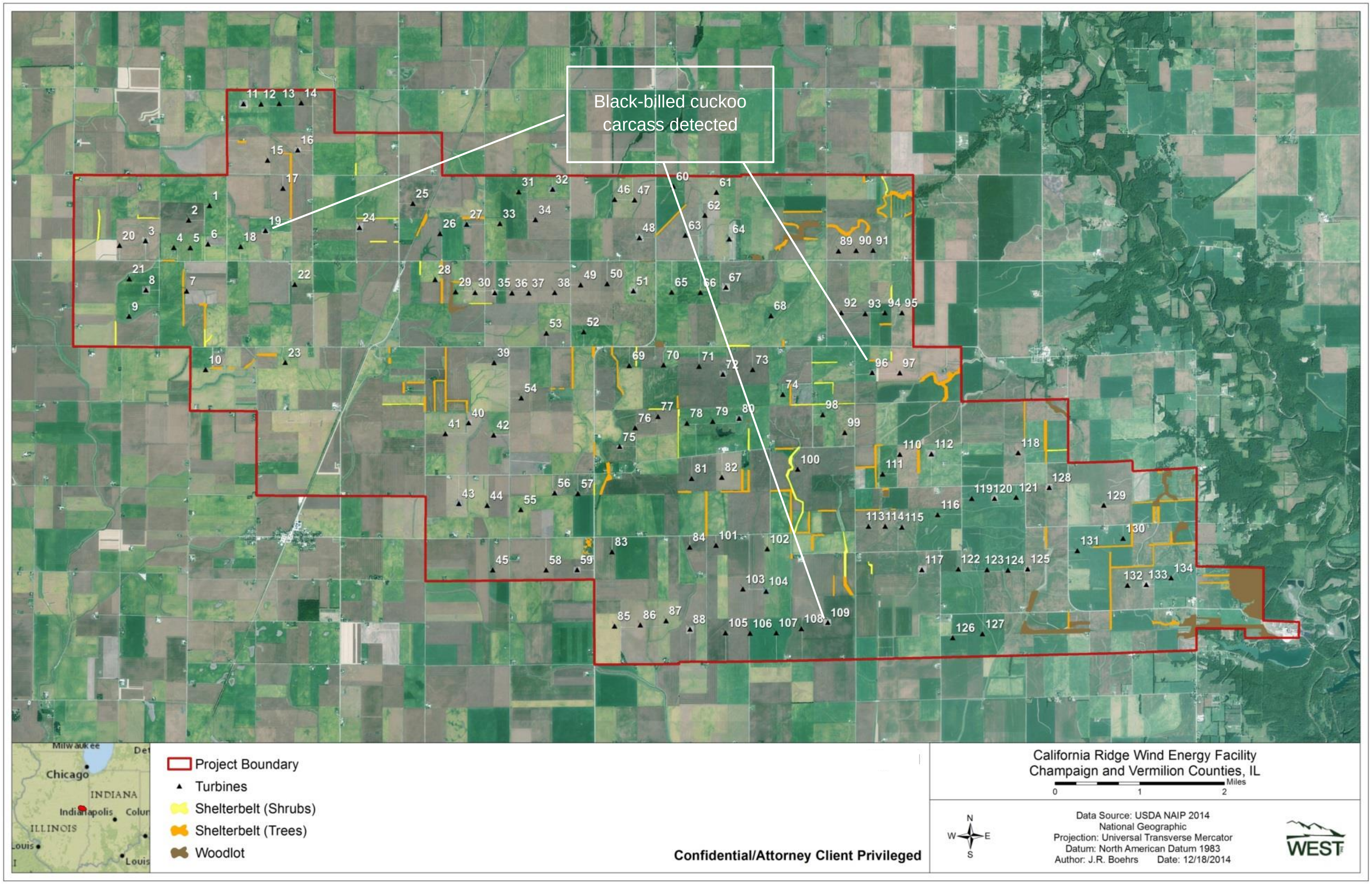

Figure 4. Locations of potential black-billed cuckoo breeding habitat and detected carcasses at California Ridge Wind Energy Project

3.0 DESCRIPTION OF ACTIVITIES

3.1 Activities with Potential for Incidental Take

The activity that may result in the take of a black-billed cuckoo is the continued operation of the Project.

3.2 Timeline

CRWE proposes to continue to operate the Project for up to 25 years, through 2040.

3.3 Other Permitting Review

The Project received all necessary permits to construct and operate prior to construction in 2011. As attached in Appendix E, the wildlife permits received for the Project include:

- USFWS Migratory Bird Permit - 5/14/12 through 3/31/15
- USFWS Migratory Bird Permit - 5/13/14 through 3/31/15
- IDNR T/E Permit - 5/18/15 through 12/31/15
- IDNR Scientific Collection Permit - 5/7/15 through 12/31/15 (carcass monitoring)
- IDNR Scientific Collection Permit - 4/27/15 through 12/31/15 (trial carcasses)
- IDNR Scientific Collection Permit - 10/16/14 through 12/31/15

No other permit reviews are currently ongoing.

CRWE has been coordinating with the Illinois Department of Natural Resources (DNR) throughout the siting, permitting and operation phases of the Project. Coordination started in 2009 as part of the initial siting and permitting process, and continued through 2011, including meeting and conference calls in March and September 2009 to discuss wildlife surveys. In the DNR's December 4, 2009 comment letter, the agency listed the black-billed cuckoo as a state-listed species that would not be directly threatened by wind turbine construction or operation at the Project, but may be subject to collision risk as a migrant.

4.0 EFFECTS OF THE PROPOSED ACTION

As stated above, continued operation of the Project may result in the incidental take of black-billed cuckoo through collision with wind turbines. As described in Section 2.1.6.1, no black-billed cuckoos were identified during pre-construction avian use surveys and no black-billed cuckoo nests were identified in the pre-construction nest surveys that were conducted. There is very little suitable breeding habitat in the Project (Figure 4), and the Project is located in a portion of the overall black-billed cuckoo range with relatively low abundance during the breeding season (Figure 2). Therefore, migrating individuals are expected to be primarily affected, with effects to breeding individuals anticipated to be unlikely. No effects to breeding habitat would occur due to operation of the Project because no wooded habitat will be cleared or modified.

4.1 Spatial Patterns

As noted in Section 2.1.6.2, one black-billed cuckoo carcass was detected in September 2013, one carcass was detected in July 2014, and one carcass was detected in September 2015 during post-construction monitoring. The 2013 carcass was an adult bird and the carcass was estimated to have occurred during the previous night. The carcass was found intact and approximately 168 ft away from turbine 96. The 2014 carcass was an adult bird and was estimated to have occurred four days before it was discovered, according to the qualified biologists conducting the post-construction monitoring. The carcass was found approximately 135 ft away from turbine 19. The 2015 carcass was a juvenile bird and the carcass was estimated to have occurred during the previous night. The carcass was found approximately 135 feet from turbine 109. Turbines 19, 96 and 109 are located at least 0.3 mi from shelterbelts, all of which are unlikely to serve as black-billed cuckoo habitat due to their small size and isolation from other patches of habitat. Other turbines at the Project that were monitored for carcasses were located in similar habitat (agriculture with limited shelterbelts) and black-billed cuckoo carcasses were not detected. Thus, it is unlikely that either turbine where a carcass was detected at the Project is in an area that is attractive to black-billed cuckoos. Inference regarding spatial patterns of collision risk are limited by the small sample of carcasses (n = 3). However, based on the current sample, there is no apparent association of carcass locations to black-billed cuckoo habitat (shelterbelts or woodlots).

4.2 Temporal Patterns

The 2013 and 2014 adult carcasses discovered at the Project occurred in September and July, respectively, and the 2015 juvenile carcass occurred in September. Although a carcass discovered in July could indicate local breeding, given the wandering behavior of black-billed cuckoos associated with caterpillar irruptions, the available data do not allow a conclusion on whether the individual had been breeding in the Project area or was arriving from a different area. The September carcasses coincide with the fall migration period, and based on monitoring data likely occurred over night. Rain, thunderstorms, or fog did not occur overnight during the estimated date when the carcasses occurred and there were rain and thunderstorm events without associated discovery of carcasses. Thus, carcass discovery did not occur with inclement weather events typically associated with bird collision risk at structures (Bevanger 1994, Shire et al. 2000, Gehring et al. 2009).

In conclusion, it is not possible to identify specific locations or time periods of risk to black-billed cuckoo from the Project, but the small sample of data indicates that risk may occur in late July and fall migration.

4.3 Plans to Minimize Area Affected

During siting of the Project, all of the turbines were placed in cultivated areas, avoiding black-billed cuckoo habitat. Additional siting measures were followed to avoid and minimize impacts to wildlife, including the black-billed cuckoo:

- Potentially-suitable foraging habitats for Indiana bat were evaluated for connectivity to one another and to the Middle Fork. If habitats were determined to be connected, a 1,000-ft setback from those habitats was established to prevent the turbine sites from being connected to the Middle Fork. Because this foraging habitat consists of wooded areas, this measure also served to set back from potential black-billed cuckoo habitat.

- The Project was sited in a previously disturbed landscape and to avoid critical habitats for sensitive species such as the black-billed cuckoo.

- Project facilities were located to avoid: (1) documented locations of any species of wildlife, fish or plants protected under the federal ESA or the state Endangered Species Protection Act such as the black-billed cuckoo, (2) known local bird migration pathways and daily movement flyways, (3) areas where birds are highly concentrated. The Project area is not known for having a high incidence of fog, mist, low cloud ceilings and low visibility.

- Fragmentation of wildlife habitat (including fragmentation of tracts of wooded potential black-billed cuckoo habitat) was avoided through the use, where practical, of lands already disturbed, including using existing roadways.

During construction, further measures were taken to avoid and minimize impacts to wildlife, including the black-billed cuckoo:

- As part of the Project's compliance with the Migratory Bird Treaty Act, all habitats (including potential black-billed cuckoo habitat) directly impacted by construction activities during the breeding season were surveyed for nests by a trained biologist prior to construction.

- Removal or disturbance of vegetation (including woody vegetation that could provide black-billed cuckoo habitat) was minimized through site management (e.g., by utilizing previously disturbed areas, designating limited equipment/materials storage yards and staging areas, scalping) and reclaiming all disturbed areas not required for operations.

- Project personnel were advised regarding speed limits on roads (25 mph) and travel was restricted to designated roads to minimize wildlife mortality due to vehicle collisions, including minimizing the potential for collision with black-billed cuckoos.

No additional avoidance or minimization measures are proposed at this time because (1) the siting and construction measures already committed to by CRWE have and will continue to minimize impacts to black-billed cuckoo; (2) no specific collision risk patterns have been detected and therefore there is no basis for effective design of potential minimization measures such as curtailment; and (3) impacts to the species have been low and are predicted to remain low during the term of the permit.

4.4 Amount of Habitat Affected

As described in Section 2.1.6, there are approximately 635 acres of potential black-billed cuckoo habitat (1.9%) within the approximately 33,524 acre Project boundary, consisting of approximately 73 acres of shrubland (mostly shelterbelts), approximately 266 acres of shelterbelt trees and approximately 296 acres of woodlots (Table 3). The Project is already built and operational, and as stated above, impacts to black-billed cuckoo habitat were avoided and minimized during siting and construction. No impacts to black-billed cuckoo habitat will occur during operation of the Project.

Table 3. Land cover types and acreages within the California Ridge Wind Energy Project

Land Cover	Acres	Percent
Agriculture (Corn/Soybeans)	30,246.6	90.2%
Agriculture (Hay Fields)	117.3	0.4%
Developed	509.2	1.5%
Mowed Grassland	690.7	2.1%
Open Water	9.8	<0.1%
Pasture	236.6	0.7%
Railroad Verge	84.3	0.3%
Savannah	103.9	0.3%
Shelterbelt (Shrubs)	72.5	0.2%
Shelterbelt (Trees)	266.4	0.8%
Unmowed Grassland	890.1	2.7%
Woodlot	296.1	0.9%
Total	**33,523.6**	

4.5 Incidental Take of Individuals

A regional percent composition approach was used to estimate the incidental take of black-billed cuckoos at the Project. The regional percent composition approach pools carcass data from other wind energy projects over time and from various locations within a given region to calculate a take estimate for black-billed cuckoo by determining the anticipated percent of all bird carcasses that will be black-billed cuckoos over the 25 year operational period.

4.5.1 Methodology

Wind energy facilities with publicly available carcass data were used to determine the percentage of all bird carcasses that were black-billed cuckoos. Based on proximity to the Project and black-billed cuckoo distribution, data from wind energy facilities in Illinois, Indiana, Ohio, Wisconsin and Michigan were included in the analysis (see Figure 2). Thus, data from wind energy facilities in these states produce a representative range of estimated fatality rates for black-billed cuckoos at the California Ridge Wind Energy Project.

Estimated fatality rates (fatalities/turbine/study period) were obtained for all birds and black-billed cuckoos for all publicly available projects within the specified region. The estimated fatality rates were multiplied by the number of turbines surveyed during monitoring to estimate the rate of fatalities per turbine during defined study periods. The adjusted fatality rates were averaged for facilities with multiple years of monitoring and adjusted for plot size. Study period was defined as the period of time the facility was monitored within a year.

Percent composition of black-billed cuckoo fatalities to all bird fatalities is calculated as follows:

$$\%\ \text{composition} = \frac{\sum_{i=1}^{n} a\text{djusted black billed cuckoo fatalities/turbines searched/study period at facility i}}{\sum_{i=1}^{n} a\text{djusted all bird fatalities/turbines searched/study period at facility i}}$$

where n is the number of facilities.

The estimated total bird fatalities at the Project based on three years of post-construction monitoring data were multiplied by the regional percent composition of black-billed cuckoo fatalities to estimate the black-billed cuckoo take at the Project.

4.5.2 Results

There are seven wind energy facilities with publicly available data in Illinois, Indiana, Wisconsin and Michigan; there are no wind projects in Ohio with publicly available fatality data (Table 4). In addition, data from two wind facilities in Illinois - the California Ridge Wind Energy Project and the Bishop Hill Wind Energy Project - were included in the dataset for the regional percent composition analysis (Table 5).

Table 4. Wind facilities with publicly available fatality estimates used in regional percent composition analysis

Project Name[1]	State	Year of Study	Black-billed cuckoo detected
Blue Sky Green Field	WI	2008	No
Cedar Ridge	WI	2009 - 2010	Yes
Crescent Ridge	IL	2005	No
Forward	WI	2008	Yes
Fowler I	IN	2009	No
Grand Ridge I	IL	2009	No
Kewaunee County	WI	1999 - 2001	No
Bishop Hill	IL	2012 - 2015	Yes
California Ridge	IL	2013 - 2015	Yes

[1] References

Project Name	Citation
Blue Sky Green Field	Gruver et al. 2009
Cedar Ridge	BHE Environmental 2010
Crescent Ridge	Kerlinger et a. 2007
Forward	Gradsky and Drake 2011
Fowler I	Johnson et al. 2010
Grand Ridge I	Derby et al. 2010
Kewaunee County	Howe et al. 2002
Bishop Hill	Table 5
California Ridge	Table 5

Table 5. Data from California Ridge and Bishop Hill Wind Energy Projects used in regional percent composition analysis

Project Name	Study Period	Estimated bird fatality/ turbine/year	Black-billed cuckoo carcass/study period	No. turbines searched	Estimated Birds /turbine /study period	Estimated Birds/ turbines searched/ study period	Estimated Black-billed cuckoo/ turbines searched/ study period
Bishop Hill	Fall 2012	0.84	1	12	1.48	29.41	0.90
	Fall 2013	1.65	0	12			
	Fall 2014	1.30	0	12			
	Fall 2015	2.05	1	20			
	Spring 2013	0.05	0	30			
	Spring 2014	0	0	30			
California Ridge	Fall 2013	2.64	1	20	2.64	68.84	1.52
	Fall 2014	2.47	1	27			
	Fall 2015	2.61	1	16			
	Spring 2013	0.08	0	30			
	Spring 2014	0.05	0	30			

Analysis of the data at the nine facilities resulted in an estimated 997.43 bird fatalities/turbines searched/study period and an estimated 4.32 black-billed cuckoo fatalities/turbines searched/study period. The regional percent composition of estimated black-billed cuckoo fatalities to estimated bird fatalities is approximately 0.4 percent (4.32 black-billed cuckoo/997.43 all birds = 0.0043).

Applying the regional percent composition of black-billed cuckoo estimated fatalities to the Project-specific estimated bird fatalities results in an estimated average of 1.53 black-billed cuckoo fatalities/study period at California Ridge Wind Energy Project (Table 6). Study period in this case represents spring and fall migration, when the Project-specific carcass studies have occurred. To account for variability, a range of 0 to 2 black-billed cuckoo take per year is estimated for the Project. Over the 25 year operation of the Project, estimated take would be up to 50 black-billed cuckoos (Table 6) after implementation of avoidance and minimization measures described above. The applicant is therefore applying for an ITA to take up to 50 black-billed cuckoos over the 25-year permit term.

Table 6. Estimated take of black-billed cuckoo at California Ridge Wind Energy Project

Estimated bird fatalities per turbine per year (Project)[1]	Estimated relative abundance of black-billed cuckoo carcasses as % of all birds (regional)	Estimated black-billed cuckoo fatalities/turbine /year	Estimated black-billed cuckoo fatalities/Project (134 turbines)/year	Range of take for 25 years operation
2.64	0.4%	0.011	Average = 1.53 Range of 0 to 2	0 - 50

[1]Based on three years of post-construction data

4.6 Management of the Affected Area

The Project is already built and operational, and as stated above, impacts to black-billed cuckoo habitat were avoided and minimized during siting and construction. As described in Section 4.3, the majority of impacts occurred within tilled fields, and any impacts to non-tilled fields were minimized during construction and restored after. No impacts to wooded habitat will occur during operation of the Project, and continued operation of the Project will not affect the ability of the black-billed cuckoo to use wooded habitat adjacent to the turbines and other components of the Project.

4.7 Measures to Minimize and Mitigate Effects

4.7.1 Minimization and Mitigation – Project Design and Operation

Design and operation of the Project incorporates the following measures to minimize and mitigate impacts to wildlife, including the black-billed cuckoo:

- Hunting, fishing, dogs, or possession of firearms by CRWE employees and designated contractor(s) in the Project area is prohibited during operation and maintenance, to minimize the potential for injury to wildlife including the black-billed cuckoo.

- Turbines employ unguyed, tubular towers and slow-rotating, upwind rotors; this design minimizes risk of bird collision.

- Avian Power Line Interaction Committee (2006) suggested practices were used to ensure that the transmission line was designed and constructed in a manner to minimize bird collision and electrocution risk.

- Collection and communication lines are buried, avoiding the potential for bird collision.

- Lighting is minimized to that which is required by the Federal Aviation Administration. The Federal Aviation Administration typically requires every structure taller than 200 ft above ground level to be lighted, but in the case of wind power developments, it allows a strategic lighting plan that provides complete conspicuity to aviators but does not require lighting every turbine. CRWE developed a lighting plan for the Project that includes the lighting of 71 Project turbines and one met tower with medium intensity dual red synchronously flashing lights for night-time use and daytime use, if needed. The turbines are lighted only as required by Federal Aviation Administration regulations, plus a low voltage, shielded light on a motion sensor at the entrance door to each turbine. To avoid disorienting or attracting birds such as the black-billed cuckoo, lighting on turbines employs strobed, minimum-intensity lights as recommended by the USFWS.

- All applicable hazardous material laws and regulations existing or hereafter enacted or promulgated regarding these chemicals are complied with and a Spill Prevention, Control and Countermeasure Plan is implemented. The only hazardous chemicals anticipated to be on-site are the chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol) and lubricants in machinery. Hazardous chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol) and lubricants are not stored in or near any stream, nor does any vehicle refueling or routine maintenance occur in or near streams. When work is conducted in and adjacent to streams, fuels and coolants are contained in the fuel tanks and radiators of vehicles or other equipment. Minimizing the potential for contamination minimizes the potential for adverse effects to black-billed cuckoo habitat in the Project.

- Fires will be handled in accordance with the Fire Protection and Prevention Plan (Invenergy Services 2013). The plan includes pre-fire planning with the local fire department, fire prevention through good housekeeping and equipment maintenance, reporting fires to the local fire authorities and CRWE management and limited fire suppression using fire extinguishers by trained CRWE personnel. At all times during operation, satisfactory spark arresters will be maintained on internal combustion engines. Preventing fires minimizes the potential for adverse effects to black-billed cuckoo habitat in the Project.

- Turbine blades remain fully feathered (i.e., blades are oriented parallel to the wind) so rotors move very slowly prior to reaching the turbine cut-in speed. At cut-in wind speeds, the blades pitch into the wind, rotor speeds increase and the generators eventually close their electrical breaker and begin generating electricity at some slightly higher wind speed, when steady wind power is provided by the rotor to the generator. Although this measure is generally employed to minimize collision risk for bats, reducing the amount of time when blades are actively spinning may also reduce the risk of bird collision.

Given the low levels and unpredictable pattern of black-billed cuckoo take for the Project, no additional minimization or operational mitigation measures are proposed.

4.7.2 Mitigation – Black-billed Cuckoo Breeding Survey Research

In order to mitigate for the anticipated low level of take, CRWE proposes to conduct breeding surveys for the black-billed cuckoo, in order to gather useful information that will inform DNR management decisions to help conserve, protect and enhance black-billed cuckoo habitat and populations in the state. Appendix F contains further details on the proposed approach to the black-billed cuckoo breeding survey; the study plan is based on *A natural history summary and survey protocol for the western distinct population segment of the yellow-billed cuckoo* (Halterman et al. 2015).

The objectives of the research are to document the presence or absence of breeding black-billed cuckoos and assess black-billed cuckoo habitat conditions in two state-owned nature preserves located within the Vermilion River and Little Vermilion River Conservation Opportunity Area (COA) located in Champaign and Vermilion Counties. The Project is located within the boundary of the COA.

The Vermilion River and Little Vermilion River COA is located in a part of the state with relatively few black-billed cuckoo BBS records, none of which have been recorded in the last five years. However, the BBS route closest to this COA is not located in prime cuckoo breeding habitat, and therefore a survey in suitable habitat within the COA would provide valuable information on whether the cuckoos are breeding in this part of the state. The western unit of the Little Vermilion River Land and Water Reserve, located just south of the city of Georgetown, was selected for black-billed cuckoo surveys and habitat assessment based on the presence of deciduous forest habitat which is located in patch sizes that are sufficient to provide suitable black-billed cuckoo breeding habitat (Appendix F).

It is anticipated that CRWE will fund two years of surveys along approximately 2,800 meters of transects within the Little Vermilion River Land and Water Reserve; as Appendix F details, each transect will be surveyed four times during the breeding season. Additionally, information on habitat with regards to three prime criteria related to black-billed cuckoo habitat suitability (general forest structure, understory canopy height and understory density) will be recorded for all the transects.

The results of the surveys will be provided to the DNR for use in conservation decisions, such as habitat management approaches. The surveys have value to even if black-billed cuckoo are not detected for several reasons. First, the survey is designed specifically to determine presence/absence of black-billed cuckoo, and negative results still provide important information regarding the species' distribution in the eastern part of the state compared other types of broad-scale data (e.g., BBS). Second, the habitat data will determine the amount of suitable black-billed cuckoo habitat in two parcels of state-owned Nature Preserves, which can be used to inform habitat management decisions for these units.

4.8 Monitoring

4.8.1 Intensive Carcass Monitoring

Post-construction avian and bat carcass monitoring has been and will continue to be conducted in accordance with the monitoring plan in Appendix B; Appendix D contains the reports documenting the results of the carcass monitoring that has been done to date. Monitoring will also help determine the effectiveness of avoidance, minimization and mitigation measures in reducing impacts at the facility. The results of post-construction monitoring intended to provide an estimate of overall fatality at a facility can be influenced by several sources of bias during field-sampling. To provide corrected estimates of fatality rates, monitoring methods account for important sources of field-sampling bias including 1) carcasses that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g., vegetation) in relation to carcass removal and searcher efficiency rates, and 5) carcasses or injured birds or bats that may land or move to areas not included in the search plots (Kunz et al. 2007). CRWE's post-construction carcass monitoring methods were designed to account for these sources of bias and adapt to preliminary results such that effectiveness, efficiency and accuracy of the study is maximized.

Post-construction carcass monitoring at the Project will[1] involve standardized carcass searches (first three years of operations; concluded in fall 2015), follow-up standardized carcass searches (once every three years thereafter), searcher efficiency trials and carcass removal trials. Standardized carcass searches will allow statistical analysis of the search results and calculation of fatality estimates. Carcass searches were conducted during spring (April 15 through May 15) and fall (August 1 through September 30) during the first three years of Project operation by a consultant to establish baseline estimates of bird and bat fatality rates. Follow-up carcass searches will be conducted during the late summer and fall season (July 15 -September 30, encompassing the time period where black-billed cuckoo carcasses have been detected at the Project, on July 29, September 15 and September 16) once every three years to confirm that no significant increase in estimated bird or bat fatality rates has occurred relative to the baseline estimates. If after the first two of the follow up surveys no black-billed cuckoo are documented in July, CRWE may adjust the survey window accordingly to August 1 - September 30.

[1] Some of this work has already occurred (see Table 2); however "will" is used for clarity and to reflect that monitoring will continue in the future.

Fatality estimates will be determined using a fatality estimator that corrects for searcher efficiency and carcass removal biases. Fatality estimates will be expressed both in terms of fatalities/turbine/season and fatalities/turbine/year and in terms of fatalities/MW/season and fatalities/MW/year and accompanied by precision and variance estimates to facilitate comparison with other studies.

4.8.2 Incidental Monitoring

CRWE personnel are trained on wildlife and how to respond to the discovery of a carcass or injured animal. An incidental reporting process was developed for operations personnel that requires the documentation and reporting of animal carcasses detected within the Project area. Operations personnel are prohibited from touching the carcass, and are required to immediately photograph and report it within two hours of discovery to the CRWE environmental staff. Once the field report is submitted, the environmental staff are required to assess each carcass report, deferring to a biologist when necessary and report all state-listed endangered or threatened species to the DNR within 24 hours of identification.

4.8.3 Reporting

Reports will be provided to the DNR to summarize the results of annual carcass monitoring, and the follow-up intensive carcass surveys that will occur every three years. All post-construction monitoring results and indicators of the effectiveness of the minimization and mitigation measures outlined in this plan will be summarized in reports. These reports will include fatality estimates and data summaries. Any black-billed cuckoo carcasses that are detected will be promptly reported to the DNR.

4.9 Adaptive Management

4.9.1 Adaptive Management Goals

The goals of the adaptive management plan are to enable the project to respond to monitoring data collected over the term of the permit. Certain trigger events and subsequent changes to the avoidance, minimization and mitigation plan have been defined as a part of the adaptive management plan, to guide the adaptive process.

4.9.2 Adaptive Management Plan

The events that would trigger changes to the avoidance, minimization and mitigation plan presented herein would be documented take of black-billed cuckoo above the anticipated level, which is expected to average up to 2 per year over the 25 year term of the permit.

If any black-billed cuckoo carcasses are detected at the Project during one year, the following actions will be taken:

1) DNR will be notified within one business day of positive identification of the discovery.
2) Carcass information will be examined and included in Project's database

A rolling average will be kept of detected black-billed cuckoo carcasses. If, over a three year period, five or more black-billed cuckoo carcasses are detected (an average of 1.67 detected per year), the following actions will be taken:

1) DNR will be notified within one business day of positive identification of the discovery.
2) Carcass information will be examined and included in Project's database CRWE and the DNR will meet and confer to determine, based on the available data, the circumstances under which the carcasses occurred.
3) If a particular cause for the carcasses can be identified, CRWE will develop specific additional on-site and/or operational mitigation measures in consultation with DNR to address the those causes
    - CRWE will conduct follow-up post-construction monitoring during the subsequent year in the season(s) in which the carcasses were discovered to assess whether on-site mitigation measures were successful at reducing mortality.
4) If there continues to be no spatial, weather or temporal pattern to when and where black-billed cuckoo carcasses are found, no mitigation measures will be taken based on one three-year period of exceeding the anticipated take levels. However, if two consecutive three year periods occur where five or more black-billed cuckoo carcasses are detected, and no spatial or temporal pattern is detected CRWE and DNR will determine the need to pursue an amendment to the Incidental Take Authorization, and the potential for adding offsite mitigation (i.e., additional research and/or other support of offsite conservation efforts).

This adaptive management plan will apply throughout the life of the Project to provide effective avoidance, minimization and mitigation measures for avoiding and reducing impacts to black-billed cuckoo.

4.10 Verification of Adequate Funding

CRWE has already funded and completed three years of intensive monitoring at the Project and will continue to fund fall monitoring at three-year intervals for the life of the Project. Prior to each year of follow-up monitoring, CRWE will provide the DNR with a letter certifying that a monitoring contract has been executed with a firm qualified to conduct monitoring in accordance with the approved monitoring plan. Funding may be in the form of bonds, certificates of insurance, escrow accounts or other financial instruments adequate to carry out all aspects of the conservation plan.

5.0 ALTERNATIVES CONSIDERED

5.1 No Action Alternative

The No Action alternative in this case would consist of the Project not being developed, constructed, or operated. The California Ridge Wind Energy Project has been built and operational since July 2012. This option is considered to be a non-viable alternative.

5.2 Construction and Operation Alternatives

Since the Project is already constructed and operational, no construction alternatives were considered. The Project was sited to avoid and minimize impacts to the black-billed cuckoo by placing all turbines in cultivated fields and avoiding and minimizing impacts to wooded habitat. Placing turbines elsewhere in the counties would not be expected to reduce the risk to the black-billed cuckoo.

Three black-billed cuckoo carcasses were discovered in three years of post-construction monitoring in agricultural fields during periods of clear weather. As described in Sections 4.1 and 4.2, it is not possible to identify specific location or time periods of risk to the black-billed cuckoo, and therefore CRWE concluded that operational modifications are not an appropriate alternative.

6.0 EFFECTS DETERMINATION

The continued operation of the California Ridge Project will not impact the likelihood of the survival of the black-billed cuckoo in Illinois for the following reasons:

- Operation of the Project is expected to result in 0 to 2 black-billed cuckoo carcasses per year (compared to estimated breeding population of 410,000 in the U.S. and breeding population of 5,000 in Illinois)

- Operation of the Project will not impact black-billed cuckoo habitat, and will not affect the black-billed cuckoo's ability to use adjacent wooded habitat during breeding or migration.

- As stated in Section 2.1, black-billed cuckoo life history is characterized by a short life span and high reproductive output, with breeding occurring every year of a female's life. In species with this type of life history, survival of individuals is not the driver of population trends. Instead, impacts to fecundity, such as direct impacts to nests and nest success have more influence on population dynamics (Stahl and Oli 2006). Furthermore, population trends of North American birds with similar life history strategies are not discernibly affected by collision mortality such as that anticipated at the Project (Arnold and Zink 2011).

In conclusion, the low level of anticipated annual take of primarily migrating individuals is not anticipated to affect the black-billed cuckoo population that migrates through or breeds in Illinois.

7.0 IMPLEMENTING AGREEMENT

7.1 Obligations and Responsibilities

CRWE will be responsible for implementing the Conservation Plan. CRWE will promptly report any black-billed cuckoo carcasses to the DNR, including any documented during the scheduled 2016 carcass survey. Reports summarizing the results of the follow-up carcass surveys to be conducted every three years after the 2016 carcass survey will be submitted to the DNR, starting with the fall 2019 report.

7.2 Relinquishment

CRWE reserves the right to relinquish the ITA prior to expiration by providing thirty (30) days advance written notice to the IDNR. CRWE may surrender the ITA by returning it to the IDNR along with a written statement of its intent to surrender and cancel the ITA. The ITA shall be deemed void and canceled upon receipt of the permit by the IDNR.

7.3 Amendment or Modification

The Conservation Plan may be amended or modified with the written consent of both CRWE and IDNR.

7.4 Terms Do Not Run With the Land

The terms the Conservation Plan and ITA are not intended to run with the land, and will not bind the existing owners of covered lands or subsequent purchasers of the project or covered lands unless such parties agree in writing to become bound by the Conservation Plan and ITA.

7.5 Compliance with Other Federal, State and Local Regulations

CRWE certifies that all activities undertaken at the California Ridge Wind Energy Project are in compliance with applicable federal, state and local regulations. No federal take authorization for the black-billed cuckoo is required.

The undersigned certify that they have the legal authority to carry out the obligations and responsibilities set forth in this agreement and Conservation Plan.

Rebecca Cranna
California Ridge Wind Energy LLC

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Appendix A. Project Area Photos

Photo 1. Typical cultivated field at California Ridge Wind Energy Project; no black-billed cuckoo breeding habitat

Photo 2. Typical shelterbelt a California Ridge Wind Energy Project; shelterbelt is not likely black-billed cuckoo breeding habitat

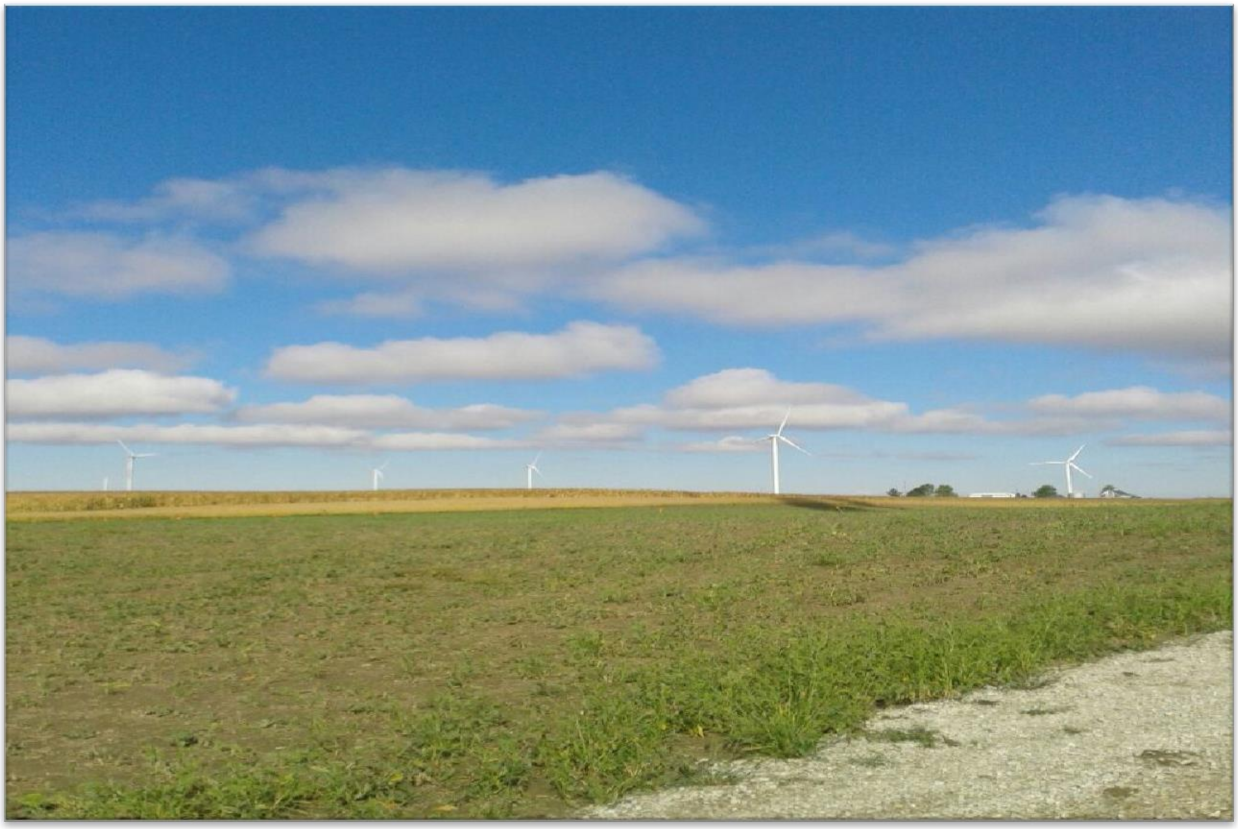

Photo 3. Turbines at California Ridge Wind Energy Project; no black-billed cuckoo breeding habitat.

Appendix B. Carcass Monitoring Plan

1.1 Monitoring Goals

The goals of post-construction monitoring are to determine overall bird and bat fatality rates at the Project and evaluate the circumstances under which fatalities occur. Post-construction monitoring results also provide triggers for adaptive management.

1.2 Species to be Monitored

The post-construction monitoring plan will address all bird and bat fatalities observed within the Project area. The monitoring plan is designed to detect carcasses and calculate all bat (and bird) fatality estimates with enough precision to determine if the operational protocols are effective in reducing all bat fatalities at the Project and with other operating projects. Within the overall bat and bird fatality estimates, estimates by species will be made, if possible, based on the number of carcasses detected.

1.3 Permits and Wildlife Handling Procedures

1.3.1 Permits

State and federal collecting/salvaging permits will be acquired from the Illinois Department of Natural Resources and the USFWS by CRWE's consultants and CRWE prior to commencement of the study to enable searchers to collect and handle carcasses in compliance with laws pertaining to the collection and possession of wildlife and migratory birds.

1.3.2 Wildlife Handling Procedures

All carcasses found will be labeled with a unique number, individually bagged and retained in a freezer at the Project Operations and Maintenance building. A copy of the original data sheet for each carcass will be placed in the bag with each frozen carcass. The carcasses may be used in searcher efficiency and carcass removal trials. In the event that a carcass of an ESA- or state-listed species is found, CRWE will arrange to submit the carcass to the appropriate authorities. If an injured bird or bat is found, the animal will be sent to a local wildlife rehabilitator, when possible.

1.4 Monitoring

1.4.1 Study Design

The results of post-construction monitoring efforts intended to provide an estimate of overall fatality at a facility can be influenced by several sources of bias during field-sampling. To provide corrected estimates of overall fatality rates, the methodology of carcass monitoring efforts must account for important sources of field-sampling bias including 1) fatalities that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g., vegetation) in relation to carcass removal and searcher efficiency rates, and 5) fatalities or injured birds or bats that may land or move to areas not included in the search plots (Kunz et al. 2007). CRWE's proposed post-construction carcass monitoring plan methodology is designed to account for these sources of bias and adapt to preliminary results such that effectiveness, efficiency and accuracy of the study is maximized.

Post-construction carcass monitoring at the Project will involve standardized carcass searches (during spring and fall in the first three years of operations), follow-up standardized carcass searches (during fall every three years thereafter), searcher efficiency trials and carcass removal trials. Standardized carcass searches will allow statistical analysis of the search results, calculation of overall fatality estimates and assessment of correlations between fatality rates and potentially-influential variables (e.g., weather, location). Carcass searches will be conducted during the first three years of Project operation during spring (April 15 through May 15) and fall (August 1 through September 30) by a consultant and by specifically-trained CRWE personnel to establish baseline fatality estimates of bird and bat fatality. Follow-up carcass searches will be conducted by trained CRWE personnel or contractors during the late summer and fall season (July 15 - September 30, encompassing the time period where black-billed cuckoo carcasses have been detected at the Project) once every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline mortality estimates. If after the first two follow up surveys no black-billed cuckoo carcasses are documented in July, CRWE may adjust the survey window accordingly, to August 1 – September 30. Searcher efficiency and carcass removal rates are two sources of field bias in mortality studies that have been proven to be highly variable and site- and researcher-specific; mortality estimators are highly sensitive to these parameters (Huso 2010). Kunz et al. (2007) and the USFWS (2010) Wind Turbine Guidelines Advisory Committee both strongly recommend that all mortality studies should conduct searcher efficiency and carcass removal trials that follow accepted methods and address the effects of differing vegetation types.

1.4.1.1 Focus Species

The post-construction monitoring study design is intended to enable detection of all bird and bat carcasses that may occur within searched areas of the Project area, as well as support the development of fatality estimates for all bird and bat species found during the mortality searches.

1.4.1.2 Sample Size

During the first three years of monitoring, standardized carcass searches will be conducted at 30 turbines. This sample size optimizes field survey effort while maximizing expected confidence in the data and associated results. Table A.1 was developed using a mean bat fatality rate and mean standard deviation calculated from results of studies at other wind energy facilities in the region. Bat fatality rates were used because they have been much more variable than bird fatality rates at wind facilities (Poulton 2010); a sample size adequate for confidence in bat data will therefore also be adequate for confidence in bird data. This table presents the 95 percent confidence intervals associated with a variety of sample sizes and demonstrates the diminishing returns in confidence as sample size is increased. A sample size of 60 turbines would require twice the survey effort but would not confer twice as much confidence in results as sampling of the 30 turbines would. When extrapolated over the entire facility (134 turbines), the upper confidence limit fatality estimate for a sample size of 30 turbines is not appreciably different than those for larger sample sizes. Sample sizes smaller than 30 turbines have increasingly larger confidence intervals and may also result in datasets which have higher standard deviations (further decreasing confidence).

During follow-up studies (discussed below under timing and duration) conducted every three years by trained CRWE personnel or contractors, a sample size of 15 turbines will be studied. This sample size is adequate for follow-up studies, as the purpose of these studies is to provide fatality estimates that can be compared against the baseline estimate established during the first three years of monitoring to confirm that no significant increase in overall bird or bat mortality has occurred.

Table A.1 Confidence Intervals of Turbine Sample Sizes for Post-Construction Monitoring.[1]

No. of Turbines Searched	**Mean Fatality (bats/turbine/year)**	**95.0% Confidence Limits**		**95.0% Confidence Interval**
		Low	**High**	
10	27.9	20.0	35.8	7.9
20	27.9	22.8	33.0	5.1
30	27.9	23.8	32.0	4.1
40	27.9	24.4	31.4	3.5
50	27.9	24.8	31.0	3.1
60	27.9	25.1	30.7	2.8
80	27.9	25.4	30.4	2.5
100	27.9	25.7	30.1	2.2

[1] For this analysis, mean fatality estimate and mean standard deviation of datasets were obtained from a subset of the post-construction monitoring studies presented in Table 4.2 of the ABPP that reported the necessary data.

A significant increase is defined as a measurable, statistically significant ($p \leq 0.10$) increase in estimated fatality relative to the baseline fatality estimate. A sample size of 15 turbines will meet the goal of detecting significant increases, as differences small enough that their detection requires a sample size of 30 turbines instead of 15 are unlikely to be biologically-justifiable as significant.

The 30 turbines sampled for the first three years of monitoring were determined using a stratified random sampling approach. The 15 turbines to be sampled for follow-up studies will be selected from the initial 30 sample turbines using a stratified random sampling approach. Selecting the follow-up sample turbines from the intensive sample turbines will reduce the introduced variables (i.e., location) and provide a more accurate comparison of fatality rates between study years.

1.4.1.3 Search Intervals

Search intervals will be once weekly for each of the 30 sample turbines during the spring and fall periods during the first three years of monitoring and once weekly for each of the 15 sample turbines during the follow-up studies. The turbine search schedule and order will be randomized so that each turbine's search plot will be sampled at differing periods during the day. If more or less intensive monitoring is deemed necessary following initial data collection (carcass searches and carcass removal trials) at the site, the search intervals will be modified accordingly. The Wind Turbine Guidelines Advisory Committee guidelines recommend that "carcass search intervals should be adequate to answer applicable questions at an appropriate level of precision to make general conclusions about the project" (USFWS 2010). A weekly search interval for fatality monitoring was deemed adequate by Kunz et al. (2007) and studies have demonstrated that a weekly search interval provides effective carcass monitoring and adequately estimates impacts from wind energy facilities (Gruver et al. 2009; Young et al. 2009), such that the added effort associated with more frequent intervals is not warranted.

1.4.2 Field Methods

1.4.2.1 Plot Size, Vegetation Mowing, Visibility Classes

Search plots measuring 256 x 256 ft will be established at the base of each sampled turbine. The methods used to establish this search plot size are recommended for detecting carcasses of both birds and bats by the Wind Turbine Guidelines Advisory Committee (USFWS 2010) and are supported by several other studies that have indicated that the majority of bird and bat carcasses typically fall within 100 ft of the turbine or within 50 percent of the maximum height of the turbine (Kerns and Kerlinger 2004; Arnett et al. 2005; Young et al. 2009; Jain et al. 2007, 2008, 2009; Piorkowski and O'Connell 2010; USFWS 2010). This plot size will exceed one-half the maximum turbine rotor height of the Project turbines (246 ft [75 m]). This should minimize the number of fatalities or injured birds or bats that land or move outside of the search plots and thereby reduce the number of bird or bat carcasses that would be undetected, causing underestimation of overall fatality.

Each search plot will be centered on a turbine location. Thirteen transects will be established in each plot for complete survey coverage. Vegetation will be mowed in each plot prior to the beginning of each study period to improve searcher efficiency. Although the majority of vegetation within each search plot is expected to consist of row crops or fallow fields, visibility classes will be established if vegetation type and density vary sufficiently. If necessary, visibility classes will be mapped within each plot, and searches will be designed to preferentially include areas of higher visibility to maximize searcher efficiency. Searcher efficiency and carcass removal rates will be determined for each visibility class.

1.4.2.2 Timing and Duration

Standardized carcass searches will be conducted at the Project site for a total of four weeks in the spring (April 15 through May 15) and eight weeks during fall (August 1 through September 30). Carcass searches will be conducted by both a consultant and specifically trained CRWE personnel during the first three years of Project operation. Trained CRWE personnel or contractors will conduct follow-up carcass searches for ten weeks during fall (July 15 through

September 30, encompassing the time period where black-billed cuckoo carcasses have been detected at the Project) every three years to determine bird and bat fatality rates.

1.4.2.3 Standardized Carcass Searches

All carcass searches will be conducted by a consulting biologist or appropriately-trained CRWE personnel experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found at the Project area. Any unknown birds and bats discovered during fatality searches will be sent to a qualified USFWS-approved bird or bat expert for positive identification. During searches, searchers will walk at a rate of approximately 2 mph while searching 10 ft on either side of each transect.

For all carcasses found, data recorded will include:

- Date and time,
- Initial species identification,
- Sex, age and reproductive condition (when possible),
- GPS location,
- Distance and bearing to turbine,
- Substrate/ground cover conditions,
- Condition (intact, scavenged),
- Any notes on presumed cause of death, and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. As previously mentioned, all carcasses will be labeled with a unique number, bagged and stored frozen (with a copy of the original data sheet) at the Project Operations and Maintenance building.

Bird and bat carcasses found in non-search areas (e.g., near a Project turbine not included in the study) will be coded as “incidental finds” and documented as much as possible in a similar fashion to those found during standard searches. Maintenance personnel will be informed of the timing of standardized searches and, in the event that maintenance personnel find a carcass or injured animal, these personnel will be trained on the collision event reporting protocol. Any carcasses found by maintenance personnel will also be considered incidental finds. Incidental finds will be included in survey summary totals but will not be included in the mortality estimates.

1.4.2.4 Searcher Efficiency and Carcass Removal Trials

Searcher efficiency trials will be used to estimate the percentage of all bird and bat fatalities that are detected during the carcass searches. Similarly, carcass removal trials will be used to estimate the percentage of bird and bat fatalities that are removed by scavengers prior to being located by searchers. When considered together, the results of these trials will represent the likelihood that a bird or bat fatality that falls within the searched area will be recorded and considered in the final fatality estimates.

Trials will be conducted during each study period by placing "trial" carcasses in the search subplots (one trial during the spring monitoring season and two trials during the fall monitoring season) to account for changes in personnel, searcher experience, weather and scavenger densities. A total of 50 searcher efficiency trial carcasses, 25 birds of variable sizes and 25 bats, will be placed in subplots according to randomly selected distances and azimuths from each turbine prior to the carcass search on the same day. Per Wind Turbine Guidelines Advisory Committee (2010) guidelines, this is the maximum number of carcasses that can be distributed across a sample size of 30 turbines without exceeding the limit of two trial carcasses per turbine and with some allowance for variation in number of trial carcasses placed at each turbine. Searcher efficiency and carcass removal trials will be limited to one spring and two fall trials to avoid attracting scavengers to the site with carcasses and potentially artificially inflating the carcass removal rate.

Each trial carcass will be discretely marked and labeled with a unique number so that it can be identified as a trial carcass. Prior to placement, the date of placement, species, turbine number, distance and direction from turbine and visibility class (if applicable) will be recorded. Species such as house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*) may be used to represent small-sized birds; rock doves (*Columba livia*) and commercially raised hen mallards (*Anas platyrhynchos*) or hen pheasants (*Phasianus colchicus*) may be used to represent medium-sized to large birds. Non-listed bat species carcasses recovered during the study will be re-used in the searcher efficiency trials, if allowed by permit. Brown mice (*Mus* or *Peromyscus* spp.) may be used to represent bats if bat carcasses are not available. If vegetation classes are established, trial carcasses will be placed in a variety of vegetation classes so that searcher efficiency rates can be determined for each class. No more than two trial carcasses will be placed simultaneously at a single turbine.

Searcher efficiency trials will be conducted blindly; the searchers will not know when trials are occurring, at which search turbines trial carcasses are placed, or where trial carcasses are location within the subplots. The number and location of trial carcasses found by searchers will be recorded and compared to the total number placed in the subplots. Searchers will be instructed prior to the initial search effort to leave carcasses, once discovered to be trial carcasses, in place. The number of trial carcasses available for detection (non-scavenged) will be determined immediately after the conclusion of the trial.

Searcher efficiency of the consultant searchers and CRWE searchers will be combined to generate the estimate of searcher bias for calculation of baseline fatality estimates. Searcher efficiency rates will be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. Spot-check trials will use 20 carcasses (10 bird and 10 bat) as there will be fewer (15) sample turbines at which to place the carcasses. All other methods will remain the same. The follow-up searcher efficiency rates will be compared to the baseline searcher efficiency rates using a t-test (significant $p \leq 0.10$) to determine if searcher efficiency has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

Carcass removal trials will be conducted immediately following the baseline searcher efficiency trials using the same trial carcasses. Trial carcasses will be left in place by searchers, and monitored for a period of up to 30 days. Carcasses will be checked on days 1, 2, 3, 4, 5, 6, 7, 10, 14, 20 and 30. The status of each trial carcass will be recorded throughout the trial. Carcass removal rates will also be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. The follow-up carcass removal rates will be compared to the baseline carcass removal rates using a t-test (significant $p \leq 0.10$) to determine if carcass removal has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

1.4.2.5 CRWE Personnel Training

CRWE searchers will be full-time CRWE employees who will be trained by qualified biologists in conducting: (1) standardized carcass searches and search protocols; (2) bird and bat identification and procedures to confirm identifications of rare species; and (3) wildlife handling procedures for all dead or injured wildlife discovered at the Project.

Standardized Carcass Searches. CRWE searchers will be trained by a qualified biologist of CRWE's choice, most likely the consulting biologist conducting the baseline carcass monitoring. Training will include:

- Location, size and configuration of each search plot and how to record carcass location;
- Knowledge of the visibility classes within each plot;
- Start and stop points and width of search transects;
- Search/walking speed;
- Practice searches with planted carcasses;
- Familiarity with data sheets;
- Recording data and observations that assist with data interpretation;
- Photographing carcasses; and
- Procedures for handling, storing and transmitting bat carcasses for positive identification.

Statistical tests (t-test, significant $p \leq 0.10$) will be conducted (1) to compare baseline fatality estimates determined using data collected by trained CRWE personnel to estimates determined using data collected by the consultant and (2) to compare searcher efficiency rates of the trained CRWE personnel to searcher efficiency rates of the consultant. These tests will confirm that CRWE personnel are adequately trained and qualified to accurately conduct follow-up carcass searches.

Bird and Bat Identification. CRWE personnel will be permitted to handle bird and bat carcasses as described in Section 1.3.1 in this monitoring plan. Any unknown carcass or those requiring additional study for identification (e.g., feather spot, bat wing, *Myotis* bats) will be labeled with a unique identification number, bagged and retained for future reference. All unknown birds and bats will be collected and provided to a qualified, USFWS-approved bird or bat expert for inspection and identification verification.

Wildlife Handling Procedures. Prior to April 15 of each year, CRWE will conduct training sessions for Project personnel to ensure that wildlife handling procedures described in Section 1.3.2 in this monitoring plan are properly implemented.

1.4.3 Statistical Methods for Estimating Fatality Rates

The methodology estimating overall bird and bat fatality rates will largely follow the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). Huso (2010) has recently proposed an estimator that may offer less bias than the Erickson estimator. The positive bias and different sensitivity to searcher efficiency and carcass removal rates associated with the Huso estimator may make comparisons to estimates derived using the Erickson (2003) or Shoenfeld (2004) estimators, which tend towards negative biases, problematic. The bird and bat fatality rates presented in the ABPP were mostly calculated from studies that used either the Erickson or Shoenfeld estimators or modifications thereof (the calculations and assumptions of these estimators are very similar). Therefore, maintaining the same biases and assumptions in estimating overall bird and bat fatality at the Project site will be useful for developing fatality estimates that can be compared to other sites and used to determine if any of the adaptive management triggers have been met.

Following Erickson et al. (2003), the estimate of the total number of wind turbine-related casualties will be based on four components: (1) observed number of casualties, (2) searcher efficiency, (3) scavenger removal rates, and (4) estimated percent of casualties that likely fall in non-searched areas, based on percent of area searched around each turbine. Variance and 90.0 percent confidence intervals will be calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009). Calculations and analyses will be conducted separately for medium/large birds, small birds and bats to provide results specific to each group.

1.4.3.1 Mean Observed Number of Casualties (c)

The estimated mean observed number of casualties (c) per turbine per study period will be calculated as:

$$c = \frac{\sum_{j=1}^{n} c_j}{n}$$

where n is the number of turbines searched, and c_j is the number of casualties found at a turbine. Incidental mortalities (those found outside of the search plots or by maintenance personnel) will not be included in this calculation, nor in the estimated fatality rate.

1.4.3.2 Estimation of Searcher Efficiency Rate (p)

Searcher efficiency (p) will represent the average probability that a carcass was detected by searchers. The searcher efficiency rates will be calculated by dividing the number of trial carcasses observers found by the total number that remained available during the trial (non-scavenged). Searcher efficiency will be calculated for each season, for varying distances from the turbine and for each vegetation class, if applicable.

1.4.3.3 Estimation of Carcass Removal Rate (t)

Carcass removal rates will be estimated to adjust the observed number of casualties to account for scavenger activity at a site. Mean carcass removal time (t) will represent the average length of time a planted carcass remained at the site before it was removed by scavengers. Mean carcass removal time will be calculated as:

$$t = \frac{\sum_{i=1}^{S} t_i}{s - s_c}$$

where *s* is the number of carcasses placed in the carcass removal trials and s_c is the number of carcasses censored. This estimator is the maximum likelihood (conservative) estimator assuming the removal times follow an exponential distribution, and there is right-censoring of the data. For the Project study, any trial carcasses still remaining at 30 days will be collected, yielding censored observations at 30 days. If all trial carcasses are removed before the end of the search period, then s_c will be zero and the carcass removal rate will be calculated as the arithmetic average of the removal times. Carcass removal rate will be calculated for each season.

1.4.3.4 Search Area Adjustment (A)

Although a complete-coverage methodology will be used, certain areas may be excluded from searching due to safety or access limitations. The adjustment for any areas that were not searched (A) will be approximated as:

$$A = \frac{\sum_{k=1}^{12} \frac{c_k}{p_k\, s_k}}{\sum_{k=1}^{12} \frac{c_k}{p_k}}$$

where c_k is the observed number of casualties found in the k^{th} 10-m distance band from the turbine, p_k is the estimated searcher efficiency rate in the k^{th} 10-m distance band from the turbine, and s_k is the proportion of the k^{th} 10-m distance bands that were sampled across all turbines.

1.4.3.5 Estimation of the Probability of Carcass Availability and Detection (π)

Searcher efficiency and carcass removal rates will be combined to represent the overall probability (π) that a casualty incurred at a turbine would be reflected in the post-construction mortality study results. This probability will be calculated as:

$$\pi = \frac{t \cdot p}{I} \cdot \left[\frac{\exp\left(1/t\right) - 1}{exp\,\left(1/t\right) - 1 + p} \right]$$

where *I* is the interval between searches. For this study, I=7 for baseline carcass searches during the spring and fall periods and for the fall period during follow-up carcass searches.

1.4.3.6 Estimation of Facility-Related Mortality (m)

Mortality estimates will be calculated using the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimated mean number of casualties/turbine/study period (m) will be calculated by dividing the estimated mean observed number of casualties/turbine/study period (c) by π, an estimate of the probability a carcass was not removed and was detected, and then multiplying by *A*, the adjustment for the area within the search plots which was not searched:

$$m = A \cdot \frac{c}{\pi}$$

1.5 Data Analysis

Analysis of data collected during the post-construction mortality study will include fatality estimates for all birds and bats to the taxonomic level where fatality estimates can be calculated (i.e., it is difficult to calculate representative fatality rates from small numbers of carcasses, so species- and genus-level fatality calculations may not be possible for some species/genera). Data analysis will be performed to assess fatality estimates by turbine location. Data will also be analyzed to determine the influence of factors such as date and location on bird and bat fatality rates.

A variety of statistical tests may be applied to the data to analyze the patterns of fatality rates in relationship to species/genera/taxa, season and location. Statistical tests applied to the data may include: ANOVA, tabular summary, graphical representation (least squares, regression, interaction plot, etc.), t-test, univariate association analyses (Pearson's and Spearman's rank correlations, linear regression), multivariate regression, chi-square goodness-of-fit and test of independence and F test. Tests will be selected based on the parameter(s) under analysis, the ability of the data to meet test assumptions and the suitability of tests for different forms of data. Comparisons between baseline overall bird and bat fatality estimates and those of follow-up studies will be evaluated using t-tests. In general, p values equal to or less than 0.10 will be considered significant.

While statistical tests will not be used to correlate fatalities with weather variables, CRWE will qualitatively evaluate fatality events with regards to notable weather events.

Appendix C. Pre-Construction Survey Reports

Wildlife Baseline Studies for the California Ridge Wind Farm Champaign and Vermilion Counties, Illinois

Final Report
March 12, 2009 – February 15, 2010

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October 27, 2010

WEST Inc. Environmental & Statistical Consultants

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

EXECUTIVE SUMMARY

Invenergy LLC has proposed a wind-energy facility, referred to as the California Ridge Wind Farm (CRWF), in Champaign and Vermilion Counties, Illinois. Invenergy LLC contracted Western EcoSystems Technology, Inc. (WEST) to conduct wildlife and landcover surveys in the proposed California Ridge Wind Farm (CRWF) to estimate the impacts of project construction and operations on wildlife. The following document contains results for fixed-point bird use surveys, incidental wildlife observations, and land cover surveys conducted within the California Ridge Wind Farm from March 12, 2009, to February 15, 2010. Acoustic bat surveys were also conducted at the CRWF, and the results were presented in a separate final report.

The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be valuable in estimating potential impacts from the proposed CRWF; 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds; and 3) recommend further studies or potential mitigation measures, if warranted.

Fixed-point bird use surveys were conducted weekly during spring and fall and monthly during winter from March 2009 through February 2010 to estimate the seasonal, spatial, and temporal use of the CRWF by birds, particularly raptors. No surveys were conducted during summer. Fixed-point surveys were carried out during 24 visits to 15 points established throughout the CRWF. Forty-eight unique bird species were identified during 360 20-minute fixed-point surveys.

Waterbirds were only observed in the spring and great blue heron was the only waterbird species observed. Use by this species was 0.04 birds/plot 20-minute survey. Waterfowl use was highest during the winter (0.15 birds/plot/20-minute survey), primarily comprised of Canada geese; use by waterfowl during the spring and fall was lower (0.05 birds/plot/20-minute survey or less). Shorebirds had higher use in spring (2.37 birds/plot/20-minute survey) than in fall (1.62), and were not observed during winter surveys. Raptor use was relatively even between seasons, ranging from 0.20 birds/plot/20-minute survey in the fall to 0.15 in the winter. Red-tailed hawk and American kestrel were the most commonly observed raptor species in the CRWF. Vulture use was consistent in the fall and spring (0.16 and 0.13 birds/plot/20-minute survey, respectively) and vultures were not observed in the winter. Upland gamebirds had relatively low use in the spring (0.09 birds/plot/20-minute survey) and were not observed in the fall or winter. Use by large corvids was relatively low in all three seasons, ranging from 0.07 to 0.03 birds/plot/20-minute survey. Passerine use ranged from 4.58 birds/plot/20-minute survey in the winter to 10.52 in the fall. The focus for small birds was within a 100-meter view shed, small bird use is not directly comparable to use by large birds, which were analyzed from an 800-meter viewshed.

For all large birds combined, use was highest at point 11, with 14.1 birds/20-minute survey, and ranged from 0.58 to 3.96 birds/20-minute survey at all other points. Mean use at point 11 was comprised primarily of shorebirds (11.4 birds/20-minute survey), particularly killdeer and American golden plover. Shorebird use at other points ranged from 0.17 to 3.50 birds/20-minute survey. Waterbird use was recorded at four points with use ranging from 0.04 to 0.12 birds/20-minute survey while waterfowl were observed at six points with use ranging from 0.04 to 0.29 birds/20-minute survey. Raptor use was highest at point five (0.54 birds/20-minute survey), and was comprised primarily of use by buteos (0.38 birds/20-minute survey). Use by raptors at the other points ranged from zero at point 15 to 0.33 at points three and 14. Vulture use was evenly

distributed among points, with use ranging from 0.04 to 0.21 birds/20-minute survey, while upland gamebird use ranged from zero to 0.17 birds/20-minute survey. Passerine use, limited to within 100 meters of the point, was highest at points five and 11, with 17.6 and 21.1 birds/20-minute survey, respectively. Use by passerines ranged from 3.08 to 13.6 birds/20-minute survey at the remaining points.No obvious flyways or concentration areas were observed. No strong association with topographic features within the study area was noted for raptors or other large birds.

A total of 265 single or groups of large birds totaling 802 individuals were observed flying within the 800-meter plot during fixed-point bird use surveys. 10.8% of flying large birds were observed within the typical rotor-swept height for potential collision with turbines that could be used at the CRWF. Most large birds (88.2%) were observed flying below the likely rotor-swept height and about 1% of large birds were observed flying above the rotor-swept height. Vultures and waterbirds were observed within the rotor-swept height more often than other large bird species (52.4% and 42.9%, respectively). Just over 17% of flying raptors were observed within the rotor-swept height, but red-tailed hawk was the only raptor species observed within the rotor-swept height. A total of 2,712 passerines and other small birds in 684 groups were recorded flying within 100 meters of the plot in the proposed CRWF. Small birds were not observed flying within the rotor-swept height during fixed-point surveys.

The objectives of the land cover surveys were to identify the vegetation types that may be directly impacted by development of the CRWF and characterize habitat suitability of the study area for federal- or state-listed sensitive species. A landcover map was developed by delineating general vegetation types (e.g., cultivated and non-cultivated areas) on aerial maps, and verified in the field. Land cover surveys were carried out within the CRWF during March 2009. The land cover surveys showed the CRWF was dominated by cultivated agriculture, including 90.2% cultivated agriculture (corn and soybeans), 2.7% unmowed grassland, 2.1% mowed grassland, 1.5% developed, and 3.5% woodlot, shelterbelts (tree and shrubs), pasture , hayfields, savannah, railroad verge, and open water.

The objective of incidental wildlife observations was to record wildlife observed outside of the standardized surveys. One red-tailed hawk carcass was observed hanging from a power line and five live bird species were recorded as incidental observations at the CRWF. All bird species recorded incidentally were also observed during fixed-point bird use surveys. The most abundant bird species recorded as an incidental observation were red-tailed hawk (18 live birds in 17 groups) and American kestrel (17 individuals). Three mammal species were also recorded incidentally, with white-tailed deer being the most commonly observed species (19 individuals).

The USFWS interim guidelines for wind-energy development suggest that wind-energy projects should be sited within previously altered habitats. The proposed project is dominated by tilled and un-tilled agriculture, and developed areas, which comprise 92.1 % of the area. Invenergy has committed to placing turbines within tilled and untilled agricultural areas, and avoiding placing turbines within pasture and grassland habitats. The area with the highest diversity of landcover in the region is located along the Middle Fork of the Vermillion River, which is located outside of the CRWF. The results of bird studies at CRWF area show raptor use rates were lower than observed at other wind-energy facilities, likely due to the dominance of tilled agriculture. Fatality rates of birds are expected to be similar to those observed at other wind-energy facilities in the Midwest, based on data collected during this study, dominance of relatively flat tilled agriculture in the CRWF, placement of wind turbines within agricultural areas, and placement of turbines away from the Middle Fork of the Vermillion River.

Three bird species listed as endangered under the Illinois endangered species act were observed within the project area. These species include northern harrier, upland sandpiper and osprey. The American golden plover, listed as a federal priority shorebird species (USFWS 2004), was also observed within the project area. Northern harriers, upland sandpipers, and osprey occurred at relatively low densities during the migration periods and the winter, and risks of collisions are considered low during these seasons based on their low abundance. However, American golden plover in comparison were observed in higher numbers during migration, although existing studies have suggested the species is not especially vulnerable to turbine collisions. Some potential exists for nesting populations of northern harrier and upland sandpiper and other state-listed species to occur within the CRWF, although large numbers are not expected based on the preponderance of tilled agriculture. Landcover data collected during this study can be utilized to identify locations where turbines or infrastructure may be located within or near potential habitat for state-listed species, and to determine if further surveys or mitigation measures are warranted.

STUDY PARTICIPANTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Invenergy LLC (Invenergy) has proposed a wind-energy facility in Champaign and Vermilion Counties, Illinois (Figures 1 and 2). Invenergy contracted Western EcoSystems Technology, Inc. (WEST) to conduct wildlife and landcover surveys in the California Ridge Wind Farm (CRWF) to estimate the impacts of wind-energy facility construction and operations on wildlife.

The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be valuable in estimating potential impacts from the proposed CRWF; 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds; and 3) recommend further studies or potential mitigation measures, if warranted. The protocols for baseline studies are similar to those used at other wind-energy facilities across the nation and follow the guidance of the National Wind Coordinating Collaborative (NWCC; Anderson et al. 1999). These protocols have been developed based on WEST's experience studying wildlife at proposed wind-energy facilities throughout the United States and were designed to help predict potential impacts to bird species, particularly raptors.

Baseline surveys, conducted from March 12, 2009, through February 15, 2010, at the CRWF consisted of fixed-point bird use surveys, incidental wildlife observations, and land cover surveys. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities. The ability to estimate potential bird mortality at the proposed CRWF is greatly enhanced by operational monitoring data collected at existing facilities. Standardized data on fixed-point surveys were collected at several wind-energy facilities in association with standardized post-construction (operational) monitoring, allowing comparisons of bird use with bird mortality. Where possible, comparisons with regional and local studies were made.

STUDY AREA

The CRWF is located in Champaign and Vermilion Counties in eastern Illinois, between the towns of Royal and Collision (Figure 1). The proposed wind-energy facility falls within the Central Corn Belt Plains Ecoregion, which encompasses a large portion of central Illinois (Woods et al. 2007). The Central Corn Belt Plains Ecoregion is composed of vast glaciated plains. Much of the region was originally dominated by tall-grass prairie and had scattered groves of trees and marshes occurring on level uplands. Today, most of the area has been cleared to make way for highly productive farms producing corn (*Zea mays*), soybeans (*Glycine max*), and livestock. The CRWF is located within the Vermilion River watershed, and the Middle Fork of the Vermilion River is located just east of the boundary of the wind resource area. The proposed CRWF lies directly west of Middle Fork State Fish and Wildlife Area and northwest of Kickapoo State Park. The CRWF has a flat to rolling topography, and is dominated by cultivated agriculture. Elevations within the study area range between approximately 200 and 250 feet (ft; 61 to 76 meters [m]) above sea level (Figure 1).

The vast majority (90.6%) of the roughly 33,500-acre (52.34-square mile [mi^2]) area is composed of cropland (Table 1). Corn and soybean are to be the most common crops, although a few hay fields are also present.

The proposed project will involve the construction and operation of 200 MW, or approximately 133 modern wind turbines. A rotor-swept height (RSH) for potential collision with a turbine blade of 35 to 130 m (115 to 427 ft) above ground level (AGL) was used for the purpose of the analyses.

METHODS

Surveys at the CRWF consisted of the following components: 1) fixed-point bird use surveys, 2) incidental wildlife observations, and 3) land cover surveys.

Fixed-Point Bird Use Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal and spatial use of the CRWF by birds, particularly raptors (defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls). Fixed-point surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980).

Survey Plots

Fifteen points (approximately one point count every 3 – 4 square miles) of the CRWF (Figure 4). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point.

Survey Methods

All species of birds observed during the 20-minute (min) fixed-point bird use surveys were recorded. A unique number was assigned to each observation.

The date, start, and end time of the survey period, and weather information such as temperature, wind speed, wind direction, cloud cover, and precipitation were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. The behavior of each bird observed and the vegetation type in which or over which the bird occurred were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval. Other information recorded about the observation included whether or not the observation was auditory only and the 10-min interval of the 20-min survey in which it was first observed.

Locations of raptors, other large birds, and species of concern seen during fixed-point bird use surveys were recorded on field maps by unique observation number. Flight paths and perched locations were digitized using ArcGIS 9.3 software. Comments were recorded in the comments section of the data sheet. Unusual animal observations were recorded on the incidental datasheets.

Observation Schedule

Fixed-point bird use surveys were conducted from March 12, 2009, through February 15, 2010. Surveys were conducted approximately once per week during the spring (March 1 to May 31) and fall (September 1 to October 31), and once per month during winter (November 1 to February 28). Surveys were carried out during daylight hours and survey periods varied to approximately cover all daylight hours during a season.

Incidental Wildlife Observations

The objective of incidental wildlife observations was to record wildlife seen outside of the standardized surveys. All raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex and age class, distance from observer, activity, height above ground (for bird species), habitat, and, in the case of sensitive species, the location was recorded by collecting Universal Transverse Mercator (UTM) coordinates using a hand-held Global Positioning System (GPS) unit.

Land Cover Surveys

The objective of the land cover surveys was to identify potential habitat for state or federally listed species, and to identify potentially important wildlife habitat. A landcover map was developed by delineating general vegetation types (e.g., cultivated and non-cultivated areas) on aerial maps (USDA National Agriculture Imagery Program [NAIP] maps). Landcover types and boundaries were verified in the field during March of 2009 (Table 2). The mapped boundaries of each vegetation type were then digitized using ArcView™ software.

Statistical Analysis

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® ACCESS database was developed to store, to organize, and to retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

<u>Species Richness</u>
Species lists (with the number of observations and the number of groups) were generated by season, and included all observations of birds detected regardless of their distance from the observer. Species richness was (i.e., number of species/plot/20-min survey) compared among seasons for fixed-point bird use surveys.

<u>Bird Use, Composition, and Frequency of Occurrence</u>
For the standardized fixed-point bird use estimates, only observations of large birds detected within the 2,625 ft (800 m) radius plot were used in the analysis. For small birds only observations within a 328 ft (100 m) radius were used. Estimates of mean bird use (i.e., number of birds/plot/20-min survey) were used to compare differences between bird types, seasons, survey points, and other wind-energy facilities. Mean use was calculated by determining the number of birds seen within each 800-m plot (or 100-m plot for small birds) for each given visit and then averaged by the number of plots surveyed during that visit. A second averaging occurred across the number of visits during the season and/or entire study period. A visit was defined as the required length of time to survey all of the plots once within the study area.

Percent composition was calculated as the proportion of the overall mean use for a particular bird type or species, and the frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Frequency of occurrence and percent composition provide relative measures of species use of the proposed CRWF. For example, a particular species might have relatively high use estimates for the study area based on just a few observations of large groups. However, the frequency of occurrence would indicate that the species only occurred during a few of the surveys and therefore may be less likely to be affected by the wind-energy facility or the transmission corridor.

Bird Flight Height and Behavior

The initial recorded flight height was used to calculate potential risk to bird species and to estimate the percentages of birds flying within the likely rotor-swept height (RSH) for potential collision with turbine blades 35 to 130 m (115 to 427 ft) above ground level (AGL), which is the blade height of typical turbines that could be used at the CRWF.

Bird Exposure Index

A relative index of collision exposure (R) was calculated for bird species observed during the fixed-point bird use surveys using the following formula:

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (large bird observations within 800 m of the observer or 100 m for small bird observations) averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals the proportion of all initial flight height observations of species *i* within the likely RSH.

Spatial Use

Data were analyzed by comparing use among plots. Mapped flight path were qualitatively compared to study area characteristics such as topographic features. The objective of mapping observed bird locations and flight paths was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the CRWF.

RESULTS

Surveys were conducted at the CRWF from March 12, 2009, through February 15, 2010. Forty-eight bird species and three mammal species were identified during all surveys completed at the CRWF. Results of the fixed-point bird use surveys, incidental wildlife observations, and land cover surveys, and the specific numbers of unique species for each survey type are discussed in the sections below.

Fixed-Point Bird Use Surveys

A total of 360 20-minute (min) fixed-point bird use surveys were conducted during 24 visits to the CRWF: 180 surveys were conducted in spring, 120 in fall, and 60 in winter (Table 3). Two different view sheds were utilized when calculating the different statistics; species richness, use, percent composition, percent frequency, and exposure index; 800 m for large birds and 100 m for small birds.

Species Richness

Forty-eight unique species were observed during all fixed-point bird use surveys, with an average species richness of 0.67 large bird species/800-m plot/20-min survey and 1.66 small bird species/100-m plot/20-min survey (Table 3). The total number of unique species was greater in the spring (45 species) and fall (30) than in the winter (12; Table 3). Species richness was greatest in the spring for both large and small birds (1.20 birds/800-m plot/20-min survey and 3.32 birds/100-m plot/20-min survey, respectively), followed by the fall (0.68 birds/800-m plot/20-min survey and 1.33 birds/100-m plot/20-min survey, respectively) and winter (0.27 birds/800-m plot/20-min survey and 0.55 birds/100-m plot/20-min survey, respectively; Table 3).

A total of 5,325 individual bird observations within 1,469 separate groups were recorded during the fixed-point surveys (Table 4). Regardless of bird size, passerines made up the greatest number of observations, comprising about 75% of all bird observations (Table 4). Three passerine species (6.3% of all species) composed 44.0% of all observations: European starling (*Sturnus vulgaris*), brown-headed cowbird (*Molothrus ater*), and red-winged blackbird (*Agelaius phoeniceus*). All other passerine species and the large bird types comprised less than 10% of the total observations for each species individually or for the large bird types, except for shorebirds which comprised 11.7% of all bird observations for all shorebird species combined (Table 4). The most abundant large bird species observed were Canada goose (*Branta canadensis*; 367 individuals in eight groups) and killdeer (*Charadrius vociferus*; 333 individuals in 119 groups). Sixty-five individual raptors were recorded within the CRWF, representing six species (Table 4).

Bird Use, Composition, and Frequency of Occurrence by Season

Mean bird use, percent composition, and frequency of occurrence were calculated by season (Tables 5a and 5b). Overall, use by large bird species was higher during the spring and fall (3.40 and 2.43 birds/800-m plot/20-min survey, respectively) than in the winter (1.05; Table 5a). Small bird use followed a similar pattern, with higher use in the fall and spring (10.53 and 9.10 birds/100-m plot/20-min survey, respectively) than in the winter (4.58; Table 5b).

<u>Waterbirds</u>
Great blue heron (*Ardea herodias*) was the only waterbird species observed, and use by this species was 0.04 birds/plot 20-min survey in spring (Table 5a). Waterbirds were not recorded in the fall or winter. Great blue herons comprised 1.1% of large bird use in the spring and were observed during 3.3% of the spring surveys (Table 5a).

<u>Waterfowl</u>
Waterfowl had the highest use in the winter (0.15 birds/plot/20-min survey), compared to other seasons (spring: 0.05; fall: <0.01; Table 5a). Canada goose was the only waterfowl species observed in the fall or winter, and comprised approximately 80% of waterfowl use in spring (Table 5a). Mallards (*Anas platyrhynchos*) accounted for the remaining spring waterfowl use. Waterfowl comprised 14.3% of large bird use in the winter and waterfowl comprised less than 2% percent of large bird use in the other seasons. Waterfowl were observed during 5% or less of surveys in any season (Table 5a).

<u>Shorebirds</u>
Shorebirds had higher use in the spring (2.37 birds/plot/20-min survey) than in the fall (1.62), and were not observed during winter surveys (Table 5a). About 66% of spring shorebird use was due to use by American golden-plover (*Pluvialis dominica*), but this species was observed during less than 3.3% of spring surveys, indicating a few large groups were observed (Table

5a). Shorebirds comprised 69.6% of overall large bird use in the spring and 66.8% of large bird use in the fall. Shorebirds were observed during 51.7% of the spring surveys compared to only 18.3% in the fall (Table 5a).

<u>Raptors</u>
Raptor use was fairly uniform among seasons, with 0.20 birds/plot/20-min survey in the fall, 0.18 in the spring, and 0.15 in the winter (Table 5a). Red-tailed hawks (*Buteo jamaicensis*) was the most commonly observed raptor species in the spring and winter (0.09 and 0.12 birds/plot/20-min survey, respectively), while American kestrels (*Falco sparverius*) had slightly higher use in the fall (0.08 birds/plot/20-min survey for American kestrels compared to 0.07 for red-tailed hawks; Table 5a). In the winter, raptors comprised 14.3% of the large bird use, compared to 8.2% in the fall and 5.2% in the spring. Raptors were observed during 15.0% of the fall surveys, 13.9% of the spring surveys, and during 11.7% of the winter surveys (Table 5a).

<u>Vultures</u>
Turkey vulture (*Cathartes aura*) was the only vulture species observed at the CRWF, and vulture use was similar in the fall and spring (0.16 and 0.13 birds/plot/20-min survey, respectively), and vultures were not observed in the winter. Turkey vultures comprised less than 7% of large bird use in either season in which they were observed. Turkey vultures were observed during 14.2% of the fall surveys and 8.9% of the spring surveys (Table 5a).

<u>Upland Gamebirds</u>
Upland gamebirds had relatively low use in the spring (0.09 birds/plot/20-min survey) and were not observed in the fall or winter (Table 5a). Nearly all upland gamebird use was attributed to ring-necked pheasant (*Phasianus colchicus*). Upland gamebirds comprised less than 3% of the overall large bird use in the spring and were observed during 8.9% of the spring surveys (Table 5a).

<u>Doves/Pigeons</u>
Dove/pigeon use was similar in the spring (0.48 birds/plot/20-min survey) and fall (0.40 birds/plot/20-min survey), but use was higher during the winter (0.72 birds/plot/20-min survey, Table 5a). Mourning dove (*Zenaida macroura)* had the highest use in the spring and winter (0.47 and 0.52 birds/plot/20-min survey, respectively), while rock pigeon (*Columba livia)* had higher use in the winter (0.20 birds/plot/20-min survey) than in spring (0.01 birds/plot/20-min survey), and was not observed during the fall surveys (Table 5a). Doves/pigeons were observed during 18.3% of the fall surveys, 23.3% of the spring surveys, and during 6.7% of the winter surveys (Table 5a).

<u>Large Corvids</u>
American crow (*Corvus brachyrhynchos*) was the only large corvid observed, and use by this species was relatively low in all three seasons (spring: 0.07; fall: 0.04; winter: 0.03 birds/plot/20-min survey; Table 5a). In any of the three seasons, American crow comprised less than 4% of the overall large bird use and was observed during less than 4% of the surveys (Table 5a).

<u>Passerines</u>
A 100-m viewshed was used for small birds, thus small bird data are not directly comparable to the large bird data as the analysis for large birds utilized an 800-m viewshed. Passerine use was much higher in the fall and spring (10.52 and 9.08 birds/plot/20-min survey, respectively) than in the winter (4.58; Table 5b). European starling had the highest use by any one species in the fall (5.47 birds/plot/20-min survey) and winter (3.30). In the spring, three species had markedly higher use: common grackle (*Quiscalus quiscula*; 1.78 birds/plot/20-min survey),

brown-headed cowbird (1.69), and red-winged blackbird (1.62). Passerines were observed during 94.4% of the spring surveys, 78.3% of the fall surveys, and during 45.0% of surveys in the winter (Table 5b).

Bird Flight Height and Behavior

Flight height characteristics were estimated for both bird types and species (Tables 5 and 6). For large bird species, 265 single birds or groups of birds totaling 802 individuals were observed flying within the 800-m plot (Table 6). A total of 10.8% of large birds were observed flying within the RSH, 88.2% were observed flying below the RSH, and about 1% of large birds were observed flying above the RSH (Table 6). Most (70.2%) f flying raptors were observed below the RSH, 17.5% were within the RSH, and 12.3% were above the RSH (Table 6). Vultures had the highest percentage of flying birds within the RSH (52.4%), followed by waterbirds with 42.9%. Raptors had the fourth highest percentage of birds within the RSH; buteos were the only raptor subtype recorded flying within the RSH (35.7%; Table 5). The majority of flying shorebirds (90.2%) and waterfowl (81.8%) were observed below the RSH. Doves/pigeons and large corvids were only observed below the RSH, and upland gamebirds were not observed in flight (Table 6). A total of 2,712 passerines and other small birds were observed flying in 684 groups within the 100-m plot; all small bird species were observed below the RSH (Table 6).

One large bird species had at least 20 groups observed flying, red-tailed hawk. This species was observed flying within the likely RSH during a portion of the initial observations (Table 7a). Of all passerine and small bird species, nine species had at least 20 groups observed flying, but none of these small bird species were observed flying within the RSH (Table 7b).

Bird Exposure Index

A relative exposure index was calculated for each bird species based on initial flight height observations and use estimates (Tables 7a and 7b). This index is only based on initial flight height observations and use estimates, and does not account for other possible collision risk factors (e.g. foraging or courtship behavior). American golden-plover had a higher exposure index than any other species (0.09), compared to an exposure index of 0.04 or less for all other large bird species. The only raptor species with an exposure index was red-tailed hawk (0.03; Table 7a). No small bird species were observed within the RSH (Table 7b).

Spatial Use

Large bird use was higher at point 11 (14.1 birds/20-min survey) compared to use at the remaining points, where use ranged from 0.58 to 3.96 birds/20-min survey (Figure 5). The higher mean use estimate for point 11 was largely due to higher shorebird use at this point (11.4 birds/20-min survey; Figure 5). Shorebird use at the other points ranged from 0.17 to 3.50 birds/20-min survey. Waterbirds within 800-m of the point were recorded at only four points (one, seven, 12, and 14) and use ranged from 0.04 to 0.12 birds/20-min survey. Waterfowl were observed at six points (one, four, eight, 11, 12, and 14), with use ranging from 0.04 to 0.29 birds/20-min survey. Raptor use ranged from 0.00 to 0.54 birds/20-min survey. Vulture use was evenly distributed among points with use ranging from 0.04 to 0.21 birds/20-min survey. Upland gamebird use ranged from zero to 0.17 birds/20-min survey. Large corvid use was also relatively low and similar among points, with use ranging from zero to 0.21 birds/20-min survey. Passerine use, focused within 100 m of the point, was highest at points five and 11 (17.6 and 21.1 birds/20-min survey, respectively), where the majority of passerine use was comprised of European starling, red-winged blackbird, brown-headed cowbird, and and common grackle. Passerine use ranged from 3.08 to 13.6 at the remaining points (Figure 5).

Flight paths for waterbirds, waterfowl, shorebirds, raptors, and vultures were digitized and mapped (Figures 6a-e). No obvious flyways or concentration areas were observed.

Sensitive Species Observations

Four sensitive species were recorded during fixed-point bird use surveys (Table 8). Three upland sandpipers (*Bartramia longicauda*), a state endangered species (IDNR 2009) and a federal species of concern (USFWS 2008), were observed within the CRWF. Ten northern harriers (*Circus cyaneus*) and one osprey (*Pandion haliaetus*), also both Illinois state-endangered species (IDNR 2009), were recorded during fixed-point surveys. In addition, 283 American golden-plovers were observed in eight groups. While this species is not federally listed, it is a species of concern on the federal priority species lists (USFWS 2004). These tallies may represent repeated observations of the same individual in some cases.

Incidental Wildlife Observations

Five bird species were recorded as incidental observations at the CRWF, totaling 49 birds within 44 separate groups during the study (Table 9). Three mammal species were also observed incidentally at the CRWF.

Bird Observations

The most commonly recorded incidental species were red-tailed hawk and American kestrel (19 and 18 individuals, respectively; Table 9). All bird species recorded incidentally were also observed during fixed-point bird use surveys within the CRWF. One adult red-tailed hawk carcass was also observed hanging from a power line on September 12, 2009, suggesting the hawk was electrocuted by the power line (Table 9).

Mammal Observations

Nineteen white-tailed deer (*Odocoileus virginianus*) in six groups were observed incidentally at the CRWF (Table 9). Five thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*) and one coyote (*Canis latrans*) were also recorded as incidental observations (Table 9).

Sensitive Species Observations

Seven northern harriers, a state endangered species (IDNR 2009), were recorded as incidental wildlife observations within the CRWF (Tables 8 and 9). This tally may represent repeated observations of the same individual in some cases.

Land Cover Surveys

The CRWF is dominated by cultivated agriculture in the form of corn and soybeans, comprising 90.2% of the CRWF. Other landcover types included, unmowed grassland, mowed grassland, developed land, woodlot, shelterbelts (tree and shrubs), pasture, hayfields, savannah, railroad verge, and open water (Table 1, Figure 3). Descriptions of each habitat type can be found in Table 2. One natural area declared by the IDNR exists within the southeast portion of the CRWF, the Orchid Hill Natural-Heritage Landmark (INPC 2010).

DISCUSSION AND IMPACT ASSESSMENT

Potential Impacts

Impacts to wildlife resources from wind-energy facilities can be direct or indirect. Direct impacts are considered to be the potential for fatalities from construction and operation of the proposed wind-energy facility. Indirect impacts include the potential to displace, either temporarily or permanently, wildlife during construction of or during the operational period of a wind-energy facility.

Project construction could affect birds through loss of habitat, potential fatalities from construction equipment, and disturbance/displacement effects from construction activities. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment. Potential mortality from construction equipment is expected to be very low. Equipment used in wind facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The risk of direct mortality to birds from construction is most likely potential destruction of a nest for ground- and shrub-nesting species during initial site clearing. Impacts from the construction of the proposed CRWF to wildlife are are expected to be low based on the preponderance of tilled agriculture within the study area, but could result in impacts to individual state-listed species if construction occurs within occupied non-tilled areas during the breeding season.

The USFWS and the IDNR have expressed concern over the potential operation of wind-energy facilities to cause fatalities or displacement impacts to birds and bats (IDNR 2007, USFWS 2003). The study described in this report was designed to help address these concerns. Discussion of the potential impacts to bats was presented in a separate final report prepared by BHE Environmental.

Direct Impacts

Data collected during this study show that the potential for collisions to occur is not equal between groups of diurnally active birds. Bird types or species that were observed flying more often within heights similar to proposes turbines include raptors, waterbirds, waterfowl, shorebirds, and turkey vultures. Passerines have also been shown to be found as fatalities at other wind-energy facilities, and are discussed below.

Raptor Use and Exposure Risk

Typically, wind-energy facilities that have shown the highest raptor fatality rates have also shown the highest raptor use rates. A regression analysis of raptor use and raptor collision mortality for 13 new-generation wind-energy facilities where similar methods were used to obtain raptor use estimates showed a significant (R^2 = 69.9%) correlation between raptor use and raptor collision mortality (Figure 7). Overall raptor use at the CRWF was relatively low compared to wind-energy facilities where raptor use is considered high (Figure 8), ranking fifth lowest relative to raptor use observed at 39 other wind-energy facilities that implemented similar protocols to the present study and had data for three or four different seasons.

Exposure indices analysis may also provide insight into which species might be the most likely turbine casualties; however, the index only considers relative probability of exposure based on abundance, proportion of observations flying, and proportion of flight height of each species within the RSH for turbines likely to be used at the wind-energy facility. This analysis is based on observations of birds during the surveys and does not take into consideration behavior (e.g., foraging; courtship; habitat selection; the ability to detect and avoid turbines) that may vary among species and influence likelihood for turbine collision. For these reasons, the exposure index is only a relative index among species observed during the surveys and within the CRWF. Actual risk for some species may be lower or higher than indicated by these data. At the CRWF, the raptor species that had the highest exposure index was red-tailed hawk, which is a raptor species common to the Midwest (Table 7a).

The data collected at the CRWF indicate few raptors utilized the study area during the study period. Overall mean raptor use at the CRWF is similar to raptor use reported from four other wind-energy facilities in the Midwest and Illinois (Table 11). To date, relatively few raptor fatalities have been reported at wind-energy facilities in the Midwest located within landscapes dominated by tilled agriculture. A total of eight raptors (including three incidental finds) were recorded as fatalities at studies of six wind-energy facilities located in tilled agriculture landscapes in Wisconsin (three facilities), Minnesota, Iowa, and Illinois (Howe et al. 2002, Johnson et al. 2002b, Jain 2005, Kerlinger et al. 2007, BHE Environmental 2009, Gruver et al. 2009; Table 12). Raptor fatality rates at the CRWF are expected to be similar to those observed at other Midwest wind-energy facilities.

Non-Raptor Use and Exposure Risk

<u>Waterfowl/Waterbirds/Shorebirds</u>
Collectively, waterbird and waterfowl use was relatively low at the CRWF comprising approximately 7.1% of overall species observations. Shorebird use was noticeably higher at approximately 11.7% of all species observations, with use being comprised primarily of killdeer and American golden plover. Potential impacts to American golden plover are discussed under Threatened, Endangered, and Sensitive Species. Potential impacts to other shorebird, waterfowl, and waterbird species are discussed below.

Wind-energy facilities with year-round use by water-dependent species have shown the highest mortality, although the levels of waterfowl, waterbird, and shorebird mortality appear insignificant compared to the use of the facilities by these groups. Of bird carcasses reported at US wind-engery facilities prior to 2007, waterbirds comprised about 1%, waterfowl comprised about 2%, and shorebirds comprised less than 1% (NRC 2007). At the Klondike wind-energy facility in Oregon, only two Canada goose fatalities were documented (Johnson et al. 2003), even though 43 groups totaling 4,845 individual Canada geese were observed during pre-construction surveys (Johnson et al. 2002a). Canada goose account for approximately 6.9% of all bird species observations at the CWRF and were observed flying within the RSH approximately 22% of the time. The recently constructed Top of Iowa wind-energy facility is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use, including migrant and resident waterfowl. During a recent study, approximately one million goose-use days and 120,000 duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during concurrent and standardized wind-energy facility fatality studies (Jain 2005). Similar findings were observed at the Buffalo Ridge wind-energy facility in southwestern Minnesota (Johnson et al. 2002b), which is located in an area with relatively high waterfowl and waterbird use and some shorebird use. Snow geese (*Chen caerulescens*), Canada geese, and mallards were the most common waterfowl observed. Three of the 55 fatalities observed during the fatality monitoring studies were waterfowl (i.e., one blue-winged teal [*Anas discors*] and two mallards). Two American coots (*Fulica americana*), one grebe, and one shorebird fatality were also found (Johnson et al. 2002b). Based on previous studies at other wind-energy facilities and a relatively low exposure index calculated during this study, water-dependent species do not seem especially vulnerable to turbine collisions and significant impacts are not likely.

<u>Vultures</u>
Despite the fact that turkey vulture are commonly observed near wind-energy facilities, turkey vultures are rarely observed as fatalities at most wind-energy facilities (Erickson et al. 2001a). One notable exception is the Buffalo Gap wind-energy facility in Texas (Tierney 2007), where

higher rates of turkey vulture fatalities were observed compared to other wind-energy facilities. The landscape at Buffalo Gap wind-energy facility differs greatly from the CRWF and is dominated by dense thickets of Ashe's juniper (*Juniperus ashei)*, post oak (*Quercus stellata)*, and mesquite (*Prosopsis glandulosa)*, with small inclusions of grassland and dryland agricultural fields. A total of 33 groups consisting of 42 individuals of turkey vulture were observed flying during surveys in the CRWF. Based on flight height data, turkey vultures were recorded within the RSH more than any other species of bird, and some potential exists for turkey vulture fatalities to occur at the CRWF.

<u>Passerines</u>
All of the passerine species observed during the study were recorded as flying below the potential RSH of turbines, indicating that most passerine species have a relatively low risk of collision during daylight hours. Many passerine species migrate at night, and at heights greater than observed during this study, and have some risk of collision with turbines. Passerines (primarily perching birds) have been the most abundant bird fatality at wind-energy facilities outside California (Erickson et al. 2001a, 2002b), often comprising more than 80% of bird fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines made up a large proportion of the birds observed during the baseline study (approximately 75%; Table 3), passerines would be expected to make up the largest proportion of fatalities at the CRWF.

While some risk of collisions exists, most passerine species typically migrate at heights greater than the heights of turbines, except during periods of inclement weather (NRC 2007). Passerines may be more vulnerable to turbine collisions when ascending or descending from stopover habitats during migration. Typically, small forest fragments are not considered high-quality nesting habitat due to their size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism (Askins et al. 1987, Robinson et al. 1995, Brawn and Robinson 1996). However, forest fragments do receive higher levels of use during migration as stopover habitat (Packett and Dunning 2009). Small forest patches and grassland areas within CRWF likely receive higher levels of use by small birds stopping over during migration than the tilled agriculture areas. Migrating small birds and other species may be more at risk of turbine collision when ascending and descending from these stopover habitats, especially if turbines are placed near forest or grassland areas. Woodlots and grasslands are relatively rare within the CRWF.

While this may indicate some risk of collision from turbines placed near suitable stopover habitat, to date, overall fatality rates for birds (including nocturnal migrants) at wind-energy facilities have been relatively low in the Midwest at facilities located in landscapes similar to the CRWF. The range of overall bird fatality estimates at five Midwest wind-energy facilities that were studied using comparable methods in similar habitats have ranged from 0.6 to 7.17 bird fatalities per MW per year (Howe et al. 2002, Johnson et al. 2002b, Jain 2005, Kerlinger et al. 2007, BHE Environmental 2009, Gruver et al. 2009; Table 12).

Indirect Impacts

The UFSWS (2003) has expressed concern over the potential of wind turbines located in grassland habitats to displace grassland birds. Habitats documented in the CRWF that may be utilized by grassland and passerine birds for nesting (unmowed grassland, mowed grassland, pasture, railroad verge, and shrub/grassland) are rare, and comprise 2344 acres (3.66 mi^2; 7.0%) of the CRWF. Many of these areas are not contiguous and occur as isolated areas within the CRWF. The USFWS interim guidelines for wind development (USFWS 2003) suggest that projects located in previously altered habitats such as the CRWF are more suitable for wind development that projects located within native grasslands. Invenergy has committed to placing all turbines within tilled and untilled agriculture, thus greatly reducing the potential for grassland birds to be displaced from nesting habitats.

Threatened, Endangered, and Sensitive Species

Three state and/or federal endangered species and one USFWS priority shorebird species were observed during surveys within the CRWF (Table 8). These species include American golden plover (USFWS priority shorebird species [USFWS 2004]), northern harrier (state-endangered [IDNR 2009]), upland sandpiper (state endangered [IDNR 2009] and a federal species of concern [USFWS 2008]), and osprey (state endangered [IDNR 2009]). All of these bird species are also further protected under the Migratory Bird Treaty Act (MBTA 1918).

Three upland sandpipers observed within three groups were recorded during the fixed-point bird surveys during the spring at the CRWF. The CRWF contains potential nesting sites for the upland sandpiper in the form of hayfields, mowed grassland, buffer strips in crop fields, and unmowed grasslands.

Upland sandpipers may nest within small grass buffer strips in tilled agricultural fields, some of which may be located near a turbine within an adjacent agricultural field. Upland sandpipers may also nest within no-till soybean fields, and some turbines are likely located within no-till soybean fields. The nesting habitat preferences of the upland sandpiper may result in birds nesting close to turbine locations. The typical flight pattern of the upland sandpiper does not include regular flights within proposed blade heights, however; upland sandpiper aerial courtship displays may involve flights near blade height. The effects of an operational wind-energy facility on breeding upland sandpipers have not been well studied. We are only aware of one published study of wind-energy facilities where upland sandpipers were present. Johnson et al. (2000a) conducted a fatality monitoring and grassland songbird displacement study at the Buffalo Ridge wind-energy facility in Minnesota. Upland sandpiper use of the facility during operation was similar to use measured prior to construction, and no upland sandpiper fatalities were documented at Buffalo Ridge.

Upland sandpipers may be impacted by the construction phase of the CRWF if construction takes place during the breeding season in occupied nesting habitat. If construction takes place outside of the breeding season, or within areas not occupied by active upland sandpiper nests, no direct impacts from construction to nesting upland sandpiper would occur, although the potential is reduced due to the placement of wind turbines in tilled agriculture. The potential for operation of the facility to affect upland sandpipers is more difficult to assess, given the lack of projects operating and monitored of projects within areas occupied by upland sandpipers. The flight habits of the upland sandpiper, and the results of Johnson et al. (2000a) suggest that upland sandpipers are not be especially vulnerable to collisions with wind turbines. The results of Johnson et al. (2000a) also suggest that upland sandpipers may not be displaced by wind turbines. While the presence of upland sandpipers during the breeding season results in some potential for the species to be found as a collision fatality, the results of Johnson et al. (2000a), and flight behavior of the species suggest the risk of collision is low.

A total of 17 individual northern harriers in 17 groups were observed within the CRWF (10 individual in 10 groups during fixed-point use bird surveys [spring, fall, and winter] and seven individuals in seven groups as incidental observations).

There were no northern harriers observed flying within the RSH during the fixed-point bird use surveys. The hunting habits of northern harriers typically involve low, coursing flights over grassland habitats (MacWhirter and Bildstein 1996), which likely decreases the potential for this species to collide with a wind turbine. Northern harriers may fly higher and within the potential RSH when conducting aerial courtship displays, and this species may occasionally fly within the RSH during migration. However, the data collected at the CRWF and other wind-energy facilities (Smallwood et al. 2009, Johnson et al. 2000b, Kerlinger 2002) indicates that northern harriers spend the majority of their time flying below blade height. Northern harriers have been documented as fatalities at other wind-energy facilities (Erickson et al. 2001a), and the potential exists for northern harriers to be found as fatalities at the CRWF, particularly during migration. However, the overall level northern harrier fatalities are typically comparatively low when compared to their relative abundance at other wind-energy facilities (Erickson et al. 2001a).

Northern harriers require large undisturbed wetlands, pastures, old fields, marshes, and upland habitats for breeding. The INHS Breeding Bird Atlas (INHS 2009) lists three confirmed and one possible breeding record in Vermilion County and three possible breeding records in Champaign County, Illinois. Some potential nesting habitat for northern harriers is present within some of the larger patches of pasture and savannah landcover types. Research regarding northern harrier response to wind turbines is limited, and has showed mixed results. In Europe, hen harriers (*Circus cyaneus*) appeared to be displaced by construction activities as well as operational facilities (Madders and Whitfield 2006, Pearce-Higgins et al. 2009). Madders and Whitfield (2006) found harriers nesting 200 – 300 m (656 – 984 ft) from an operational wind turbine, and Pearce-Higgins et al. (2009) found foraging northern harriers to be less abundant within 250-m (820-ft) of operating turbines compared to control areas. The CRWF is comprised of approximately 4.0% of habitats that northern harrier may find suitable for nesting (unmowed grassland, native grassland, railroad verge, pasture and savannah), which may reduce the likelihood of northern harriers nesting in the CRWF.

A total of 283 individual American golden-plovers observed in eight groups were observed in the spring during the fixed-point bird use surveys at the CRWF. American golden-plovers may utilize soybean fields east-central Illinois as stopover habitat during the spring migration. The site is comprised of approximately 90% agricultural lands. In a relatively small area in west-central Indiana (Benton and White Counties), Braile (1999) estimated that the number of migrant American golden-plover foraging during stopovers, largely associated with agricultural lands, ranged from 42,000 to 84,000 individuals, which is a substantial fraction of the world's population. Studies conducted at the Fowler Ridge Wind Farm in Benton County, Indiana on American golden-plover revealed that no American golden-plovers were found as fatalities during a concurrent fatality study in the spring of 2009, indicating that the species may not be at risk of turbine collisions (Johnson et al. 2009c, presentation at The Wildlife Society).

The USFWS and the IDNR have expressed concern over the potential of wind-energy facilities in central Illinois to displace American golden-plovers from areas used during spring migration. This region is commonly used by staging American golden-plovers during spring migration as it historically had large concentrations of staging American golden-plovers. Johnson et al. (2009c) recorded no observations of plovers within 400-m of turbines in Indiana; however, lower amounts of soybean fields were present near turbines, which is the preferred foraging habitat for American golden-plovers. Johnson et al. (2009c) suggested that farmers rotate crop types between corn and soybean on a regular basis, and that additional years of study were needed before strong conclusions regarding American golden-plover responses to wind turbines could be made. If American golden-plovers avoid areas near turbines during spring migration, potential fatality rates for the species may be reduced. American golden-plovers utilize soybean fields for foraging in Indiana and Illinois during migration. While American golden-plovers have some potential to be displaced by wind turbines, the potential for displacement from wind turbines to impact any species is of greater concern when preferred habitats are limited or rare. The data collected during this study do not indicate that the CRWF is utilized as heavily as other well known American golden-plover stopover areas, such as Union Township in Benton County, Indiana. It is unlikely that potential displacement from soybean fields in the CRWF would have a large impact on American golden-plover populations considering the abundance of soybean fields in Illinois.

One osprey was recorded during the fixed-point use bird surveys at the CRWF during the spring. This species is typically found in close association to water resources such as lakes and rivers, as their diet primarily made up of fish (Poole et al. 2002). There are no records of breeding osprey located within Vermilion or Champaign Counties, Illinois, and this species is considered an uncommon migrant and occasional summer resident. While some potential exists for ospreys to collide with turbines at any wind-energy facility in Illinois during migration, the risk is considered low for the CRWF based on the low observed use of the site.

There is one Illinois Natural Heritage Landmark located within the site, Orchid Hill (INPC 2010), which is largely known for its diversity of orchids. There are no known state listed plant species that occur within the Orchid Hill site.

Avian point count surveys at CRWF were conducted during the spring and fall migration, and winter periods. Surveys were not conducted during the summer due to preponderance of tilled agriculture, which limited the amount of potential nesting habitat and summer use for most birds. However; some areas of grassland and shelterbelts were identified during the landcover mapping efforts that have some potential to support breeding populations of species protected under the Illinois Endangered Species Act. Bird species identified by the Illinois Department of Natural Resources as potentially nesting within the CRWF include the barn owl (*Tyto alba*), short-eared owl (*Asio flammeus*), and loggerhead shrike (*Lanius ludovicianus*). These species, as well as other state-listed species such as the least bittern (*Ixobrychus exilis*), and black-billed cuckoo (*Coccyzus erythropthalmus*) also have some potential to migrate through the project area, although none were observed utilizing the project area during avian point count surveys, and abundances are expected to be low. The experimental, non-essential population eastern migratory population of the whooping crane (*Grus americana*) may also occur within most areas of Illinois during migration.

Other non-avian species protected by the Illinois Endangered Species Act were identified by the Illinois Department of Natural Resources as having varying potential to occur within the CRWF. These species included the following which could occur in wetland or aquatic habitats: Blanding's turtle (*Emydoidea blandingii*), smooth softshell turtle (*Apalone mutica*), River redhorse (*Moxostoma carinatum*), Eastern sand darter (*Ammocrypta pellucidum*), Bigeye chub (*Hybopsis amblops*), Clubshell (*Pleurobema clava*), riffleshell (*Epioblasma torulosa*), slippershell (*Alasmidonta viridis*), little spectaclecase (*Villosa lienosa*), wavy-rayed lampmussel (*Lampsilis fasciola*), rainbow (*Villosa lienosa*), purple wartyback (*Cyclonaias tuberculata*), kidneyshell (*Ptychobranchus fasciolaris*), rabbitsfoot (*Quadrula cylindrica*), purple Lilliput (*Toxolasma lividus*), salamander mussel (*Simpsonaias ambigua*), and mudpuppy (*Necturus maculosus*). One amphibian species, the silvery salamander (*Ambystoma platineum*) was identified by the

IDNR as having some potential to occur along woodlands connected to the Middle Fork of the Vermillion River. The ornate box-turtle (*Terrapene ornata*) was identified by the IDNR as potentially occurring within open grasslands and agricultural fields. Mammals identified by the IDNR included bat species (addressed in a separate report), and the Franklin's ground squirrel (*Spermophilus franklinii*), which may occur along the right-of-ways of railroads and highways, or other grassland landcover types. The USFWS identified the following plant species as having some potential to occur within native prairie remnants in the CRWF: prairie bush clover (*Lespedeza leptostachya*) and eastern prairie fringed orchid (*Platanthera leucophaea*). Native prairie remnants were not observed from public roads during the landcover mapping effort. The only landcover type that could contain any native prairie remnants was the railroad verge.

CONCLUSION

The USFWS interim guidelines for wind-energy development suggest that wind-energy projects should be sited within previously altered habitats (USFWS 2003). The proposed project is dominated by tilled and un-tilled agriculture, and developed areas, which comprise 92.1 % of the area. Invenergy has committed to placing turbines within tilled and untilled agricultural areas, and avoiding placing turbines within pasture and grassland habitats. The area with the highest diversity of landcover in the region is located along the Middle Fork of the Vermillion River, which is located outside of the CRWF. The results of bird studies at CRWF area show raptor use rates during the spring, fall and winter were lower than observed at other wind-energy facilities, likely due to the dominance of tilled agriculture. Fatality rates of birds are expected to be similar to those observed at other wind-energy facilities in the Midwest, based on data collected during this study, dominance of relatively flat tilled agriculture in the CRWF, placement of wind turbines within agricultural areas, and placement of turbines away from the Middle Fork of the Vermillion River.

Three bird species listed as endangered under the Illinois endangered species act were observed within the project area (IDNR 2009). These species include northern harrier, upland sandpiper (also federal species of concern; USFWS 2008), and osprey. The American golden plover, listed as a federal priority shorebird species (USFWS 2004), was also observed within the project area. Northern harriers, upland sandpipers, and osprey occurred at relatively low densities during the migration periods and the winter, and risks of collisions are considered low during these seasons based on their low abundance. However, American golden plover in comparison were observed in higher numbers during migration, although existing studies have suggested the species is not especially vulnerable to turbine collisions. Some potential exists for nesting populations of northern harrier, upland sandpiper and other state-listed species to occur within the CRWF, although large numbers are not expected based on the preponderance of tilled agriculture. Landcover data collected during this study can be utilized to identify locations where turbines or infrastructure may be located within or near potential habitat for state-listed species, and to determine if further surveys or mitigation measures are warranted.

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Table 1. The land cover types, coverage, and composition within the California Ridge Wind Farm, based on land cover surveys conducted by WEST in March of 2009.

Habitat	Acres	% Composition
Agriculture (Corn/Soybeans)	30,246.60	90.2
Agriculture (Hay Fields)	117.34	0.4
Developed	509.22	1.5
Mowed Grassland	690.72	2.1
Open Water	9.84	<0.1
Pasture	236.61	0.7
Railroad Verge	84.27	0.3
Savannah	103.87	0.3
Shelterbelt (Shrubs)	72.51	0.2
Shelterbelt (Trees)	266.40	0.8
Unmowed Grassland	890.10	2.7
Woodlot	296.11	0.9
Total	**33,523.58**	**100**

Table 2. Descriptions of habitats mapped at the California Ridge Wind Farm by Western EcoSystems Technology, Inc.

Habitat	Habitat Description
Tilled Agriculture	Areas with planted crops (typically soybean [*Glycine max*], corn [*Zea mays*]).
Un-Tilled Agriculture	Area with untilled agriculture (hay or alfalfa [*Medicago sativa*]).
Developed	House, barn, building, city, major highways.
Abandoned Structure	Dilapidated structure.
Pasture	Areas with planted grasses used for livestock grazing.
Mowed Non-native Grassland	Areas regularly mowed that are dominated by non-native grasses such as fescues (*Festuca* spp.).
Unmowed Non-native Grassland	Areas that have not been mowed that are dominated by non-native grasses such as fescues.
Illinois Natural Heritage Landmark	Natural area designated and administered by the Illinois Department of Naturual Resources (Orchid Hill).
Savannah	Unmowed non-native planted grassland with interspersed trees/shrubs.
Woodlot	Areas with a group of deciduous trees present (does not include areas smaller than one acre [43,560 ft^2]).
Shelterbelt with deciduous trees	Rows between properties or crop fields that consist of mature deciduous trees.
Shelterbelt with shrubs/grass	Barriers of shrubs or grass between agriculture fields.
Railroad verge	Active railroad track that has a verge on both sides consisting of grasses, shrubs, and/or trees.
Open water	Ponds or lakes.

Table 3. Summary of species richness (species/plot[a]/20-minute survey) and sample size, by season and overall, during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness Large Birds	Species Richness Small Birds

Spring	12	180	45	1.20	3.32
Fall	8	120	30	0.68	1.33
Winter	4	60	12	0.27	0.55
Overall	**24**	**360**	**48**	**0.67**	**1.66**

[a] 800-m radius for large birds and 100-m radius for small birds.

Table 4. Total number of individuals (obs) and groups (grps) for each bird type, raptor subtype, and species[a], by season and overall, during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

		Spring		Fall		Winter		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**6**	**7**	**0**	**0**	**0**	**0**	**6**	**7**
great blue heron	*Ardea herodias*	6	7	0	0	0	0	6	7
Waterfowl		**3**	**9**	**1**	**1**	**5**	**359**	**9**	**369**
Canada goose	*Branta canadensis*	2	7	1	1	5	359	8	367
mallard	*Anas platyrhynchos*	1	2	0	0	0	0	1	2
Shorebirds		**110**	**426**	**22**	**195**	**0**	**0**	**132**	**621**
American golden-plover	*Pluvialis dominica*	8	283	0	0	0	0	8	283
killdeer	*Charadrius vociferus*	97	138	22	195	0	0	119	333
upland sandpiper	*Bartramia longicauda*	3	3	0	0	0	0	3	3
Wilson's snipe	*Gallinago delicata*	2	2	0	0	0	0	2	2
Raptors		**28**	**32**	**19**	**24**	**7**	**9**	**54**	**65**
Accipiters		*0*	*0*	*2*	*2*	*1*	*1*	*3*	*3*
sharp-shinned hawk	*Accipiter striatus*	0	0	2	2	1	1	3	3
Buteos		*15*	*18*	*7*	*8*	*5*	*7*	*27*	*33*
red-tailed hawk	*Buteo jamaicensis*	14	17	7	8	5	7	26	32
rough-legged hawk	*Buteo lagopus*	1	1	0	0	0	0	1	1
Northern Harrier		*5*	*5*	*4*	*4*	*1*	*1*	*10*	*10*
northern harrier	*Circus cyaneus*	5	5	4	4	1	1	10	10
Falcons		*7*	*8*	*6*	*10*	*0*	*0*	*13*	*18*
American kestrel	*Falco sparverius*	7	8	6	10	0	0	13	18
Other Raptors		*1*	*1*	*0*	*0*	*0*	*0*	*1*	*1*
osprey	*Pandion haliaetus*	1	1	0	0	0	0	1	1
Vultures		**16**	**23**	**17**	**19**	**0**	**0**	**33**	**42**
turkey vulture	*Cathartes aura*	16	23	17	19	0	0	33	42
Upland Gamebirds		**16**	**17**	**0**	**0**	**0**	**0**	**16**	**17**
northern bobwhite	*Colinus virginianus*	1	1	0	0	0	0	1	1
ring-necked pheasant	*Phasianus colchicus*	15	16	0	0	0	0	15	16

Table 4. Total number of individuals (obs) and groups (grps) for each bird type, raptor subtype, and species[a], by season and overall, during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

		Spring		Fall		Winter		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Doves/Pigeons		**53**	**86**	**22**	**48**	**4**	**43**	**79**	**177**
mourning dove	*Zenaida macroura*	52	84	22	48	3	31	77	163
rock pigeon	*Columba livia*	1	2	0	0	1	12	2	14
Large Corvids		**7**	**12**	**1**	**5**	**2**	**2**	**10**	**19**
American crow	*Corvus brachyrhynchos*	7	12	1	5	2	2	10	19
Passerines		**906**	**2,184**	**182**	**1,513**	**37**	**305**	**1,125**	**4,002**
American goldfinch	*Carduelis tristis*	18	26	20	38	0	0	38	64
American robin	*Turdus migratorius*	94	182	30	68	0	0	124	250
barn swallow	*Hirundo rustica*	40	71	7	37	0	0	47	108
blue jay	*Cyanocitta cristata*	1	2	3	7	0	0	4	9
brown-headed cowbird	*Molothrus ater*	119	411	9	200	0	0	128	611
brown thrasher	*Toxostoma rufum*	3	3	1	1	0	0	4	4
cedar waxwing	*Bombycilla cedrorum*	1	2	0	0	0	0	1	2
chipping sparrow	*Spizella passerina*	14	15	1	1	0	0	15	16
cliff swallow	*Petrochelidon pyrrhonota*	0	0	3	14	0	0	3	14
common grackle	*Quiscalus quiscula*	120	387	7	30	0	0	127	417
common yellowthroat	*Geothlypis trichas*	7	9	0	0	0	0	7	9
dickcissel	*Spiza americana*	10	17	1	2	0	0	11	19
eastern kingbird	*Tyrannus tyrannus*	6	8	0	0	0	0	6	8
eastern meadowlark	*Sturnella magna*	105	131	10	13	0	0	115	144
European starling	*Sturnus vulgaris*	48	168	34	780	10	228	92	1,176
gray catbird	*Dumetella carolinensis*	2	2	0	0	0	0	2	2
horned lark	*Eremophila alpestris*	87	123	18	44	20	46	125	213
house finch	*Carpodacus mexicanus*	2	3	0	0	0	0	2	3
house sparrow	*Passer domesticus*	17	47	4	11	1	1	22	59
indigo bunting	*Passerina cyanea*	5	5	0	0	0	0	5	5
Lapland longspur	*Calcarius lapponicus*	16	105	0	0	5	20	21	125
northern cardinal	*Cardinalis cardinalis*	8	9	1	1	0	0	9	10
purple martin	*Progne subis*	0	0	1	30	0	0	1	30
red-winged blackbird	*Agelaius phoeniceus*	140	402	11	143	1	10	152	555

Table 4. Total number of individuals (obs) and groups (grps) for each bird type, raptor subtype, and species[a], by season and overall, during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Species/Type	Scientific Name	Spring # grps	Spring # obs	Fall # grps	Fall # obs	Winter # grps	Winter # obs	Total # grps	Total # obs
song sparrow	*Melospiza melodia*	16	21	0	0	0	0	16	21
tree swallow	*Tachycineta bicolor*	7	12	13	84	0	0	20	96
unidentified sparrow		0	0	1	2	0	0	1	2
unidentified warbler		0	0	1	1	0	0	1	1
vesper sparrow	*Pooecetes gramineus*	20	23	6	6	0	0	26	29
Other Birds		**4**	**4**	**1**	**2**	**0**	**0**	**5**	**6**
chimney swift	*Chaetura pelagica*	2	2	0	0	0	0	2	2
northern flicker	*Colaptes auratus*	2	2	1	2	0	0	3	4
Overall		**1,149**	**2,800**	**265**	**1,807**	**55**	**718**	**1,469**	**5,325**

[a] Regardless of distance from observer.

Table 5a. Mean bird use (number of birds/plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type, raptor subtype, and species by season during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

	Use			% Composition			% Frequency		
Species/Type	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**
Waterbirds	**0.04**	**0**	**0**	**1.1**	**0**	**0**	**3.3**	**0**	**0**
great blue heron	0.04	0	0	1.1	0	0	3.3	0	0
Waterfowl	**0.05**	**<0.01**	**0.15**	**1.5**	**0.3**	**14.3**	**1.7**	**0.8**	**5.0**
Canada goose	0.04	<0.01	0.15	1.1	0.3	14.3	1.1	0.8	5.0
mallard	0.01	0	0	0.3	0	0	0.6	0	0
Shorebirds	**2.37**	**1.62**	**0**	**69.6**	**66.8**	**0**	**51.7**	**18.3**	**0**
American golden-plover	1.57	0	0	46.2	0	0	3.3	0	0
killdeer	0.77	1.62	0	22.5	66.8	0	48.3	18.3	0
upland sandpiper	0.02	0	0	0.5	0	0	1.7	0	0
Wilson's snipe	0.01	0	0	0.3	0	0	1.1	0	0
Raptors	**0.18**	**0.20**	**0.15**	**5.2**	**8.2**	**14.3**	**13.9**	**15.0**	**11.7**
Accipiters	*0*	*0.02*	*0.02*	*0*	*0.7*	*1.6*	*0*	*1.7*	*1.7*
sharp-shinned hawk	0	0.02	0.02	0	0.7	1.6	0	1.7	1.7
Buteos	*0.10*	*0.07*	*0.12*	*2.9*	*2.7*	*11.1*	*7.8*	*5.8*	*8.3*
red-tailed hawk	0.09	0.07	0.12	2.8	2.7	11.1	7.2	5.8	8.3
rough-legged hawk	<0.01	0	0	0.2	0	0	0.6	0	0
Northern Harrier	*0.03*	*0.03*	*0.02*	*0.8*	*1.4*	*1.6*	*2.8*	*3.3*	*1.7*
northern harrier	0.03	0.03	0.02	0.8	1.4	1.6	2.8	3.3	1.7
Falcons	*0.04*	*0.08*	*0*	*1.3*	*3.4*	*0*	*3.9*	*5.0*	*0*
American kestrel	0.04	0.08	0	1.3	3.4	0	3.9	5.0	0
Other Raptors	*<0.01*	*0*	*0*	*0.2*	*0*	*0*	*0.6*	*0*	*0*
osprey	<0.01	0	0	0.2	0	0	0.6	0	0
Vultures	**0.13**	**0.16**	**0**	**3.8**	**6.5**	**0**	**8.9**	**14.2**	**0**
turkey vulture	0.13	0.16	0	3.8	6.5	0	8.9	14.2	0
Upland Gamebirds	**0.09**	**0**	**0**	**2.8**	**0**	**0**	**8.9**	**0**	**0**
northern bobwhite	<0.01	0	0	0.2	0	0	0.6	0	0
ring-necked pheasant	0.09	0	0	2.6	0	0	8.3	0	0

Table 5a. Mean bird use (number of birds/plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type, raptor subtype, and species by season during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

	Use			% Composition			% Frequency		
Species/Type	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**
Doves/Pigeons	**0.48**	**0.40**	**0.72**	**14.1**	**16.4**	**68.3**	**23.3**	**18.3**	**6.7**
mourning dove	0.47	0.40	0.52	13.7	16.4	49.2	23.3	18.3	5.0
rock pigeon	0.01	0	0.20	0.3	0	19.0	0.6	0	1.7
Large Corvids	**0.07**	**0.04**	**0.03**	**2.0**	**1.7**	**3.2**	**3.9**	**0.8**	**3.3**
American crow	0.07	0.04	0.03	2.0	1.7	3.2	3.9	0.8	3.3
Overall	**3.40**	**2.43**	**1.05**	**100**	**100**	**100**			

Table 5b. Mean bird use (number of birds/100-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species by season during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

	Use			% Composition			% Frequency		
Species/Type	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**
Passerines	**9.08**	**10.52**	**4.58**	**99.8**	**99.8**	**100**	**94.4**	**78.3**	**45.0**
American goldfinch	0.11	0.32	0	1.2	3.0	0	6.7	16.7	0
American robin	0.78	0.52	0	8.5	4.9	0	33.9	22.5	0
barn swallow	0.34	0.22	0	3.8	2.1	0	19.4	5.0	0
blue jay	0	<0.01	0	0	<0.1	0	0	0.8	0
brown-headed cowbird	1.69	1.67	0	18.6	15.8	0	47.2	7.5	0
brown thrasher	0	<0.01	0	0	<0.1	0	0	0.8	0
cedar waxwing	0.01	0	0	0.1	0	0	0.6	0	0
chipping sparrow	0.04	<0.01	0	0.4	<0.1	0	3.3	0.8	0
cliff swallow	0	0.12	0	0	1.1	0	0	2.5	0
common grackle	1.78	0.22	0	19.5	2.1	0	41.7	5.0	0
common yellowthroat	0.03	0	0	0.3	0	0	2.2	0	0
dickcissel	0.06	0.02	0	0.6	0.2	0	2.8	0.8	0
eastern kingbird	0.04	0	0	0.5	0	0	3.3	0	0
eastern meadowlark	0.31	0.05	0	3.4	0.5	0	24.4	4.2	0
European starling	0.68	5.47	3.30	7.4	52.0	72.0	20.0	22.5	11.7
gray catbird	0.01	0	0	0.1	0	0	1.1	0	0
horned lark	0.51	0.37	0.77	5.6	3.5	16.7	32.2	15.0	31.7
house finch	0.02	0	0	0.2	0	0	1.1	0	0
house sparrow	0.26	0.09	0.02	2.9	0.9	0.4	8.9	3.3	1.7
indigo bunting	0.03	0	0	0.3	0	0	2.8	0	0
Lapland longspur	0.49	0	0.33	5.4	0	7.3	7.2	0	8.3
northern cardinal	0.05	<0.01	0	0.5	<0.1	0	4.4	0.8	0
purple martin	0	0.25	0	0	2.4	0	0	0.8	0
red-winged blackbird	1.62	0.43	0.17	17.8	4.1	3.6	48.9	6.7	1.7
song sparrow	0.09	0	0	1.0	0	0	6.1	0	0
tree swallow	0.04	0.66	0	0.5	6.2	0	3.3	10.0	0
unidentified sparrow	0	0.02	0	0	0.2	0	0	0.8	0
unidentified warbler	0	<0.01	0	0	<0.1	0	0	0.8	0
vesper sparrow	0.10	0.05	0	1.1	0.5	0	8.3	5.0	0

Table 5b. Mean bird use (number of birds/100-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species by season during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

	Use			% Composition			% Frequency		
Species/Type	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**
Other Birds	**0.02**	**0.02**	**0**	**0.2**	**0.2**	**0**	**1.7**	**0.8**	**0**
chimney swift	<0.01	0	0	<0.1	0	0	0.6	0	0
northern flicker	0.01	0.02	0	0.1	0.2	0	1.1	0.8	0
Overall	**9.10**	**10.53**	**4.58**	**100**	**100**	**100**			

Table 6. Flight height characteristics by bird type and raptor subtype during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010. Large bird observations were limited to within 800 m and small birds were limited to within 100 m.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories 0 - 35 m	35 - 130 m[a]	> 130 m
Waterbirds	6	7	31.83	100	57.1	42.9	0
Waterfowl	5	11	32.20	57.9	81.8	18.2	0
Shorebirds	99	509	5.97	82.0	90.2	9.8	0
Raptors	46	57	31.22	87.7	70.2	17.5	12.3
Accipiters	*3*	*3*	*12.00*	*100*	*100*	*0*	*0*
Buteos	*22*	*28*	*58.05*	*84.8*	*39.3*	*35.7*	*25.0*
Northern Harrier	*10*	*10*	*2.40*	*100*	*100*	*0*	*0*
Falcons	*10*	*15*	*6.90*	*83.3*	*100*	*0*	*0*
Other Raptors	*1*	*1*	*30.00*	*100*	*100*	*0*	*0*
Vultures	33	42	51.09	100	45.2	52.4	2.4
Upland Gamebirds	0	0	0	0	0	0	0
Doves/Pigeons	68	160	6.53	90.4	100	0	0
Large Corvids	8	16	7.62	84.2	100	0	0
Large Birds Overall	**265**	**802**	**17.25**	**82.9**	**88.2**	**10.8**	**1.0**
Passerines	680	2,707	5.06	85.3	100	0	0
Other Birds	4	5	12.50	100	100	0	0
Small Birds Overall	**684**	**2,712**	**5.10**	**85.4**	**100**	**0**	**0**

[a] The likely "rotor-swept height" for potential collision with a turbine blade, or 35 to 130 m (115 to 427 ft) above ground level.

Table 7a. Relative exposure index and flight characteristics for large bird species during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[a] based on Initial obs	Exposure Index	% Within RSH at Anytime
American golden-plover	8	0.53	100	17.7	0.09	17.7
turkey vulture	33	0.08	100	52.4	0.04	61.9
red-tailed hawk	21	0.10	84.4	37.0	0.03	51.9
Canada goose	4	0.08	52.9	22.2	<0.01	22.2
great blue heron	6	0.01	100	42.9	<0.01	42.9
killdeer	89	0.62	67.3	0	0	0
mourning dove	66	0.47	89.6	0	0	0
rock pigeon	2	0.09	100	0	0	0
American crow	8	0.05	84.2	0	0	0
American kestrel	10	0.03	83.3	0	0	0
ring-necked pheasant	0	0.03	0	0	0	0
northern harrier	10	0.02	100	0	0	0
sharp-shinned hawk	3	0.01	100	0	0	0
upland sandpiper	0	<0.01	0	0	0	0
Wilson's snipe	2	<0.01	100	0	0	0
mallard	1	<0.01	100	0	0	0
rough-legged hawk	1	<0.01	100	0	0	0
osprey	1	<0.01	100	0	0	100
northern bobwhite	0	<0.01	0	0	0	0

[a] RSH: The likely “rotor-swept height” for potential collision with a turbine blade, or 35 to 130 m (115 to 427 ft) above ground level (AGL).

Table 7b. Relative exposure index and flight characteristics for small bird species during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[a] based on Initial obs	Exposure Index	% Within RSH at Anytime
European starling	68	2.90	82.8	0	0	0
brown-headed cowbird	99	0.94	95.8	0	0	0
red-winged blackbird	104	0.72	90.7	0	0	0
common grackle	108	0.65	98.6	0	0	0
horned lark	61	0.59	70.7	0	0	0
American robin	68	0.38	77.2	0	0	0
Lapland longspur	16	0.31	92.6	0	0	0
barn swallow	42	0.17	100	0	0	0
tree swallow	17	0.16	82.8	0	0	0
eastern meadowlark	24	0.12	51.6	0	0	0
house sparrow	15	0.12	69.5	0	0	0
American goldfinch	21	0.11	79.3	0	0	0
purple martin	1	0.06	100	0	0	0
vesper sparrow	9	0.04	41.7	0	0	0
song sparrow	3	0.03	25.0	0	0	0
cliff swallow	3	0.03	100	0	0	0
dickcissel	2	0.02	41.7	0	0	0
northern cardinal	4	0.02	50.0	0	0	0
eastern kingbird	6	0.01	100	0	0	0
chipping sparrow	2	0.01	37.5	0	0	0
indigo bunting	3	<0.01	60.0	0	0	0
common yellowthroat	0	<0.01	0	0	0	0
northern flicker	3	<0.01	100	0	0	0
house finch	2	<0.01	100	0	0	0
gray catbird	0	<0.01	0	0	0	0
cedar waxwing	0	<0.01	0	0	0	0

Table 7b. Relative exposure index and flight characteristics for small bird species during fixed-point bird use surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[a] based on Initial obs	Exposure Index	% Within RSH at Anytime
unidentified sparrow	1	<0.01	100	0	0	0
chimney swift	1	<0.01	100	0	0	0
unidentified warbler	0	<0.01	0	0	0	0
brown thrasher	0	<0.01	0	0	0	0
blue jay	1	<0.01	100	0	0	0

[a] RSH: The likely "rotor-swept height" for potential collision with a turbine blade, or 35 to 130 m (115 to 427 ft) above ground level (AGL).

Table 8. Summary of sensitive species observed at the California Ridge Wind Farm during fixed-point bird use surveys (FP) and as incidental wildlife observations (Inc.) from March 12, 2009 – February 15, 2010.

			FP		Inc.		Total	
Species	**Scientific Name**	**Status**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**
American golden-plover	*Pluvialis dominica*	FPS	8	283	0	0	**8**	**283**
northern harrier	*Circus cyaneus*	SE	10	10	7	7	**17**	**17**
upland sandpiper	*Bartramia longicauda*	SE/FSOC	3	3	0	0	**3**	**3**
osprey	*Pandion haliaetus*	SE	1	1	0	0	**1**	**1**
Total	**4 species**		**22**	**297**	**7**	**7**	**29**	**304**

FSOC = federal species of concern (USFWS 2008); FPS = USFWS priority shorebird species (USFWS 2004); SE = state endangered. (IDNR 2009)

Table 9. Incidental wildlife observed while conducting all surveys at the California Ridge Wind Farm from March 12, 2009 – February 15, 2010.

Species	Scientific Name	# grps	# obs
red-tailed hawk	*Buteo jamaicensis*	18	19
American kestrel	*Falco sparverius*	13	17
northern harrier	*Circus cyaneus*	7	7
turkey vulture	*Cathartes aura*	5	5
great blue heron	*Ardea herodias*	2	2
Bird Subtotal	**5 species**	**44**	**49**
white-tailed deer	*Odocoileus virginianus*	6	19
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	5	5
coyote	*Canis latrans*	1	1
Mammal Subtotal	**3 species**	**12**	**25**

Table 10. Comparison of raptor use estimates and raptor mortality at wind-energy facilities in North America and the California Ridge Wind Farm.

Wind-Energy Facility	Use Estimate[a]	Raptor Mortality[b]	No. of Turbines	Total MW
California Ridge, IL	0.17			
Midwest				
NPPD Ainsworth, NE		0.06	36	59.4
Wolfe Island, Ont.		0.04	86	197.8
Buffalo Ridge, MN	0.64	0.02	281	210.75
Blue Sky Green Field, WI		0	88	145
Western				
Diablo Winds, CA	2.16	0.87	31	20
SMUD, CA		0.53		15
High Winds, CA	2.34	0.39	90	162
Leaning Juniper, OR	0.52	0.21	67	100.5
Big Horn, WA	0.51	0.15	133	199.5
Hopkins Ridge, WA	0.70	0.14	83	150
Klondike II, OR	0.50	0.11	50	75
Stateline, OR/WA (2002)	0.23	0.09	454	300
Stateline, OR/WA (2003)	0.21	0.09	454	300
Wild Horse, WA	0.29	0.09	127	229
Klondike III, OR		0.06	122	375
Zintel, WA	0.43	0.05	38	50
Nine Canyon, WA		0.05	37	48
Marengo II, WA		0.05	39	70.2
Biglow Canyon I, WA (2009)		0.04	76	125.4
Biglow Canyon I, WA (2008)		0.03	76	125.4
Combine Hills, OR	0.75	0	41	41
Vansycle, OR	0.66	0	38	24.9
Klondike, OR	0.50	0	16	24
Marengo I, WA		0	78	140.4
Dillon, CA		0	45	45
Northeastern				
Noble Ellenburg, NY (2009)		0.49	54	80
Noble Ellensburg, NY (2008)		0.32	54	80
Noble Clinton, NY (2008)		0.29	67	100.5
Maple Ridge, NY (2007)		0.25	195	321.75
Noble Clinton, NY (2009)		0.24	67	100
Noble Bliss, NY (2008)		0.19	67	100
Noble Bliss, NY (2009)		0.18	67	100
Maple Ridge, NY (2006)		0.04	120	198
Buffalo Mountain, TN (2006)		0	18	29
Buffalo Mountain, TN (2000-2003)		0	3	1.98
Mount Storm, WV (2008)		0	82	164

Table 10. Comparison of raptor use estimates and raptor mortality at wind-energy facilities in North America and the California Ridge Wind Farm.

Wind-Energy Facility	Use Estimate[a]	Raptor Mortality[b]	No. of Turbines	Total MW
Southern Plains				
Buffalo Gap, TX		0.10	67	134
Rocky Mountains				
Summerview, Alb. (2005/2006)		0.11	39	70.2
Judith Gap, MT		0.09	90	135
Foote Creek Rim, WY (Phase I; 1999)		0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)		0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		0	69	41.4

[a] number of raptors/plot/20-min survey
[b] number of fatalities/MW/year
Data from the following sources:

Facility	Use Estimate	Mortality Estimate	Facility	Use Estimate	Mortality Estimate
NPPD Ainsworth, NE		Derby et al. 2007	Vansycle, OR	WCIA and WEST 1997	Erickson et al. 2000
Wolfe Island, Ont.		Stantec Ltd. 2010	Klondike, OR	Johnson et al. 2002a	Johnson et al. 2003
Buffalo Ridge, MN	Erickson et al. 2002b	Erickson et al. 2002b	Marengo I, WA		URS Corporation 2010a
Blue Sky Green Field, WI		Gruver et al. 2009	Dillon, CA		Chatfield et al. 2009
Diablo Winds, CA	WEST 2006	WEST 2008	Noble Ellensburg, NY (09)		Jain et al. 2010c
SMUD, CA		URS et al. 2005	Noble Ellensburg, NY (08)		Jain et al. 2009a
High Winds, CA	Kerlinger et al. 2005	Kerlinger et al. 2006	Noble Clinton, NY (08)		Jain et al. 2009b
Leaning Juniper, OR	Kronner et al. 2005	Gritski et al. 2008	Maple Ridge, NY (07)		Jain et al. 2008
Big Horn, WA	Johnson and Erickson 2004	Kronner et al. 2008	Noble Clinton, NY (09)		Jain et al. 2010b
Hopkins Ridge, WA	Young et al. 2003a	Young et al. 2007a	Noble Bliss, NY (08)		Jain et al. 2009c
Klondike II, OR	Johnson 2004	NWC and WEST 2007	Noble Bliss, NY (09)		Jain et al. 2010a
Stateline, OR/WA (02)	Erickson et al. 2002b	Erickson et al. 2004	Maple Ridge, NY (06)		Jain et al. 2007
Stateline, OR/WA (03)	Erickson et al. 2003b	Erickson et al. 2004	Buffalo Mountain, TN (06)		Fiedler et al. 2007
Wild Horse, CA	Erickson et al. 2003d	Erickson et al. 2008	Buffalo Mountain, TN (00-03)		Nicholson 2003, 2005
Klondike III, OR		Gritski et al. 2009	Mount Storm, WV (08)		Young et al. 2009
Zintel, WA	Erickson et al. 2002a	Erickson et al. 2008	Buffalo Gap, TX		Tierney 2007
Nine Canyon, WA	Erickson et al. 2001b	Erickson et al. 2003c	Summerview, Alb. (05/06)		Brown and Hamilton 2006
Marengo II, WA		URS Corporation 2010b	Judith Gap, MT		TRC 2008
Biglow Canyon I, WA (09)		Enk et al. 2010	Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003c
Biglow Canyon I, WA (08)		Jeffrey et al. 2009	Foote Creek Rim, WY (Phase I; 00)		Young et al. 2003c
Combine Hills, OR	Young et al. 2003d	Young et al. 2006	Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003c

Table 11. Comparison of seasonal raptor use at other wind-energy facilities in the Midwestern region to the California Ridge Wind Farm.

	Raptor Use (# raptors/20-min survey)				
Site	**Fall**	**Winter**	**Spring**	**Summer**	**Reference**
California Ridge, IL	0.20	0.15	0.18	-	This study
Buffalo Ridge, MN	0.78	0.22	0.64	0.60	Johnson et al. 2000a
Black Fork, OH	0.13	-	0.26	-	Ecology and Environment 2009
Grand Ridge, IL	0.20	0.10	0.32	-	Derby et al. 2009
Buckeye Wind, OH	0.11	-	0.20	-	Stantec 2009

Table 12. Avian mortality associated with other wind-energy facilities in the Midwestern region.

Location	Per Megawatt Mortality Estimates	Source
Top of Iowa, IA	0.7	Jain 2005
Buffalo Ridge, MN	3.4	Johnson et al. 2000a, 2002b
Crescent Ridge, IL	0.6	Kerlinger et al. 2007
Kewaunee County, WI	2.0	Howe et al. 2002
Cedar Ridge, WI	6.55	BHE Environmental 2009
Blue Sky Green Field, WI	7.17	Gruver et al. 2009
Mean	**3.5**	

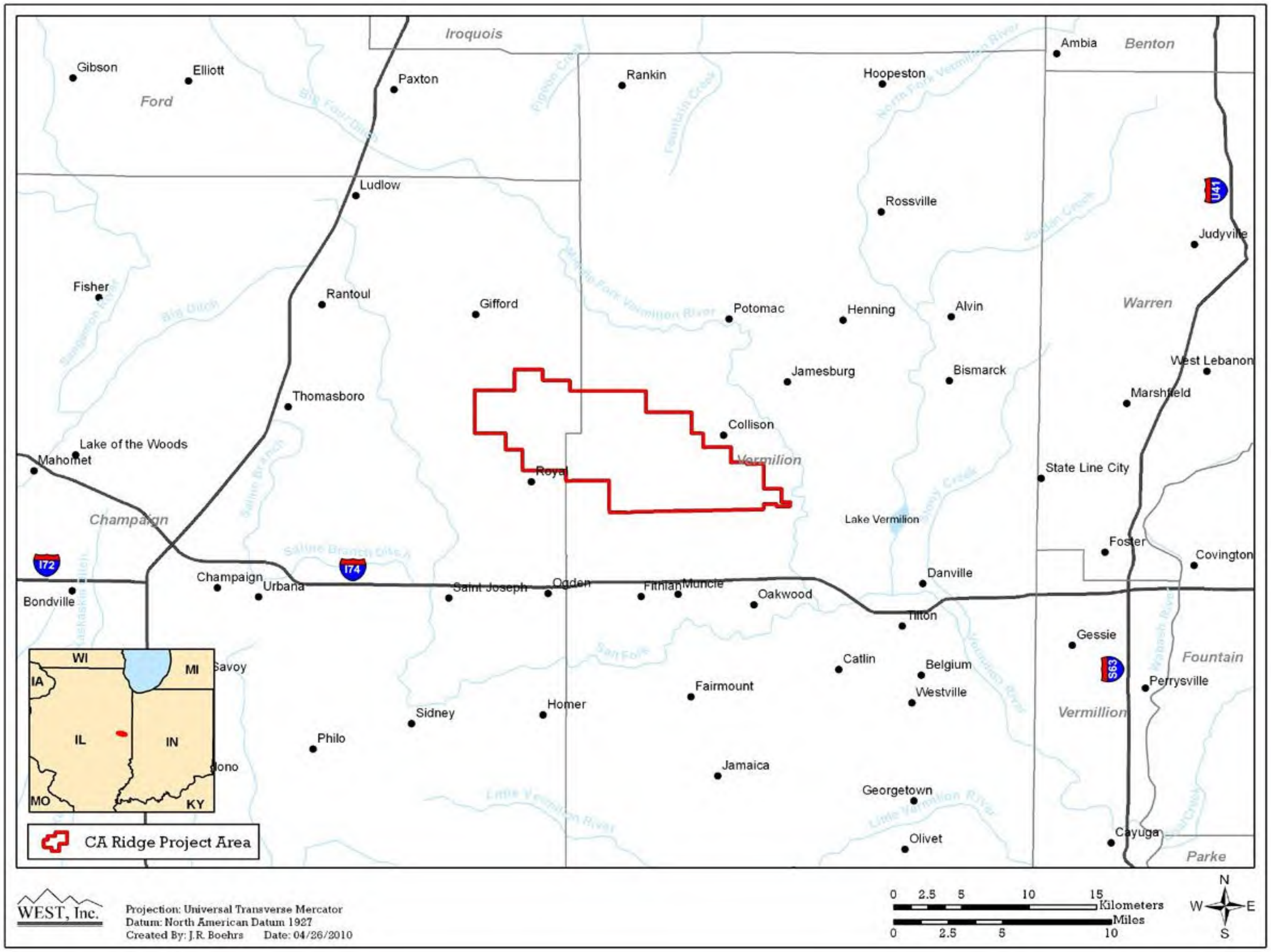


Figure 1. Location of the California Ridge Wind Farm.

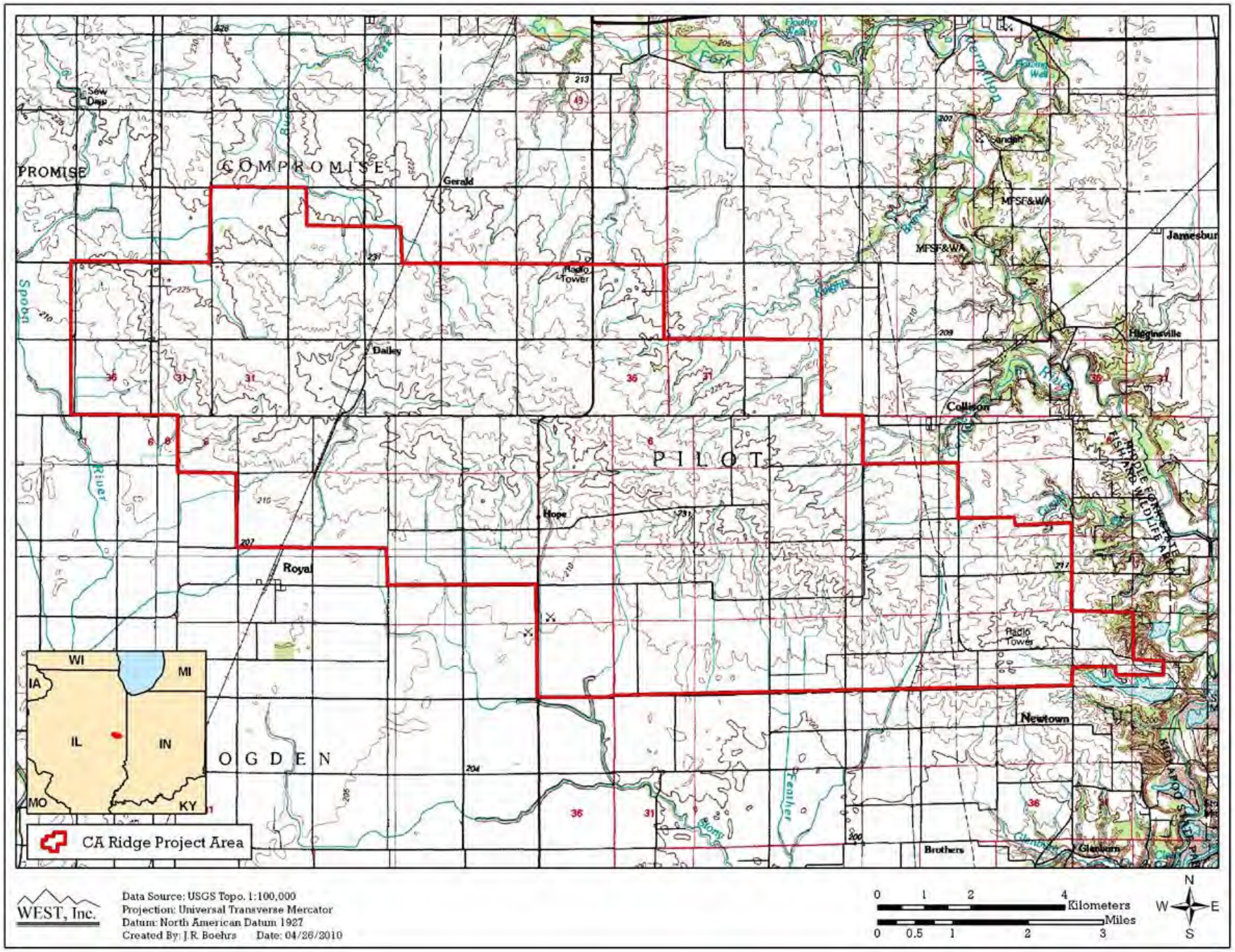


Figure 2. Overview of the California Ridge Wind Farm.

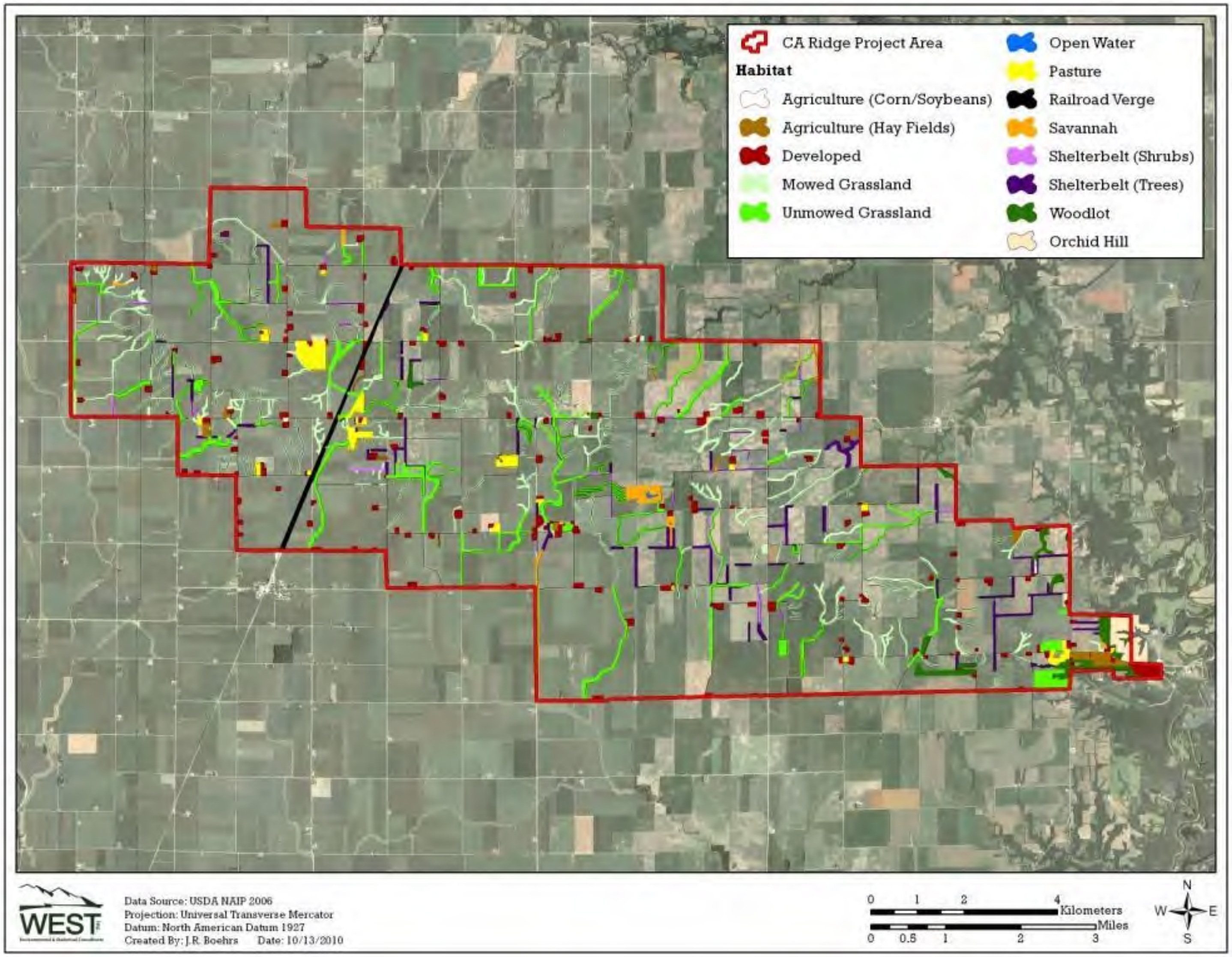


Figure 3. Habitat map of the California Ridge Wind Resource Area.

Figure 3. Habitat map of the California Ridge Wind Farm.

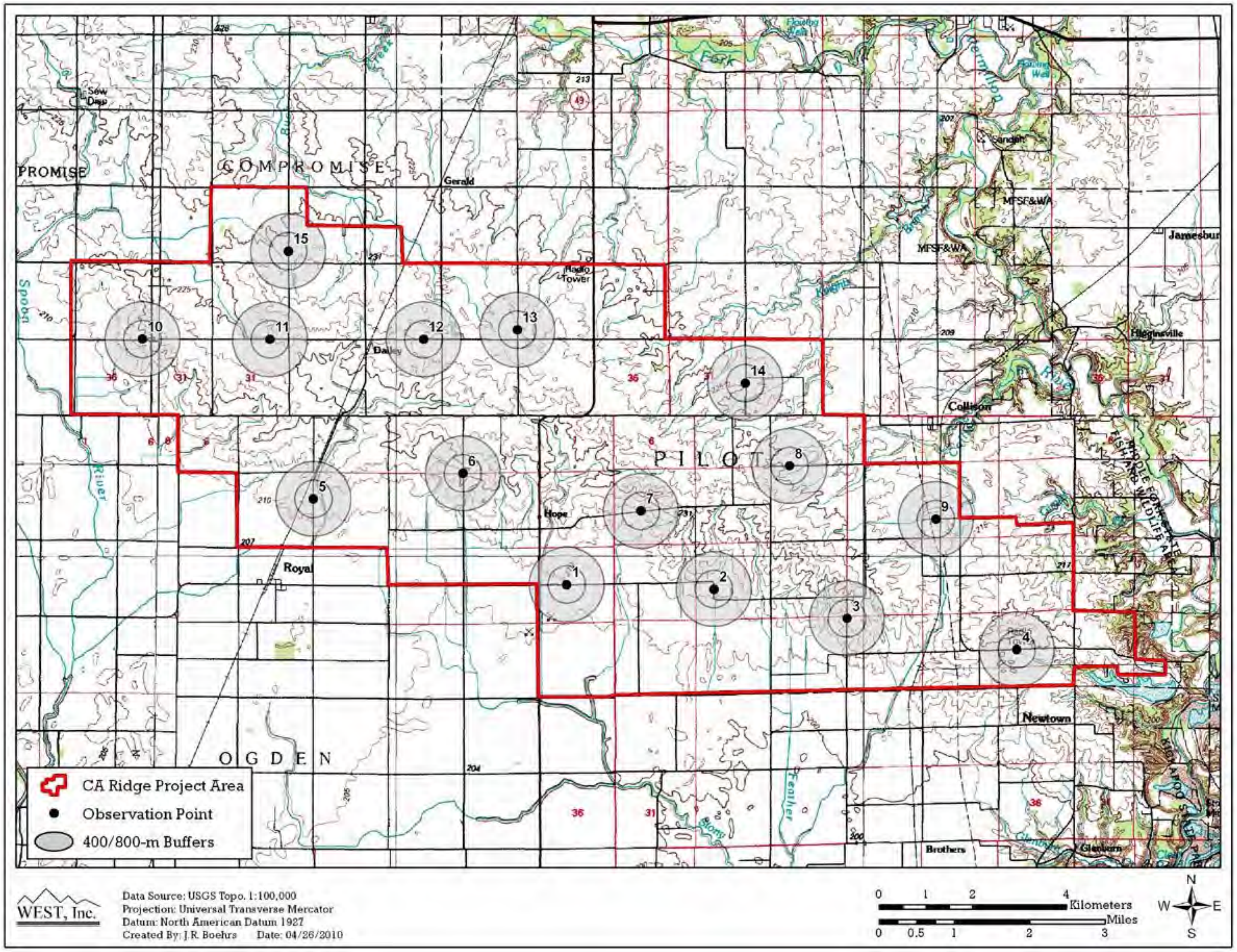
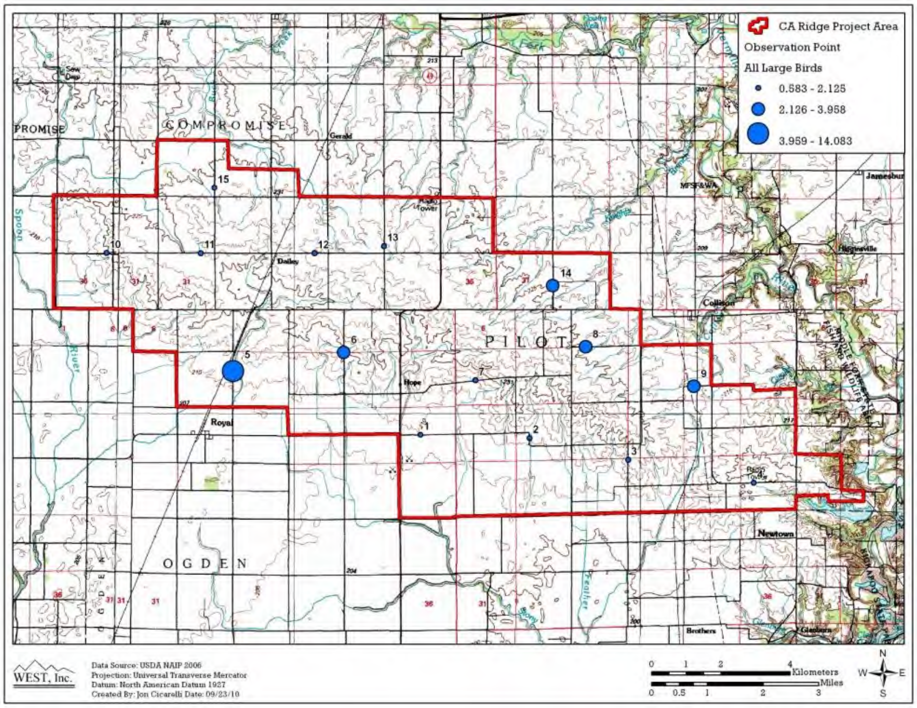


Figure 4. Fixed-point bird use survey points at the California Ridge Wind Farm.



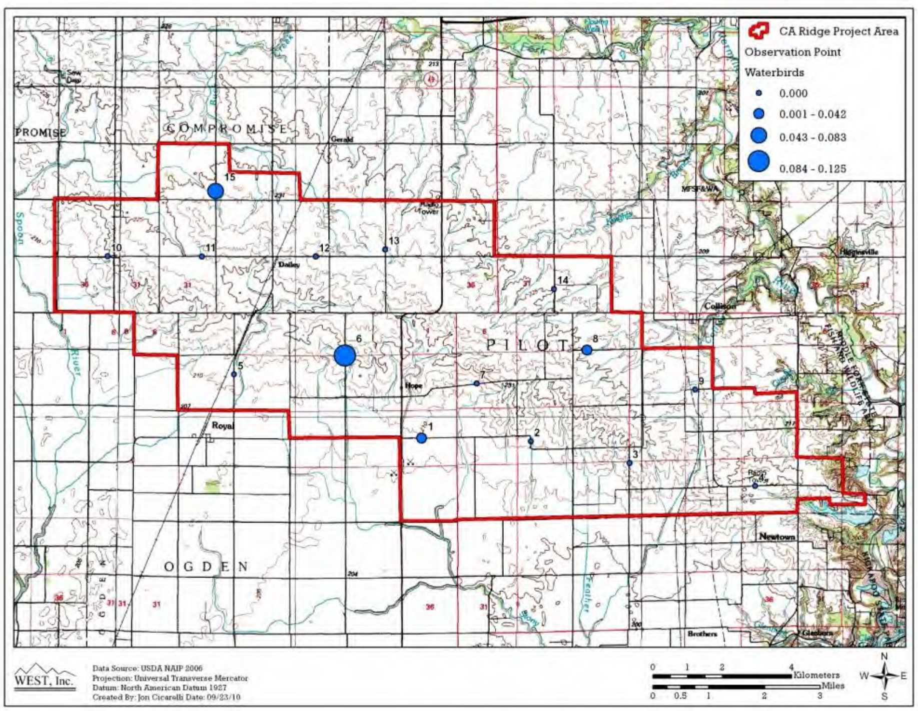
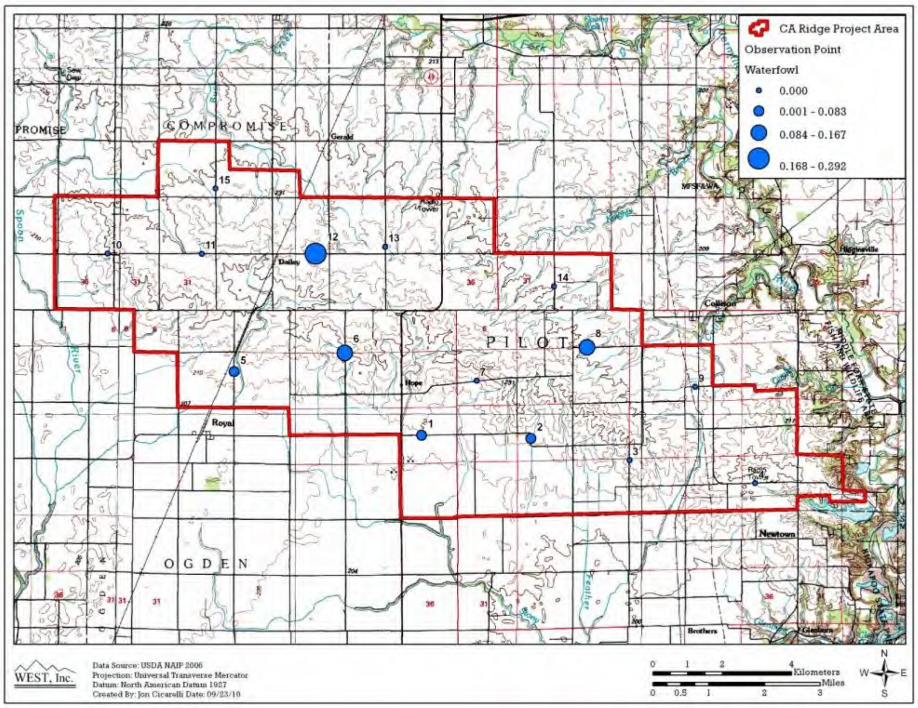


Figure 5. Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.



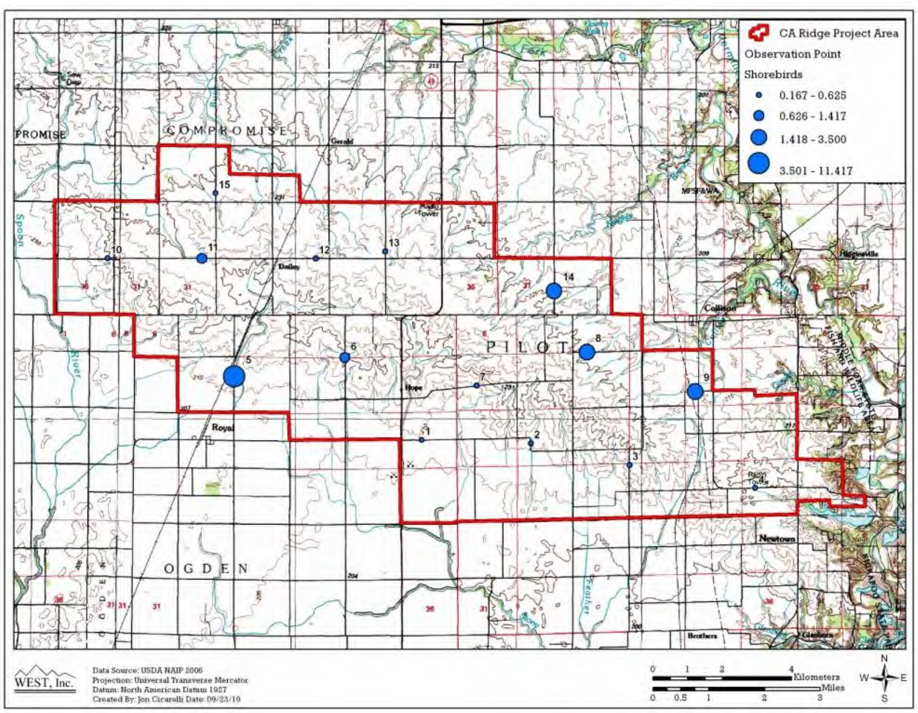
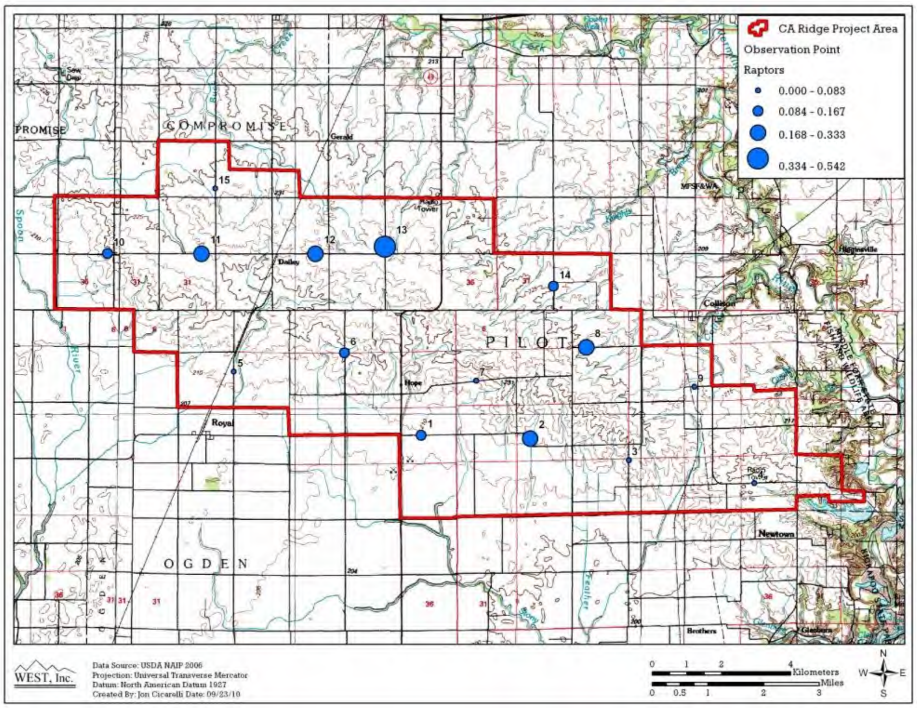


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.



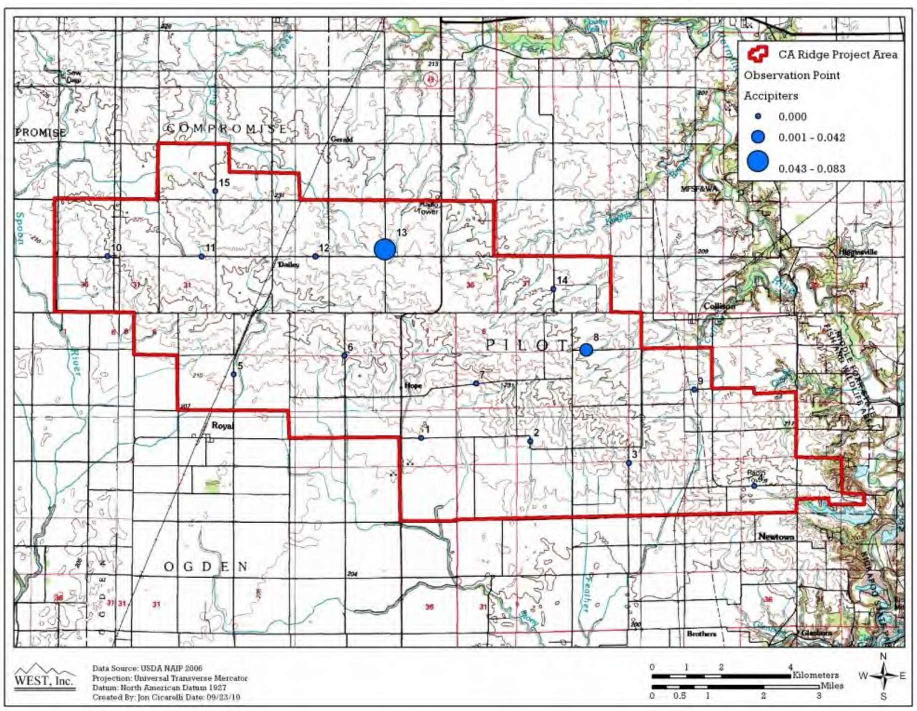
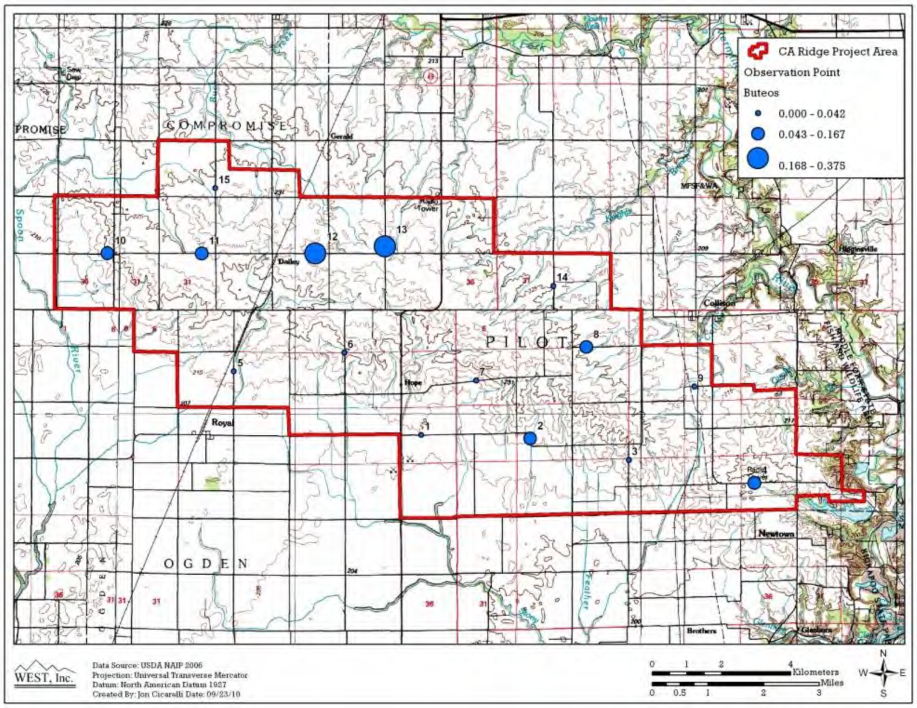


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.



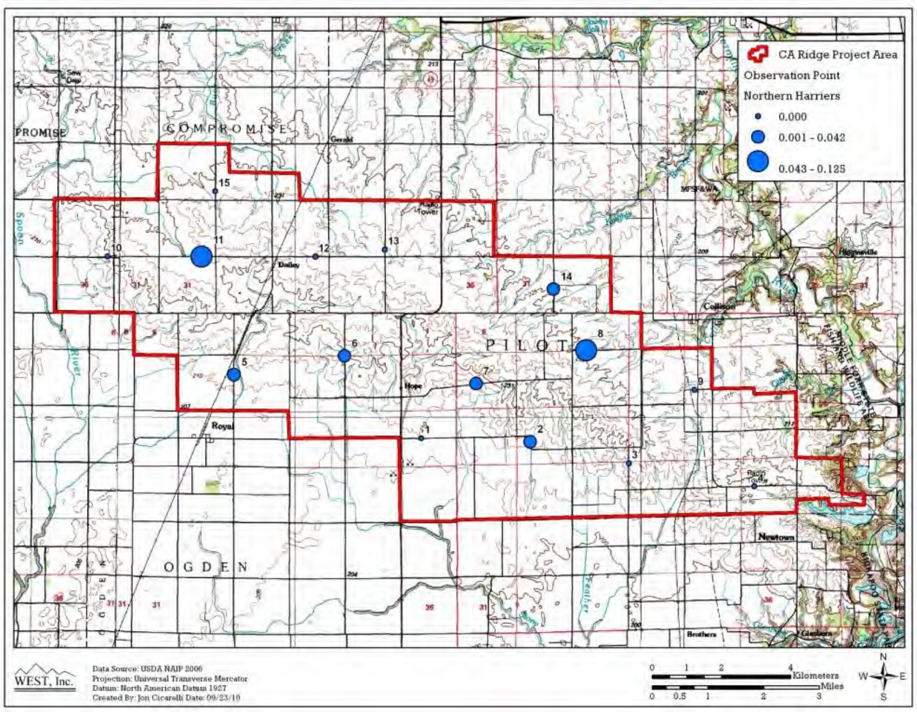
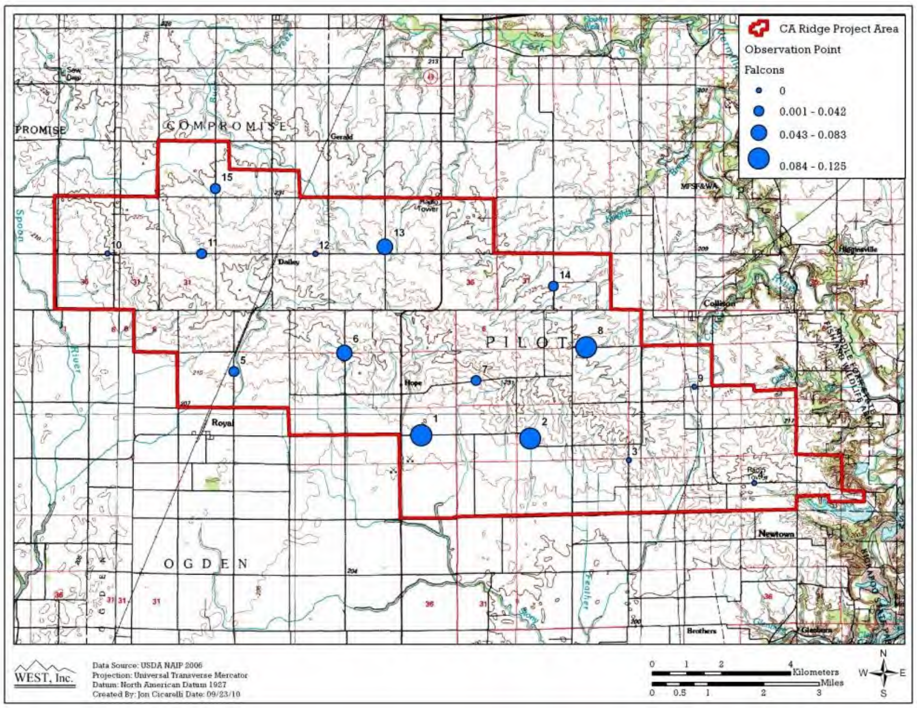


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.



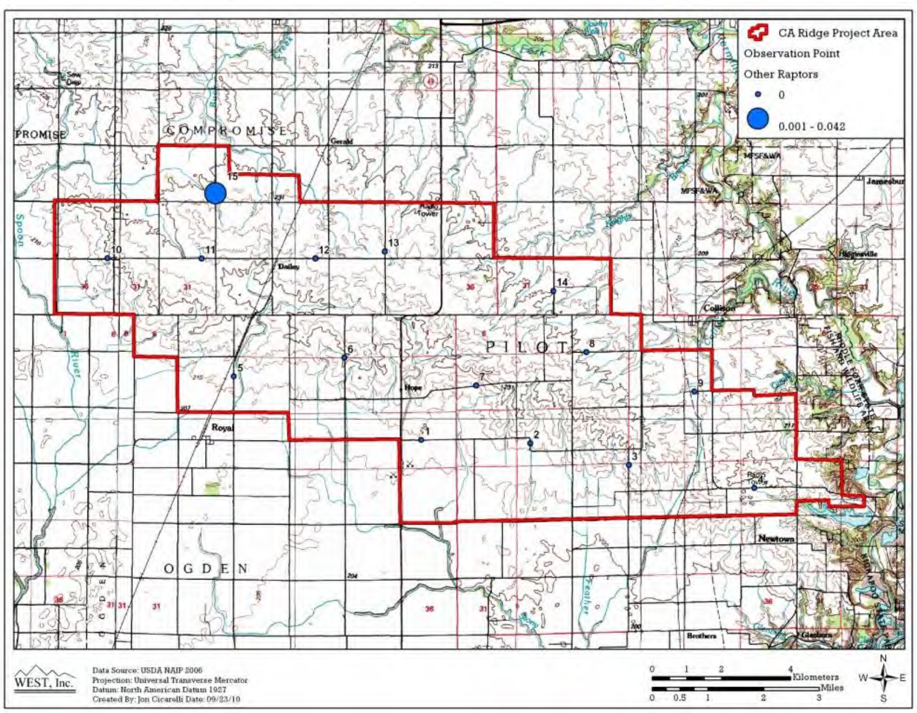
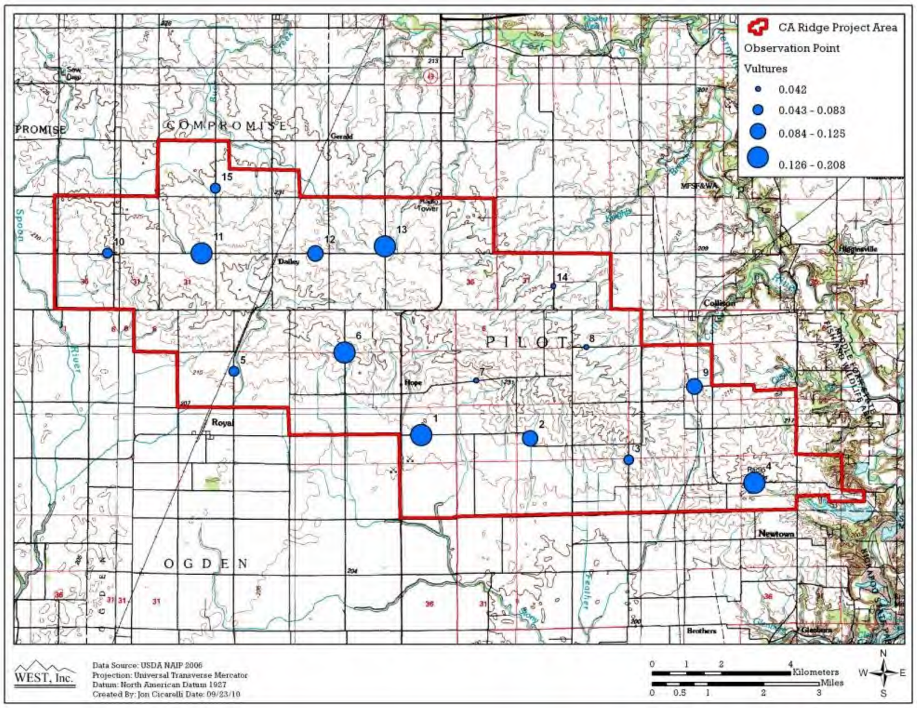


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.



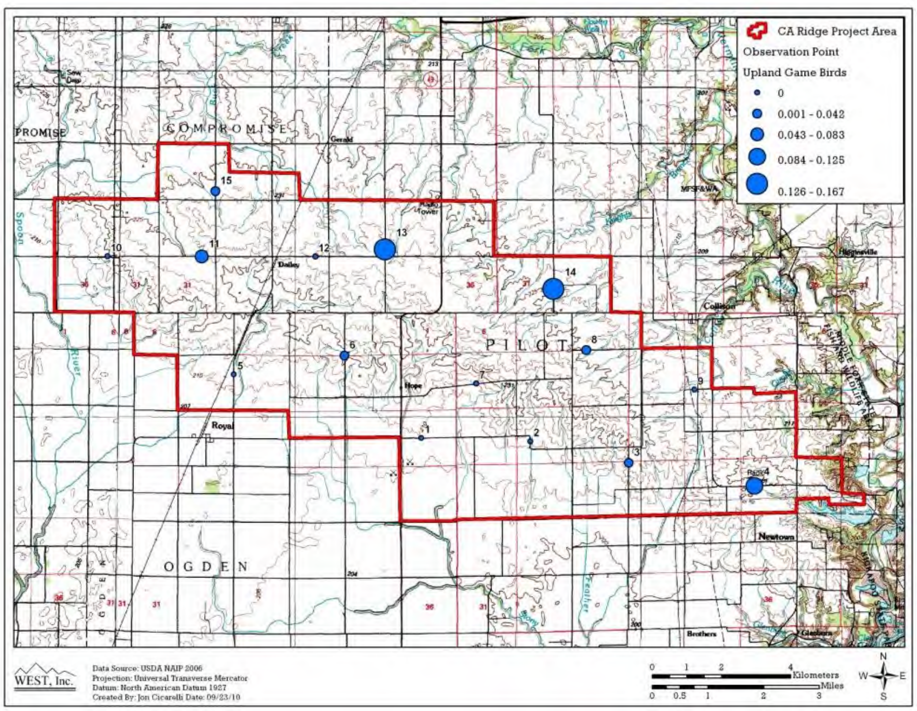


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm.

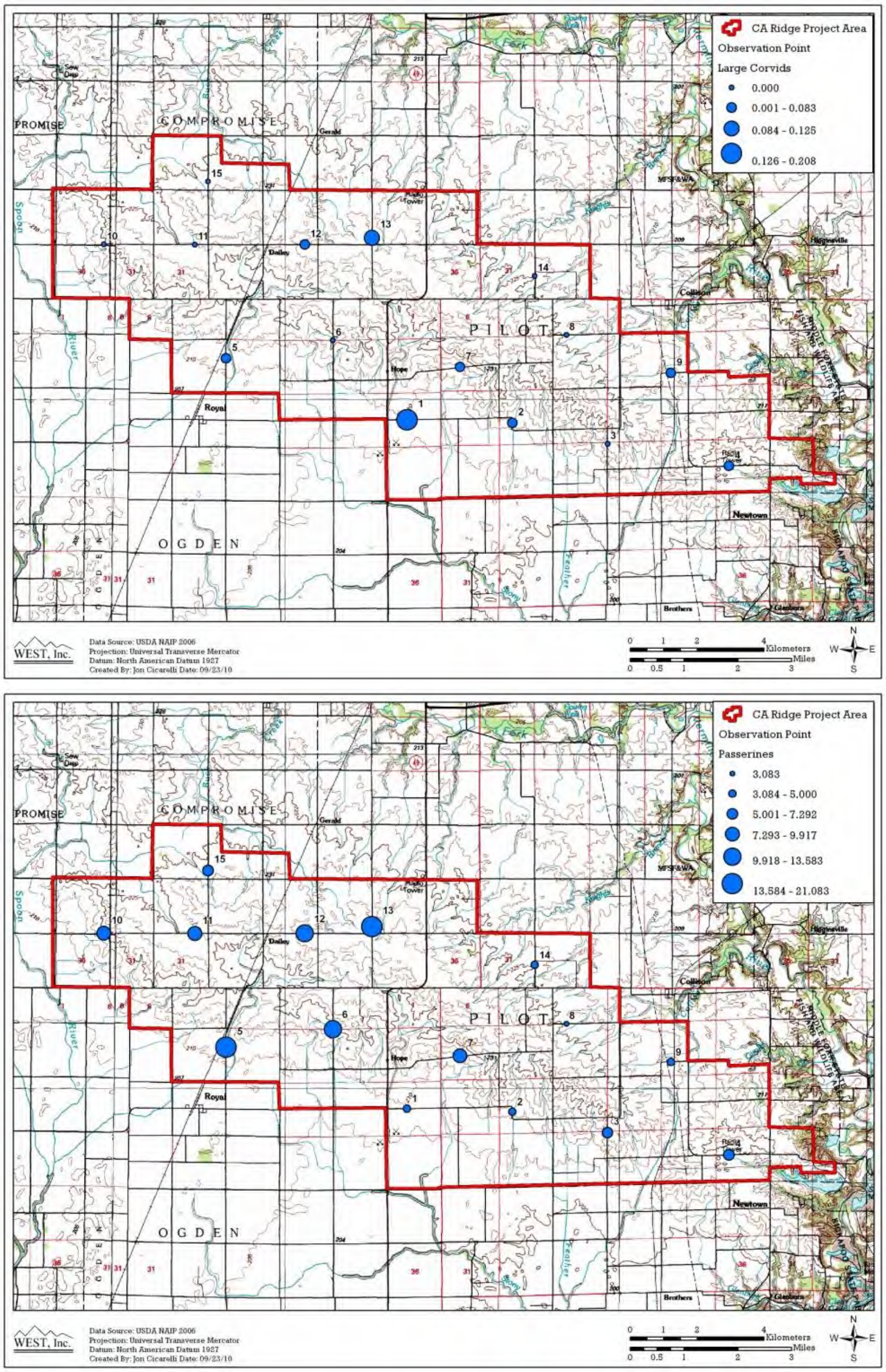


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use survey point for all birds, major bird types, and raptor subtypes at the California Ridge Wind Farm. Observations of passerines and other small birds were focused within 100-meter viewsheds.

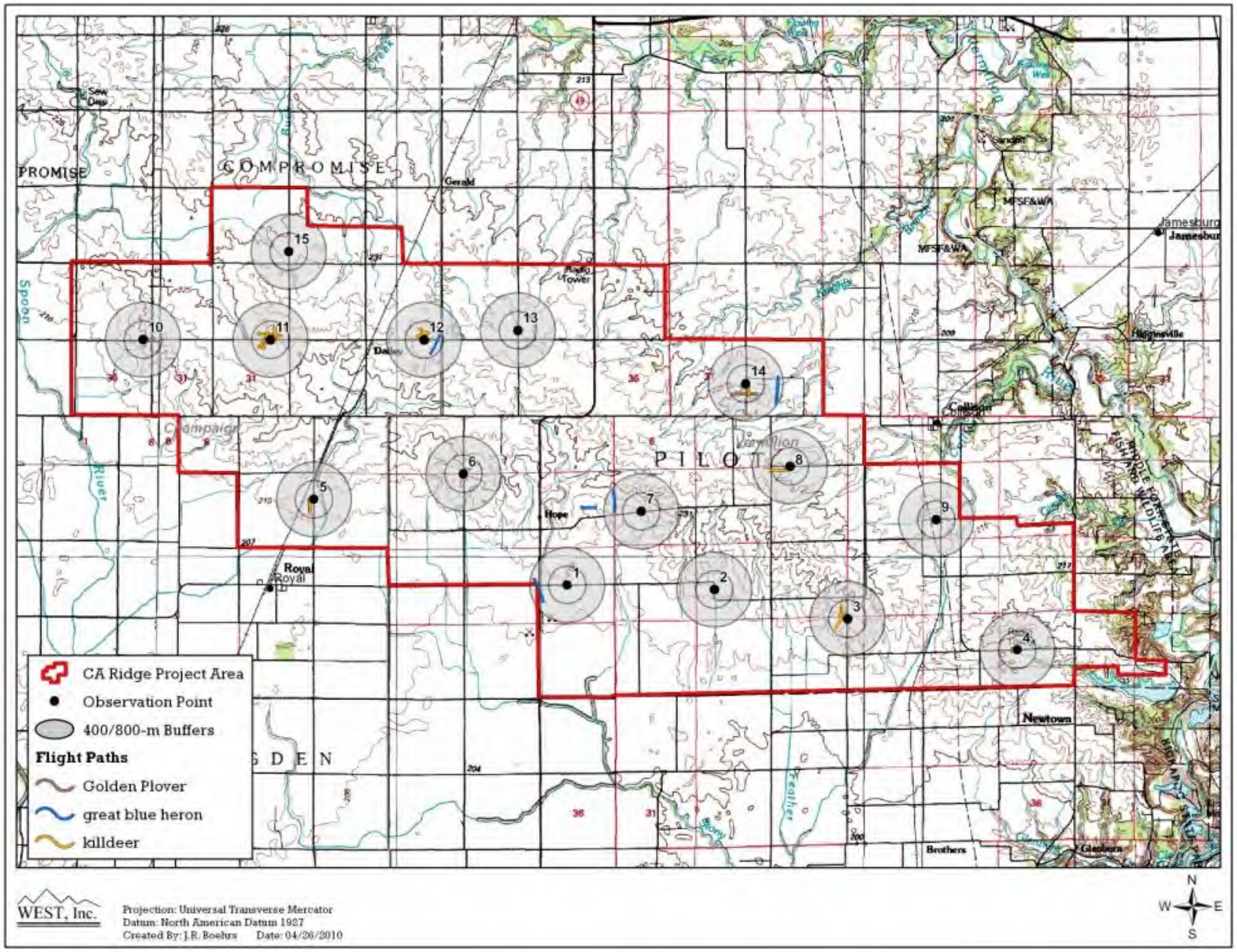


Figure 6a. Spatial use by flight paths of waterbirds and shorebirds at the California Ridge Wind Farm.

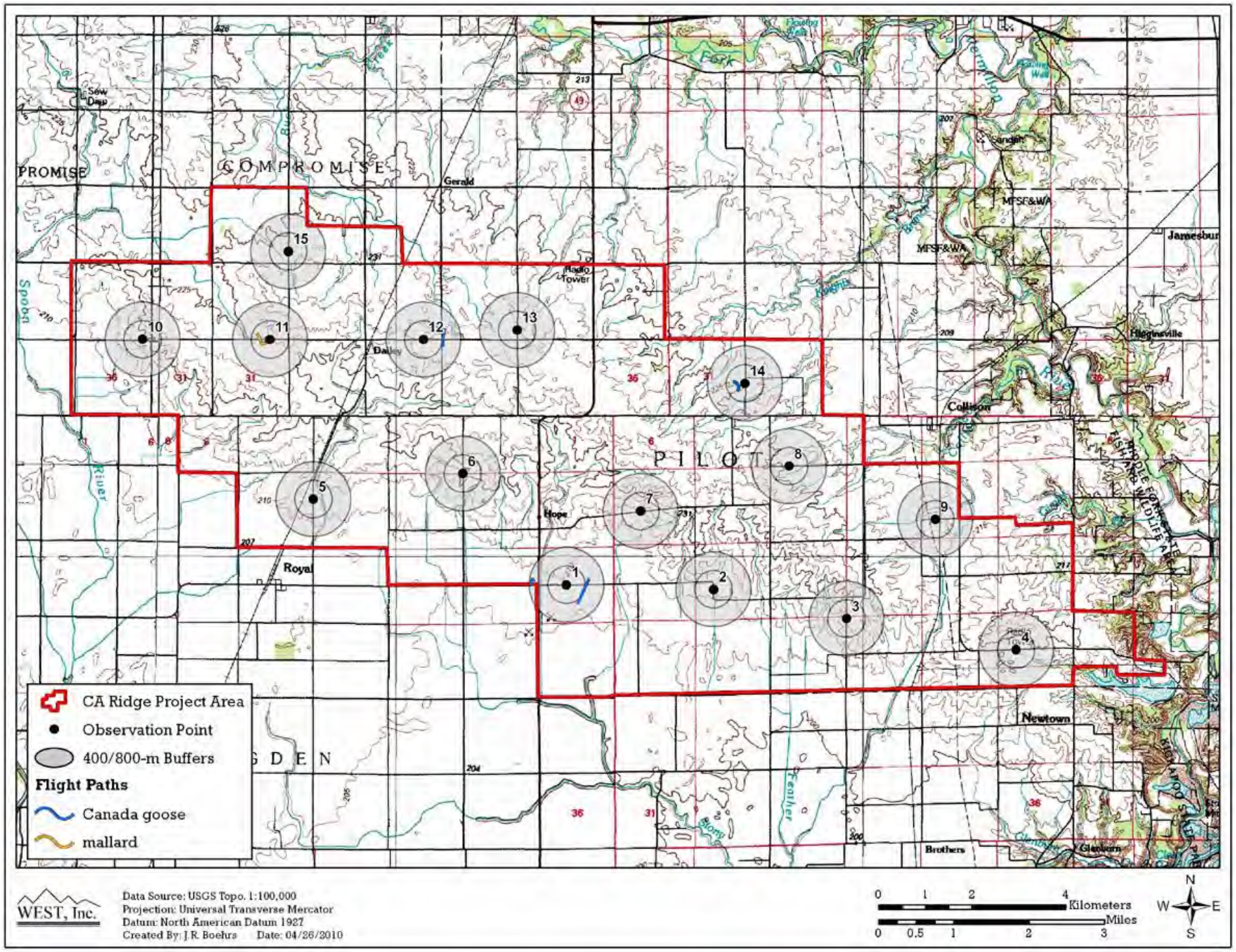


Figure 6b. Spatial use by flight paths of waterfowl at the California Ridge Wind Farm.

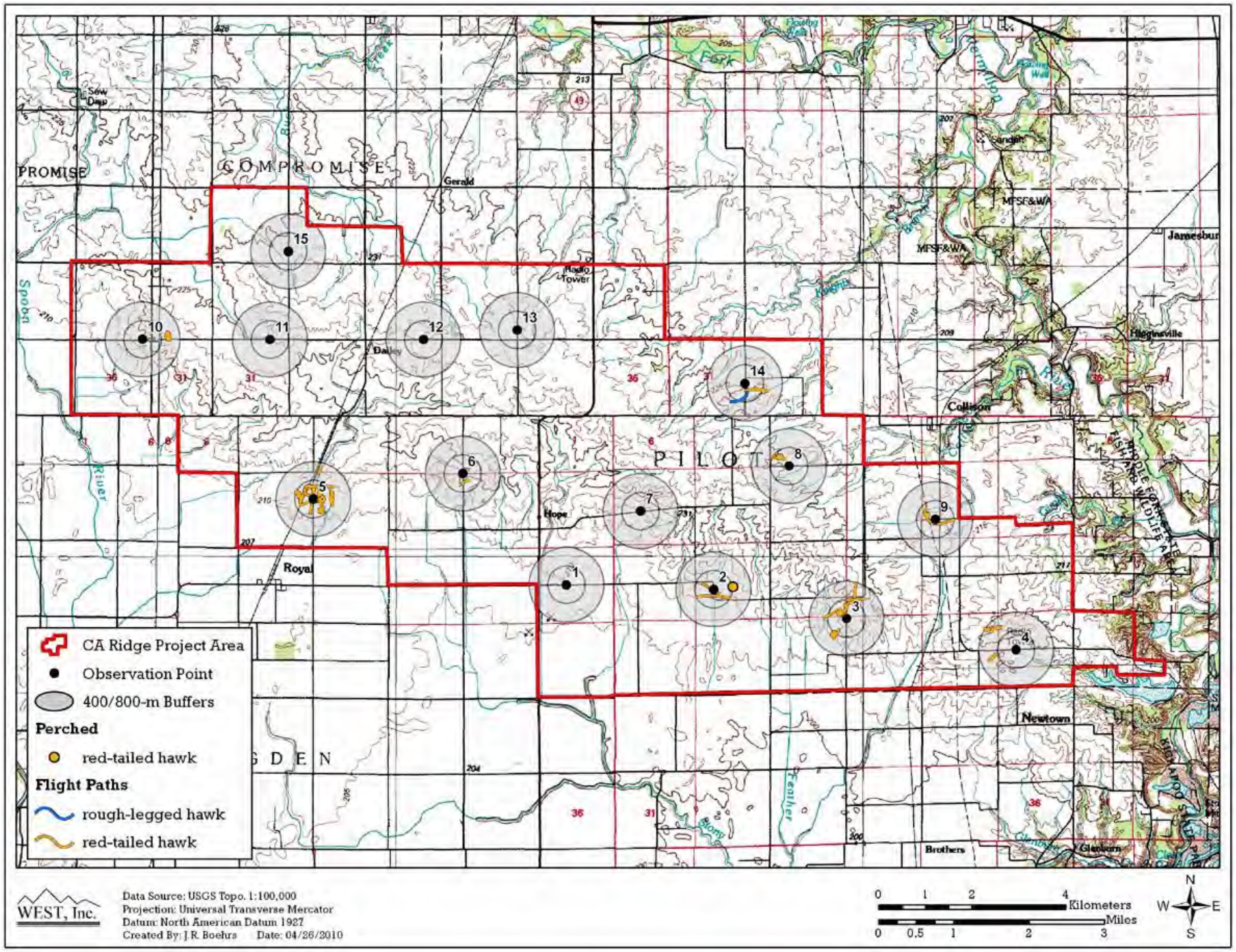


Figure 6c. Spatial use by flight paths of buteos at the California Ridge Wind Farm.

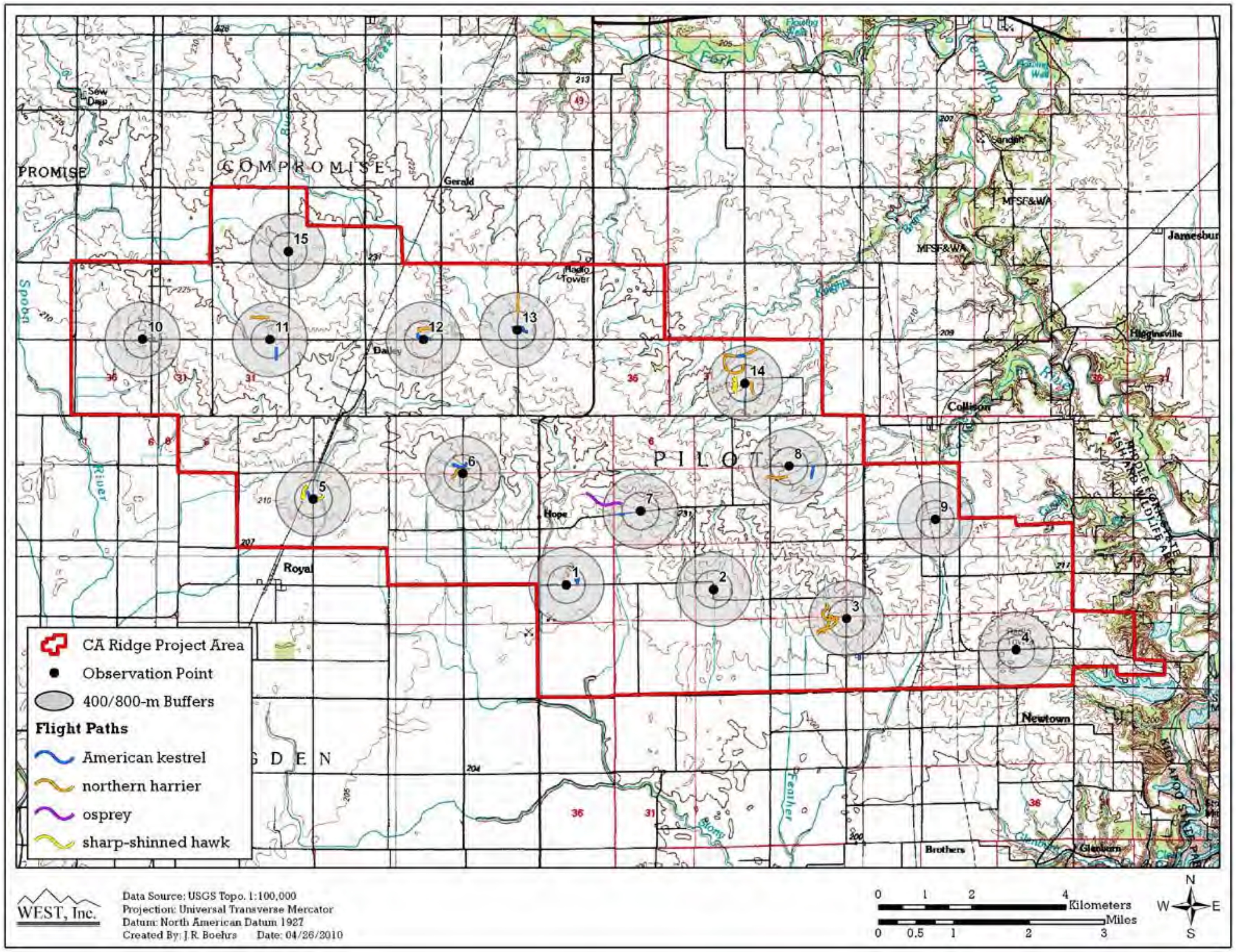


Figure 6d. Spatial use by flight paths of accipiters, falcons, harriers, and other raptor species at the California Ridge Wind Farm.

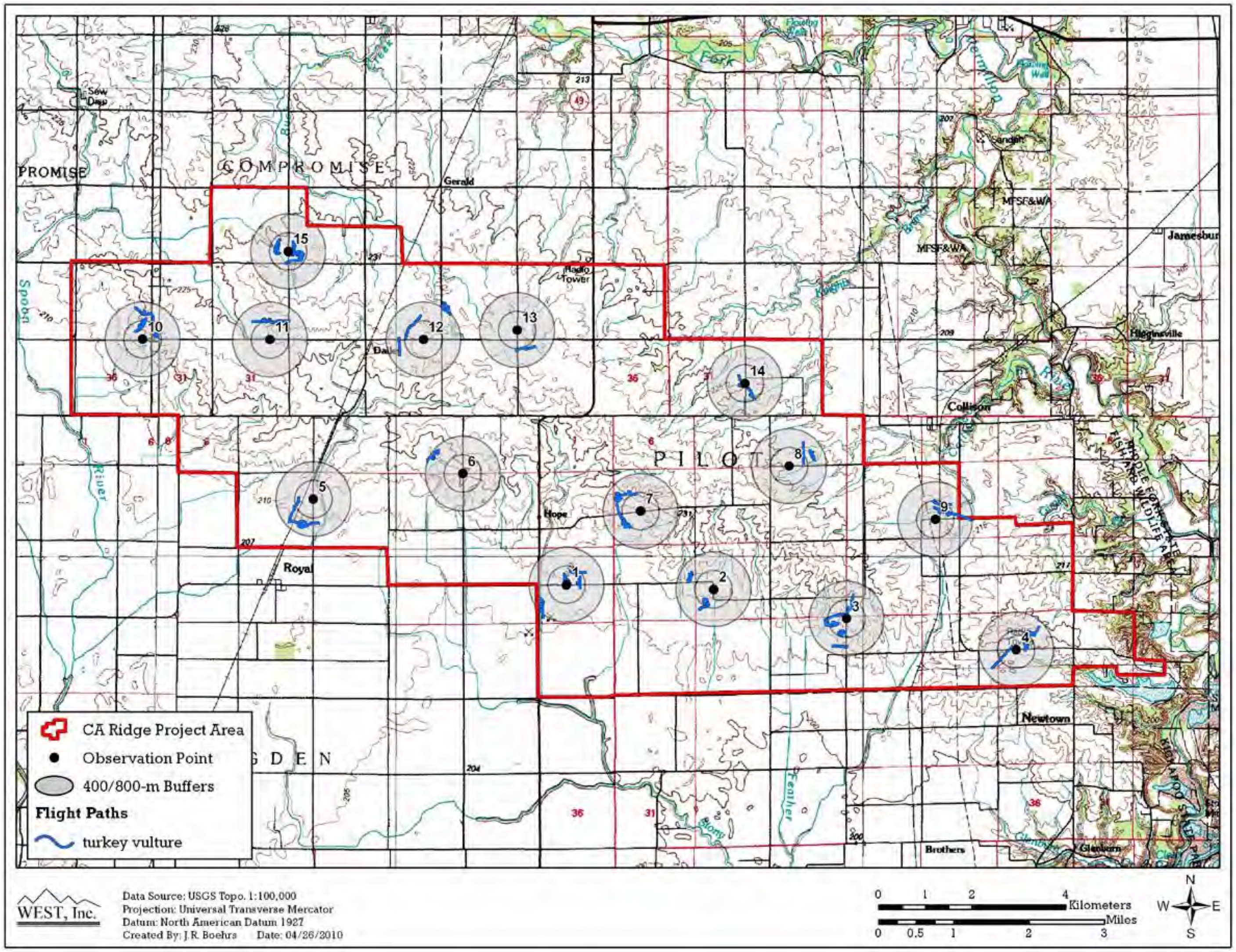
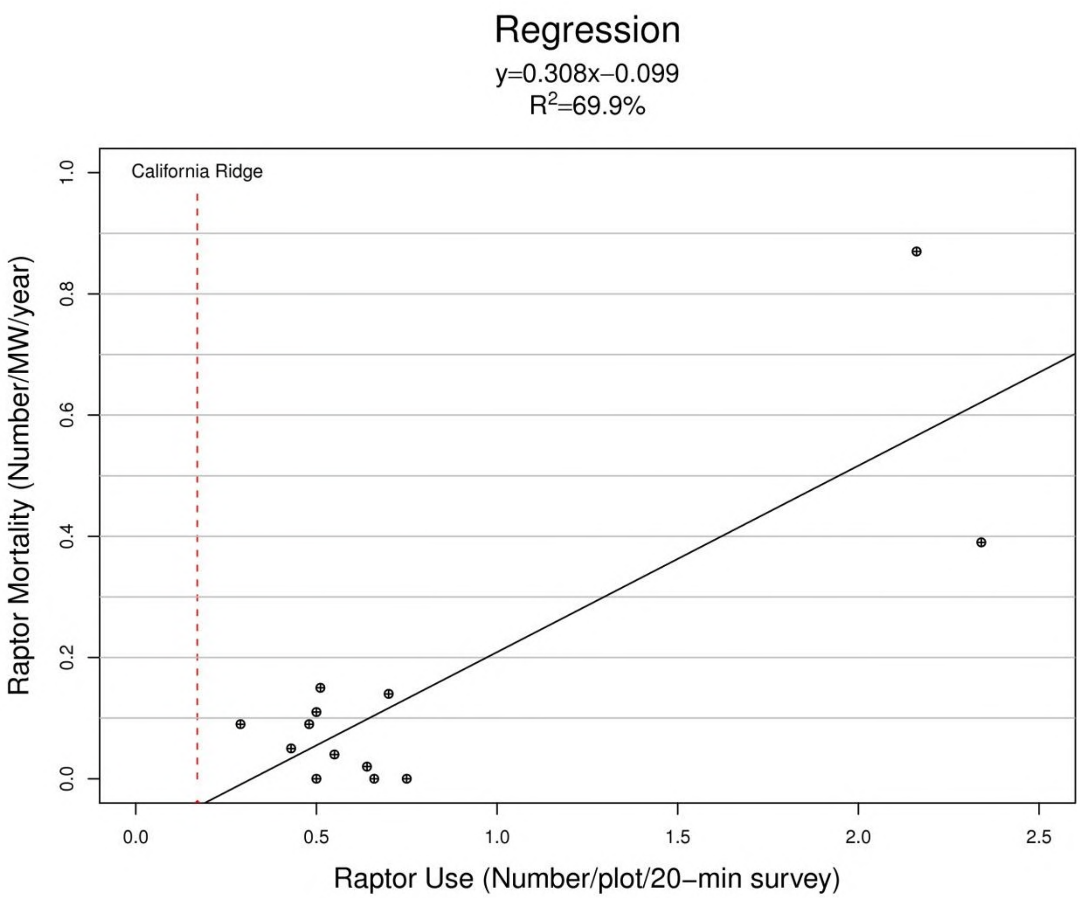


Figure 6e. Spatial use by flight paths of vultures at the California Ridge Wind Farm.



Overall Raptor Use 0.17
Predicted Fatality Rate 0 fatalities/MW/year
90.0% Prediction Interval (0, 0.22 fatalities/MW/year)

Figure 7. Regression analysis comparing raptor use estimations versus estimated raptor mortality.

Data from the following sources:

Study and Location	Raptor Use (birds/plot /20-min survey)	Source	Raptor Mortality (fatalities/MW/yr)	Source
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003d	0.00	Young et al. 2006
Diablo Winds, CA	2.16	WEST 2006	0.87	WEST 2008
Foote Creek Rim, WY	0.55	Johnson et al. 2000b	0.04	Young et al. 2003c
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Klondike, OR	0.50	Johnson et al. 2002a	0.00	Johnson et al. 2003
Stateline, WA/OR	0.48	Erickson et al. 2004	0.09	Erickson et al. 2002b
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2000
Wild Horse, WA	0.29	Erickson et al. 2003d	0.09	Erickson et al. 2008
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b
Bighorn, WA	0.51	Johnson and Erickson 2004	0.15	Kronner et al. 2008

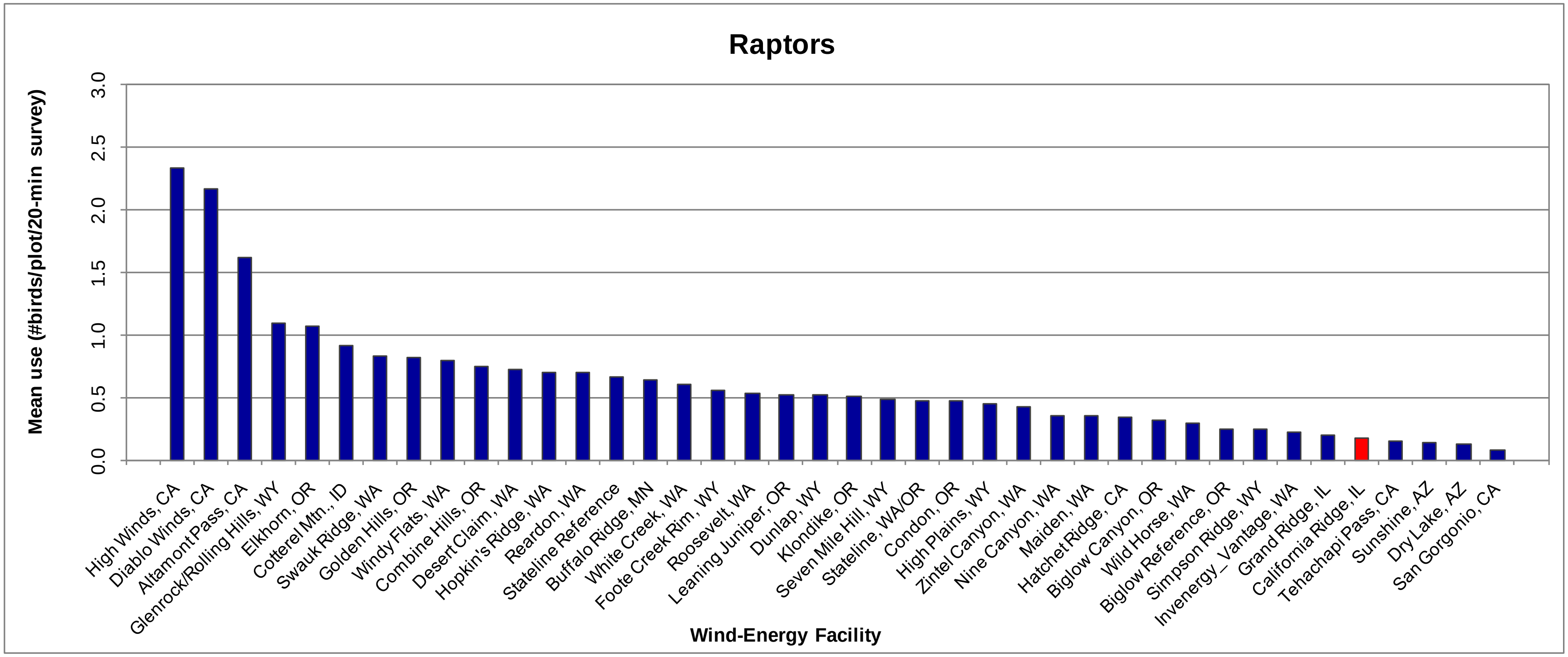


Figure 8. Comparison of annual raptor use between the California Ridge Wind Farm and other US wind-energy facilities.
Data from the following sources:

California Ridge, IL	This study.				
High Winds, CA	Kerlinger et al. 2005	Stateline Reference	URS et al. 2001	Nine Canyon, WA	Erickson et al. 2001b
Diablo Winds, CA	WEST 2006	Buffalo Ridge, MN	Erickson et al. 2002b	Maiden, WA	Erickson et al. 2002b
Altamont Pass, CA	Erickson et al. 2002b	White Creek, WA	NWC and WEST 2005	Hatchet Ridge, CA	Young et al. 2007b
Glenrock/Rolling Hills, WY	Johnson et al. 2008a	Foote Creek Rim, WY	Erickson et al. 2002b	Biglow Canyon, OR	WEST 2005c
Elkhorn, OR	WEST 2005a	Roosevelt, WA	NWC and WEST 2004	Wild Horse, WA	Erickson et al. 2003d
Cotterel Mtn., ID	BLM 2006	Leaning Juniper, OR	Kronner et al. 2005	Biglow Reference, OR	WEST 2005c
Swauk Ridge, WA	Erickson et al. 2003a	Dunlap, WY	Johnson et al. 2009a	Simpson Ridge, WY	Johnson et al. 2000b
Golden Hills, OR	Jeffrey et al. 2008	Klondike, OR	Johnson et al. 2002a	Invenergy_Vantage, WA	WEST 2007
Windy Flats, WA	Johnson et al. 2007	Seven Mile Hill, WY	Johnson et al. 2008b	Grand Ridge, IL	Derby et al. 2009
Combine Hills, OR	Young et al. 2003d	Stateline, WA/OR	Erickson et al. 2002b	Tehachapi Pass, CA	Erickson et al. 2002b
Desert Claim, WA	Young et al. 2003b	Condon, OR	Erickson et al. 2002b	Sunshine, AZ	WEST and the CPRS 2006
Hopkin's Ridge, WA	Young et al. 2003a	High Plains, WY	Johnson et al. 2009b	Dry Lake, AZ	Young et al. 2007c
Reardon, WA	WEST 2005b	Zintel Canyon, WA	Erickson et al. 2002a	San Gorgonio, CA	Erickson et al. 2002b

Appendix D. Post-Construction Survey Reports

Post-construction Monitoring and American Golden-Plover Report for the California Ridge I Wind Energy Project

Spring 2013

Prepared for:

Invenergy LLC

Prepared by:

Jason P. Ritzert, Rhett Good, and Michelle Ritzert

Western EcoSystems Technology, Inc.
408 West 6th Street
Bloomington, Indiana 47403

December 13, 2013

WEST Inc.

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Andrea Palochak	Technical Editor

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The California Ridge I Wind Energy Project (the Project) in Champaign and Vermilion Counties, Illinois is owned by California Ridge Wind Energy LLC and consists of 134 1.6 megawatt (MW) turbines. Western EcoSystems Technology, Inc. (WEST) was contracted to conduct post-construction carcass monitoring and American Golden-Plover (*Pluvialis dominica*; AMGP) surveys. This memo presents the methods and results of the carcass and AMGP monitoring surveys conducted between April 15 and May 20, 2013.

2.0 METHODS

2.1 Carcass Monitoring

Carcass searches were conducted per the methods outlined in the ABPP (California Ridge Wind Energy LLC 2011). Due to an observation of AMGP during the AMGP surveys within the Project, carcass surveys were conducted twice weekly during the study period (California Ridge Wind Energy LLC 2011). Thirty of the 134 turbines were monitored using 78 meter (m) x 78 m (256 feet [ft] x 256 ft) square plots centered on the turbine. Within each plot, 13 transects were spaced at approximately six m intervals and searchers walked at a rate of 45 to 60 m per minute (about 148 to 197 ft per minute) scanning the ground out to three m (10 ft) on either side of the transect for casualties.

All bird and bat carcasses located within search plots, regardless of species, were recorded. Total number of carcasses were estimated by adjusting for search frequency, removal bias (length of stay in the field), area searched, and searcher efficiency bias (percent found).

One searcher efficiency trial and one carcass removal trial was conducted. Trials were conducted using large bird carcasses (rock pigeon [*Columba livia*]), small bird carcasses (northern bobwhite [*Colinus virginianus*]), and brown mice carcasses (*Mus* or *Peromyscus* spp.) to substitute for bat carcasses. Trial bird carcasses were placed at search turbines by a biologist not involved in the carcass searches. Carcasses were placed at predetermined randomly selected points (random azimuth and distance from the turbine) within any given turbine's searchable area. Searchers had no knowledge of the number, placement, or timing of bias trial carcasses.

Data recorded for each trial carcass at the time of placement included date of placement, species, turbine number, and the distance to and direction from the turbine. Carcasses were identified as bias trial carcasses through the placement of small, inconspicuous black zip ties on the birds' legs. Carcasses were checked by a biologist not involved in the search effort, prior to the first day of a scheduled search to track availability and removal rates. The first day the carcass was discovered by the searcher was recorded.

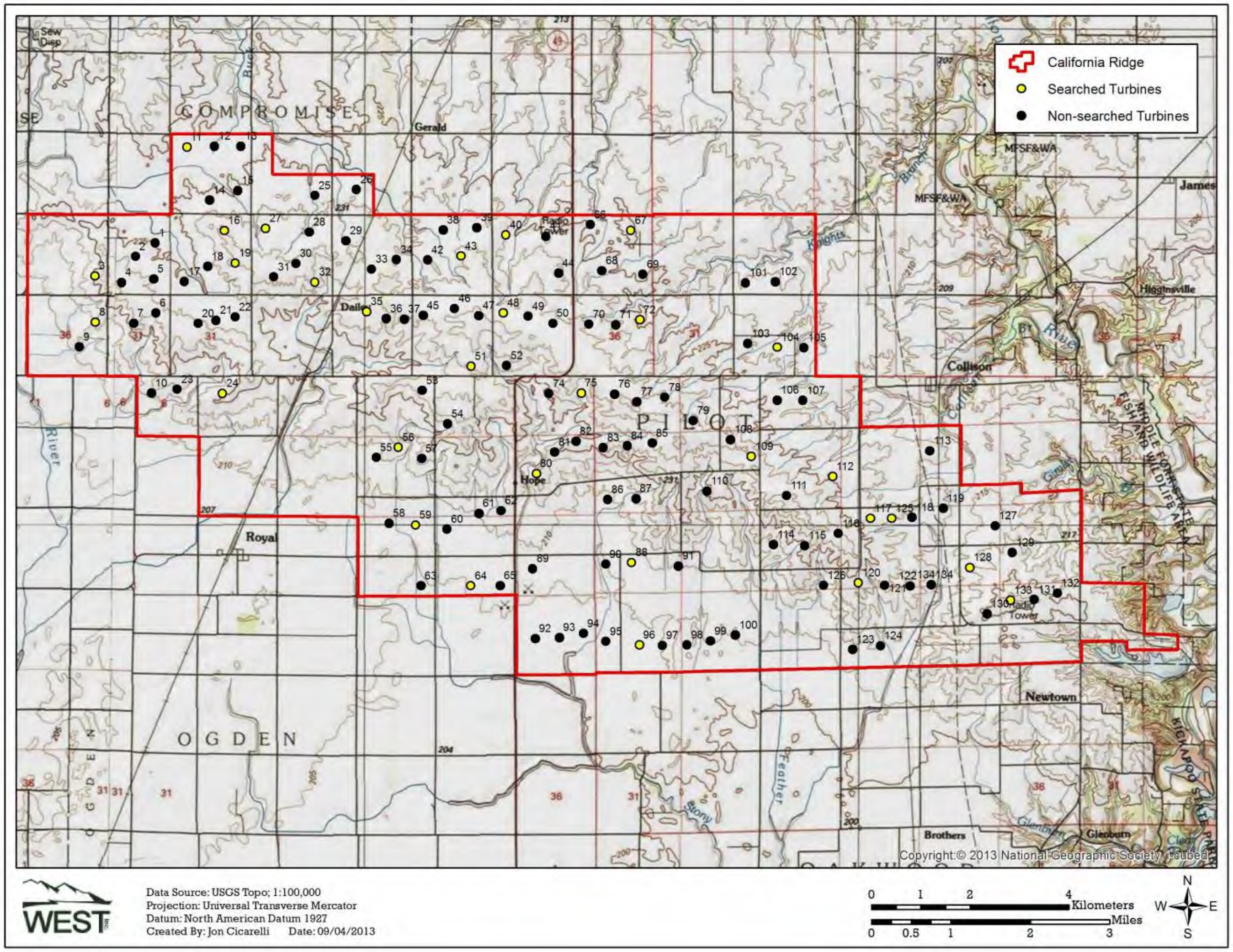

Figure 1. Turbine and search plot locations of the California Ridge I Wind Energy Project.

Carcasses were checked on days one through seven, then on days 10, 14, 20, and 30. Each carcass was left in the field until removed by a scavenger, until it became decomposed such that is was beyond recognition, or for a maximum of 30 days; at which time the number of days after placement until removal, decomposition, or the end of the trial period was recorded.

2.2 American Golden-Plover Monitoring

The AMGP migration monitoring surveys followed methods outlined in the ABPP (California Ridge Wind Energy LLC 2011). Surveys were conducted from April 1 to May 20, 2013, which coincides with the peak spring migration stopover period for AMGPs in the upper Midwest.

Four survey transects were established that bisected the Project area with two transects following north-south roads and the other four following east-west roads (Figure 2). Surveys were conducted four days per week. Surveys began at 0800 am, and ended when all transects were completed. Observers drove transects at approximately 15-20 mph (6.7-8.9 m/s) while looking for plovers on both sides of the road and stopped at observations points spaced approximately one mile (1.6 km) apart. Stops lasted for no more than three minutes if no plovers were observed and no unplanned stops were made unless plovers were observed.

Data collected for all individuals and flocks detected during surveys included: date, time, location, habitat, weather conditions, number of individuals observed, behavior (e.g. resting, feeding, etc.), flight height, and direction of flight. If AMGPs were observed during a transect survey, observers spent approximately 30 minutes collecting additional data on plover behavior and flight height/direction at up to two observation locations per day. Weather conditions (e.g. temperature, wind speed, cloud cover) were also recorded at the beginning and end of each transect survey.

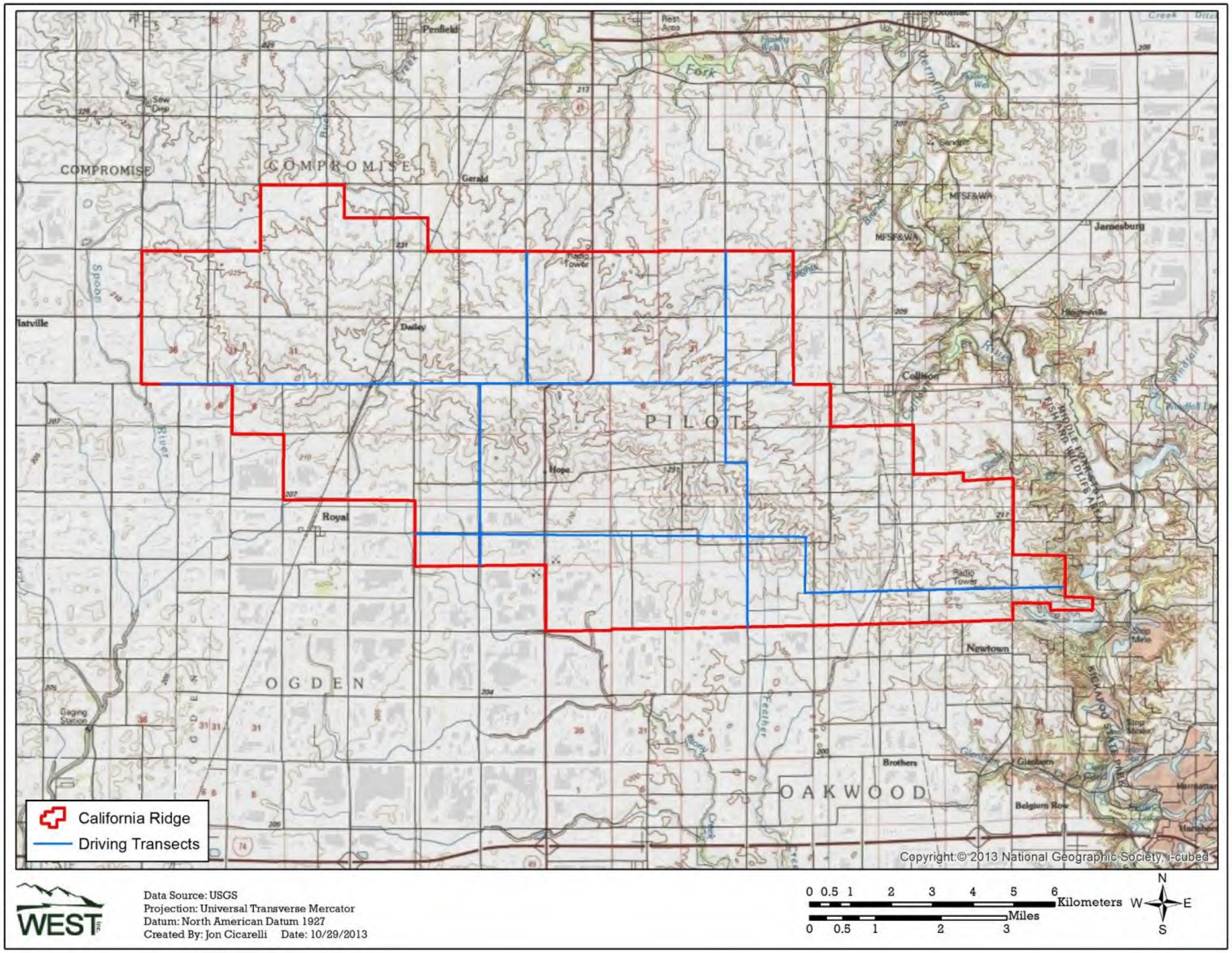

Figure 2. Location of American Golden-Plover transects within the California Ridge I Wind Energy Project.

2.3 Statistical Analysis

2.3.1 Carcass Monitoring

Statistical methods for estimating mortality rates were based on:

1. Observed number of bat and bird carcasses found during standardized searches during the monitoring period;
2. Searcher efficiency; and
3. Scavenger removal rates.

2.3.2 Definition of Variables

The following variables were used in the equations below:

c_i the number of carcasses detected at plot *i* for the entire study period

n the number of search plots

$\bar{c}$ the average number of carcasses observed per turbine per monitoring period

s the number of carcasses used in the carcass removal trials

s_c the number of carcasses in the carcass removal trials that remained in the study area at Day 30

t_i the time (in days) a carcass remained in the study area before it was removed, as determined by the carcass removal trials

$\bar{t}$ the average time (in days) a carcass remained in the study area before it was removed, as determined by the carcass removal trials

d the total number of carcasses placed in the searcher efficiency trials

p the estimated proportion of detectable carcasses found by observers, as determined by the searcher efficiency trials

I the average interval between standardized fatality searches, in days

$\hat{\pi}$ the estimated probability that a fatality was both available to be found during a search and was found, as determined by the carcass removal trials and the searcher efficiency trials (i.e., detection probability)

m the estimated annual average number of carcasses per turbine per year, adjusted for carcass removal and searcher efficiency bias

2.3.3 Observed Number of Fatalities

The estimated average number of fatalities ($\bar{c}$) observed per turbine per monitoring period was:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{n} \qquad (1)$$

2.3.4 Estimation of Carcass Non-Removal Rates

Estimates of carcass non-removal rates were used to adjust carcass counts for carcass removal bias. Mean carcass removal time ($\bar{t}$) was the average length of time a carcass remained in the study area before it was removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c} \qquad (2)$$

2.3.5 Estimation of Searcher Efficiency Rates

Searcher efficiency rates were expressed as *p,* the proportion of trial carcasses that were detected by observers in the searcher efficiency trials. These rates were estimated by carcass size and season.

2.3.6 Estimation of Facility-Related Fatality Rates

The estimated per turbine fatality rate (*m*) was calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}} \qquad m = \qquad (3)$$

where $\hat{\pi}$ included adjustments for carcass removal (from scavenging and other means) and searcher efficiency bias.

This formula has been independently verified by Shoenfeld (2004). The final reported estimates of *m* were calculated according to the formula above. Associated standard errors and 90 percent confidence intervals were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating variances, and confidence intervals for complicated test statistics. For each bootstrap sample, $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and *m* were calculated. A total of 1,000 bootstrap samples were used for each estimate. The standard deviation of the bootstrap estimates was reported as the estimated standard error. The lower fifth and upper ninety-fifth percentiles of the 1,000 bootstrap estimates were taken as estimates of the lower limit and upper limit of the 90 percent confidence intervals.

2.3.7 American Golden-Plover Monitoring

AMGP observations were used to determine the dates during which plovers were present in the Project area. The locations and number of birds for each observation were recorded to determine areas of plover use within the Project. Habitat characteristics recorded at each observation and at the observation points were analyzed to assess plover selection of different habitats within the Project area. Behavioral observation data was analyzed to determine flight paths between areas of use, average flight heights within the Project, and time spent flying in the rotor swept height (RSH) for turbines by plovers. The flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height.

3.0 RESULTS

3.1 Carcass Monitoring

A total of 238 turbine searches was conducted from April 15 to May 10, 2013. Eight carcasses (two birds and six bats) were found during surveys and no carcasses were found incidentally (Table 1). One yellow-bellied sapsucker (*Sphyrapicus varius*) was found on April 15, 2013 at turbine 56 and one red-tailed hawk (*Buteo jamaicensis*) was found on April 26, 2013 at turbine 125. The yellow-bellied sapsucker was found between 10 and 20 meters from the turbine, and the red-tailed hawk between 30 and 40 meters (Table 2).

Table 1. Total number of bird and bat casualties and the composition of casualties discovered at the California Ridge I Wind Energy Project from April 15 to May 10, 2013.

	Fatalities during Scheduled Searches		Total	
Species	**Total**	**% Comp.**	**Total**	**% Comp.**
Birds				
red-tailed hawk	1	50.0	1	50.0
yellow-bellied sapsucker	1	50.0	1	50.0
Overall Birds	2	100	2	100
Bats				
hoary bat	2	33.3	2	33.3
silver-haired bat	2	33.3	2	33.3
big brown bat	1	16.7	1	16.7
eastern red bat	1	16.7	1	16.7
Overall Bats	6	100	6	100

Table 2. Distribution of distances from turbines of bird and bat carcasses found during scheduled searches or incidentally on turbine search plots at the California Ridge I Wind Energy Project.

Distance to Turbine (m)	% Bird carcasses	% Bat carcasses
0 to 10	0	0
10 to 20	50.0	16.7
20 to 30	0	16.7
30 to 40	50.0	50.0
40 to 50	0	16.7
50 to 60	0	0
60 to 70	0	0
70 to 80	0	0
80 to 90	0	0
>90	0	0

Four species of bats were found during surveys, including two hoary bats (*Lasiurus cinereus*), two silver-haired bats (*Lasionycteris noctivagans*), one big brown bat (*Eptesicus fuscus*) and one eastern red bat (*Lasiurus borealis*). Bats were found at six different turbines on six different dates. Bats were typically found between 30 to 40 meters from turbines, with 100% of all bat carcasses being found within 50 m (164 ft) of the turbine (Table 2).

One searcher efficiency trial was conducted on April 17, 2013 and carcasses were spread throughout the Project. A total of 60 carcasses (12 large birds, 13 small birds, and 35 mice [bat surrogate]) was placed for the trial. The overall searcher efficiency rate for small birds was 36.4%, compared to 100% for large birds, and 65% for mice (Table 3).

Table 3. Searcher efficiency results at the California Ridge I Wind Energy Project as a function of carcass size.

Size	Date	# Placed	# Available	# Found	% Found
Small Birds	4/17/2013	13	11	4	36.4
Large Birds	4/17/2013	12	7	7	100
Mice (bat surrogate)	4/17/2013	35	20	13	65.0

One carcass removal trial was conducted at the Project. The mean carcass removal rate was 18.05 days for large birds, 27.81 days for small birds, and 12.33 days for mice. By day ten, roughly 75% of small birds, 60% of large birds, and 35% of mice remained where they were placed. By day 30, approximately 45% small birds, 20% of large birds, and 15% of mice remained (Figure 2).

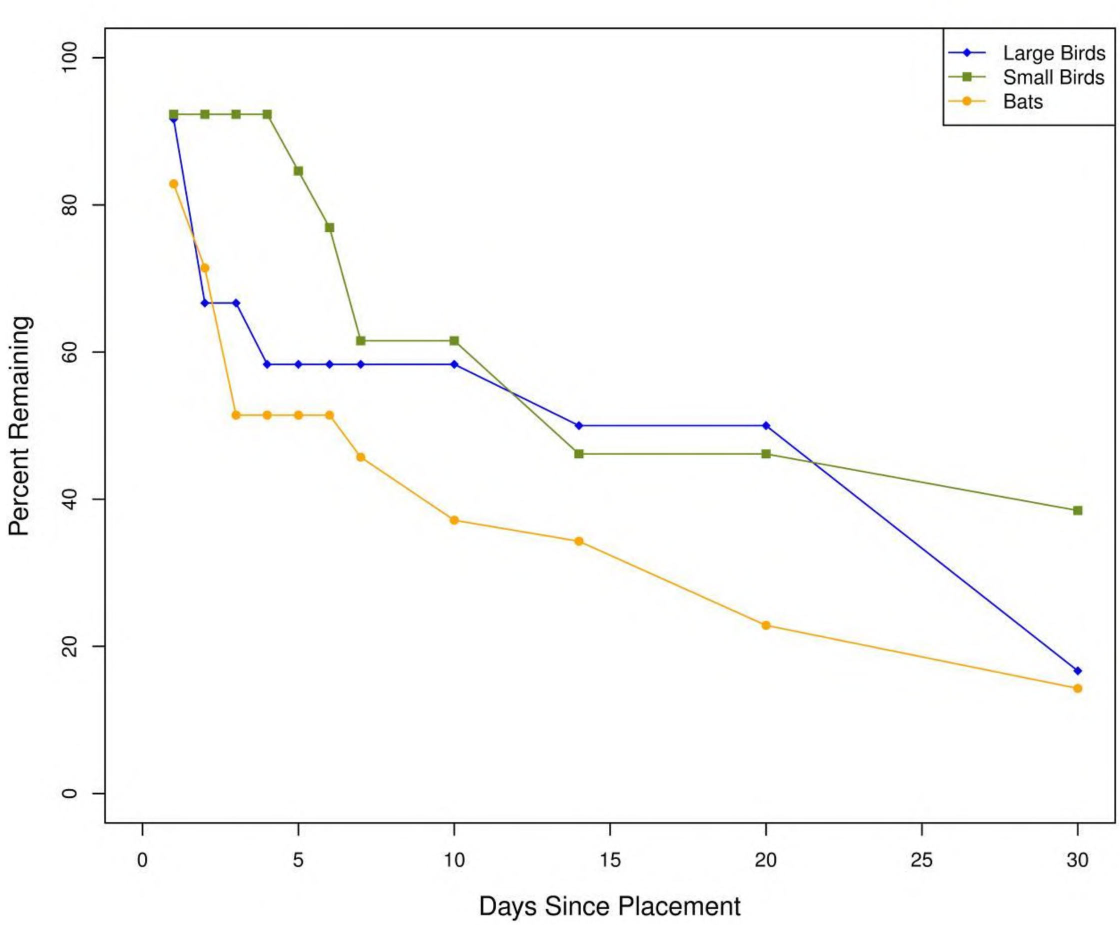

Figure 2. Carcass removal rates at the California Ridge I Wind Energy Project.

3.2 Fatality Estimates

Fatality estimates and 90% confidence intervals were calculated for birds and bats (Table 4; Appendices A and B). The fatality estimates were adjusted based on the corrections for carcass removal and observer detection bias. Fatality estimates were calculated based on the spring study period. Estimates were provided per turbine and per MW based on the 1.6-MW capacity of the turbines at the Project (Table 4; Appendices A and B).

Table 4. Bird and bat fatality estimates for California Ridge I Wind Energy Project from April 15 to May 10, 2013.

	Corrected Fatality Estimate
# fatalities/turbine/study period	
Small Birds	0.04
Large Birds	0.04
Raptors	0.04
All Birds	0.08
Bats	0.26
# fatalities/MW/study period	
Small Birds	0.03
Large Birds	0.02
Raptors	0.02
All Birds	0.05
Bats	0.16

3.3 American Golden-Plover Monitoring

Eleven groups totaling 1,394 AMGPs were observed during surveys from April 8 to May 19, 2013 (Table 5). Peak observations occurred during the week of April 29 when four groups of AMGPs were observed totaling 1,020 birds.

Table 5. Number of observations and groups of American Golden-Plovers by week observed at the California Ridge I Wind Energy Project during spring 2013.

	Spring 2013		
Week	**# Observations**	**# Groups**	**Mean Group Size**
April 8 – 14	45	1	45
April 15 – 21	0	0	0
April 22 – 28	0	0	0
April 29 – May 5	1,020	4	255
May 6 – 12	314	6	52
May 13 – 19	15	1	15
Total	**1,394**	**11**	**127**

Mean group size ranged from 15 the week of May 13 to 255 the week of April 29, and averaged 127 over the course of the study (Table 5). The majority of AMGP observations were recorded in the western portion of the project (Figure 3).

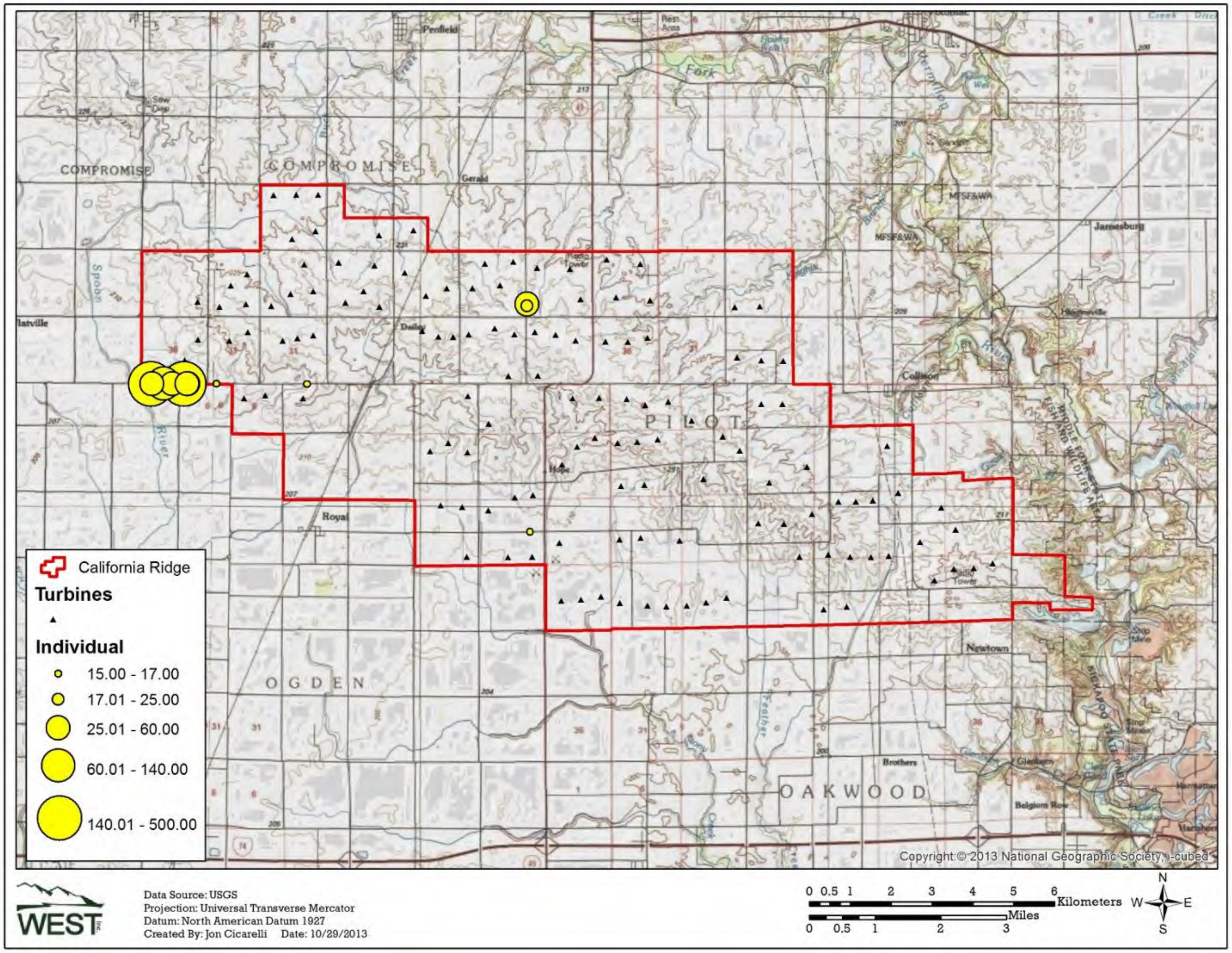

Figure 3. Location and the number American Golden Plover individuals observed during the spring 2013 surveys at the California Ridge I Wind Energy Project.

During the spring 2013 surveys, the majority of AMGP observations were recorded in no-till soybean fields (93.8%; Table 6). The remaining observations were recorded in tilled fields (5%) or stubble soybean fields (1.2%).

Table 6. Observations of American golden plovers foraging or perching by habitat within the California Ridge I Wind Energy Project.

	Phase I Spring 2013	
Habitat	**Total # Obs**	**% Composition**
No-till Soybean	1,307	93.8
Tilled Field	70	5.0
Stubble Soybean	17	1.2
Stubble Corn	0	0.0
Other	0	0.0
Tilled Corn	0	0.0
Tilled Soybean	0	0.0
Winter Wheat	0	0.0
Pasture	0	0.0
Overall	**1,394**	**100**

All AMGPs observed flying (three groups) were recorded below the RSH (Table 7) and the average flight height of AMGP observations was 11.2 meters (36.7 ft) above ground level (AGL). AMGP were observed flying to the north, south and northwest during surveys (Figure 3).

Table 7. Flight behavior of American golden plovers in relation to wind turbine rotor swept heights at the California Ridge Wind Resource Area.

		Percent of groups flying in relation to RSH		
Survey Year and Location	**No. Groups Flying**	**below RSH <56 m (<184 ft)**	**within RSH 56–144 m (184 – 472 ft)**	**above RSH >144 m >472 ft)**
2013 Project Area	3	100	0	0

RSH: 56 to 144 m (184 to 472 ft) above ground level (AGL).

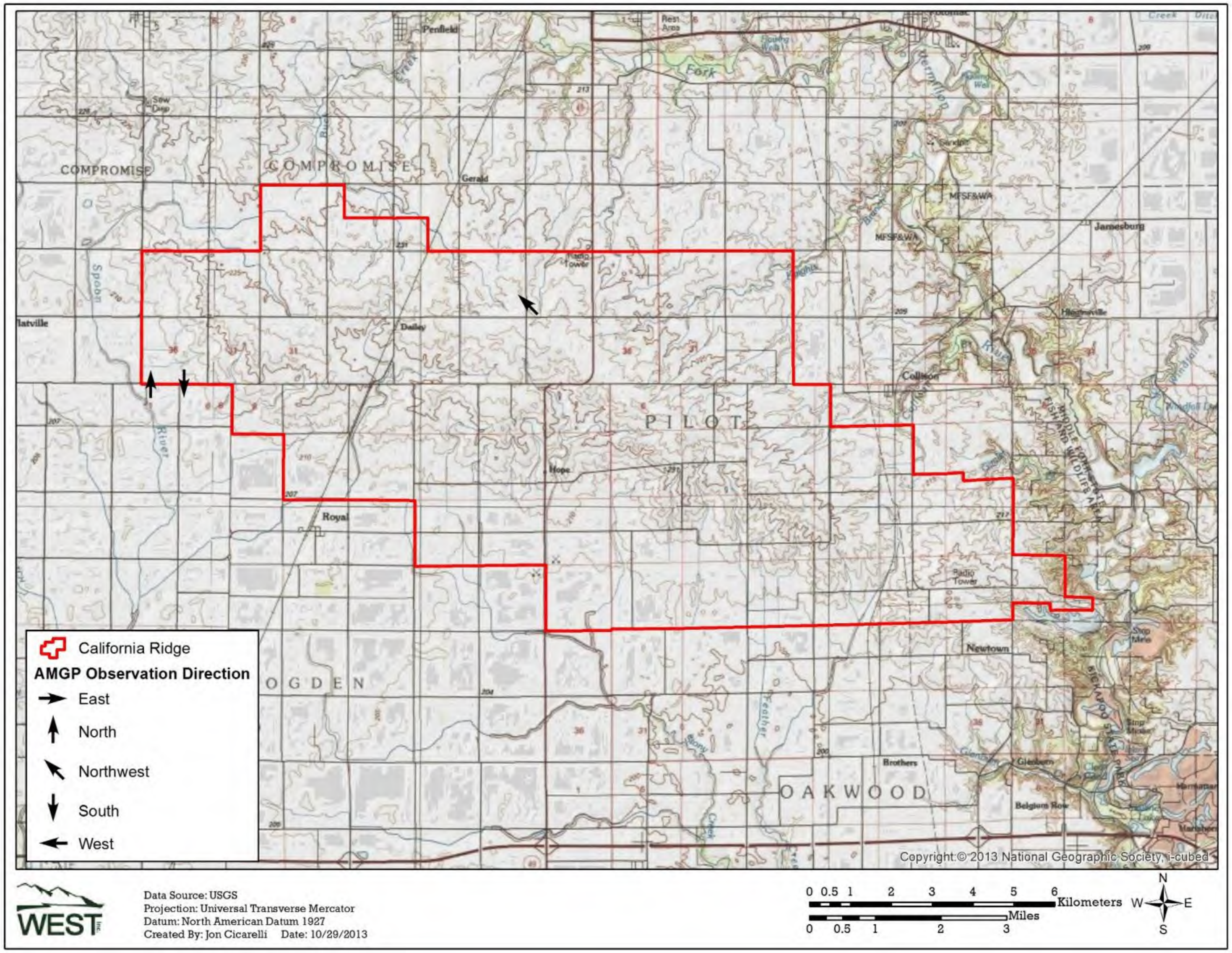

Figure 3. Flight direction of observed American golden-plovers in the California Ridge I Wind Energy Project, spring 2013.

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Appendix A. Complete estimated bird fatality table for the California Ridge I Wind Energy Facility for studies conducted from April 15 to May 10, 2013

Appendix A. Complete estimated bird fatality table for the California Ridge I Hill Wind Energy Facility for studies conducted from April 15 to May 10, 2013.

Parameter	Mean	90% CI
Observer Detection		
P (small birds)	0.36	0.18 – 0.64
P (large birds)	1	-
Mean Carcass Removal Time (days)		
$\bar{t}$ *(small birds)*	27.81	14.3 – 56.8
$\bar{t}$ *(large birds)*	18.05	10.1 – 30.0
Estimated Fatality Rates (Fatalities/turbine/study period)		
Small birds	0.03	0.00 – 0.10
Large birds	0.03	0.00 – 0.10
Raptors	0.03	0.00 – 0.10
Average Probability of Carcass Availability and Detected		
Small birds	0.78	0.47 – 0.91
Large birds	0.91	0.85 – 0.95
Adjusted Fatality Estimates (Fatalities/turbine/study period)		
Small birds	0.04	0.00 – 0.14
Large birds	0.04	0.00 – 0.11
Raptors	0.04	0.00 – 0.11
All birds	0.08	0.00 – 0.19

Appendix B. Complete estimated bat fatality table for the California Ridge I Wind Energy Facility for studies conducted from April 15 to May 10, 2013

Appendix B. Complete estimated bat fatality table for the California Ridge I Wind Energy Facility for studies conducted from April 15 to May 10, 2013.

Parameter	Mean	90 % CI
Observer Detection		
A (bats)	0.65	0.45 – 0.85
Mean Carcass Removal Time (days)		
$\bar{t}$ *(bats)*	12.33	8.28 – 17.83
Estimated Fatality Rates (Fatalities/turbine/study period)		
Bats	0.20	0.13 – 0.27
Average Probability of Carcass Availability and Detected		
Bats	0.77	0.65 – 0.86
Adjusted Fatality Estimates (Fatalities/turbine/study period)		
Bats	0.26	0.17 – 0.35

Bird Carcass Monitoring Report for the California Ridge Wind Energy Facility Champaign and Vermillion Counties, Illinois

July 15, 2013 – September 30, 2013

Prepared for:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The California Ridge Wind Energy Facility (CRWEF or Project), located in Champaign and Vermilion Counties, Illinois (Figure 1), is owned by California Ridge Wind Energy LLC (CRWE) and consists of 134 1.6-megawatt (MW) turbines. This report includes the results of bird carcass monitoring conducted as part of a larger post-construction monitoring and bat deterrent research study conducted in the Project area from July 15 – September 30, 2013. The 20 turbines included in this study were operated with bat deterrent devices and the normal cut-in wind speed of 3.0 m per second (m/s; 6.7 mi per hour [mph]); all other turbines at the CRWEF were operated at with a raised cut-in speed of 6.9 m/s (15.5 mph).

1.1 Study Area

The CRWEF is approximately 17.6 kilometers (km, 11 miles [mi]) east to west and approximately 9.6 km (5.9 mi) north to south (Figure 1). Corn and soy bean production is the dominant land use in the Project area; trees are sparsely distributed and typically restricted to small clumps, generally associated with homes or small riparian areas. The Middle Fork River, a tributary of the Vermilion River, is proximate to the northern and eastern ends of the CRWEF and is approximately 3.2 km (2.0 mi) from the nearest turbine at its closest point on the eastern end.

2.0 METHODS

The study design followed procedures described in CRWE's approved New Recovery Permit (TE03502B), which was implemented in lieu of the study plan outlined in the CRWE Avian and Bat Protection Plan (ABPP; CRWE 2011) and included bi-daily searches at 20 study turbines (Figure 2). While the bird fatality rate was estimated based on the number of carcasses found in turbines searches, it is important to note that the cause of death of each carcass discovered was not determined, and therefore all of the carcasses found may not have been attributable to the Project (e.g., some carcasses may have perished due to reasons not related to wind-energy production, such as predation).

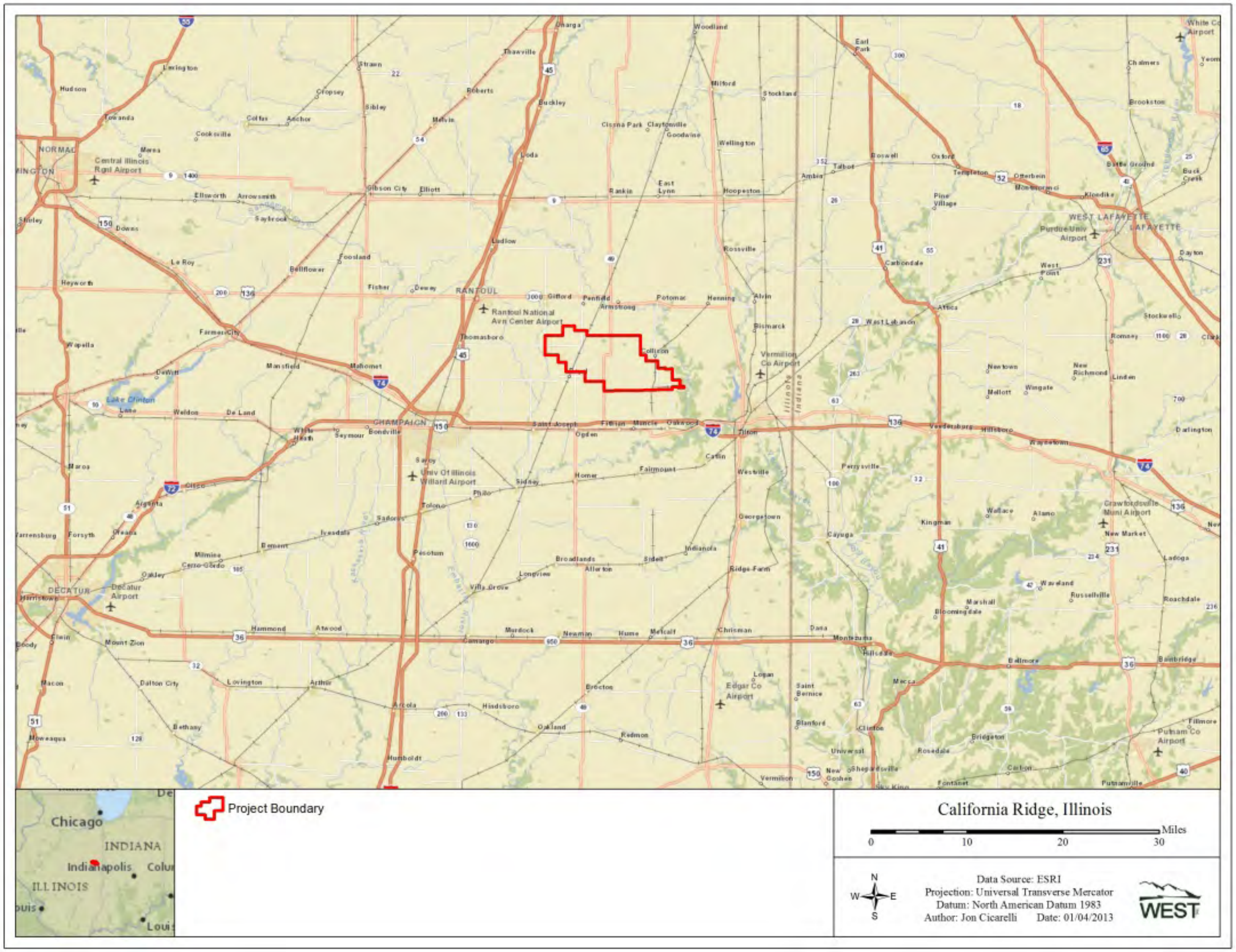

Figure 1. Location of the California Ridge Wind Energy Facility.

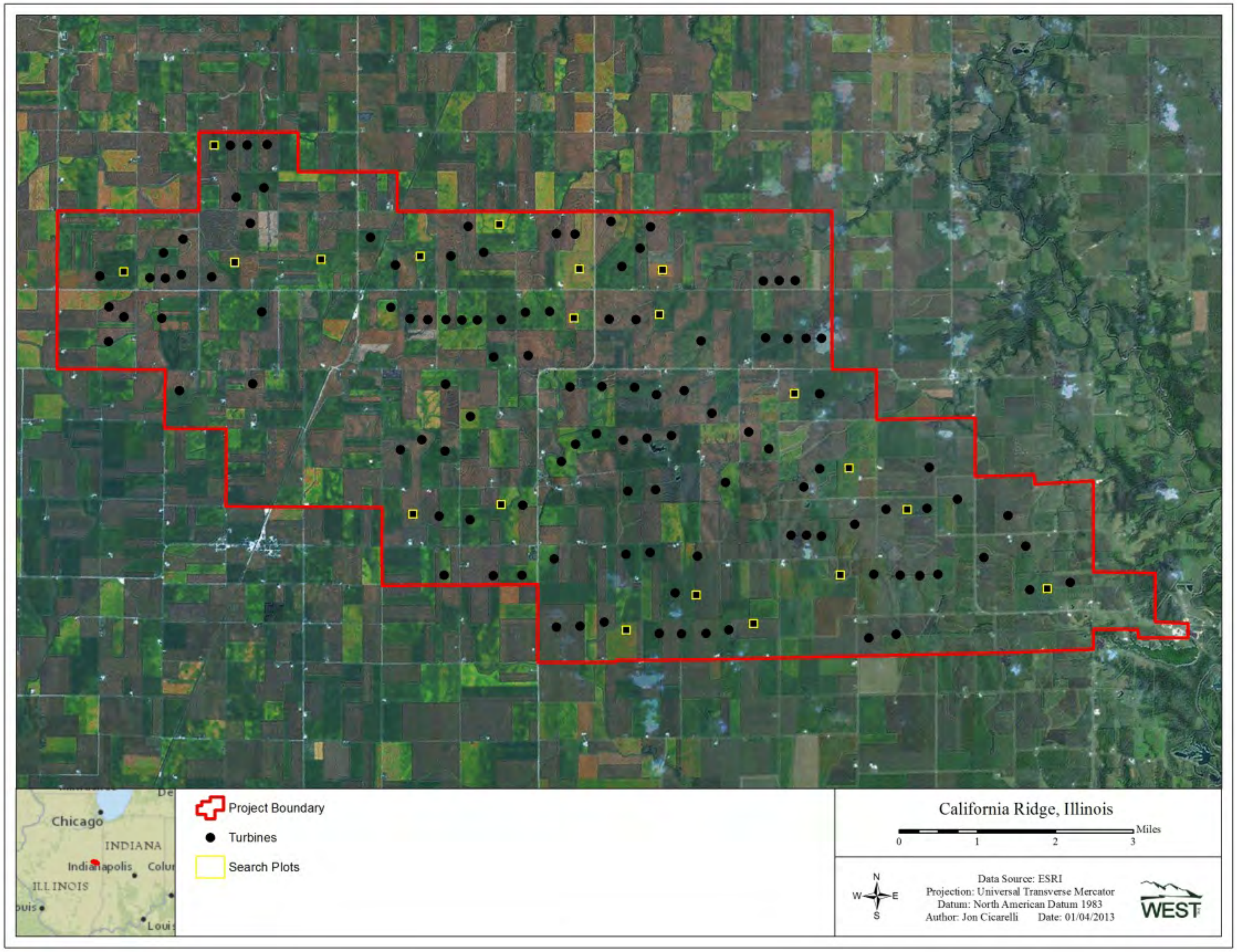

Figure 2. Location of research turbines at the California Ridge Wind Energy Facility.

2.1.1 Plot Selection and Condition

Twenty turbines were randomly selected using a systematic random sampling approach, which helped to ensure that study turbines were well distributed across the CRWEF (Figure 2). At each of the 20 study turbines, 160 x 160 meter (m; 525 x 525 foot [ft]) square plots centered on the turbine were established. Plots were mowed prior to the start of the study, as well as periodically during the study, to remove cultivated crops and weeds. Therefore, plots contained areas with little or no vegetation (e.g., access roads and turbine pads), bare ground, or varying levels of dead or regenerating low vegetation (Figure 3).

2.1.2 Search Methods

Carcass search methods were consistent with those described in the Permit application. Technicians were trained in proper search techniques, including walking speed, search images, and data collection. Plots were searched by teams of two technicians following transects oriented perpendicular to plot edges and spaced 5 to 6 m (16 to 20 ft) apart. Technicians walked transects while scanning the ground ahead of them 2 to 3 m (7 to 10 ft) on either side of transects. Walking rates were generally 45 to 60 m (148 to 197 ft) per minute, but were sometimes slower depending on conditions. All 20 turbines were searched every other day (10 each day) between July 15 and September 6, and then all 20 were searched daily from September 7 to September 30[1].

When a carcass was found by a technician, the location was marked using a pin flag. After the plot was completely searched, technicians went back to any marked carcasses to record data. For each carcass discovered, technicians assigned a unique carcass identification (ID) that consisted of the date, 4-letter species code, plot ID, and carcass number (e.g., 071513-ERBA-19-1). Technicians also recorded the following information on data forms: carcass ID, plot ID, date, technician's initials, carcass information (approximate time since death [in days], species, sex and age [when possible], physical condition [e.g., intact, scavenged, dismembered], state of decomposition, and any insect infestation), distance and bearing from turbine, and Universal Transverse Mercator (UTM) coordinates. Technicians also marked the location of the carcass on a grid map representing the plot and took at least four photos of each carcass, with at least two close-ups of the carcass, and two showing the location relative to the turbine and plot conditions.

After all data were collected, searchers collected the carcass, placed it in a plastic bag along with an identification tag that included the unique carcass ID and placed it in a cooler until the end of the day's survey. Each day all carcasses found were placed in a freezer located at the on-site operations and maintenance building. A binder kept at the freezer included a log in which technicians recorded all carcasses deposited in the freezer. The binder also included copies of all relevant permits needed to legally collect and hold carcasses.

[1] The change to daily searches at all turbines was made to increase the number of bat carcasses that could be assigned to treatment or control for the deterrent research study.

Figure 3. Example ground conditions at search plots used in the California Ridge Wind Energy Facility carcass monitoring study. The top photo is of a plot in mowed corn, the bottom photo is of a plot in mowed soybean.

Carcasses were collected under one or more of the following permits: Illinois Department of Natural Resources (IDNR) Salvage Permit, No. NH13.5223; IDNR Endangered or Threatened Species Permit, No. 11-14Sa; and/or USFWS Native Endangered Species Recovery Permit, No. TE03502B-0.

2.1.3 Bias Trials

Scavenger removal and searcher efficiency trials (bias trials) were conducted to assess sources of bias and to improve the accuracy of fatality rate estimation. Bias trials were designed to estimate the proportion of carcasses removed by scavengers prior to scheduled searches and the proportion of remaining carcasses that were missed by searchers during scheduled searches. One scavenger removal and searcher efficiency trial was conducted for birds using house sparrow (*Passer domesticus*) carcasses. The trial lasted 30 days, or until all placed carcasses were removed by scavengers, whichever came first.

For each trial, 20 carcasses were placed on up to 20 plots. The locations of the placed carcasses (i.e., distance and bearing from turbine) were randomly assigned prior to the start of bias trials. Trial carcasses were discreetly marked so that technicians, who were blind to the presence and location of trial carcasses, could identify them when they were found. When technicians located a bias trial carcass they recorded the same information as for non-trial carcasses. Found carcasses were left in place for use in the concurrent scavenger removal trial. As such, each bias trial carcass was used to estimate both searcher efficiency and scavenger removal rates.

Technicians checked each carcass every day during days 1-7, then on days 10, 14, 20, and 30. During checks, technicians recorded whether the carcass remained, and if so, the condition of the carcass (e.g., intact – no scavenging, evidence of scavenging, whole carcass, partial carcass, etc.) and the source of scavenging, if it could be determined. If the carcass was not found in its previous location during a check, bias trial technicians were instructed to search within a 5-m (16-ft) radius circle of the previous carcass location. If after three visits the carcass was not located by the technician, it was assumed to have been scavenged and was noted as having been removed by a scavenger prior to the first visit during which it was not found. Any bias trial carcasses remaining after 30 days (or 11 days for the final trial) were disposed of.

Using data from this trial, the number of days that passed until a carcass was first found during a scheduled search was estimated, as was the number of days that a carcass persisted and was available to be found. These mean durations were used to estimate searcher efficiency and scavenger removal rates.

2.1.4 Fatality Rate Estimation

Estimates of facility-related bird fatality rates were calculated based on:

1) Observed number of bird carcasses found during standardized searches during the monitoring period;
2) The probability for a bird carcass to remain in search areas and be detected by the observers during combined bias trials (see below).

Carcasses found on search plots were included in the fatality rate estimates regardless of whether they were found during a scheduled search or incidentally at some other time. It was assumed that all carcasses found incidentally on search plots would have been found at the next search if they had not been found incidentally. Carcasses found during searches but not within a search plot were not included in fatality rate estimates.

The probability of carcass availability and detection ($\hat{\pi}$) was calculated based on the results of the bias trial that simultaneously accounted for searcher efficiency and carcass removal. Carcasses were placed in the field and left until they were either found by searchers or removed by some means, such as scavenging. The ratio of the number of carcasses found to the number placed was then calculated and used as an empirical estimate of the probability of availability and detection. Estimated fatality rates were calculated based on the variables and equations below.

<u>Definition of Variables</u>

The following variables were used in the equations below:

- c_i number of carcasses detected at plot *i* for the study period of interest (e.g., one monitoring year), for which the cause of death was either unknown or was attributed to the facility
- k number of turbines searched (including the turbines centered within each search plot)
- $\overline{c}$ average number of carcasses observed per turbine per monitoring year
- A proportion of the search area of a turbine actually searched
- $\hat{\pi}$ estimated probability that a carcass was found during a search and was available
- m estimated annual average number of carcasses per turbine per year, adjusted for removal and searcher efficiency bias

Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per monitoring year is:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{k \cdot A} \qquad \text{(Equation 1)}$$

Estimated Fatality Rate

The estimated per turbine annual fatality rate (*m*) is calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}} \qquad \text{(Equation 2)}$$

where $\hat{\pi}$ includes adjustments for both carcass removal (from scavenging and other means) and searcher efficiency bias.

The empirical method depends on a balanced distribution of trial carcasses placed throughout the search interval. Empirical estimates for the probability of available and detected were calculated as follows:

$$\hat{\pi} = \frac{\text{number of trial carcasses detected}}{\text{number of trial carcasses placed}}. \qquad \text{(Equation 3)}$$

The reported estimates standard errors and 90% confidence intervals were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. For each bootstrap sample, $\bar{c}$, $\hat{\pi}$, and *m* are calculated. A total of 1,000 bootstrap samples were calculated. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5th and upper 95th percentiles of the 1,000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

3.0 RESULTS

A total of 1,030 turbine searches were conducted from July 15 – September 30, 2013. A total of 41 bird carcasses were found during the study; 38 carcasses were found during scheduled searches and three were found outside of search plots and considered incidental discoveries (Table1, Appendix A). The majority of bird carcasses found were small birds that could not be identified to species (39.5% of all carcasses). Of the carcasses that could be identified to species, killdeer (*Charadrius vociferous*) was the most commonly found (six carcasses, 15.8% of all carcasses; Table 1).

Table 1. Number and percent composition of bird carcasses found during post-construction carcass monitoring at the California Ridge Wind Energy Facility from July 15 – September 30, 2013.

	Carcasses Found during Scheduled Searches		Carcasses Found Incidentally at Search Plots*		Other Incidental Finds**		Total	
Species	**Total**	**% Comp.**	**Total**	**% Comp.**	**Total**	**% Comp.**	**Total**	**% Comp.**
unidentified bird (small)	15	39.5	0	0	0	0	15	36.6
killdeer	6	15.8	0	0	1	33.3	7	17.1
mourning dove	3	7.9	0	0	0	0	3	7.3
unidentified passerine	3	7.9	0	0	0	0	3	7.3
black-billed cuckoo	1	2.6	0	0	0	0	1	2.4
eastern wood-pewee	1	2.6	0	0	0	0	1	2.4
horned lark	1	2.6	0	0	0	0	1	2.4
magnolia warbler	1	2.6	0	0	0	0	1	2.4
mourning warbler	1	2.6	0	0	0	0	1	2.4
red-tailed hawk	1	2.6	0	0	0	0	1	2.4
Swainson's thrush	1	2.6	0	0	0	0	1	2.4
unidentified empidonax	1	2.6	0	0	0	0	1	2.4
unidentified warbler	1	2.6	0	0	0	0	1	2.4
vesper sparrow	1	2.6	0	0	0	0	1	2.4
yellow-billed cuckoo	1	2.6	0	0	0	0	1	2.4
house sparrow	0	0	0	0	2	66.7	2	4.9
Total	**38**	**100.0**	**0**	**0**	**3**	**100.0**	**41**	**100.0**

*Carcasses found incidentally on turbine search plots were included in analyses.
**Carcasses found prior to the start of the study.

One black-billed cuckoo (*Coccyzus erythropthalmus*), a state threatened species (Illinois Species Protection Board, IDNR 2011), was found on September 15. No bird species listed under the federal Endangered Species Act (ESA 1973, USFWS 2014) was found.

For most bird carcasses, the estimated time of death was undetermined (47.2%; Table 2). For carcasses where an estimated time of death could be determined, the majority were estimated to have died the night prior to a scheduled search (27.8%). Bird carcasses were found sporadically throughout the study period with no clear temporal pattern (Figure 4). Approximately 76% percent of all bird carcasses were found within 70 m (230 ft) of turbines, with the highest percentage (36.8%) of carcasses found between 60 – 70 m (197 – 230 ft), and 18.4% of birds carcasses found between 50 – 60 m (164 – 197 ft; Table 3). Bird carcasses revealed no discernible distribution throughout the Project area (Figure 5).

Twenty small bird carcasses were used for carcass removal and searcher efficiency trials. Mean scavenger removal time for trial carcasses was 18.2 days (Figure 6). Of the 20 available trial carcasses, 14 were found, resulting in a searcher efficiency rate of 70% for house sparrow sized birds.

Table 2. Estimated time since death of bird carcasses at the California Ridge Wind Energy Facility from July 15 – September 30, 2013.

Estimated Time Since Death	Number of Carcasses	Percent Composition
last night	10	27.8
2-3 days	7	19.4
4-7 days	2	5.6
7-14 days	0	0
>2 weeks	0	0
>month	0	0
Unknown	17	47.2

Table 3. Distribution of distances from turbines of all bird carcasses found during scheduled searches and incidentally on turbine search plots at the California Ridge Wind Energy Facility from July 15 – September 30, 2013.

Distance to Turbine (m)	% Bird Carcasses
0 to 10	0
10 to 20	2.6
20 to 30	5.3
30 to 40	5.3
40 to 50	7.9
50 to 60	18.4
60 to 70	36.8
70 to 80	7.9
80 to 90	7.9
> 90	7.9

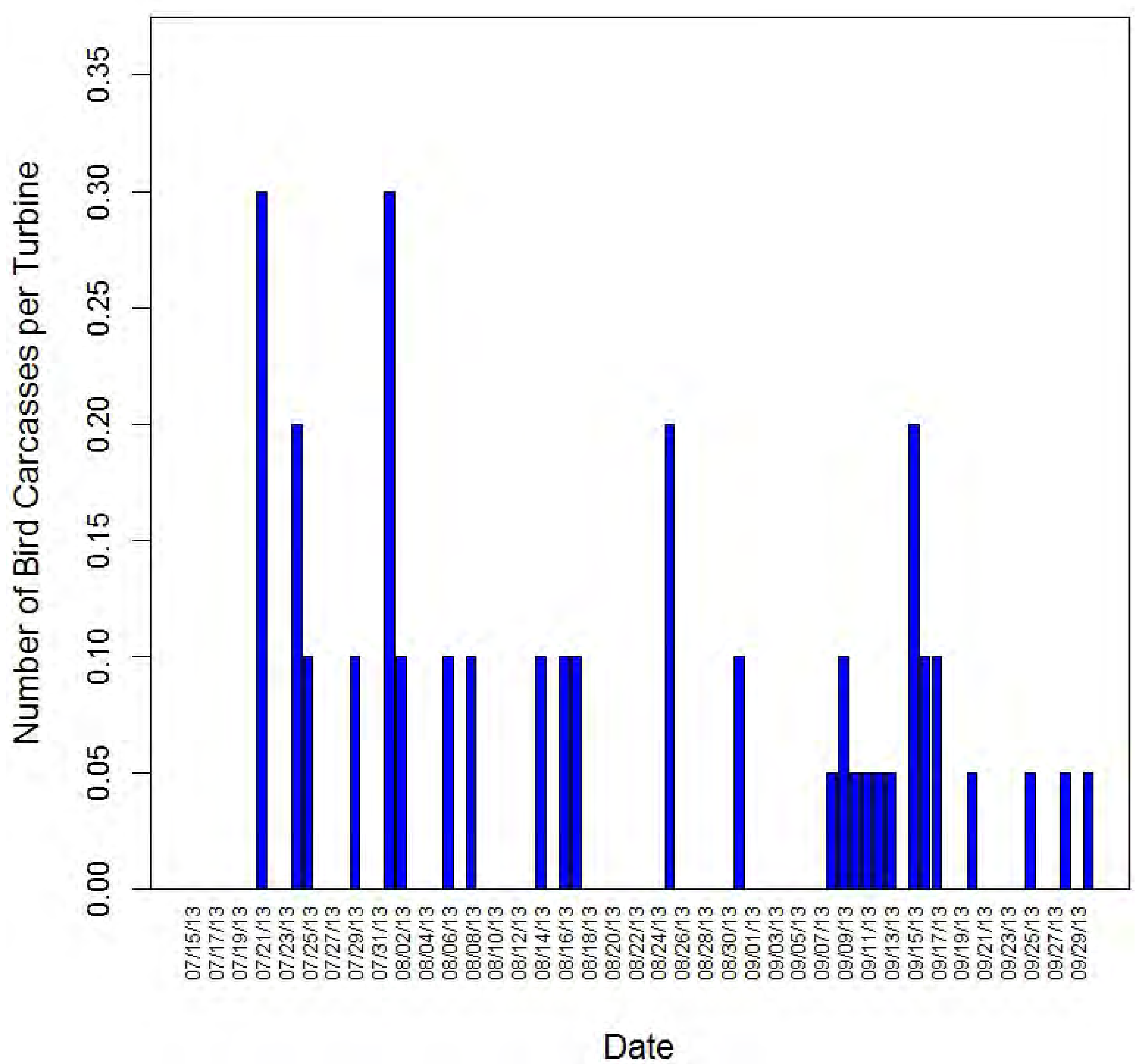

Figure 4. Timing of bird carcasses per turbine found during scheduled searches or incidentally on turbine search plots at the California Ridge Wind Energy Facility from July 15 – September 30, 2013.

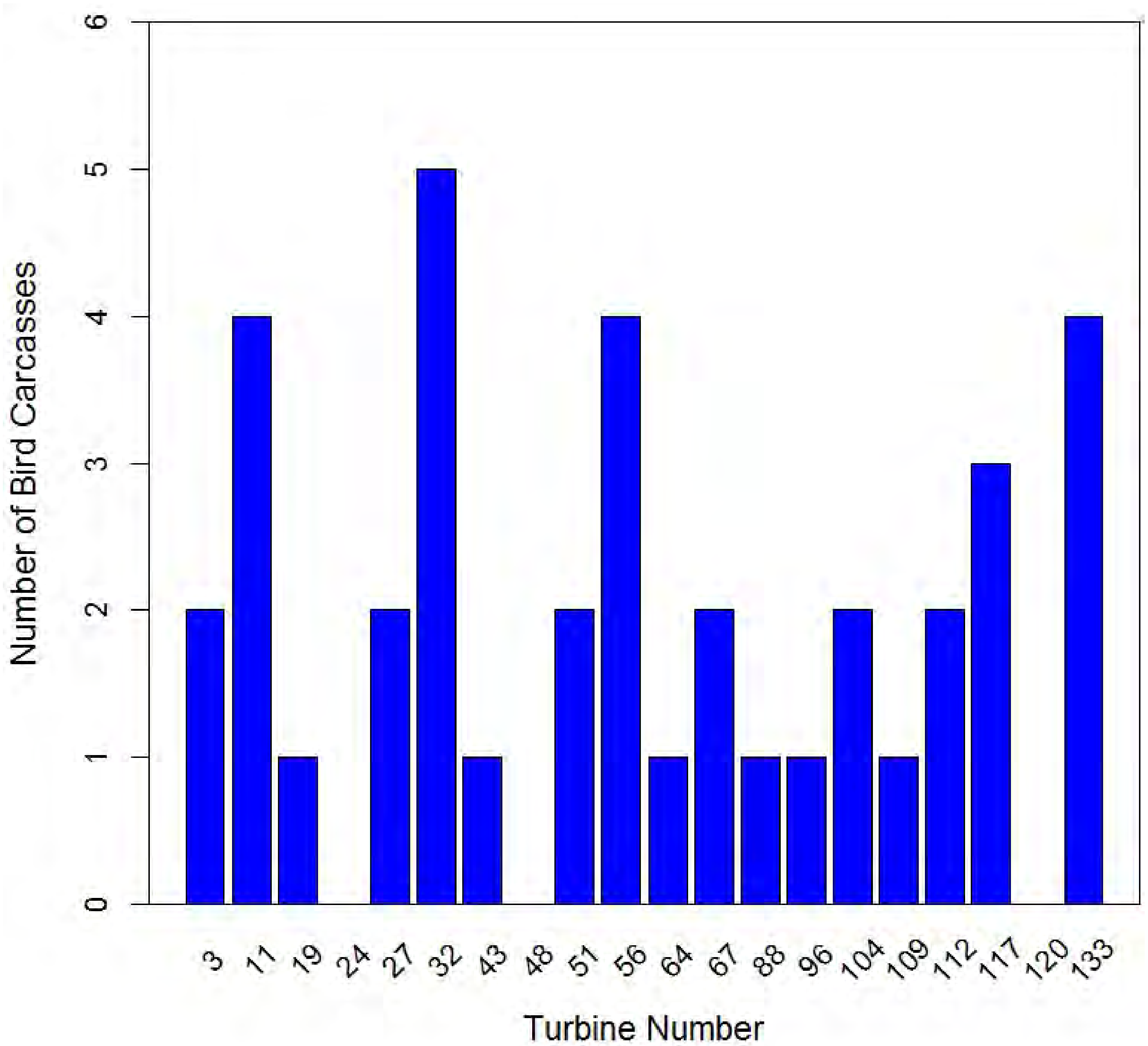

Figure 5. Number of bird carcasses by turbine found during scheduled searches or incidentally on turbine search plots at the California Ridge Wind Energy Facility.

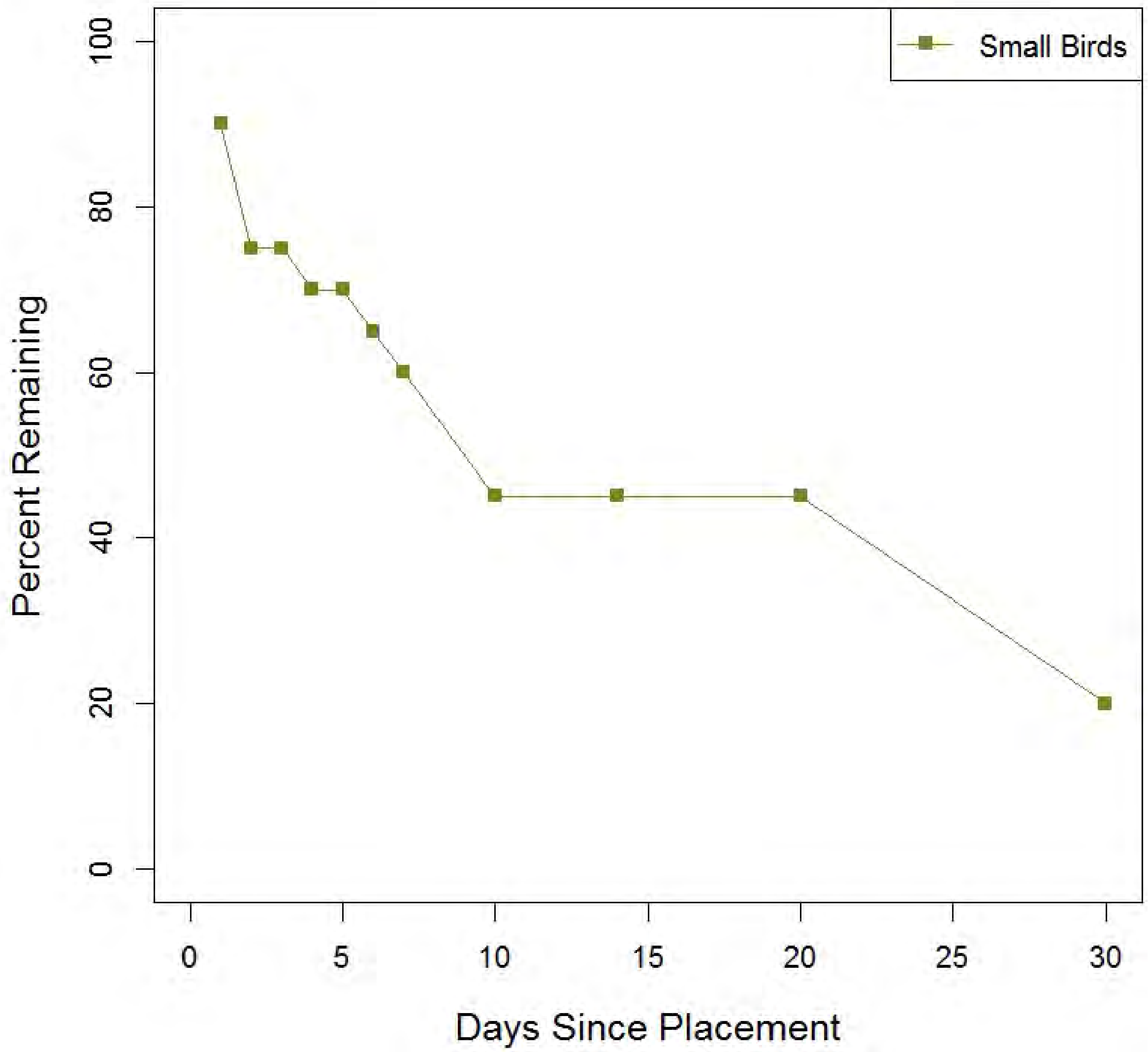

Figure 6. Carcass removal rates at the California Ridge Wind Energy Project from July 15 – September 30, 2013.

3.1 Estimate Bird Fatality Rates

Estimated bird fatality rates per turbine and per MW and 90% confidence intervals are reported in Table 4 and Appendix B. Since searcher efficiency and carcass removal trials were conducted using small birds (house sparrows) and did not include raptor-sized birds, a single red-tailed hawk (*Buteo jamaicensis*) carcass found was not included in fatality estimates.

Table 4. Estimated bird fatality rates and 90% confidence intervals for the California Ridge Wind Energy Facility for the period from July 15 to September 30, 2013.

Metric	Corrected Fatality Estimate (90% CI)
Estimated # fatalities/turbine/study period	2.64 (1.76 - 3.82)
Estimated # fatalities/MW/study period	1.65 (1.10- 2.39)

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Appendix A. Complete Bird Fatality Listing, July 15 to September 30, 2013, at the California Ridge Wind Energy Facility

Appendix A. Complete bird fatality listing, July 15 to September 30, 2013, at the California Ridge Wind Energy Facility.

Date	Common Name	Location	Distance from Turbine	Type of Find	Condition
7/21/2013	unidentified bird (small)	117	91	Scheduled Search	Feather Spot
7/21/2013	unidentified bird (small)	56	70	Scheduled Search	Feather Spot
7/21/2013	unidentified bird (small)	56	68	Scheduled Search	Feather Spot
7/24/2013	unidentified bird (small)	133	70	Scheduled Search	Feather Spot
7/24/2013	unidentified bird (small)	43	59	Scheduled Search	Feather Spot
7/25/2013	unidentified passerine	56	14	Scheduled Search	Scavenged
7/29/2013	red-tailed hawk	67	56	Scheduled Search	Dismembered
7/30/2013	killdeer	75	457	Incidental Find	Intact
8/1/2013	unidentified bird (small)	133	62	Scheduled Search	Feather Spot
8/1/2013	unidentified bird (small)	133	61	Scheduled Search	Feather Spot
8/1/2013	house sparrow	102	800	Incidental Find	Intact
8/1/2013	house sparrow	102	800	Incidental Find	Intact
8/1/2013	unidentified bird (small)	104	26	Scheduled Search	Feather Spot
8/2/2013	unidentified bird (small)	67	69	Scheduled Search	Feather Spot
8/6/2013	vesper sparrow	88	69	Scheduled Search	Dismembered
8/8/2013	unidentified passerine	109	62	Scheduled Search	Feather Spot
8/14/2013	killdeer	117	91	Scheduled Search	Feather Spot
8/16/2013	unidentified bird (small)	117	76	Scheduled Search	Feather Spot
8/17/2013	unidentified bird (small)	11	84	Scheduled Search	Feather Spot
8/25/2013	unidentified bird (small)	51	49	Scheduled Search	Feather Spot
8/25/2013	mourning dove	104	58	Scheduled Search	Feather Spot
8/31/2013	unidentified bird (small)	11	25	Scheduled Search	Intact
9/8/2013	killdeer	32	71	Scheduled Search	Feather Spot
9/9/2013	killdeer	11	40	Scheduled Search	Dismembered
9/9/2013	unidentified sparrow	32	76	Scheduled Search	Feather Spot
9/10/2013	unidentified bird (small)	32	70	Scheduled Search	Feather Spot
9/11/2013	mourning dove	19	53	Scheduled Search	Feather Spot
9/12/2013	unidentified passerine	3	22	Scheduled Search	Intact
9/13/2013	mourning dove	3	100	Scheduled Search	Feather Spot
9/15/2013	black-billed cuckoo	96	51	Scheduled Search	Intact
9/15/2013	magnolia warbler	32	67	Scheduled Search	Scavenged
9/15/2013	yellow-billed cuckoo	133	83	Scheduled Search	Intact
9/15/2013	killdeer	27	69	Scheduled Search	Feather Spot
9/16/2013	horned lark	56	30	Scheduled Search	Intact
9/16/2013	killdeer	27	47	Scheduled Search	Feather Spot

Appendix A. Complete bird fatality listing, July 15 to September 30, 2013, at the California Ridge Wind Energy Facility.

Date	Common Name	Location	Distance from Turbine	Type of Find	Condition
9/17/2013	mourning warbler	64	35	Scheduled Search	Intact
9/17/2013	Swainson's thrush	11	57	Scheduled Search	Intact
9/20/2013	eastern wood-pewee	51	58	Scheduled Search	Intact
9/25/2013	killdeer	112	69	Scheduled Search	Feather Spot
9/28/2013	unidentified warbler	32	66	Scheduled Search	Intact
9/30/2013	unidentified empidonax	112	40	Scheduled Search	Intact

Appendix B. Complete Estimated Shoenfeld Bird Fatality Rates for the California Ridge Wind Energy Facility for Studies Conducted from July 15 – September 30, 2013

Appendix B. Complete estimated bird fatality table for the California Ridge Wind Energy Facility for studies conducted from July 15 to September 30, 2013.

	Shoenfeld	
Parameter	**Estimate**	**90% CI**
Observer Detection		
A (small birds)	0.70	0.55 – 0.85
Mean Carcass Removal Time (days)		
$\bar{t}$ (small birds)	18.22	11.26 – 28.36
Estimated Fatality Rates (Fatalities/turbine/study period)		
Small birds	1.30	0.85 – 1.75
Adjusted Fatality Estimate (Fatalities/turbine/study period)		
Small birds	1.90	1.19 – 2.82

Bird and Bat Carcass Monitoring and American Golden-Plover Survey Report for the California Ridge I Wind Energy Facility Champaign and Vermilion Counties, Illinois

April 1 and May 16, 2014

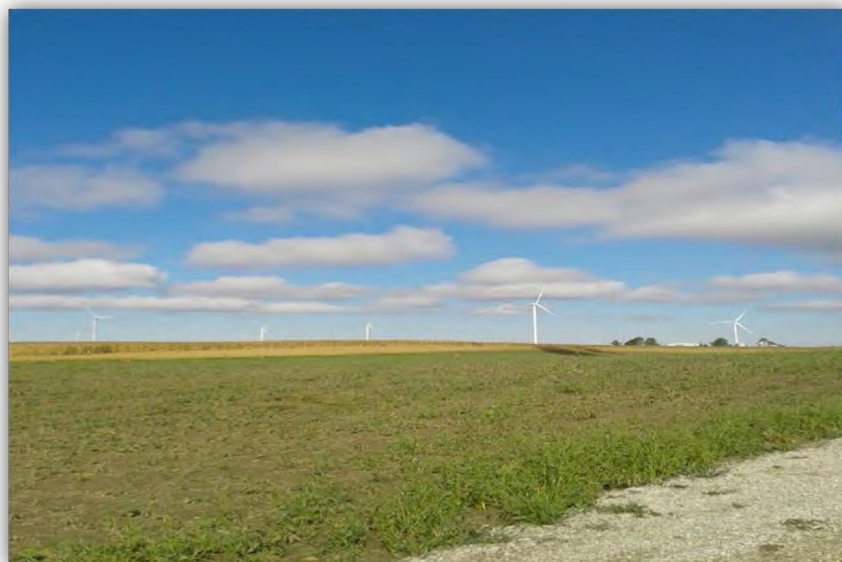

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The California Ridge I Wind Energy Facility (CRWEF or Project), located in Champaign and Vermilion Counties, Illinois (Figure 1) is owned by California Ridge Wind Energy LLC (CRWE) and consists of 134 1.6 megawatt (MW) turbines. This report includes the results of post-construction carcass monitoring and American golden-plover (*Pluvialis dominica*; AMGP) surveys conducted between April 1 and May 16, 2014. Carcass monitoring and AMGP surveys were conducted to comply with the CRWE Avian and Bat Protection Plan (ABPP; CRWE 2011).

1.1 Study Area

The CRWEF is approximately 17.6 kilometers (km, 11 miles [mi]) east to west and approximately 9.6 km (5.9 mi) north to south (Figure 1). Corn and soy bean production is the dominant land use in the Project area; trees are sparsely distributed and typically restricted to small clumps, generally associated with homes or small riparian areas. The Middle Fork River, a tributary of the Vermilion River, is proximate to the northern and eastern ends of the CRWEF and is approximately 3.2 km (2.0 mi) from the nearest turbine at its closest point on the eastern end.

The CRWEF is located within the Vermilion River watershed within the Central Corn Belt Plains Ecoregion, which encompasses a large portion of central Illinois (Woods et al. 2007). The Central Corn Belt Plains Ecoregion is composed of vast glaciated plains; much of this region was historically dominated by tallgrass prairie, with groves of trees and marshes scattered across the level uplands.

2.0 METHODS

2.1 Carcass Monitoring

The study design followed procedures described in the CRWE ABPP (CRWE 2011) and included weekly and bi-weekly searches at 30 study turbines (Figure 2). While the bird and bat fatality rates were estimated based on the number of carcasses found in turbines searches, it is important to note that the cause of death of each carcass discovered was not determined, and therefore all of the carcasses found may not have been attributable to the Project (e.g., some carcasses may have perished due to reasons not related to wind-energy production, such as predation).

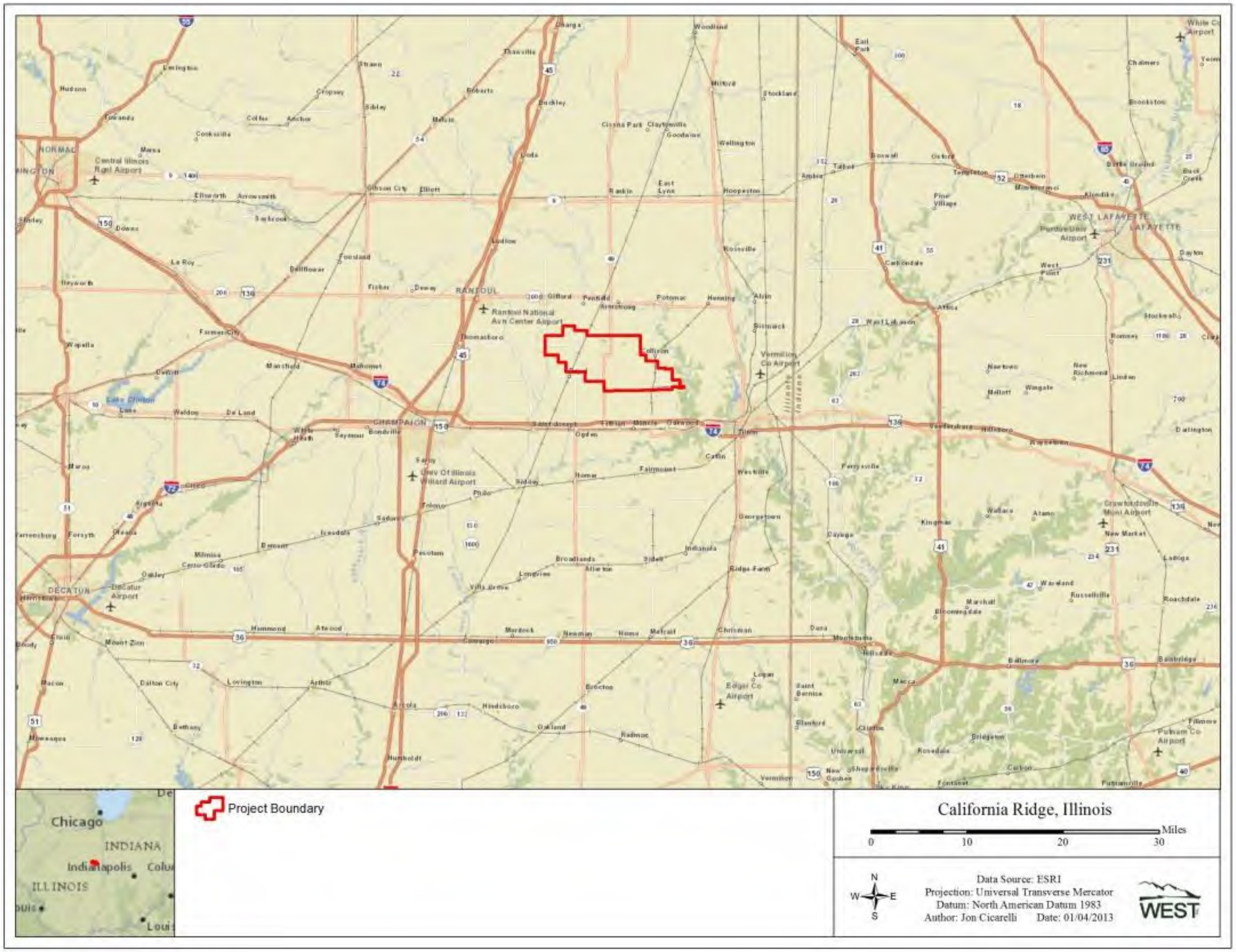

Figure 1. Location of the California Ridge I Wind Energy Facility.

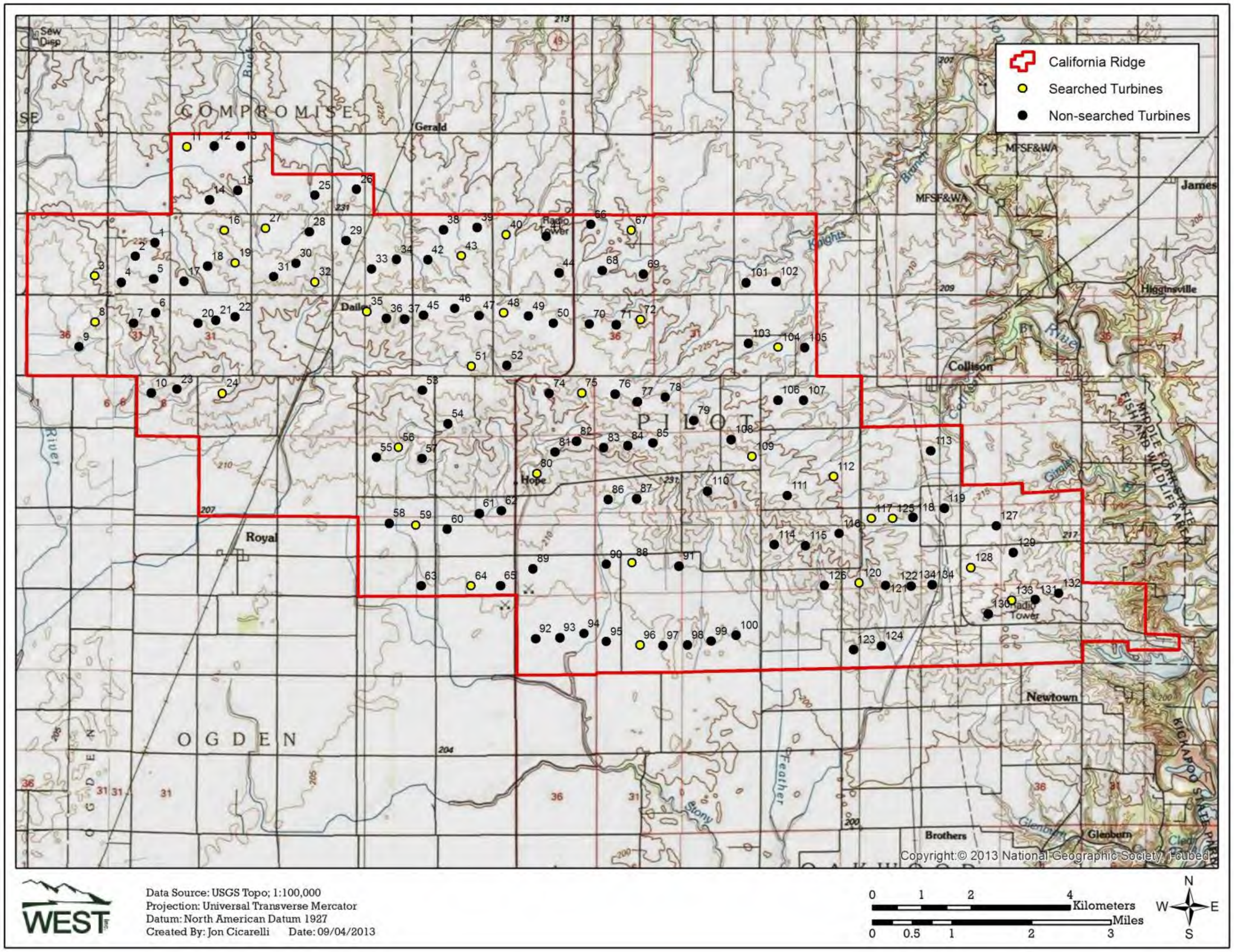

Figure 2. Turbine and search plot locations of the California Ridge I Wind Energy Facility.

2.1.1 Plot Selection and Condition

Thirty turbines were selected using a systematic random sampling approach, which ensured that study turbines were distributed across the CRWEF (Figure 2). At each of the 30 study turbines, 78 x 78 meter (m; 256 x 256 foot [ft]) square plots centered on the turbine were established. Plots were delineated prior to planting so that farmers could avoid seeding. Plots were monitored and mowed if necessary to remove any cultivated crops or weeds during the study. Therefore, plots contained areas with little or no vegetation (e.g., access roads and turbine pads), bare ground, or varying levels of dead or regenerating low vegetation (Figure 3).

2.1.2 Search Methods

Carcass search methods were consistent with those described in CRWE's APBB (CRWE 2011). Technicians were trained in proper search techniques, including walking speed, search images, and data collection. Plots were searched following transects oriented perpendicular to plot edges and spaced 5 to 6 m (16 to 20 ft) apart. Technicians walked transects while scanning the ground ahead of them 2 to 3 m (7 to 10 ft) on either side of transects. Walking rates were generally 45 to 60 m (148 to 197 ft) per minute, but were sometimes slower depending on plot conditions (e.g. searches were slower after hard rains due to muddy conditions). Due to AMGP being observed prior to the start of carcass surveys, all 30 plots were searched twice weekly during the study period per CRWE's ABPP.

When a carcass was found by a technician, the location was marked using a pin flag. After the plot was completely searched, technicians went back to any marked carcasses to record data. For each carcass discovered, technicians assigned a unique carcass identification (ID) that consisted of the date, 4-letter species code, plot ID, and carcass number (e.g., 071513-EUST-19-1). Technicians also recorded the following information on data forms: carcass ID, plot ID, date, technician's initials, estimated time since death (in days), species, sex and age (when possible), physical condition (e.g., intact, scavenged, dismembered), state of decomposition, distance and bearing from turbine, and Universal Transverse Mercator (UTM) coordinates. Technicians also marked the location of the carcass on a grid map representing the plot and took at least four photos of each carcass, with at least two close-ups of the carcass, and two showing the location relative to the turbine and plot conditions.

After all data were recorded, searchers collected the carcass, placed it in a plastic bag along with an identification tag that included the unique carcass ID. All carcasses found each day were placed in a freezer located at the on-site operations and maintenance building. A binder kept at the freezer included a log in which technicians recorded all carcasses deposited in the freezer. The binder also included copies of all relevant permits needed to legally collect and hold carcasses. Carcasses were collected under one or more of the following permits: IDNR Salvage Permit, No. NH13.5223; IDNR Endangered or Threatened Species Permit, No. 11-14Sa; and/or United States Fish and Wildlife Service (USFWS) Special Purpose Utility Permit for Migratory Bird Mortality Monitoring, No. MB01827B-0.

Figure 3. Example ground conditions at search plots used in the California Ridge Wind Energy Facility carcass monitoring study. The top photo is of a plot in mowed corn, the bottom photo is of a plot in mowed soybean.

2.1.3 Bias Trials

Scavenger removal and searcher efficiency trials (bias trials) were conducted to assess sources of bias and to improve the accuracy of fatality rate estimation. Bias trials were designed to estimate the proportion of carcasses removed by scavengers prior to scheduled searches and the proportion of remaining carcasses that were missed by searchers during scheduled searches. One searcher efficiency and one carcass removal bias trial was conducted during the study period using house sparrows (*Passer domesticus*) and Coturnix quail (*Coturnix spp.*) for small birds, mallards (*Anas platyrhynchos*), and ring-necked pheasants (*Phasianus colchicus*) for large birds, and previously salvaged bat species (big brown bat [E*ptesicus fuscus]*, eastern red bat [*Lasiurus borealis]*, hoary bat [*Lasiurus cinereus]*, and silver-haired bat [*Lasionycteris noctivagans])*. The scavenger removal trial lasted 30 days or until all placed carcasses were removed by scavengers, whichever came first.

For the bias trials, carcasses were randomly placed on search plots. The locations of the placed carcasses (i.e., distance and bearing from turbine) were randomly assigned prior to the start of bias trials. Trial carcasses were discreetly marked so that technicians, who were blind to the presence and location of trial carcasses, could identify them when they were found. When technicians located a bias trial carcass they recorded the location, species, and time of the discovery. Found carcasses were left in place for use in the concurrent scavenger removal trial. As such, each bias trial carcass was used to estimate both searcher efficiency and scavenger removal rates.

During the scavenger removal trial, technicians checked each carcass every day during days 1-7, then on days 10, 14, 20, and 30. During checks, technicians recorded whether the carcass remained, and if so, the condition of the carcass (e.g., intact – no scavenging, evidence of scavenging, whole carcass, partial carcass, etc.) and the source of scavenging, if it could be determined. If the carcass was not found in its previous location during a check, bias trial technicians were instructed to search within a 5 m (16 ft) radius circle of the previous carcass location. If after three visits the carcass was not located by the technician, it was assumed to have been scavenged and was noted as having been removed by a scavenger prior to the first visit during which it was not found. Any bias trial carcasses remaining after 30 days were disposed of.

Using data from these trials, the number of days that passed until a carcass was first found during a scheduled search was estimated, as was the number of days that a carcass persisted and was available to be found. These mean durations were used to estimate searcher efficiency and scavenger removal rates.

2.1.4 Fatality Rate Estimation

Estimated bird and bat fatality rates were calculated based on:

1. Observed number of bat and bird carcasses found during standardized searches during the study period;
2. Searcher efficiency; and
3. Scavenger removal rates.

The probability of carcass availability and detection ($\hat{\pi}$) was calculated based on the results of the bias trial. Estimated fatality rates were calculated based on the variables and equations below.

2.1.5 Definition of Variables

The following variables were used in the below equations:

- c_i number of carcasses detected at plot *i* during the study period
- n number of search plots
- $\bar{c}$ average number of carcasses observed per turbine per study period
- s number of carcasses used in the carcass removal trial
- s_c number of carcasses in the carcass removal trial that remained in the study area at Day 30
- t_i time (in days) a carcass remained in the study area before it was removed, as determined by the carcass removal trial
- $\bar{t}$ average time (in days) a carcass remained in the study area before it was removed, as determined by the carcass removal trial
- d total number of carcasses placed in the searcher efficiency trial
- p estimated proportion of detectable carcasses found by observers, as determined by the searcher efficiency trial
- I average interval between standardized carcass searches, in days
- $\hat{\pi}$ estimated probability that a carcass was both available to be found during a search and was found, as determined by the carcass removal and the searcher efficiency trials (i.e., detection probability)
- m estimated annual average number of carcasses per turbine per study period, adjusted for carcass removal and searcher efficiency bias

2.1.6 Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per study period was:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{n}$$

2.1.7 Estimated Carcass Removal Rate

Estimates of carcass removal rates were used to adjust carcass counts for carcass removal bias. Mean carcass removal time ($\bar{t}$) was the average length of time a carcass remained in the study area before it was removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

2.1.8 Estimated Searcher Efficiency Rate

Searcher efficiency rates were expressed as *p,* the proportion of trial carcasses that were detected by observers in the searcher efficiency trials. These rates were estimated by carcass size. No visibility classes were mapped since the plots were all in tilled agriculture and had similar visibility classes.

2.1.9 Estimated Fatality Rate

The estimated per turbine fatality rate (*m*) was calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}}$$

where $\hat{\pi}$ included adjustments for carcass removal (from scavenging and other means) and searcher efficiency bias.

The final reported estimates of m were calculated according to the formula above, which was independently verified by Shoenfeld (2004). Associated standard errors and 90% confidence intervals (CIs) were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating variances, and confidence intervals for complicated test statistics. For each bootstrap sample, $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated. A total of 1,000 bootstrap samples were used for each estimate. The standard deviation of the bootstrap estimates was reported as the estimated standard error. The lower fifth and upper ninety-fifth percentiles of the 1,000 bootstrap estimates were taken as estimates of the lower limit and upper limit of the 90% CIs. In addition, all areas within all surveyed plots were searchable; therefore no area correction factors were needed.

2.2 American Golden-Plover Monitoring

The AMGP migration monitoring surveys followed methods outlined in the ABPP (CRWE 2011). Surveys were conducted from April 1 to May 16, 2014, which coincides with the peak spring migration stopover period for AMGP in the upper Midwest (O'Neal and Alessi 2008).

2.2.1 Survey Methods

Four survey transects were established that bisected the Project area with two transects following north-south roads and the other two following east-west roads (Figure 4). Surveys were conducted four days per week. Surveys began at 0800 am, and ended when all transects had been searched. Observers drove transects at approximately 24 – 32 kilometers per hour (kph; 15-20 miles per hour [mph]) while looking for AMGP on both sides of the road and stopped at observations points spaced approximately 1.6 kilometers (km; one mile [mi]) apart. If AMGP were observed while driving, the observer stopped and monitored the group of AMGP for up to three minutes or until he or she lost visual contact with the AMGP. No unplanned stops were made unless AMGP were observed.

Data collected for all AMGP observations included: date, time, location, habitat, weather conditions, number of birds observed, behavior (e.g., resting, feeding, etc.), flight height, and direction of flight. Weather conditions (e.g., temperature, wind speed, cloud cover) were also recorded at the beginning and end of each survey day.

2.2.2 American Golden-Plover Data Analysis

The locations and number of individual birds for each AMGP observation were recorded to determine areas of AMGP use within the Project area. Habitat characteristics recorded at each observation location and at survey points were analyzed to assess AMGP selection of different habitats within the Project area. Flight observation data were analyzed to determine flight paths between areas of use, average flight heights within the Project area, and percent of AMGP observations at rotor-swept height (RSH). AMGP flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height.

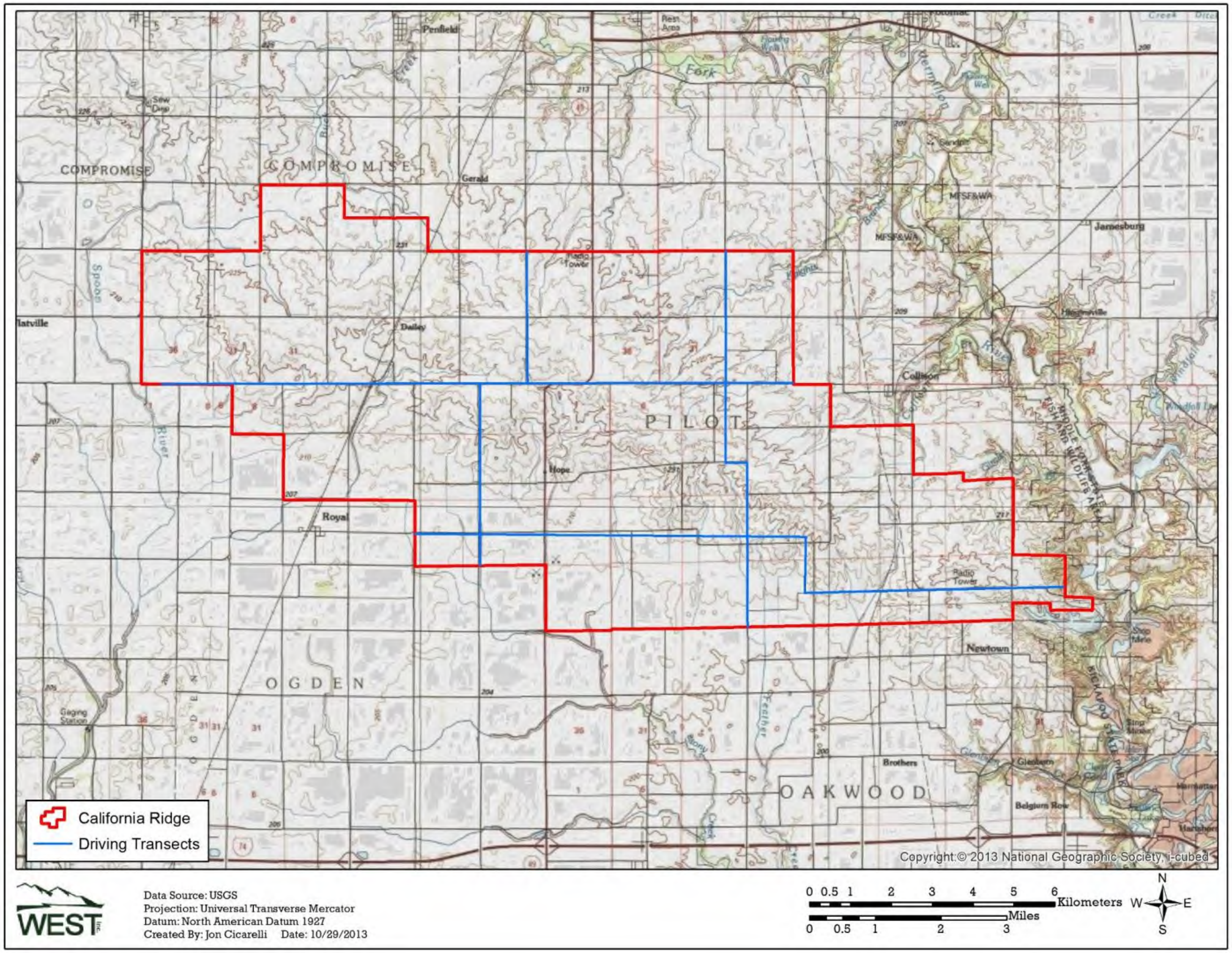

Figure 4. Location of American Golden-plover transects within the California Ridge I Wind Energy Project.

3.0 RESULTS

3.1 Carcass Monitoring

A total of 270 turbine searches were conducted from April 15 to May 16, 2014. Nine carcasses (one bird and six bats) were found during surveys and no carcasses were found incidentally (Table 1). One killdeer (*Charadrius vociferus*) was found on April 21, 2014 at turbine 3 between 40 and 50 m (131 and 164 ft; Table 2) from the turbine.

Two species of bats were found during surveys: five silver-haired bats (*Lasionycteris noctivagans*) and three eastern red bats (*Lasiurus borealis*). Bats were found at seven different turbines on seven different dates. The majority of bats (62.5%) were found less than 10 m (33 ft) from turbines. Additionally, bats were found from 30 to 40 m (98 to 131 ft; 12.5%) and 40 to 50 m (25%; Table 2) from turbines.

Table 1. Total number of bird and bat carcasses and the composition of carcasses discovered at the California Ridge I (Spring 2014) Wind Energy Facility from April 15 to May 16, 2014.

	Carcasses Found during Scheduled Searches		Carcasses Found Incidentally at Search Plots*		Other Incidental Finds		Total	
Species	**Total**	**% Comp**	**Total**	**% Comp**	**Total**	**% Comp**	**Total**	**% Comp**
Birds								
killdeer	1	50	0	0	0	0	1	100
Overall Birds	1	100	0	0	0	0	1	100
Bats								
silver-haired bat	5	62.5	0	0	0	0	5	62.5
eastern red bat	3	37.5	0	0	0	0	3	37.5
Overall Bats	8	100	0	0	0	0	8	100

*Carcasses found incidentally on turbine search plots were included in analyses.

Table 2. Distribution of distances from turbines of bird and bat carcasses found during scheduled searches or incidentally on turbine search plots at the California Ridge I Wind Energy Facility from April 15 to May 16, 2014.

Distance to Turbine (m)	% Bird Carcasses	% Bat Carcasses
0 to 10	0	62.5
10 to 20	0	0
20 to 30	0	0
30 to 40	0	12.5
40 to 50	100	25
50 to 60	0	0
60 to 70	0	0
70 to 80	0	0
80 to 90	0	0
>90	0	0

One searcher efficiency trial was conducted on April 18, 2014 and carcasses were spread throughout the Project area. Fifty carcasses (10 large birds, 13 small birds, and 27 bats) were placed for the trial. The searcher efficiency rate was 80% for large birds, 69.2% for small birds, and 81.5% for bats (Table 3).

Table 3. Searcher efficiency results at the California Ridge I Wind Energy Project as a function of carcass size.

Size	# Placed	# Available	# Found	% Found
Small Birds	13	13	9	**69.2**
Large Birds	10	10	8	**80.0**
Bats	27	27	22	**81.5**

One carcass removal trial was placed on April 18, 2014 and carcasses were spread throughout the Project area. The mean carcass removal rate was 11.1 days for large birds, 10.25 days for small birds, and 8.85 days for bats. By day ten, approximately 50% of large birds, 60% of small birds, and 40% of bats remained where they were placed. By day 20, approximately 10% of large birds, 0% small birds, and 10% of mice remained (Figure 5).

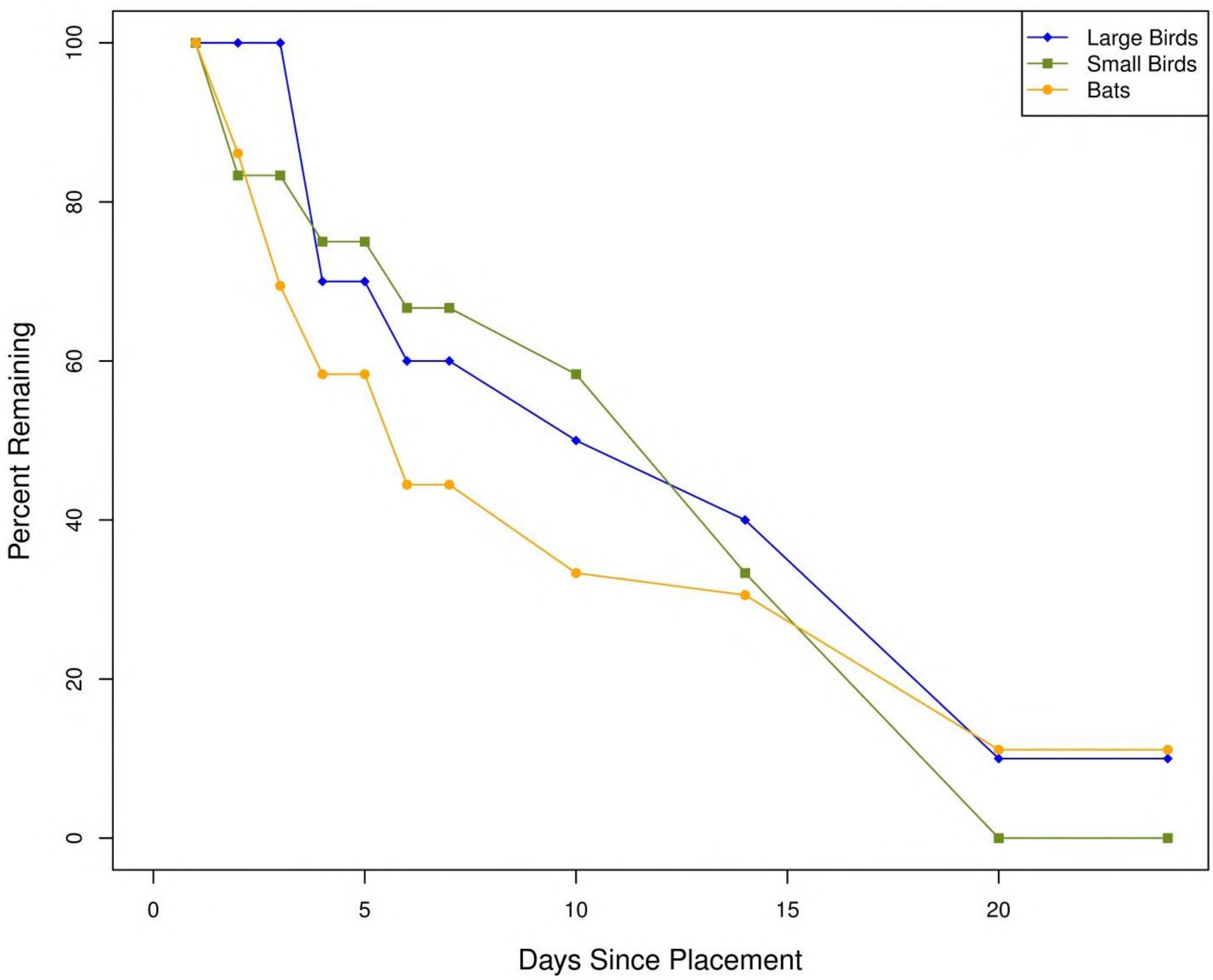

Figure 5. Carcass removal rates at the California Ridge I Wind Energy Facility.

3.2 Estimated Fatality Rates

Fatality estimates and 90% confidence intervals were calculated for birds and bats for the period from April 15 to May 16, 2014 (Appendices A and B). The fatality estimates were adjusted based on the corrections for carcass removal and observer detection bias. Estimates were provided per turbine and per MW based on the 1.6-MW capacity of the turbines at the Project (Table 4).

Table 4. Estimated bird and bat fatality rates for California Ridge I Wind Energy Facility for the period from April 15 to May 16, 2014.

	Corrected Fatality Estimate	90% Confidence Interval
Estimated # fatalities/turbine/study period		
Small Birds	0.05	0 – 0.14
Large Birds	0	0
Raptors	0	0
All Birds	0.05	0 – 0.14
Bats	0.36	0.14 – 0.59
Estimated # fatalities/MW/study period		
Small Birds	0.03	0 – 0.07
Large Birds	0	0
Raptors	0	0
All Birds	0.03	0 – 0.07
Bats	0.19	0.05 – 1.08

3.3 American Golden-plover Monitoring

Fifty-eight groups of AMPG totaling an estimated 4,478 birds were observed during surveys from April 1 to May 16, 2014 (Table 5). Peak observations of AMPG occurred during the week of April 27 when 25 groups of AMGP were observed, totaling 2,193 birds.

Table 5. Number of individuals and groups of American golden-plovers by week observed at the California Ridge I Wind Energy Facility during the period from April 1 to May 16, 2014.

Week	# Individuals	# Groups	Mean Group Size
April 1 - 5	0	0	0
April 6 - 12	0	0	0
April 13 - 19	110	3	37
April 20 - 26	255	6	43
April 27 – May 3	2,193	25	88
May 4 – 10	1,920	24	80
May 11 – May 16	0	0	0
Total	**4,478**	**58**	**77**

Mean group size ranged from 37 birds the week of April 13 to 88 birds the week of April 27, and averaged 77 over the course of the study (Table 5). The majority of AMGP observations were recorded in the western portion of the Project area (Figure 6).

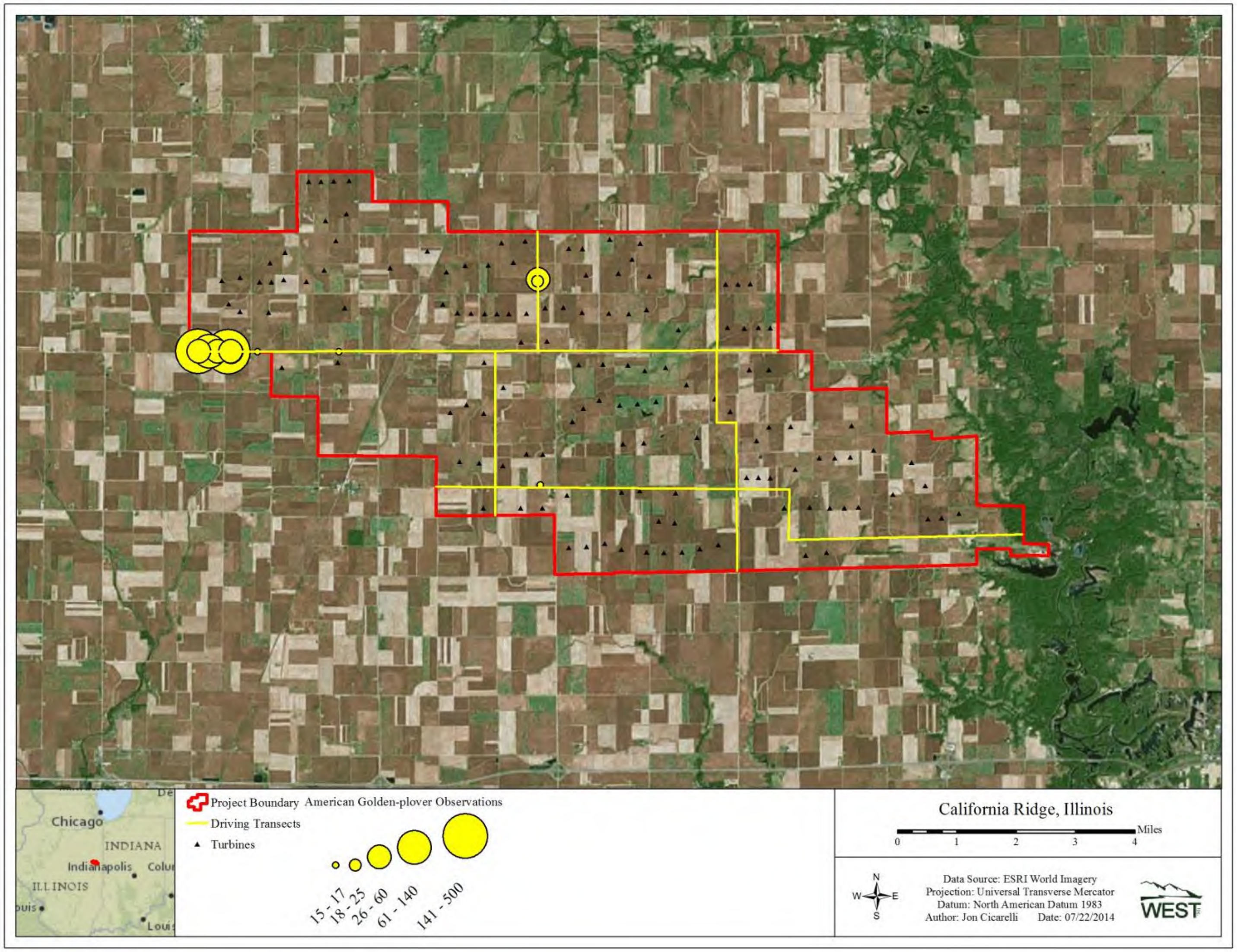

Figure 6. Location and the number American golden-plover observations during spring 2014 surveys at the California Ridge I Wind Energy Facility.

The majority of AMGP observations were recorded in no-till soybean fields (45.3%; Table 6); the remaining observations were recorded in tilled fields (22.7%), stubble soybean fields (15.5%), and stubble corn (16.5%).

Table 6. Observations of American golden-plovers (AMPG) foraging or perching by habitat within the California Ridge I Wind Energy Facility.

Habitat	Total # of AMGP Observations	% Composition
No-till Soybean	645	45.3
Tilled Field	323	22.7
Stubble Soybean	220	15.5
Stubble Corn	235	16.5
Other	0	0.0
Tilled Corn	0	0.0
Tilled Soybean	0	0.0
Winter Wheat	0	0.0
Pasture	0	0.0
Overall	**1,394**	**100**

All AMGPs observed flying (two groups) were recorded below the RSH; the average flight height of AMGP observations was 11.6 m (38.1 ft) above ground level. AMGP were observed flying northerly and southerly during surveys (Figure 7).

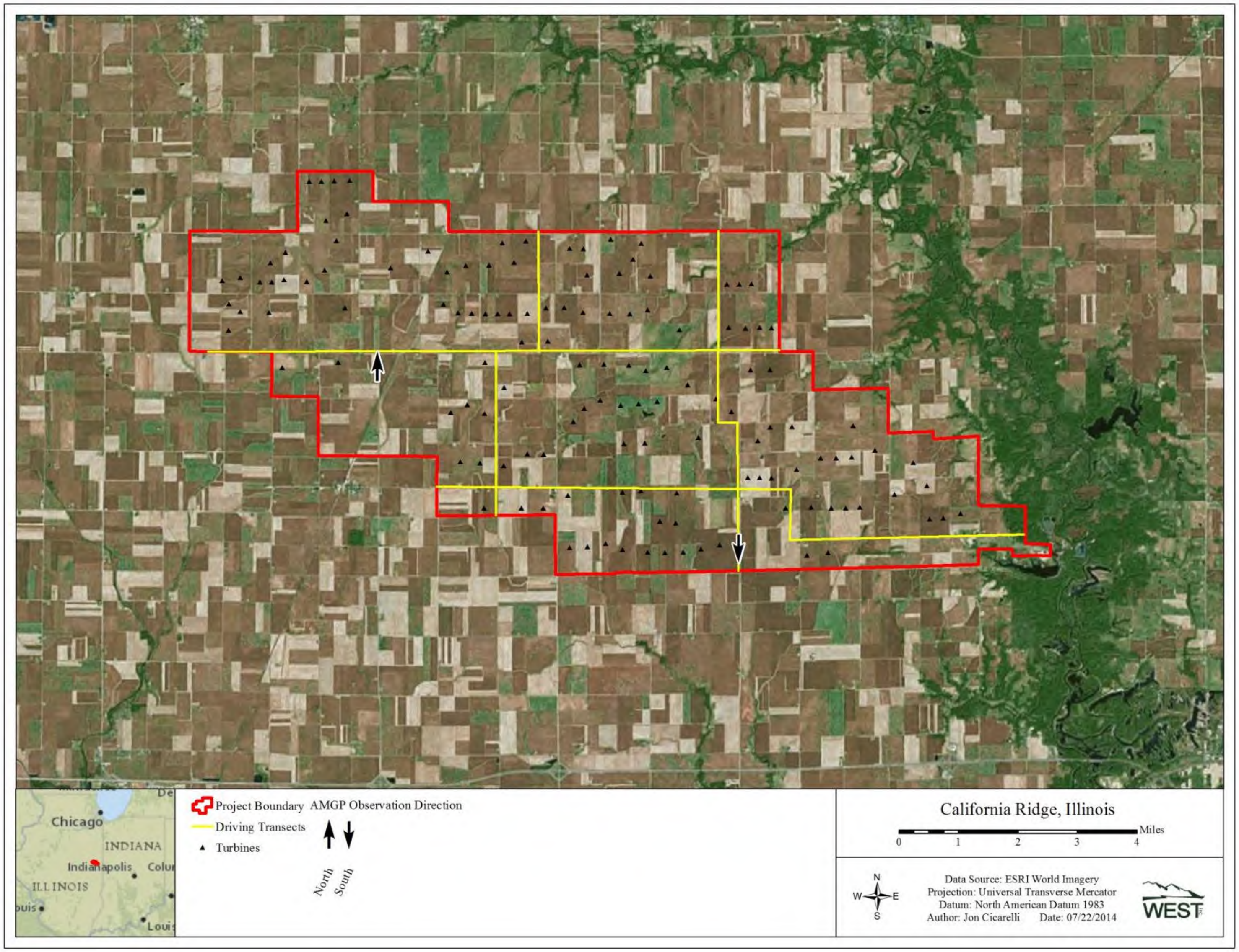

Figure 7. Flight direction of observed American golden-plovers in the California Ridge I Wind Energy Project, spring 2014.

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Appendix A. Estimated bird fatality rates for the period from April 15 to May 16, 2014 at the California Ridge I Wind Energy Facility

Appendix A. Estimated bird fatality rates for the California Ridge I Wind Energy Facility for studies conducted from April 15 to May 16, 2014.

Parameter	Mean	90% CI
Observer Detection		
P (small birds)	0.69	0.46 – 0.92
P (large birds)	0.80	0.60 – 1.00
Mean Carcass Removal Time (days)		
$\bar{t}$ *(small birds)*	10.25	7.29 – 13.17
$\bar{t}$ *(large birds)*	11.1	7.45 – 14.55
Observed (Uncorrected for Bias) Fatality Rates (Fatalities/turbine/study period)		
Small birds	0.03	0-0.1
Large birds	0	-
Raptors	0	-
Average Probability of Carcass Availability and Detected		
Small birds	0.73	0.59 - 0.81
Large birds	0.78	0.64 - 0.85
Corrected Fatality Estimates (Fatalities/turbine/study period)		
Small birds	0.05	0.00-0.14
Large birds	0	-
Raptors	0	-
All birds	0	0.00-0.14

Appendix B. Estimated bat fatality rates for the period from April 15 to May 16, 2014 at the California Ridge I Wind Energy Facility

Appendix B. Estimated bat fatality rates for the California Ridge I Wind Energy Facility for studies conducted from April 15 to May 16, 2014.

Parameter	Mean	90% CI
Observer Detection		
P (bats)	0.82	0.70 – 0.93
Mean Carcass Removal Time (days)		
$\bar{t}$ *(bats)*	8.85	6.83 – 11.10
Observed (Uncorrected for Bias) Fatality Rates (Fatalities/turbine/study period)		
Bats	0.27	0.1 – 0.43
Average Probability of Carcass Availability and Detected		
Bats	0.74	0.67 - 0.80
Corrected Fatality Estimates (Fatalities/turbine/study period)		
Bats	0.36	0.14 –0.59

2014 Avian Carcass Monitoring Report

California Ridge Wind Energy Facility
Vermilion and Champaign Counties, Illinois

January 22, 2015

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Table of Contents

List of Tables

List of Figures

Attachments

Note: *Submitted to Invenergy Electronically via MS Excel File

EXECUTIVE SUMMARY

Avian carcass monitoring was conducted at the California Ridge Wind Energy Facility (CRWEF), concurrent with bat carcass monitoring during studies of experimental bat deterrent technology and turbine curtailment between August 1 and October 9, 2014. Thirty turbines were randomly selected for daily monitoring between August 2 and October 8, 2014. However, due to turbine maintenance issues and crew logistical constraints, the schedule was revised to include 27 turbines that were searched daily. Technicians, including dog/handler teams, were instructed to search for any bird carcasses within 60-meter radius plots centered beneath each of the 27 turbines.

During carcass monitoring, search crews were assessed for search proficiency (searcher efficiency) using 29 bird carcasses across 10 placement dates. Searchers were targeted for a single search, after which the trial placement crew checked whether undiscovered carcasses had been removed by scavengers. Carcasses remaining after the 1 day search were collected. Of the 29 carcasses placed throughout the plots, 22 were recovered, resulting in an overall search efficiency of 0.76. In addition to search proficiency testing, 20 bird carcasses were placed to assess the rate of carcass removal (e.g. by scavengers). These carcasses were placed in two 10-carcass trials of 20 days each. During these trials, technicians were informed of the location of each carcass, and were instructed to confirm the presence or absence of each carcass. Using a maximum likelihood estimator, we calculated that carcasses were removed after an average of 27.41 days.

These bias adjustments, along with adjustments accounting for missed searches and imperfect search areas, were used to estimate total bird fatality at the CRWEF. An estimate of 332 bird fatalities (95% confidence interval of 235 – 434 birds) was generated. This value equated to a point estimate of 2.5 birds per turbine (1.8 – 3.2 birds/turbine) or 1.5 birds per nameplate Megawatt (1.1 – 2.0 birds/MW). The 95% confidence intervals were generated using a bootstrap method with 5,000 iterations.

1.0 INTRODUCTION

The California Ridge Wind Energy Facility (CRWEF) is located in Champaign and Vermilion Counties, Illinois. The facility is owned by California Ridge Wind Energy LLC and consists of 134 1.6 megawatt (MW) turbines. This report details the results of carcass monitoring conducted at the CRWEF during 2014. The objective of this monitoring program was to assess the levels of avian fatality at this facility in compliance with the CRWEF Bird and Bat Conservation Strategy (California Ridge Wind Energy LLC 2011), in addition to the guidelines and recommendations of the Illinois Department of Natural Resources (IDNR) and the US Fish and Wildlife Service.

2.0 METHODS

The 2014 monitoring program was conducted concurrently with a study of experimental bat deterrent and curtailment treatments at a subset of 30 randomly selected turbines at the CRWEF. Twenty-seven (27) of these 30 turbines were included in the avian monitoring program. These 27 turbines were monitored daily between August 2 and October 8, 2014. The results of the bat deterrent and curtailment research are reported separately.

Daily monitoring was conducted within circular plots of 60-meter (m) radius centered on each of the selected turbines, with the exception of the plot at Turbine 56 (which had a more restricted search area due to a personnel safety issue created by the agricultural drainage system). Searches were conducted by either a team of 2 human searchers or a dog and handler team. Transect boundaries, along with markers along the center line of each plot running east to west, were established using wooden stakes. This center line was set with 6 meter spacing between transects. Human searchers followed each north/south transect during a search, and also searched in between each pair of adjacent transects (Figure 1). Between marker stakes, marking paint (color coded to specific transect lines) was used to keep the searcher crews oriented. In total, there were 21 transects per full plot.

2.1 Project Area

The CRWEF is approximately 17.6 kilometers (km) east to west, and approximately 9.6 km north to south (see Attachment A). The wind farm is located approximately 16 km northwest of Danville, IL, and approximately 32 km from Champaign, IL, along State Route 49. The study area consisted of mostly agricultural land, with sparsely distributed oak-hickory wood lots. A tributary of the Vermilion River, the Middle Fork River, flows adjacent to the eastern side of the wind farm, and at the closest point is approximately 3.2 km from the nearest turbine. This river is designated as a “State Scenic River”, and provides wildlife habitat in the form of temperate deciduous forest, with some interspersed tallgrass prairie.

2.2 Fatality Monitoring

2.2.1 Selection of Turbines

A subset of 30 turbines was randomly selected during a prior monitoring season (Gruver et al. 2014). For consistency, the same subset of turbines was used in the 2014 monitoring. The turbines were split into a group of 20 that were assigned to a bat deterrent experiment and 10 that were assigned to a curtailment experiment. The 20 “deterrent” and 10 “curtailment” turbines are listed in Table 1 below and were distributed throughout the entire CRWEF facility (Attachment A).

Table 1: List of Deterrent and Curtailment Turbines

Deterrent Turbines	3	11	19	24	27	32	43	48	51	56	64	67	88	96	104	109	112	117	120	133
Curtailment Turbines	8	16	35	40	59	72	75	80	125	128										

Three of the 30 selected turbines were ultimately removed from the final data analysis. Turbine 64 was down for significant maintenance and was removed from the search rotation on August 19, 2014. Furthermore, 2 curtailment turbines, 75 and 125, were removed from the study, due to limitations in the logistical capabilities of the field crews. The remaining 27 turbines were searched daily, unless a limiting factor (e.g., turbine maintenance or lightning) prohibited the search of a plot in a safe manner. Search and carcass data collected at Turbines 64, 75, and 125 were removed from the dataset; these turbines were considered unmonitored for the 2014 season.

<u>2.2.2 Study Schedule</u>

This report considers the data from August 2 to October 8, 2014. All 27 turbines were included on the schedule during that period. However, searches were not conducted from September 24 to 26 at the 20 turbines used in the bat deterrent study and from September 25 to 27 at the 10 turbines used in the curtailment study, because of a site-wide power outage caused by electrical substation maintenance. The decision to not search any given plot was approved by Shoener Field Crew Supervisor (Carlyle Meekins/Brad Romano) or the Site Supervisor (Matt Wingler). When a search could not be conducted, it was recorded in the “Comments” section of the daily search summary sheet.

For the purpose of maintaining consistent search conditions, the search day commenced at 7:00 am (plus/minus 10 minutes), weather and site conditions permitting. When a search day could not be started on time, it was recorded in the “Comments” section of the daily search summary sheet.

<u>2.2.3 Search Plots, Visibility Classes, and Habitats</u>

Search plots with a 60-m radius were established beneath each of the monitored turbines (Figure 1). Plots were marked with painted and staked transects that were spaced approximately 6 meters apart. Plots were mowed, sprayed with herbicide, and/or treated with controlled burn techniques to maximize carcass detectability. These methods were utilized throughout the season on areas that became difficult to search. Due to intensive plot condition maintenance, the habitat conditions varied across the season. Therefore, visibility classes for placed and found carcasses (including both actual carcasses and searcher efficiency/carcass removal trials) were determined at the time of placement or recovery, not during the periodic plot mapping efforts.

The search conditions in each plot encompassing the 27 selected turbines were defined and mapped into 3 visibility classes. This action was completed at the beginning and end of the study period.

The visibility classes identified within the plots were defined as follows:

Class 1 (easy): Bare ground 90% or greater; all ground cover sparse and 6 inches or less in height (e.g., Gravel pad/road, bare dirt)

Class 2 (moderate): Bare ground 25% or greater; all ground cover 6 inches or less in height and mostly sparse.

Class 3 (difficult): Bare ground 25% or less; vegetation ranging up to 12 inches in height.

Attachment B shows habitat class by individual grid from both at the beginning and the end of the study period, divided into the 3 searched visibility classes.

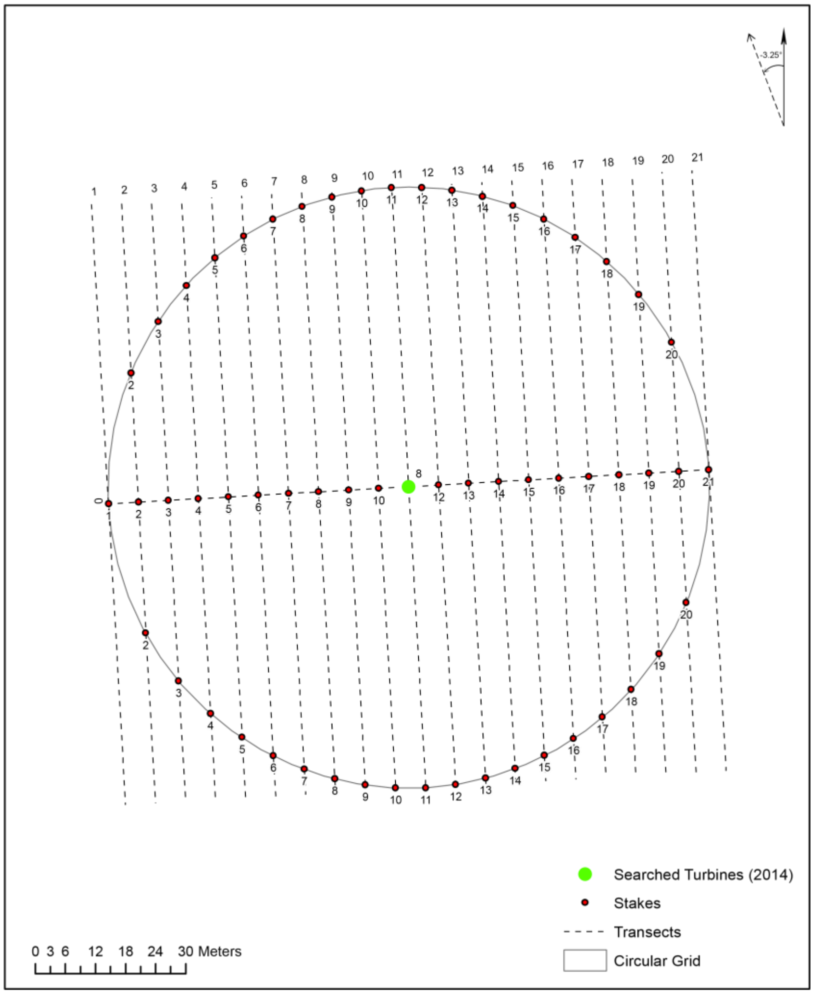

Figure 1. Diagram of a Typical Search Plot

2.2.4 Search Methods

Searches were conducted by either a team of 2 human searchers or a dog and handler team. The search order depended on the pre-determined schedule developed for the experimental treatment/control study designs of the bat fatality experiments. When a plot was searched by a human team, the plot area was examined by an observer walking along each transect and in between each pair of adjacent transects through the search plots and visually searching for bird carcasses. Searches were conducted starting from the center 2 transects (10.5 and 11), and searchers were assigned to "A" and "B" sides based on the orientation of their names on the personnel schedule. The "A" side started on transect 10.5 and worked west, while the "B" side started on transect 11 and worked east. Search crews started on the north side of the plots on even days and the south on odd days. Individual searchers and turbines to be searched were initially selected through a stratified random process to ensure unbiased randomization. Searcher schedules were then altered to accommodate personal requests for time off. Searches were conducted at a slow pace while looking side-to-side for available carcasses.

In addition to human visual searches, 2 dog and handler teams were used to attain as close to 100% carcass retrieval as possible across a 3-day period. These dogs were trained and handled by "Conservation K-9's", a biological research team based out of the University of Washington, Seattle, Washington, USA. The handlers would determine any predominant wind direction prior to starting a search and station the dog downwind from the plot. Upon starting a search, the handler and dog would search into the wind using a zigzag pattern to ensure that any carcass scent would be detected by the dogs. For purposes of simplicity, both human and dog/handler teams are subsequently referred to as "searcher(s)" unless otherwise specified.

On a full search plot, average human searcher times at a single turbine ranged from 39.8 to 49.0 minutes depending on ground cover and topography. Average dog and handler search times at a single turbine ranged from 29.9 to 44.3 minutes.

When a searcher discovered a carcass, he/she would flag its location using a roll of flagging or a pin flag, and then continue searching until the entire plot had been surveyed. This ensured that each plot was searched thoroughly and at a consistent rate. After the plot was completely searched, the searcher bagged the carcass using gloves or by inverting the collection bag. All carcasses were collected using this method as a safety precaution and to reduce the possible human scent bias for any carcasses used later in trials. The bags were labeled with a unique identification number. Carcasses were handled in accordance with the IDNR Scientific Permit and the IDNR Permit for Possession of Endangered or Threatened Species. A laser rangefinder (Nikon ProStaff 550 or similar) was used to determine the distance to the turbine, and an azimuth to the tower was taken with a compass. This information, along with time, weather data, transect number, and visibility class, was recorded on a Carcass Data Form (see Attachment C). Carcasses were stored in a freezer at the site's maintenance facility.

When found, each carcass was assigned a unique specimen number. The specimen number was made up of 5 parts: capital letters representing the wind farm, the date, the turbine number, the searcher's initials, and a sequential specimen number for carcasses found that day by the searcher. For example, a Specimen Number of Q09241402JS02 denotes that the carcass was found at Wind Farm "Q" on September 24, 2014, at Turbine 2 by John Smith, and that it is the second carcass John found during searches on that date.

2.2.5 Documentation of Incidental Carcasses

Incidental fatalities were defined in this study as carcasses found outside of the search plots or carcasses found within a plot but outside of a scheduled survey period. Incidental fatalities were reported to the Shoener Field Crew Supervisor or Wildlife Monitoring Technicians on site that day. If a carcass was found by personnel other than a searcher, the carcass was left in place for retrieval by a Technician or Field Supervisor. Upon retrieval, a Carcass Data Form was completed. This form is identical to that used during standard searches. The carcass was then tagged and stored in the freezer on site. Carcasses were handled in accordance with the IDNR Special Use Permit. Incidental carcasses were not factored into the fatality statistics as they were found outside the standard search parameters.

2.2.6 Alive and Injured Specimens

If an alive or injured bird was discovered during the searches or incidentally, the Shoener Field Crew Supervisor was to be immediately alerted. An additional protocol included notifying IDNR to request further instructions on how to handle the specimen. No birds were allowed to be euthanized without authorization from the IDNR.

2.3 Search Bias Corrections

The number of carcasses found during the standardized searches is normally lower than the overall number of bird fatalities likely to have occurred at the site. Therefore, to adjust for inherent bias in the searches, correction factors were applied to the raw number of retrieved carcasses. Searcher efficiency (SE) and carcass/scavenger (CR) removal trials were conducted to adjust the carcass counts for observer and carcass removal bias, respectively. Observer bias may occur during standardized searches if the searchers have difficulty locating carcasses due to vegetative growth or the size/color of the species. Carcass removal bias may occur if the carcasses are removed by scavengers prior to the time the searchers arrive for the next scheduled survey. Other adjustments to the carcass counts are made to account for the percentage of unsearchable area within the search plots, and the proportion of turbines within the wind farm that were searched during the study. For the purpose of fatality estimation, the proportion of turbines that were considered searched was 27 out of 134.

Searcher efficiency trials and carcass removal trials were performed throughout the monitoring season. Bird carcasses found during searches were used in the SE and CR trials once they were validated and deemed suitable for use. Carcasses that were considered for use were first inspected, and no carcasses missing appendages, having open wounds, or in general poor condition were used. Carcasses of threatened or endangered species were not used for SE or CR trials. Sixteen (16) bird species were used for searcher efficiency and carcass removal trials, with the majority of individuals being adult rock pigeon (*Columba livia*) and juvenile Northern bobwhite (*Colinus virginianus*), which were provided from a carcass supplier. SE and CR trials were conducted in various weather conditions. The carcasses were placed randomly in each search plot. Due to scheduling logistics, human search teams were tested at deterrent turbines, and dog and handler teams were tested at curtailment turbines.

2.3.1 Searcher Efficiency Field Methods

In total, 29 individual bird carcass trials were performed to determine searcher efficiency during the monitoring season. Searcher efficiency trials commenced in the second week of August and ended on the last day of the search season. Toe, wing, or finger clippings were used to mark the carcasses in a way that was anonymous to the searchers during the trials. Carcass distribution among the visibility classes varied per turbine to reflect site conditions. All visibility classes were tested at each turbine, and distribution generally reflected the amount of each visibility class present at that specific turbine. To avoid bias, all carcass distances and azimuths were generated using the random number function on Microsoft® Office Excel before arriving at the wind farm. Carcasses were tossed into the air to determine position, simulating a bird falling from the turbine. Gloves were worn at all times while handling and preparing the carcasses.

The 13 bird species used in the searcher efficiency trials included: American redstart (*Setophaga ruticilla*), chestnut-sided warbler (*Setophaga pensylvanica*), eastern kingbird (*Tyrannus tyrannus*), horned lark (*Eremophila alpestris*), house finch (*Haemorhous mexicanus*), killdeer (*Charadrius vociferus*), juvenile Northern bobwhite, purple martin (*Progne subis*), rock pigeon, rose-breasted grosbeak (*Pheucticus ludovicianus*), Tennessee warbler (*Oreothlypis peregrina*), and yellow-billed cuckoo (*Coccyzus americanus*).

All searchers were tested for searcher efficiency in rough proportion to the amount of search time they conducted (for example, searchers who searched multiple times per week were tested more frequently than searchers who searched less than once per week). Trials were unannounced and were set up near dusk after daily searches were completed. Carcasses were marked discreetly in an effort to keep searchers blind to the trials. Trials were placed 12 to 24 hours prior to a targeted search in an attempt to best simulate the conditions of actual bird fatality patterns, as well as to minimize the scavenging of trial carcasses. Any carcasses recovered by search technicians the next day were collected and checked for identifying marks by the trial placement manager. Any carcasses that could not be recovered by search technicians or trial placement personnel were considered scavenged and were not included in the statistical analysis.

2.3.2 Scavenger/Carcass Removal Field Methods

A total of 20 bird carcasses were used to measure carcass removal during the monitoring season. The trial carcasses were placed in all searched visibility classes. The carcasses were placed in the afternoon, near dusk, and were monitored for removal once every 24 hours for 20 days after which any remains were collected. Each carcass was marked with a discreetly placed black zip tie to identify the carcass as a test carcass. At the end of the trial, the remains were collected. Carcass locations and positions were determined in the same manner for carcass removal trials as for searcher efficiency trials.

The 9 species used in CR trials included great horned owl (*Bubo virginianus*), horned lark, house sparrow (*Passer domesticus*), killdeer, juvenile Northern bobwhite, red-tailed hawk (*Buteo jamaicensis*), ring-necked pheasant (*Phasianus colchicus*), rock pigeon, and Tennessee warbler.

2.3.3 Searchable Area Corrections

Searchable area corrections were made by dividing fatality counts for each turbine by the proportion of the total area (120 m circle) that was searched for that turbine. The percentage of searchable area at each turbine was estimated through analysis of the visibility class maps, presented in Attachment B, in ArcGIS. All plots were entirely searchable except T56, which was 52% searchable, due to searcher avoidance of drainage features for safety.

2.4 Analysis

2.4.1 Bird Carcass Data

All data collected in the field was transferred to Microsoft® Office Excel spreadsheets and reviewed for consistency and correctness. The completed data record is provided in Attachment D. All analysis of fatality data was completed in Excel or Program R (R Development Core Team 2008). P-values were compared to an alpha of 0.05 in order to assess significance. Patterns were analyzed using descriptive statistics, such as averages, percentages, and ranges, which were also calculated in Excel. Fatality estimates and bootstrapping values were calculated using Program R.

2.4.2 Temporal and Spatial Patterns

Temporal patterns were analyzed within the study period by breaking down the carcass data by week. Tables and graphs created in Excel were used to review these temporal patterns over the entire search period.

A histogram created in Excel was used to assess the frequency of carcasses within 10-meter distance classes starting at the turbine base. Averages and percentages were calculated using Excel.

2.4.3 Age, Species, and Sex

Bird carcasses found on site were identified by Brad Romano or Michael David, Shoener Environmental Ornithologists. In this validation process, species, age, and sex were verified.

All species found at the site were compared to the prioritization listing in Illinois' Wildlife Action Plan. Wildlife Action Plan species are those species that are being proactively managed to prevent their populations from entering further decline (IDNR 2005, IDNR 2012).

2.4.4 Fatality Estimation

Estimates of total fatality for each of the monitoring seasons were computed using Excel and the R program. In this method, carcass counts at each turbine were adjusted for the searchable area and for the proportion of surveys completed at that turbine. A daily search interval was used to estimate fatality (as this was the mode of the actual search interval in the monitoring season) using the mortality estimator of Erickson et al. (2004):

$$m = \frac{\bar{c}}{\hat{\pi}}$$

and

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I}\left[\frac{e^{\frac{I}{t}} - 1}{e^{\frac{I}{t}} - 1 + p}\right]$$

The turbine estimates were then summed, and the result was adjusted for the proportion of turbines at the site that were searched, providing the final overall mortality estimate.

The per-turbine annual fatality rate, (*m*), is the quotient of the mean number of carcasses observed per turbine (c) and pi-hat, the fatality adjustment value calculated using search interval (*I)*, mean carcass removal time ($\bar{t}$), and overall mean searcher efficiency (*p*). Presented below are details of how searcher efficiency, carcass removal, search area, and missed search days are calculated and included in this method of fatality estimation.

Searcher Efficiency and Carcass Removal Corrections

Searcher efficiency and carcass removal (SECR) corrections were completed by Shoener Environmental. The probability that a carcass would be detected by searchers given that it was available to be found, *p*, was assessed through the searcher efficiency trials. The estimate of *p* was calculated as the number of trial carcasses found by searchers divided by the total number of successful trials (excluding trials where the carcasses were not found by searchers and were also not found later that day by testers; these carcasses were assumed to have been scavenged). Excel was used to create tables and to perform all statistical analysis on searcher efficiency data. This analysis included calculating basic descriptive statistics, such as averages and ranges of searcher efficiencies, calculating p-values and confidence intervals, and conducting binomial proportion hypothesis tests to analyze the significance of these statistics.

To estimate the time that carcasses persisted in the study plots, the average time a carcass was present in carcass removal trials, *t*, was calculated. Because the daily trial checks were halted after 20 days, the data are right-censored at 20 days. This right-censoring was compensated for by estimating the mean time to removal using a maximum likelihood estimator for *t* with the following formula:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where *s* is the number of test carcasses used in search trials, s_c is the number of test carcasses that remained in the study area at the end of the 20-day removal trial period, and t_i is the number of days carcass *i* remains in the search area (censored at 20 days for this purpose). Excel was used to determine descriptive statistics such as averages and ranges.

Searchable Area Corrections

Searchable area corrections were made by dividing fatality counts for each turbine by the proportion of the total area (60-m radius circle) that was searchable for that turbine. The percentage of searchable area at each turbine was estimated through analysis of the visibility class maps in ArcGIS.

Adjustment for Proportion of Surveys Completed per Turbine

Searches were scheduled to be conducted daily. If a day within the season was missed (the 3 days skipped due to site maintenance, for instance), searches were resumed on the next scheduled day. In this way, for the period of interest, an average search interval of 1 day was maintained. The Erickson et al. (2004) estimator accounts for the average search interval (*I*) directly in the estimation of fatality.

Bootstrapping Method

A bootstrapping analysis was conducted to determine a 95% confidence interval for the fatality estimate. The bootstrapping analysis was completed in Program R by Shoener Environmental. The bootstrapping confidence interval for the fatality estimate was obtained by bootstrapping (1) searcher efficiency trials, (2) the carcass removal trials, and (3) the sampled turbines to model each source of error. This bootstrapping process included 5,000 iterations of the stated factors.

3.0 RESULTS

3.1 Summary of Search Effort

Out of the 1,836 plot searches scheduled between August 2 and October 8, 2014, 1,741 (94.8%) plot searches were completed. Out of the 95 searches not completed, 8 were due to either turbine maintenance or unsafe weather conditions, and 6 were due to search crew limitations. The remaining missed searches (81) were due to the 3 days missed because of the site-wide electrical system maintenance, which offset the rotations assigned for the bat deterrent and turbine curtailment experiments.

Turbine 56 required the shortest overall search effort because of topographic restrictions that reduced the searchable area of the plot. On average, searches at Turbine 56 were completed in 24.4 minutes. The longest average search time was at Turbine 3, which took an average of 48.1 minutes to search. Table 2 presents the average search time and number of searches for each turbine by month and the overall percentage of scheduled surveys which were completed.

Table 2: Summary of Average Search Times, Frequency, and Percentage of Completed Surveys.

	August		September		October		Total		Total Scheduled Surveys	% Surveys Completed Overall
Turbine	Average Search Minutes	No. Searches	Average Search Minutes	No. Searches	Average Search Minutes	No. Searches	Average Search Minutes	No. Searches		
3	48.1	30	48.6	26	45.9	8	48.1	64	68	94.1
8	41.4	30	44.4	27	36.0	8	42.0	65	68	95.6
11	42.2	30	39.1	27	39.5	8	40.6	65	68	95.6
16	40.4	30	38.1	27	34.6	8	38.7	65	68	95.6
19	42.7	30	41.4	27	40.9	8	42.0	65	68	95.6
24	41.9	30	40.1	27	39.9	8	40.9	65	68	95.6
27	46.6	30	45.1	27	45.8	8	45.9	65	68	95.6
32	46.2	30	43.9	26	40.6	8	44.6	64	68	94.1
35	40.1	30	35.9	27	35.9	8	37.8	65	68	95.6
40	40.1	30	40.8	27	39.5	8	40.3	65	68	95.6
43	49.0	28	46.2	27	37.0	8	46.3	63	68	92.6
48	44.7	30	44.9	27	36.5	8	43.8	65	68	95.6
51	44.2	30	43.9	27	36.8	8	43.2	65	68	95.6
56	25.3	28	24.5	27	20.9	8	24.4	63	68	92.6
59	43.7	30	38.5	27	36.7	8	40.7	65	68	95.6
67	44.4	29	44.1	27	37.2	8	43.4	64	68	94.1
72	42.1	30	41.3	27	38.6	8	41.3	65	68	95.6
80	41.2	30	38.6	27	36.6	8	39.5	65	68	95.6
88	43.9	30	44.3	27	47.2	8	44.4	65	68	95.6
96	45.5	30	45.2	26	34.6	8	44.1	64	68	94.1
104	49.1	28	45.1	26	41.3	8	46.4	62	68	91.2
109	44.3	30	41.9	26	40.6	8	42.9	64	68	94.1
112	37.7	29	39.3	26	38.8	8	38.5	63	68	92.6
117	42.2	30	40.8	27	38.5	8	41.2	65	68	95.6
120	44.2	30	43.1	27	40.5	8	43.3	65	68	95.6
128	38.8	30	39.9	27	36.9	8	39.0	65	68	95.6
133	44.5	30	43.4	27	40.5	8	43.6	65	68	95.6
All	**42.8**	**802**	**41.6**	**723**	**38.4**	**216**	**41.8**	**1741**	**1836**	**94.8**

3.2 Bird Carcass Summary

Sixty-one (61) bird carcasses were recovered during standard searches within the August 2 to October 8, 2014 monitoring program. Nineteen (19) species and 5 unidentified carcasses were recovered. Species predominantly represented the passerine order. Two killdeer carcasses were excluded from fatality estimation because they were unfledged birds found on the gravel roads. Bird carcasses were recovered during searches at 23 out of the 27 searched turbines.

3.2.1 Bird Carcasses by Species

A total of 19 species were recovered at the CRWEF. In addition, 5 individual carcasses could not be identified to species due to their condition. Horned lark, killdeer, and Tennessee warbler were the most commonly found species. Two (2) of the recovered killdeer carcasses were identified as unfledged birds; thus, they were not included in the fatality estimation for the site. Table 3 presents the bird species data for 2014.

Table 3: Bird Carcasses by Species

Scientific Name	Species	Number Found	Percent of Total	Illinois and/or USFWS Status
Spinus tristis	American Goldfinch	1	1.6	None
Setophaga ruticilla	American Redstart	3	4.9	None
Turdus migratorius	American Robin	1	1.6	None
Hirundo rustica	Barn Swallow	1	1.6	None
Setophaga castanea	Bay-breasted Warbler	1	1.6	None
Setophaga striata	Blackpoll Warbler	1	1.6	None
Petrochelidon pyrrhonota	Cliff Swallow	2	3.3	None
Setophaga pensylvanica	Chestnut-sided Warbler	3	4.9	None
Picoides pubescens	Downy Woodpecker	1	1.6	None
Eremophila alpestris	Horned Lark	8	13.1	None
Passer domesticus	House Sparrow	2	3.3	None
Charadrius vociferus	Killdeer*	8	13.1	None
Setophaga magnolia	Magnolia Warbler	3	4.9	None
Progne subis	Purple Martin	3	4.9	None
Vireo olivaceus	Red-eyed Vireo	6	9.8	None
Columba livia	Rock Pigeon	1	1.6	None
Catharus ustulatus	Swainson's Thrush	1	1.6	None
Oreothlypis peregrina	Tennessee Warbler	8	13.1	None
	Unknown Bird	5	8.2	None
Coccyzus americanus	Yellow-billed Cuckoo	2	3.3	None
	Total	**61**	**100.0**	**None**
*Includes 2 unfledged individuals, which were excluded from site fatality estimates				

3.2.2 Bird Carcasses by Turbine

Bird carcasses were recovered at 23 out of the 27 turbines searched during the 2014 season. No carcasses were recovered at Turbines 43, 48, 117, and 133. The greatest number of bird carcasses (n = 6) was recovered at Turbine 19. Table 4 displays carcass distribution by turbine.

Table 4: Bird Carcasses Found by Turbine

Turbine Number	3	8	11	16	19	24	27	32	35	40	43	48	51	56
Number Found	1	4	2	3	6	5	1	4	1	1	0	0	1	3
Turbine Number	**59**	**67**	**72**	**80**	**88**	**96**	**104**	**109**	**112**	**117**	**120**	**128**	**133**	**Total**
Number Found	2	4	1	1	1	3	3	5	1	0	4	4	0	**61**

3.2.3 Temporal Patterns

The greatest number of birds (n = 30, 49.2%) was recovered in September. In August, 25 birds (41.0%) were recovered, and in October, 6 (9.8%) were recovered. However, September was the only entire month included in the monitoring season. There was no clear trend in recoveries by week; between 2 and 12 carcasses were recovered each week, with the peak value of 12 being recovered the week of September 13 – 19. Table 5 presents the bird carcasses recovered by month, while Figure 2 presents the counts of birds by week.

Table 5. Bird Carcass Recoveries by Month

Month	Number Found	Percent of Total
August	25	41.0
September	30	49.2
October	6	9.8
Total	**61**	**100**

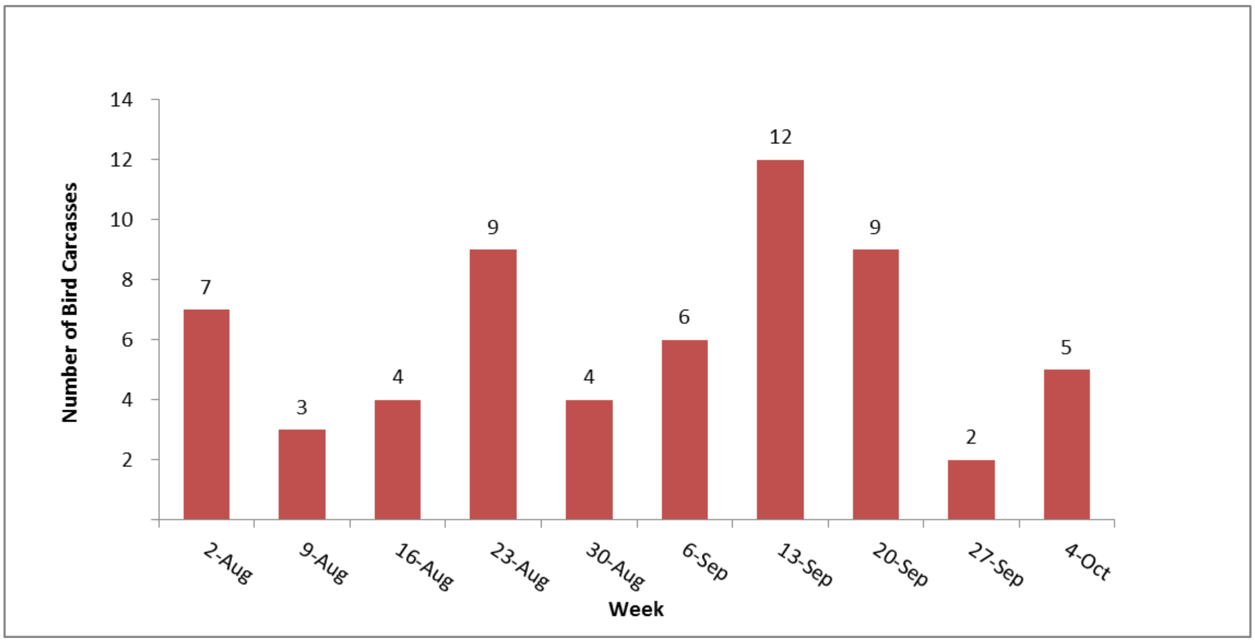

Figure 2. Bird Carcass Recoveries by Week.

3.2.4 Spatial Patterns

Out of the 61 carcasses recovered, 60 had distance from turbine information associated with them. One carcass did not have distance information because it was noted as injured, and when it was approached, it ran into an un-harvested corn field (see Section 3.2.6). Carcasses were recovered between 0.5 and 60.5 meters from the turbine. Out of the 60 carcasses with distance information, the highest percentage (61%) was recovered between 40 and 59.9 meters from the turbine. Table 6 presents the carcass counts by 10-meter distance band, while Figure 3 presents the proportion of carcasses recovered within each 10-meter distance band.

Table 6. Bird Carcass Recoveries by Distance (m).

	Distance (m)								
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	Unknown	Total
Number of Bird Carcasses Found	2	2	9	6	19	18	4	1	**61**
Percent	3.3	3.3	15.0	10.0	31.7	30.0	6.7	N/A	**100.0**

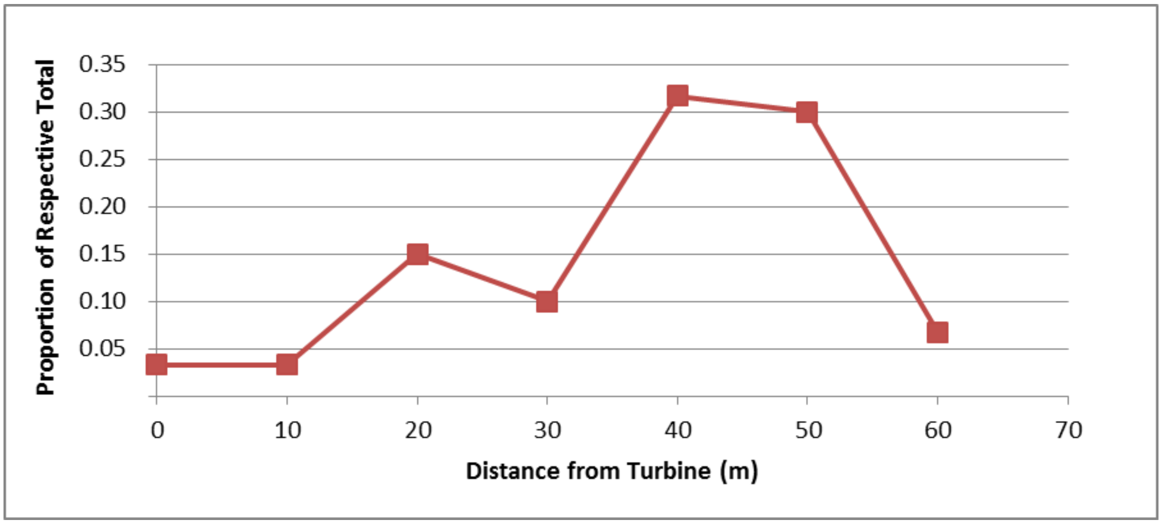

Figure 3. Proportion of Bird Carcass Recoveries by Distance (m).

3.2.5 Incidental Bird Carcass Recoveries

Thirty-eight (38) incidental bird carcasses of 17 species and 1 unknown category (7 individuals) were found during the setup, technician training, and formal study period. Two (2) incidentally-recovered birds were determined to be state threatened or endangered species. On September 20, 2014, a barn owl (*Tyto alba*) was recovered at the side of IL-US Route 49. Due to the location and overall distance to the turbine (over 300 meters), its death was determined to be unassociated with turbine operations. The barn owl is considered a "State Endangered" species in the Illinois Comprehensive Wildlife Conservation Plan & Strategy (IDNR 2005, 2012). Prior to the study season, practice searches were conducted over a three day period in July 2014. During these searches, a total of 9 bird carcasses were found. The second state-listed species, a black-billed cuckoo (*Coccyzus erythropthalmus*) which is considered threatened, was found 41.0 meters from Turbine 19 on July 29, 2014.

3.2.6 Alive and Injured Specimens

A single bird was observed alive and apparently injured or unable to fly on August 4, 2014, at Turbine 109. The species of the bird was not identified, but it was reported as a "small songbird" (pers. comm. Ross Bailey to Carlyle Meekins). When approached, the bird escaped into an un-harvested corn field and was not re-observed.

3.3 Fatality Estimation

3.3.1 Searcher Efficiency

Searcher efficiency trials were conducted with 30 carcasses that were placed on the search plots across 10 days in the 2014 monitoring period (each carcass is considered a trial). No more than 3 carcasses were placed on a single turbine within the 2014 season. Table 7 provides a summary of the number of carcasses placed during searcher efficiency trials. Please note that the trials were conducted 10 times for a period of 1 day each, and only one carcass was scavenged prior to the targeted search; therefore, the total successful placements included 29 birds. Carcasses were checked for scavenging activity at the end of the trial, after searches were completed. Out of the 29 carcasses successfully placed, 9 were placed targeting the dog and handler crews and the remaining 20 were placed targeting the human searchers. The data from the 29 carcasses was reflective of the amount each crew, including the dog and handler teams, searched and was, therefore, pooled in the analysis.

The searchers found 22 out of 29 successfully placed carcasses, making overall searcher efficiency for the trials 0.76 (95% confidence interval bounds of 0.60 and 0.91, respectively). The searcher efficiency for the 10 individual trial days ranged from 0.00 to 1.00, as displayed in Table 7.

Table 7: Searcher Efficiency Trials by Date

Date of Trials	Carcasses Placed Successfully	Carcasses Found	Search Efficiency
8/28/2014	1	0	0.00
9/3/2014	2	2	1.00
9/5/2014	4	3	0.75
9/9/2014	2	1	0.50
9/11/2014	4	4	1.00
9/15/2014	2	2	1.00
9/17/2014	4	3	0.75
9/21/2014	2	0	0.00
9/26/2014	4	3	0.75
10/2/2014	4	4	1.00
Total	**29**	**22**	**0.76**

3.3.2 Carcass Removal

Two (2) carcass removal trials were implemented, one each on August 31 and September 14, 2014. Each trial period had 10 carcasses placed, with no more than 2 carcasses placed at any one turbine. The carcass removal trial carcasses were each monitored daily for 20 days. A total of 20 carcasses of 9 species were placed and monitored for removal.

Carcass persistence was calculated using the maximum likelihood estimation formula developed by Erickson et al. (2004). In the August 31 and September 14 trial periods, average carcass persistence was found to be 27.75 days and 27.00 days, respectively. The overall average carcass persistence was 27.41 days before removal. Table 8 displays average carcass persistence for each trial period and the overall average carcass persistence.

Table 8: Overall Carcass Removal—Erickson Estimator

Trial Date	Average Carcass Persistence (Days)
8/31/2014	27.75
9/14/2014	27.00
Overall	**27.41**

3.3.3 Searchable Area Corrections

Searchable area corrections were included for each turbine equal to the proportion of the potential 60-m radius plot that could actually be searched. All plots, except for the plot established at Turbine 56, were fully searchable. The plot at Turbine 56 was 52% searchable, due to delayed clearing efforts and 2 agricultural drainage ditches that were deemed unsafe to search (Attachment B). The searchable area at Turbine 56 was maintained in a similar manner to all other plots for the duration of the season. Table 9 presents the searchable area factor for each turbine.

Table 9: Searchable Area Corrections by Turbine

Turbine	Searchable Area Correction Factor 2014	Turbine	Searchable Area Correction Factor 2014
3	1.00	59	1.00
8	1.00	67	1.00
11	1.00	72	1.00
16	1.00	80	1.00
19	1.00	88	1.00
24	1.00	96	1.00
27	1.00	104	1.00
32	1.00	109	1.00
35	1.00	112	1.00
40	1.00	117	1.00
43	1.00	120	1.00
48	1.00	128	1.00
51	1.00	133	1.00
56	0.52		

3.3.4 Estimated Bird Fatalities

The total bird fatality estimate for the fall 2014 period at CRWEF was 332 birds. The 95% confidence interval lower and upper bounds obtained through the bootstrapping analysis were 235 and 434, respectively. The estimated bird fatality rate per turbine was 2.5 (95% confidence interval 1.8 – 3.2). The per-megawatt estimated bird fatality rate was 1.5 (95% confidence interval 1.1 – 2.0). The confidence interval limits were obtained through bootstrapping analysis. Table 10 presents the estimated bird fatalities for the fall period (August 2 to October 8) in 2014.

Table 10: Bird Fatality Estimates for the California Ridge Wind Energy Facility – August 2 to October 8, 2014

	Point Estimate	95% Confidence Interval
Estimated Total Birds	332	235 - 434
Est. Birds per Turbine	2.5	1.8 - 3.2
Est. Birds per MW	1.5	1.1 - 2.0

5.0 REFERENCES

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Attachment A:
Site Vicinity and Turbine Location Maps

Attachment B:
Search Plot and Visibility Class Maps

Attachment C:
Sample Field Data Forms

Attachment D:
Search Data, Carcass Data, and Trial Data*

**Submitted Electronically via MS Excel File*

2015 Fall Bat and Bird Carcass Monitoring Report

California Ridge Wind Energy Facility
Vermilion and Champaign Counties, Illinois

December 3, 2015

Technical report submitted to:
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Table of Contents

List of Tables

List of Figures

Attachments

EXECUTIVE SUMMARY

Bird and bat carcass monitoring was conducted at the California Ridge Wind Energy Facility (CRWEF) between July 17 and October 2, 2015. The monitoring was conducted for the purposes of 1) monitoring nightly turbine curtailment under 5.0 m/s wind speed and 2) assessing the efficacy of a prototype acoustic bat deterrent.

The curtailment operations regime was monitored at 5 randomly selected turbines. The searched plot area included access roads to 60 meters (m) and all area within 20 m of each selected turbine. Vegetation within 20 m of the turbines was cleared periodically throughout the season. Curtailment turbine plots were visually searched by a human crew on a three day interval. In addition, 16 turbines outfitted with a prototype bat deterrent system were searched daily from July 17 to October 2. Search crews included humans and a conservation detection dog/human handler team. Human search teams surveyed the 16 plots 1 of every 3 days; the dog/handler team surveyed the plots the remaining 2 of the 3 days. Search plots consisted of 60 m circles that were cleared of vegetation. Bird data from the deterrent set of turbines is included within this report; the results of the bat deterrent research are summarized elsewhere.

Four bat carcasses were recovered from the 5 curtailment turbines. The eastern red bat (*Lasiurus borealis*) was found most frequently (n=3, 75%). Bat carcass recoveries were distributed sporadically between August 16 and September 6. Five bat carcasses of 3 species were found incidental to standard searches. Two of these were found at non-searched turbines, the other 3 were found at the curtailment plots but not during scheduled searches. No state- or federally-listed bat species were found.

Thirty three bird carcasses of 17 species and 1 "unknown warbler" category (Family Parulidae) were recovered at the 21 monitored plots. Red-eyed vireo (*Vireo olivaceus*) was found most frequently (n=5, 15%). Ninety one percent of the species were of the Order Passeriformes, or perching birds; the only other observed Order was Charadriformes, or shorebirds. The sole shorebird species was killdeer (*Charadrius vociferus*, n=3). Bird carcass observations peaked during the week of September 6, when 14 birds were found. Incidental bird carcass observations included 13 individuals of 10 species and 1 "unknown bird" category. One carcass of a state-threatened bird species, a juvenile black-billed cuckoo (*Coccyzus erythropthalmus*), was found during a scheduled search of Turbine 109 on September 16. No other carcasses of state- or federally-listed birds were observed.

Search bias trials were performed using 25 bird carcasses and 177 bat carcasses placed as part of the deterrent study. In part, bias trials assessed the effectiveness of searchers in finding available carcasses (SE). Carcasses were placed in 31 instances between July 22 and October 1. Dog search crews held a significantly higher SE (0.96, 95% Confidence Interval 0.92 – 0.99) than their human counterparts (0.38, CI 0.27 – 0.49; $z=-8.912$, $p < 0.05$).

Human SE in easy visibility class was 0.59 (CI 0.42 – 0.76) and in difficult visibility class was 0.24 (CI 0.06 – 0.42) ($z=-2.544$, $p<0.05$). Human SE in easy visibility class also differed from SE in moderate visibility class areas (0.23, CI 0.06 – 0.39; $z=2.77$, $p<0.05$). Interestingly, SE for dog/handler crews also varied; the SE for easy visibility class (1.0) was significantly higher than SE for carcasses in difficult visibility class areas (0.89, CI 0.78 – 0.99; $z=-2.565$, $p<0.05$).

Carcass removal (CR) rates were assessed using 25 bird carcasses placed as a single concurrent SE/CR trial. Technicians were informed of the location of each placed bird carcass after the initial searcher efficiency trial period. Carcasses were checked for removal by scavengers on days 1 through 7, 10, 14, and 20. Using a maximum likelihood estimator, we calculated that carcasses were removed after an average of 31.5 days (d). Carcasses were removed fastest (13.9 d) in bare ground areas (easy visibility class), less frequently in sparsely vegetated areas (31.3 d, moderate visibility class), and much less frequently in dense vegetation (120.9 d, difficult visibility class).

1.0 INTRODUCTION

The California Ridge Wind Energy Facility (CRWEF) is located in Champaign and Vermilion Counties, Illinois. The facility is owned by California Ridge Wind Energy LLC and consists of 134 1.6 megawatt (MW) turbines.

The CRWEF is approximately 17.6 kilometers (km) east to west, and approximately 9.6 km north to south (see Attachment A). The wind farm is located approximately 16 km northwest of Danville, IL, and approximately 32 km from Champaign, IL, along State Route 49. The study area consisted of mostly agricultural land, with sparsely distributed oak-hickory wood lots. A tributary of the Vermilion River, the Middle Fork River, flows adjacent to the eastern side of the wind farm, and at the closest point is approximately 3.2 km from the nearest turbine. This river is designated as a “State Scenic River”, and provides wildlife habitat in the form of temperate deciduous forest, with some interspersed tallgrass prairie.

The objectives of the field monitoring were to: 1) obtain data on the effects of a prototype acoustic bat deterrent system and 2) monitor the impacts of the nightly turbine curtailment regime implemented at the portion of the site not included in the deterrent study. The 16 deterrent study turbines were operated fully-feathered below normal cut-in wind speed (3.0 m/s) and the remainder of the site was operated at fully-feathered below 5.0 m/s wind speed. The bat data collected during searches at the 16 deterrent study turbines are not included in this report because the deterrent “treatment” assignments were regularly adjusted. The results of this bat deterrent study are provided in a separate report.

This report summarizes the avian data collected from all 21 turbines and the bat data from the 5 turbines operating under the 5.0 m/s curtailment regime.

2.0 METHODS

2.1 Bird and Bat Carcass Monitoring

2.1.1 Turbine Selection

A subset of 30 turbines, distributed throughout the CRWEF facility, was randomly selected during monitoring conducted in 2013 and 2014 (Ritzert et al. 2014, Ritzert et al 2014a, Gruver et al. 2014). For consistency, the same subset of turbines was considered in the 2015 monitoring selection. A total of 16 turbines were selected for use in the bat deterrent study and 5 were selected for use in monitoring of the site curtailment regime (Attachment A). Hereafter, these are referred to as the “deterrent” and “curtailment” turbines, respectively.

2.1.2 Study Schedule

Carcass monitoring was conducted between July 17 and October 2, 2015. Curtailment turbine plots were searched once every 3 days and deterrent turbine plots were searched daily. The order in which the plots were searched was stratified such that each plot was searched at a different time of day each week.

2.1.3 Search Plots, Visibility Classes, and Habitats

Searched area at the 5 curtailment turbines included a cleared 20 meter (m) circular area centered on each turbine and any access road within 60 m of the turbines (Attachment B). Sixty (60) m cleared circular plots were established underneath each of the 16 deterrent prototype turbines. Plots were marked with 5 or 15 concentric 4 m wide transects at the 20 and 60 m plots, respectively. Vegetation mowing, or clearing, occurred periodically throughout the season. The average plot conditions were mapped once at the end of the season; searchable area within the plot was designated into 3 visibility classes (below). All plots were entirely searchable. Plot conditions were diverse, areas of at least 2 visibility classes were present at every plot.

Visibility classes for all carcasses (including both actual carcasses and bias trials) were determined at the time of placement, observation, or recovery.

Visibility classes were defined as follows:

Easy (1): Bare ground 90% or greater; all ground cover sparse and 0.15 m or less in height (e.g., gravel pad/road, bare dirt)

Moderate (2): Bare ground 25% or greater; all ground cover mostly sparse and 0.15 m or less in height.

Difficult (3): Bare ground 25% or less; ground cover ranging up to 0.3 m in height.

2.1.4 Search Methods

Searches were conducted by a team of 2 human searchers or by a dog and handler team. Human searchers started at the northern-most stake of the plot and searched approximately 4 meters apart from one another, working clockwise on even calendar days and counterclockwise on odd calendar days. Upon reaching the starting stake after each revolution around the plot, technicians would move inward toward the next transect and continue searching in the same fashion. The observers walked along each transect while they visually searched side-to-side for carcasses. Searches were conducted with a pace of approximately 45 m per minute (1.6 mph).

Dog and handler teams were utilized at the deterrent study turbines. They searched 2 consecutive days between the human team searches in order to “sweep” the study turbines before the next deterrent operations assignment. Dog and handler search effort varied widely, with the goal of 100% carcass recovery rate. Typically, a handler would orient the dog to begin crisscrossing the plot, moving through the plot either with or into the prevailing wind direction. Spacing and speed of the search pattern was determined in response to the daily environmental conditions. For instance, if rainy weather and/or dense, tall vegetation were encountered, the dog crew made narrower or additional passes through the plot area until the handler was satisfied that there were few to no carcasses missed by the dog.

When a searcher (hereafter includes human and dog/handler teams, collectively) discovered a bird or bat carcass, he/she would flag its location and then continue searching until the entire plot was surveyed. Once completed, the searcher returned to each carcass for data collection. Each carcass was assigned a unique ID that was retained throughout the data record. Bat carcasses were collected in accordance with IDNR and USFWS scientific collection permits. Bird carcasses were left in place where they were found. A laser rangefinder (Nikon ProStaff 550 or similar) was used to determine the distance to the turbine, and an azimuth to the tower was taken with a compass. This information, along with time, weather data, transect number, and visibility class, were recorded using electronic data management software on Carcass Data Form (see Attachment C). All bird and bat carcasses were photographed; photographs were labeled with the carcass's respective unique ID. Bat carcasses were individually packaged and labeled with the carcass's unique ID and stored in an on-site freezer.

2.1.5 Documentation of Incidental Carcasses

Incidental carcass discoveries were defined as carcasses found: 1) outside of the delineated search plots or 2) within a plot but outside of a scheduled survey period. If a carcass was found by personnel other than a member of the search staff (i.e. turbine maintenance technician), the search staff was notified of its location. The search staff would visit the turbine at their earliest availability and relocate the carcass, subsequently performing data collection. Data collection and handling of incidental carcasses was treated the same as for carcasses found during scheduled searches. Incidental carcasses are reported separately as they are not typically factored into fatality estimates.

2.2 Bias Corrections

Searcher efficiency (SE) and carcass removal (CR) trials were conducted in order to account for observer and carcass removal bias, respectively.

All trial placements were performed unannounced to the search staff, and included no more than 2 carcasses within any plot. Carcasses were marked using discreetly placed small zip ties. Trial carcasses were placed in all visibility classes within the plots, and trial carcass distribution generally reflected the amount of each visibility class present at the turbines. To avoid bias, trial carcass placement locations (distances and azimuths from turbines) were generated using the random number function on Microsoft® Office Excel before arriving at the wind farm. Carcasses were tossed into the air and allowed to fall into place. Gloves were worn at all times while handling and preparing the carcasses.

Carcasses of threatened or endangered species were not used for SE or CR trials. Trial carcasses included purchased, pre-frozen game birds, pre-frozen bat carcasses provided by the University of Illinois – Champaign-Urbana rabies testing repository, and "fresh" bat carcasses previously collected at CRWEF. Bat species used in monitoring included: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). Bird species included common quail (*Coturnix coturnix*).

2.2.1 Searcher Efficiency Trial Field Methods

Searchers were given a single opportunity to discover the available SE trial carcasses. Trials were unannounced and were set up near dusk after daily searches were completed. Trial carcasses were placed 12 to 24 hours prior to a targeted search. After the search, the trial placement manager visited each carcass and checked for scavenging. Any carcasses that were not found by searchers or by the trial manager were considered scavenged and were not included in the statistical analysis of searcher efficiency.

2.2.2 Carcass Removal Trial Field Methods

A single placement of bird carcasses was used to measure carcass removal (CR) rates; the placement was performed unannounced to the search crew and also counted toward the SE data. After scheduled searches were completed, the whereabouts of any remaining trial carcasses were provided to the search staff. Trial carcasses were monitored for removal once every 24 hours for the first 7 days, and then on days 10, 14, and 20 after which any remains were collected. If a carcass was not re-observed during an assigned check, the searcher was instructed to survey within approximately 10 m of the original location in an attempt to re-locate the carcass. If a carcass was re-located after having been marked as removed (scavenged), the data were revised in-kind.

2.3 Analysis

2.3.1 Carcass Data

All field data were transferred to Microsoft® Office Excel spreadsheets and reviewed for consistency and correctness. Data analysis was completed using Excel. Patterns were analyzed using descriptive statistics, such as averages, percentages, and ranges, which were also calculated in Excel. Due to the difference in search strategy, carcasses are reported separately for curtailment and deterrent groups, unless otherwise noted.

Temporal Patterns

Using the data pooled across all searched turbines, carcasses were tallied by calendar week. Temporal trends were analyzed through use of figures created in Excel.

Age, Species, and Sex

All carcasses found on the site were initially identified by search personnel, then reviewed by Carlyle Meekins, the field biologist and crew lead, and finally by Brad Romano, the Shoener Environmental Project Manager. In this validation process, species, age, and sex were verified, where possible.

All species found at the site were compared to the prioritization listing in Illinois' Wildlife Action Plan. Wildlife Action Plan species are those species that are being proactively managed to prevent their populations from further decline (IDNR 2005, IDNR 2012).

2.3.2 Bias Corrections

Searcher Efficiency

The probability that a carcass would be detected by searchers given that it was available to be found, p, was assessed through the SE trials. The estimate of p was calculated as the number of trial carcasses found by searchers divided by the total number of available carcasses at the time of the search. Excel was used to create tables and to perform all statistical analysis on SE data. This analysis included calculating basic descriptive statistics, such as averages and ranges of SEs as well as 95% confidence intervals of each calculated mean. SE probability was tested using a z-test associated p-value, assuming a normal distribution. Data considered for testing included testing between overall values for birds and bats and pairwise testing between visibility classes. If birds and bats were significantly different ($p \leq 0.05$), visibility class data for the two types were tested separately. If SE for birds and bats was similar ($p > 0.05$), the data were pooled by visibility class.

Carcass Removal

To estimate the time that carcasses persisted in the study plots, the average time a carcass was present, *t*, was calculated. Because the trial checks were halted after 20 days, the data are right-censored. This right-censoring was compensated for by estimating the mean time to removal using a maximum likelihood estimator for *t* with the following formula, excerpted from Erickson et al. (2004):

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where s is the number of test carcasses used in search trials, s_c is the number of test carcasses that remained in the study area at the end of the removal trial period, and t_i is the number of days carcass i remains in the search area. Excel was used to determine descriptive statistics such as averages and ranges.

3.0 RESULTS

3.1 Carcass Searches

3.1.1 Search Summary

A total of 126 searches were conducted at the 5 curtailment plots and 1,234 searches were conducted at the 16 deterrent plots between July 17 and October 2. A total of 18 scheduled searches were missed, resulting in an overall search completion of 99%. Average curtailment plot search times were between 11.9 and 13.6 minutes at Turbines 16 and 59, respectively. Average deterrent plot search times were between 36.8 and 41.5 minutes at Turbines 24 and 88, respectively.

3.1.2 Carcass Summary

Four bat carcasses of 2 species were found during standard searches at the curtailment plots. Eastern red bats (n=3) comprised 75% of the recovered bat carcasses; the other species was a silver-haired bat (*Lasionycteris noctivagans*). None of the species recovered are state- or federally-listed species, nor are any cited in the IL Wildlife Action Plan (WAP, IDNR 2005, IDNR 2012).

Thirty-three bird carcasses of 17 species and 1 unknown type were found during standard searches. A majority (91%) were passerine bird species, Order Passeriformes. Red-eyed vireo (*Vireo olivaceus*, n=5) composed 15% of the observed carcasses (Table 1).

One carcass of a state-threatened bird species, a juvenile black-billed cuckoo (*Coccyzus erythropthalmus*), was found during monitoring. It was observed on September 16 at Turbine 109. In addition, carcasses of 2 species cited in the IL WAP as rare or declining were observed. A single ovenbird (*Seiurus aurocapilla*) and 3 yellow-billed cuckoos (*Coccyzus americanus*) were observed during the carcass monitoring.

Table 1: Bird Carcass Summary – All Monitored Turbines

Scientific Name	Common Name	Jul	Aug	Sep	Oct	Total	Illinois and/or USFWS Status
Setophaga ruticilla	American Redstart	0	1	0	0	1	
Coccyzus erythropthalmus	Black-billed Cuckoo	0	0	1	0	1	State Threatened
Molothrus ater	Brown-headed Cowbird	0	1	0	0	1	
Petrochelidon pyrrhonota	Cliff Swallow	0	0	1	0	1	
Setophaga tigrina	Cape May Warbler	0	0	1	0	1	
Setophaga pensylvanica	Chestnut-sided Warbler	0	0	1	0	1	
Contopus virens	Eastern Wood-Pewee	0	0	1	0	1	
Eremophila alpestris	Horned Lark	0	1	1	0	2	
Charadrius vociferus	Killdeer	1	1	1	0	3	
Empidonax minimus	Least Flycatcher	0	0	1	0	1	
Zenaida macroura	Mourning Dove	1	0	0	0	1	
Seiurus aurocapilla	Ovenbird	0	0	1	0	1	Rare or Declining
Progne subis	Purple Martin	0	1	3	0	4	
Vireo olivaceus	Red-eyed Vireo	0	0	5	0	5	
Agelaius phoeniceus	Red-winged Blackbird	1	0	0	0	1	
Coccyzus americanus	Yellow-billed Cuckoo	0	1	2	0	3	Rare or Declining; Rare or Vulnerable Habitat
Vireo flavifrons	Yellow-throated Vireo	0	0	1	0	1	
Family *Parulidae*	Unknown Warbler	0	0	4	0	4	
All		3	6	20	0	29	

Carcasses by Turbine

Between 0 and 2 bat carcasses were recovered at individual curtailment turbines. No bat carcasses were recovered at Turbines 16 and 59. Searches at Turbines 125 and 128 recovered 1 bat each; 2 were recovered at Turbine 40.

Searches at 6 turbines, 16, 32, 48, 59, 96, and 125 yielded no bird carcasses. Between 1 and 4 birds were found at each of the remaining 15 turbines. Turbine 104 had the highest bird carcass observation rate (n=4).

Temporal Patterns

Bats were recovered between the weeks of August 16 and September 6. Birds were found during the weeks of July 19 and August 9 through September 27. Bat carcass recoveries occurred without an apparent peak; however, bird carcass finds peaked the week of September 6 (Fig. 1).

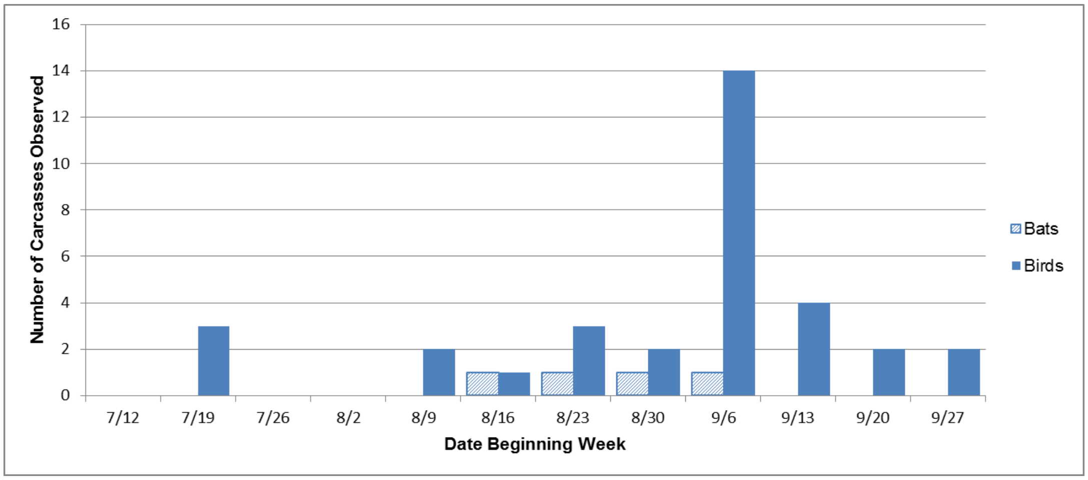

Figure 1: Bird and Bat Carcass Counts by Calendar Week.

Incidental Carcass Summary

Five bat carcasses were found incidental to the standard searches of the curtailment plots. Three species, including: big brown bat (n=1), eastern red bat (n=3), and silver-haired bat (n=1) were found. Two of the incidental carcasses were found by O&M Personnel at non-search turbines and the remaining 3 were found by search staff but outside of scheduled searches. No threatened, endangered, or WAP bat species were found. In addition, the deterrent study (bat data not reported here) included 116 incidental bat carcasses.

Thirteen birds of 10 species and 1 unknown category were recovered incidentally. They included 2 horned lark (*Eremophila alpestris*), 2 yellow-billed cuckoo, 1 American redstart (*Setophaga ruticilla*), 1 killdeer (*Charadrius vociferus*), 1 Nashville warbler (*Oreothrypis ruficapilla*), 1 northern bobwhite (*Colinus virginianus*), 1 ovenbird, 1 rose-breasted grosbeak (*Pheucticus ludovicianus*), 1 red-eyed vireo, and 1 Tennessee warbler (*Oreothlypis peregrina*). Additionally, 1 carcass of unknown bird species was found. No threatened or endangered bird species were found. Carcasses of 3 WAP bird species, including yellow-billed cuckoo, northern bobwhite, and ovenbird were found. These are cited as conservation concern species due to their apparent rarity and population declines within IL (IDNR 2005, IDNR 2012). Incidental carcasses were not included in any tabulation or analysis.

3.1.3 Bias Assessment

Searcher Efficiency

Searcher efficiency trials were conducted with 172 bat and 25 bird carcasses that were available to be found during 1 day of testing (Tables 2 and 3). A total of 31 placements were performed, with no more than 2 carcasses placed at a single turbine each period. Human searchers found 30 of 79 carcasses for an overall SE of 0.38 (95% Confidence Interval [CI] of 0.27 – 0.49). Dog/handler team SE was 0.96 (0.92 – 0.99), which was significantly higher than that of the human search teams ($z=-8.912$, $p<0.05$).

Table 2: Human Searcher Efficiency Results Summary.

Place Date	No. Available Carcasses	No. Carcasses Found	Searcher Efficiency	CI Lower Bound	CI Upper Bound
7/22	6	4	0.67	0.29	1.00
7/28	6	1	0.17	0.00	0.46
7/31	4	2	0.50	0.01	0.99
8/9	5	0	0.00	0.00	0.00
8/21	6	4	0.67	0.29	1.00
8/27	6	4	0.67	0.29	1.00
9/2	5	1	0.20	0.00	0.55
9/8	5	1	0.20	0.00	0.55
9/14	25	9	0.36	0.17	0.55
9/20	5	1	0.20	0.00	0.55
9/29	6	3	0.50	0.10	0.90
Total	**79**	**30**	**0.38**	**0.27**	**0.49**

Table 3: Dog/Handler Searcher Efficiency Results Summary.

Place Date	No. Available Carcasses	No. Carcasses Found	Searcher Efficiency	CI Lower Bound	CI Upper Bound
7/23	6	6	1.00	1.00	1.00
7/24	6	6	1.00	1.00	1.00
7/29	6	6	1.00	1.00	1.00
7/30	6	5	0.83	0.54	1.00
8/1	6	5	0.83	0.54	1.00
8/2	6	6	1.00	1.00	1.00
8/10	6	6	1.00	1.00	1.00
8/11	6	6	1.00	1.00	1.00
8/22	6	5	0.83	0.54	1.00
8/23	6	6	1.00	1.00	1.00
8/28	6	6	1.00	1.00	1.00
8/29	6	6	1.00	1.00	1.00
9/3	6	5	0.83	0.54	1.00
9/4	6	6	1.00	1.00	1.00
9/9	6	6	1.00	1.00	1.00
9/10	6	5	0.83	0.54	1.00
9/21	5	5	1.00	1.00	1.00
9/22	6	6	1.00	1.00	1.00
9/30	5	5	1.00	1.00	1.00
10/1	6	6	1.00	1.00	1.00
Total	**118**	**113**	**0.96**	**0.92**	**0.99**

Human SE did not significantly differ for birds and bats ($z=0.246$, $p=0.40$). Therefore, bird and bat data were pooled to test for differences between the search visibility classes. SE differed between easy (0.59, CI 0.42 – 0.76) and both moderate (0.23, CI 0.07 – 0.39) and difficult (0.24, CI 0.06 – 0.42) visibility classes ($z=2.776$ and -2.544, respectively; $p<0.05$)(Fig.2).

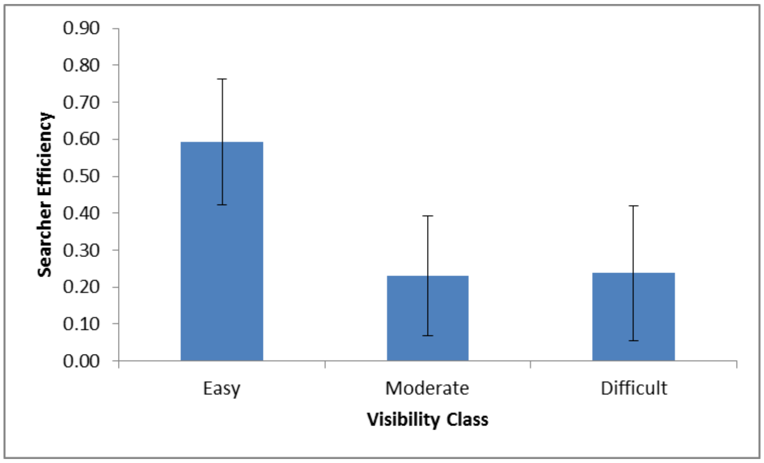

Figure 2: Human Searcher Efficiency Across 3 Search Conditions.
Error bars represent 95% confidence intervals.

Dog/handler teams were not tested with bird carcasses, thus visibility class analysis included only bats. SE differed significantly between easy (1.0) and difficult (0.89, 0.78 – 0.99) visibility classes (Fig. 3).

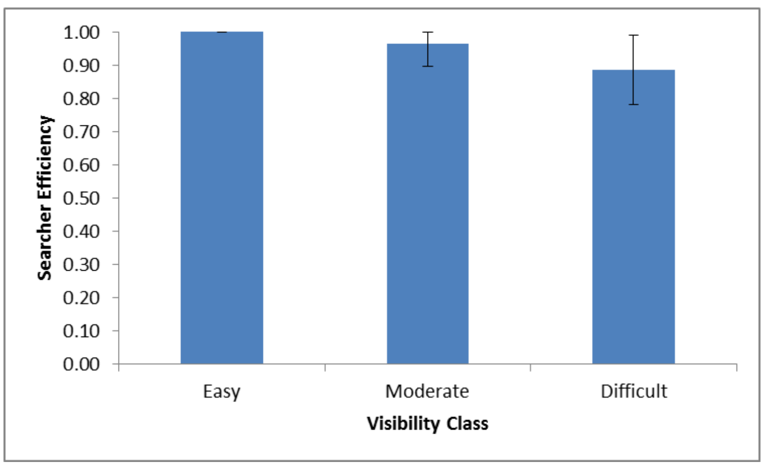

Figure 3: Dog/Handler Searcher Efficiency Across 3 Search Conditions.
Error bars represent 95% confidence intervals.

Carcass Removal

Twenty five (25) bird carcasses were used in a single carcass removal trial. Fourteen (56%) of the carcasses were not scavenged during the trial period. Mean carcass persistence during the trial was estimated to be 31.5 days. Carcass persistence appeared to vary across the 3 visibility classes. Carcasses were removed fastest in easy visibility class (13.9 d). They lasted longer when placed in moderate visibility class areas (31.3 d) and longest in difficult areas (120.9 d).

4.0 CONCLUSION

Bird and bat carcass monitoring was conducted at the CRWEF between July 17 and October 2, 2015, using 5 plots to assess the site-wide curtailment regime of a 5.0 m/s cut-in wind speed and 16 plots to assess a prototype bat deterrent system. The curtailment turbines were searched every 3 days by human searchers and the deterrent turbines were searched daily, with human crews searching every 3 days and dog/handler crews searching the rest of the days.

Four bat carcasses were recovered from the 5 curtailment turbines. The eastern red bat was found most frequently (n=3, 75%); the only other species recovered during searches was a silver-haired bat. Five bat carcasses were found incidental to the scheduled searches. Eastern red bat was the most commonly recovered incidental species (n=3, 60%). No state- or federally-listed bat species were found.

Thirty three bird carcasses of 17 species and 1 “unknown warbler” category (Family Parulidae) were recovered at the 21 monitored plots. Red-eyed vireo was found most frequently (n=5, 15%). Ninety one percent of the species were of the Order Passeriformes, or perching birds; the only other observed Order was Charadriformes, or shorebirds. The sole shorebird species was killdeer (n=3). Incidental bird carcass observations included 13 individuals of 10 species and 1 “unknown bird” category. One carcass of a state-threatened bird species, a juvenile black-billed cuckoo, was found during a scheduled search of Turbine 109 on September 16. No other carcasses of state- or federally-listed birds were observed.

Searcher efficiency of dog/handler crews was higher than that of human searchers (0.96 vs. 0.38, respectively). Regardless of search crew, efficiency varied between the plot types. Significant differences were found between easy and moderate/difficult visibility classes; carcasses in easy to search areas were more readily found than those placed in higher and/or more dense vegetation. This trend was also observed for dog/handler crews, although significant differences were only observed between easy and difficult visibility classes.

Carcass removal rates had a mean of 31.5 days. Carcasses were removed by scavengers fastest in easy visibility class areas (13.9 d), slower in moderate visibility class (31.3 d), and much slower in difficult visibility class areas (120.9 d).

5.0 REFERENCES

Erickson, W.P., Jeffrey, J., Kronner, K., and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001 – December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Gruver, J., P. Rabie, C. Meinke, S. Howlin, and K. Bay. 2014. Bat deterrent research study California Ridge Wind Energy Facility Champaign and Vermilion Counties, Illinois: year 1 research report. Technical report submitted to: California Ridge Wind Energy, LLC. Chicago, IL, USA.

Illinois Department of Natural Resources (IDNR). 2012. The Illinois Wildlife Action Plan; Bird Tables. Updated: September 2012. Accessed December 2, 2014. Available: http://www.dnr.illinois.gov/conservation/IWAP/Documents/SpeciesNeedingConservation/birdscolor.pdf.

Illinois Department of Natural Resources (IDNR). 2005. The Illinois Comprehensive Wildlife Conservation Plan and Strategy, Version 1.0. Available: http://www.dnr.illinois.gov/conservation/IWAP/Documents/WildlifeActionPlanFinal.pdf

Attachment A:
Site Vicinity and Turbine Location Maps

Attachment B:
Search Plot and Visibility Class Maps

Attachment C:
Sample Field Data Form

Appendix E. Natural Resources Permits

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

WESTERN ECOSYSTEMS TECHNOLOGY
dba WEST, INC
804 N COLLEGE AVENUE, SUITE 103
BLOOMINGTON, IN 47404
U.S.A.

2. AUTHORITY-STATUTES
16 USC 703-712

REGULATIONS
50 CFR Part 13
50 CFR 21.27

3. NUMBER
MB22090A-2 AMENDMENT

4. RENEWABLE
[X] YES
[ ] NO

5. MAY COPY
[X] YES
[ ] NO

6. EFFECTIVE
10/13/2011

7. EXPIRES
03/31/2013

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
RHETT E GOOD
PROJECT MANAGER

9. TYPE OF PERMIT
SPECIAL PURPOSE - MISCELLANEOUS

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. Authorized to retrieve, transport and temporarily possess carcasses of migratory birds found on company/utility property, right-of-ways, and throughout the States of Indiana, Illinois, Iowa, and MInnesota.

Carcasses from each site to be stored in freezers at the wind-energy facility offices at each site location with logs maintained at each site in respective freezers.

Auithorized to conduct bird fatalitiy studies via salvage at several wind-energy facilities in Region 3. Locations of sites is per application dated 09/10/2010.

Permittee must submit an annual report containing the following information to USFWS Migratory Bird Permit Office, 1 Federal Drive, Ft Snelling, MN 55111, with the following information:

location (including proximity to and description of the nearest company facility), species of bird, and details of its discovery.

Specimens collected may be disposed of via any of the following methods: burial or incineration; donation to a public scientific or educational institution.

E. Any person who is

(1) employed by or under contract to you for the activities specified in this permit, or
(2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

[X] ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS

ANNUAL REPORT DUE: 01/31

ISSUED BY	TITLE	DATE
[signature]	CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 3	10/13/2011

For list of authorized subpermittees, see application dated 09/10/2010.

F. Authorized to collect, stabilize and immediately transport sick and injured migratory birds found on company property, facilities, or right-of-ways to federally licensed rehabilitators for care. All rehabilitation costs are the responsibility of the permittee.

All injured birds collected must be reported to the Migratory Bird Permit Office within 3 working days via fax to 612-713-5393 with the following information:

a general description of the extent of the injury; species of bird; location (including proximity to, and description of the nearest company facility); details of its discovery.

G. Authorized to humanely euthanize migratory birds with injuries that compromise survival. This includes but is not limited to birds that have sustained severe injuries to wings, legs or feet.

H. Authorized in emergency situations occurring on company property or right-of-ways to conduct the following activities:

trap and/or relocate migratory birds; remove and/or relocate active nests with eggs and/or young except for endangered/threatened species, bald and/or golden eagles.

These methods may be used when birds or nests are posing a direct threat to human health and safety or when the safety of the bird is at risk if the nest and/or birds are not removed. Emergency activity must be reported to the Migratory Bird Permit Office within 3 working days via fax to 612-713-5393.

Nothing in this permit authorizes the take of uninjured, healthy birds, and active nests with eggs and/or young in non-emergency situations without additional permits.

I. Personnel must maintain records in accordance with 50 CFR 13.46 and 50 CFR 21.27.

J. Personnel must carry in their company vehicle a copy of this permit when engaging in permitted activities.

K. All required records relating to permitted activity shall be kept at the location indicated by the permittee to the Migratory Bird Permit Office.

L. All banded birds must be reported to the Bird Banding Laboratory at <www.reportband.gov> or 1-800-327-BAND.

M. **(Amended 08/08/2011)**. Amend Condition D above for the following:

Add as an authorized location the Timber Road II wind farm project in Paulding County, Ohio. Per email received 07/28/2011, permittee has obtained required ODNR state permits (Scientific Collection Wild Animal Permit 12-148 issued 6/1/2011 and authorization from ODNR via separate letter of authorization dated July 28, 2011 for work on ESA species to include state endangered and threatened species to include bat species.

Also, in Condition D, change location for annual reporting to USFWS to new regional office location at:

USFWS, Migratory Bird Permit Office, 5600 American Blvd West, Bloomington, MN 55437 (effective May 31, 2011)

N. **(Amended 10/13/2011)**: Amend to add authorized activity at the Blue Creek wind energy facility in Paulding and Van Wert counties, Ohio. Permittee has ODNR and Ohio Power Siting Board approval with appropriate certificates/permits/letters of authorization.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

1. PERMITTEE

BISHOP HILL ENERGY LLC
ONE SOUTH WACKER DRIVE
SUITE 1900
CHICAGO, IL 60606
U.S.A.

3. NUMBER
TE71464A-0

4. RENEWABLE	5. MAY COPY
☒ YES	☒ YES
☐ NO	☐ NO

6. EFFECTIVE	7. EXPIRES
07/10/2012	03/01/2014

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
BRYAN SCHUELER
VICE PRESIDENT

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED

HENRY COUNTY, ILLINOIS

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

E. PERMITTEE IS AUTHORIZED TO TAKE AND SALVAGE INDIANA BAT (*MYOTIS SODALIS*) FOR SCIENTIFIC RESEARCH AIMED AT RECOVERY OF THE SPECIES: DETERMINATION OF SPECIES PRESENCE OR PROBABLE ABSENCE, STUDIES TO DOCUMENT HABITAT USE, AND TO EVALUATE POTENTIAL IMPACTS TO THE SPECIES. A MAXIMUM OF THREE (3) INDIANA BATS PER YEAR IS AUTHORIZED TO BE TAKEN DURING THE PERIOD AUGUST 1 - SEPTEMBER 30, AS CONDITIONED HEREIN.

F. ACTIVITIES ARE AUTHORIZED AT THE BISHOP HILL WIND ENERGY FACILITY, HENRY COUNTY, ILLINOIS.

G. YOU MAY CONDUCT RESEARCH AND MONITORING TO TEST **CURTAILMENT STRATEGIES** AS FOLLOWS:

G.1. YOUR RESEARCH MAY TEST THE OPERATIONS AT WIND SPEEDS OF 5.5 M/S, 6.0 M/S, 6.5 M/S, AND 6.9 M/S, WITH FEATHERING. EACH TREATMENT MAY BE APPLIED TO A 14-TURBINE GROUP FOR SEVEN (7) NIGHTS TWICE DURING THE STUDY PERIOD OF AUGUST 1 - SEPTEMBER 30.

G.2. IF AN INDIANA BAT IS DISCOVERED TO HAVE BEEN TAKEN UNDER A TURBINE THAT IS PART OF THE TEST, THE NEXT HIGHER CUT-IN SPEED FROM THE SPEED CAUSING FATALITY WILL BECOME THE OPERATING REGIME FOR THAT TREATMENT.

G.3. OF THE TURBINES IDENTIFIED FOR CURTAILMENT STUDY (A TOTAL OF 56 TURBINES), VEGETATION AT 12 TURBINES SHALL BE CLEARED/MOWED FOR MAXIMUM SEARCHING EFFORT (78 METER X 78 METER PLOT).

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS

ANNUAL REPORT DUE: 01/31

ISSUED BY	TITLE	DATE
[signature]	CHIEF - ENDANGERED SPECIES	07/10/2012

G.4. FORTY-FOUR (44) TURBINES MAY BE SEARCHED ALONG ROADS AND PADS AT THE BASE OF THE TURBINE. SEARCHING MUST BE CONDUCTED TO A DISTANCE OF 78 METERS FROM THE TURBINE ALONG ANY ROADS/PADS/CLEARED AREAS.

H. YOU MAY CONDUCT RESEARCH TO STUDY TEMPERATURE AND WIND SPEED INTERACTIONS AS FOLLOWS:

H.1. YOU ARE AUTHORIZED TO OPERATE AN ADDITIONAL FIVE (5) TURBINES AT 5.5 M/S, WITH FEATHERING, DURING THE PERIOD OF AUGUST 1 - SEPTEMBER 30.

H.2. TURBINES IDENTIFIED FOR THE TEMPERATURE STUDY SHALL HAVE VEGETATION CLEARED/MOWED TO MAXIMIZE SEARCHER EFFICIENCY. CLEARING SHALL OCCUR TO A 78 METER X 78 METER PLOT.

I. CARCASS SEARCHES MUST BE CONDUCTED DURING THE STUDY PERIOD AS OUTLINED IN YOUR APPLICATION. IN ADDITION, THE FOLLOWING CONDITIONS APPLY TO YOUR SEARCHES:

I.1. INDIVIDUALS WHO ARE EMPLOYED BY BISHOP HILL TO COMPLETE THIS TASK MUST HAVE THE APPROPRIATE FEDERAL FISH AND WILDLIFE PERMITS TO SALVAGE AND IDENTIFY MYOTIS SPECIES.

I.2. SEARCH INTERVALS WILL BE SUCH THAT THERE IS AT LEAST AN 80 PERCENT CHANCE THAT A CARCASS HAS NOT BEEN SCAVENGED AND REMAINS TO BE DETECTED.

I.3. THE FOLLOWING INFORMATION MUST BE COLLECTED DURING FATALITY SEARCHES:

I.3.a. A DIGITAL PHOTO DOCUMENTING THE DISCOVERY OF THE CARCASS MUST BE TAKEN PRIOR TO COLLECTION.

I.3.b. THE SPECIMEN SHALL BE INDIVIDUALLY LABELED WITH A UNIQUE IDENTIFIER, BAGGED AND FROZEN.

I.3.c. COLLECTION DATA SHALL BE RECORDED FOR EACH INDIVIDUAL SALVAGED, INCLUDING:

- DATE AND TIME
- INITIAL SPECIES DETERMINATION
- SEX, AGE, REPRODUCTIVE CONDITION (IF POSSIBLE)
- GPS LOCATION
- TURBINE AT WHICH SPECIMEN IS DISCOVERED
- DISTANCE AND BEARING TO TURBINE
- SUBSTRATE/GROUND COVER CONDITIONS
- CONDITION OF SPECIMEN (INTACT, SCAVENGED)
- ESTIMATED TIME SINCE DEATH (NUMBER OF DAYS)
- NOTES ON PRESUMED CAUSE OF DEATH
- AIR TEMPERATURE ON THE NIGHT PRIOR TO COLLECTION AND NIGHT OF PRESUMED DEATH
- WIND SPEEDS, DIRECTION AND GENERAL WEATHER CONDITIONS FOR NIGHTS PRECEDING SEARCH

J. IN THE EVENT THAT AN INDIANA BAT IS FOUND, NOTIFICATION SHALL BE MADE TO THE USFWS (CONDITIONS L.1 AND L.2) WITHIN 24 HOURS OF VERIFIED DISCOVERY. YOUR INITIAL NOTICE MAY BE VIA TELEPHONE; HOWEVER, WRITTEN DOCUMENTATION OF THE DISCOVERY, INCLUDING WIND SPEED AND GENERAL WEATHER CONDITIONS ASSOCIATED WITH THE MORTALITY EVENT, MUST FOLLOW WITHIN FIVE DAYS.

K. AN ANNUAL REPORT OF YOUR ACTIVITIES IS DUE BY JANUARY 31 FOLLOWING EACH YEAR THAT YOUR PERMIT IS IN EFFECT. CONSISTENT WITH YOUR APPLICATION AND STUDY DESIGN, YOUR REPORT SHALL INCLUDE RESULTS OF THE TURBINE CURTAILMENT STUDY, TEMPERATURE STUDY, AND MORTALITY MONITORING. AT A MINIMUM, YOUR REPORT MUST INCLUDE:

K.1. A SUMMARY OF YOUR FINDINGS, INCLUDING OBSERVED AND ADJUSTED FATALITY RATES BY SPECIES, WHERE PRACTICAL, EXPRESSED IN TERMS OF FATALITIES/TURBINE/SEASON AND FATALITIES/MW/SEASON.

K.2. COPIES OF ALL DATA ANALYSES CONDUCTED BY BISHOP HILL LLC OR ITS CONTRACTOR, INCLUDING STATISTICAL TESTS, CORRELATIONS ANALYSES, AND FATALITY ESTIMATES.

K.3. A DISCUSSION OF THE RESULTS AND THEIR IMPLICATIONS FOR OPERATIONS AT BISHOP HILL WIND FACILITY, HENRY COUNTY, ILLINOIS.

K.4. ALL RAW DATA AND COPIES OF DATA COLLECTION SHEETS, PHOTOGRAPHS, AND FIELD NOTES, IF REQUESTED BY THE USFWS UPON REVIEW OF REPORTING INFORMATION PROVIDED UNDER CONDITIONS K.1. - K.3. FAILURE TO PROVIDE DATA MAY RESULT IN REVOKATION OF YOUR PERMIT OR MAY DISQUALIFY BISHOP HILL LLC FOR FUTURE PERMITS UNDER THE ENDANGERED SPECIES ACT.

L. REPORTS AND PUBLICATIONS MUST BE PROVIDED TO ALL OF THE OFFICES LISTED BELOW. IN LIEU OF HARD COPY, DOCUMENTS MAY BE PROVIDED ELECTRONICALLY IN MS WORD OR PORTABLE DOCUMENT FORMAT.

L.1. LISA MANDELL
REGIONAL RECOVERY PERMITS COORDINATOR
U.S. FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES - ENDANGERED SPECIES
5600 AMERICAN BLVD. WEST, SUITE 990
BLOOMINGTON, MN 55437-1458
612-713-5343; FAX 612-713-5292
email: Lisa_Mandell@fws.gov

L.2. RICK NELSON
FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
1511 47TH AVENUE
MOLINE, IL 61265
309-757-5800 X201; FAX 309-757-1710
email: Richard_C_Nelson@fws.gov

L.3. JOE KATH
ENDANGERED SPECIES COORDINATOR
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF NATURAL HERITAGE
ONE NATURAL RESOURCE WAY
SPRINGFIELD, IL 62702-1271
217-785-8764; FAX 217-785-2438
email: joe.kath@illinois.gov

CC: FWS/ESFO - ROCK ISLAND, IL
FWS/OFFICE OF LAW ENFORCEMENT
FWS/MIGRATORY BIRDS
ILLINOIS DNR, ATTN: TE COORDINATOR

END

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

BISHOP HILL ENERGY LLC
ONE SOUTH WACKER DRIVE
SUITE 1900
CHICAGO, IL 60606
U.S.A.

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

3. NUMBER
TE71464A-1 AMENDMENT

4. RENEWABLE: [X] YES [ ] NO

5. MAY COPY: [X] YES [ ] NO

6. EFFECTIVE
08/01/2013

7. EXPIRES
03/01/2014

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
BRYAN SCHUELER
VICE PRESIDENT

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED

HENRY COUNTY, ILLINOIS

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

E. PERMITTEE IS AUTHORIZED TO TAKE AND SALVAGE INDIANA BAT (*MYOTIS SODALIS*) FOR SCIENTIFIC RESEARCH AIMED AT RECOVERY OF THE SPECIES: DETERMINATION OF SPECIES PRESENCE OR PROBABLE ABSENCE, STUDIES TO DOCUMENT HABITAT USE, AND TO EVALUATE POTENTIAL IMPACTS TO THE SPECIES. A MAXIMUM OF THREE (3) INDIANA BATS PER YEAR IS AUTHORIZED TO BE TAKEN DURING THE PERIOD AUGUST 1 - SEPTEMBER 30, AS CONDITIONED HEREIN.

F. ACTIVITIES ARE AUTHORIZED AT THE BISHOP HILL WIND ENERGY FACILITY, HENRY COUNTY, ILLINOIS.

G. YOU MAY CONDUCT RESEARCH AND MONITORING TO TEST **CURTAILMENT STRATEGIES** AS FOLLOWS:

G.1. YOUR RESEARCH MAY TEST THE OPERATIONS AT WIND SPEEDS OF 4.5 M/S, 5.5 M/S, AND 6.9 M/S, WITH FEATHERING. EACH TREATMENT MAY BE APPLIED TO A 19-TURBINE GROUP FOR SEVEN (7) NIGHTS TWICE DURING THE STUDY PERIOD OF AUGUST 1 - SEPTEMBER 30.

G.2. IF AN INDIANA BAT IS DISCOVERED TO HAVE BEEN TAKEN UNDER A TURBINE THAT IS PART OF THE TEST, THE NEXT HIGHER CUT-IN SPEED FROM THE SPEED CAUSING FATALITY WILL BECOME THE OPERATING REGIME FOR THAT TREATMENT.

G.3. OF THE TURBINES IDENTIFIED FOR CURTAILMENT STUDY (A TOTAL OF 57 TURBINES), VEGETATION AT 12 TURBINES SHALL BE CLEARED/MOWED FOR MAXIMUM SEARCHING EFFORT (78 METER X 78 METER PLOT).

[X] ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS

ANNUAL REPORT DUE: 01/31

ISSUED BY	TITLE	DATE
Lisa Mandell	ACTING CHIEF - ENDANGERED SPECIES	08/01/2013

G.4. FORTY-FIVE (45) TURBINES MAY BE SEARCHED ALONG ROADS AND PADS AT THE BASE OF THE TURBINE. SEARCHING MUST BE CONDUCTED TO A DISTANCE OF 80 METERS FROM THE TURBINE ALONG ANY ROADS/PADS/CLEARED AREAS.

H. YOU MAY CONDUCT RESEARCH TO STUDY **TEMPERATURE** AND WIND SPEED INTERACTIONS AS FOLLOWS:

H.1. YOU ARE AUTHORIZED TO OPERATE AN ADDITIONAL FIVE (5) TURBINES AT 5.5 M/S, WITH FEATHERING, DURING THE PERIOD OF AUGUST 1 - SEPTEMBER 30.

H.2. TURBINES IDENTIFIED FOR THE TEMPERATURE STUDY SHALL HAVE VEGETATION CLEARED/MOWED TO MAXIMIZE SEARCHER EFFICIENCY. CLEARING SHALL OCCUR TO A 78 METER X 78 METER PLOT.

I. **CARCASS SEARCHES** MUST BE CONDUCTED DURING THE STUDY PERIOD AS OUTLINED IN YOUR APPLICATION. IN ADDITION, THE FOLLOWING CONDITIONS APPLY TO YOUR SEARCHES:

I.1. INDIVIDUALS WHO ARE EMPLOYED BY BISHOP HILL TO COMPLETE THIS TASK MUST HAVE THE APPROPRIATE FEDERAL FISH AND WILDLIFE PERMITS TO SALVAGE AND IDENTIFY MYOTIS SPECIES.

I.2. SEARCH INTERVALS WILL BE SUCH THAT THERE IS AT LEAST AN 80 PERCENT CHANCE THAT A CARCASS HAS NOT BEEN SCAVENGED AND REMAINS TO BE DETECTED.

I.3. THE FOLLOWING INFORMATION MUST BE COLLECTED DURING FATALITY SEARCHES:

I.3.a. A DIGITAL PHOTO DOCUMENTING THE DISCOVERY OF THE CARCASS MUST BE TAKEN PRIOR TO COLLECTION.

I.3.b. THE SPECIMEN SHALL BE INDIVIDUALLY LABELED WITH A UNIQUE IDENTIFIER, BAGGED AND FROZEN.

I.3.c. COLLECTION DATA SHALL BE RECORDED FOR EACH INDIVIDUAL SALVAGED, INCLUDING:

- DATE AND TIME
- INITIAL SPECIES DETERMINATION
- SEX, AGE, REPRODUCTIVE CONDITION (IF POSSIBLE)
- GPS LOCATION
- TURBINE AT WHICH SPECIMEN IS DISCOVERED
- DISTANCE AND BEARING TO TURBINE
- SUBSTRATE/GROUND COVER CONDITIONS
- CONDITION OF SPECIMEN (INTACT, SCAVENGED)
- ESTIMATED TIME SINCE DEATH (NUMBER OF DAYS)
- NOTES ON PRESUMED CAUSE OF DEATH
- AIR TEMPERATURE ON THE NIGHT PRIOR TO COLLECTION AND NIGHT OF PRESUMED DEATH
- WIND SPEEDS, DIRECTION AND GENERAL WEATHER CONDITIONS FOR NIGHTS PRECEDING SEARCH

J. IN THE EVENT THAT AN INDIANA BAT IS FOUND, NOTIFICATION SHALL BE MADE TO THE USFWS (CONDITIONS L.1 AND L.2) WITHIN 24 HOURS OF VERIFIED DISCOVERY. YOUR INITIAL NOTICE MAY BE VIA TELEPHONE; HOWEVER, WRITTEN DOCUMENTATION OF THE DISCOVERY, INCLUDING WIND SPEED AND GENERAL WEATHER CONDITIONS ASSOCIATED WITH THE MORTALITY EVENT, MUST FOLLOW WITHIN FIVE DAYS.

K. AN ANNUAL REPORT OF YOUR ACTIVITIES IS DUE BY JANUARY 31 FOLLOWING EACH YEAR THAT YOUR PERMIT IS IN EFFECT. CONSISTENT WITH YOUR APPLICATION AND STUDY DESIGN, YOUR REPORT SHALL INCLUDE RESULTS OF THE TURBINE CURTAILMENT STUDY, TEMPERATURE STUDY, AND MORTALITY MONITORING. AT A MINIMUM, YOUR REPORT MUST INCLUDE:

K.1. A SUMMARY OF YOUR FINDINGS, INCLUDING OBSERVED AND ADJUSTED FATALITY RATES BY SPECIES, WHERE PRACTICAL, EXPRESSED IN TERMS OF FATALITIES/TURBINE/SEASON AND FATALITIES/MW/SEASON.

K.2. COPIES OF ALL DATA ANALYSES CONDUCTED BY BISHOP HILL LLC OR ITS CONTRACTOR, INCLUDING STATISTICAL TESTS, CORRELATIONS ANALYSES, AND FATALITY ESTIMATES.

K.3. A DISCUSSION OF THE RESULTS AND THEIR IMPLICATIONS FOR OPERATIONS AT BISHOP HILL WIND FACILITY, HENRY COUNTY, ILLINOIS.

K.4. ALL RAW DATA AND COPIES OF DATA COLLECTION SHEETS, PHOTOGRAPHS, AND FIELD NOTES, IF REQUESTED BY THE USFWS UPON REVIEW OF REPORTING INFORMATION PROVIDED UNDER CONDITIONS K.1. - K.3. FAILURE TO PROVIDE DATA MAY RESULT IN REVOKATION OF YOUR PERMIT OR MAY DISQUALIFY BISHOP HILL LLC FOR FUTURE PERMITS UNDER THE ENDANGERED SPECIES ACT.

L. REPORTS AND PUBLICATIONS MUST BE PROVIDED TO ALL OF THE OFFICES LISTED BELOW. IN LIEU OF HARD COPY, DOCUMENTS MAY BE PROVIDED ELECTRONICALLY IN MS WORD OR PORTABLE DOCUMENT FORMAT.

L.1. LISA MANDELL
REGIONAL RECOVERY PERMITS COORDINATOR
U.S. FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES - ENDANGERED SPECIES
5600 AMERICAN BLVD. WEST, SUITE 990
BLOOMINGTON, MN 55437-1458
612-713-5343; FAX 612-713-5292
email: Lisa_Mandell@fws.gov

L.2. RICK NELSON
FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
1511 47TH AVENUE
MOLINE, IL 61265
309-757-5800 X201; FAX 309-757-1710
email: Richard_C_Nelson@fws.gov

L.3. JOE KATH
ENDANGERED SPECIES COORDINATOR
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF NATURAL HERITAGE
ONE NATURAL RESOURCE WAY
SPRINGFIELD, IL 62702-1271
217-785-8764; FAX 217-785-2438
email: joe.kath@illinois.gov

CC: FWS/ESFO - ROCK ISLAND, IL
FWS/OFFICE OF LAW ENFORCEMENT
FWS/MIGRATORY BIRDS
ILLINOIS DNR, ATTN: TE COORDINATOR

END

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Last Name: **Good** First Name: **Rhett** Permit Number: **NH13.5223**

Issued: **1/31/2013** **Expires: 12/31/2013**

Business Name: Western EcoSystems Technology Inc.

Street Address: 408 West Sixth Street

City: Bloomington State: IN Zip Code: 47404

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all associates may salvage all listed and non-listed deceased birds and bats (and their parts) and deposit these specimens in a freezer for later analysis - there is no limit to the number of specimens that may be collected and this permit authorizes activities in all Illinois counties, with an initial emphasis on Woodford, Livingston, Henry, McLean, and LaSalle Counties [As listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL.)] strictly for scientific, educational, and/or zoological purposes.] Salvaged specimens may also be used during scavenger removal trials. This permit authorizes activities described in the: Avian and Bat Fatality Monitoring Plan-Grand Ridge Project (on file in Springfield, IL.). A federal permit is required for all projects involving federally regulated species, including migratory birds and their parts, including nests, feathers, etc. - this permit does not allow the collection of birds and/or their parts without the accompanying Federal Permit. Endangered and Threatened Species activities in Illinois are covered under Illinois E&T Permit #08-29S. Upon project completion, all salvaged animals shall be reported to both the IDNR and USFWS prior to disposal - these agencies may want certain specimens for analysis, etc. A report to the Illinois DNR (attn: Joseph Kath) shall be provided within 90 days of project completion.
This permit will also allow: live collection; photograph & handle for data collection; release unharmed near capture location; - for all non-listed mussels throughout Illinois.
Individuals working under direction of applicant include: Jason Ritzert, Michelle Ritzer, Sandra Simon, Kevin Murray

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: Rhett Good

(Permit not valid unless signed)

Approved By: [signature]

Office of Resource Conservation

Date: 2/5/13

TERMS FOR SCIENTIFIC PERMIT

1. Under no circumstances shall a scientific permit be used in lieu of sport or commercial licenses.
2. All taking shall be performed by or under the direct supervision of the permittee. Permitte must be present with persons involved in actual taking.
3. All gear left unattended must be tagged bearing name and scientific permit number of permittee.
4. Permittee must be at least eighteen (18) years of age.
5. Permits are not transferable and PERMITTE SHALL CARRY PERMIT AT ALL TIMES WHEN TAKING FAUNA.
6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provsions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

The Department of Natural Resources is an equal opportunity employer.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Last Name: **Good** First Name: **Rhett** Permit Number: **NH14.5223**

Issued: **4/15/2014** **Expires: 12/31/2014**

Business Name: Western EcoSystems Technology Inc.

Street Address: 408 West Sixth Street

City: Bloomington State: IN Zip Code: 47404

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all associates may salvage all listed and non-listed deceased birds and bats (and their parts) and deposit these specimens in a freezer for later analysis - there is no limit to the number of specimens that may be collected and this permit authorizes activities in all Illinois counties, with an initial emphasis on Woodford, Livingston, Henry, McLean, and LaSalle Counties [As listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL.)] strictly for scientific, educational, and/or zoological purposes.] Salvaged specimens may also be used during scavenger removal trials. This permit authorizes activities described in the: Avian and Bat Fatality Monitoring Plan-Grand Ridge Project (on file in Springfield, IL.). A federal permit is required for all projects involving federally regulated species, including migratory birds and their parts, including nests, feathers, etc. - this permit does not allow the collection of birds and/or their parts without the accompanying Federal Permit. Endangered and Threatened Species activities in Illinois are covered under Illinois E&T Permit #08-29S. Upon project completion, all salvaged animals shall be reported to both the IDNR and USFWS prior to disposal - these agencies may want certain specimens for analysis, etc. A report to the Illinois DNR (attn: Joseph Kath) shall be provided within 90 days of project completion. If live or deceased endangered and threatened species are encountered during the permitted activity, the occurrence needs to be documented (preferably with photographs of diagnostic characteristics and geographic location) and reported in writing to the IDNR Division of Natural Heritage, Endangered Species Coordinator within one (1) week.
Individuals working under direction of applicant include: Jason Ritzert, Michelle Ritzert, Sandra Simon, Kevin Murray, Benjamin Hale, Goniela Isakali

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: Rhett G

(Permit not valid unless signed)

Approved By: [signature]

Office of Resource Conservation

Date: 4-15-14

TERMS FOR SCIENTIFIC PERMIT

1. Under no circumstances shall a scientific permit be used in lieu of sport or commercial licenses.
2. All taking shall be performed by or under the direct supervision of the permittee. Permitte must be present with persons involved in actual taking.
3. All gear left unattended must be tagged bearing name and scientific permit number of permittee.
4. Permittee must be at least eighteen (18) years of age.
5. Permits are not transferable and PERMITTE SHALL CARRY PERMIT AT ALL TIMES WHEN TAKING FAUNA.
6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provsions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 703-712

REGULATIONS
50 CFR Part 13
50 CFR 21.27

1. PERMITTEE

BISHOP HILL ENERGY LLC
ONE SOUTH WACKER DRIVE
C/O MATTHEW A. RUHTER
SUITE 1900
CHICAGO, IL 60606
U.S.A.

3. NUMBER
MB72234A-0

4. RENEWABLE	5. MAY COPY
[X] YES [ ] NO	[X] YES [ ] NO
6. EFFECTIVE 05/14/2012	7. EXPIRES 03/31/2015

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
KEVIN E. PARZYCK
VICE PRESIDENT DEVELOPMENT CENTRAL

9. TYPE OF PERMIT
SPECIAL PURPOSE UTILITY PERMIT FOR MIGRATORY BIRD MORTALITY MONITORING

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Henry County, IL: Townships of Andover, Cambridge, Burns, Kewanee, Clover, Galva, Oxford, Weller and Wethersfield. Stark Countie: Townships of Elmira, Goshen and Toulon.
133 GE 1.5-MW or 1.6 GE-MW wind turbines spanning approx. 27 miles through the above townships.

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

Block 10: Bishop Hill Energy LLC
Henry and Stark Counties
Illinois

D. **Possession and transport.** You are authorized to collect, transport and temporarily possess carcasses and partial remains of migratory birds found at the location/property specified in Block 10 for monitoring migratory bird mortality associated with operation of the wind facility. To accurately determine species fatality rates, which is the important research justification for authorizing this special purpose permit, the monitoring study should include standardized carcass searches, searcher efficiency trials, and carcass removal by scavenger trials.

Except for take caused by your infrastructure and operations, you may not collect or disturb and must immediately report to U.S. Fish and Wildlife Service Office of Law Enforcement (OLE) any dead migratory birds that appear to have been poisoned, shot, or otherwise killed or injured as the result of potential criminal activity. Your OLE contact phone number is 217-793-9554 Springfield IL office.

E. **Relocation.** Except for Endangered or Threatened Species and Bald Eagles or Golden Eagles, *in emergency situations* you are authorized to relocate active migratory bird nests, including eggs or nestlings, found at the location/property specified in Block 10 when (1) the safety of the migratory birds, nests or eggs is at risk, or (2) the migratory birds, nests, or eggs pose a threat of serious bodily injury or a risk to human life, including a threat of fire hazard or power outage. You may not use this authority for situations in which migratory birds are merely causing a nuisance. You must monitor relocated nests daily to assess success of the relocation.

If you seek to harass or live-trap and relocate an Endangered or Threatened Species, Bald Eagles, or Golden Eagles you must get an

[X] ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
ANNUAL REPORT DUE: 01/31

ISSUED BY	TITLE	DATE
[signature]	CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 3	05/11/2012

additional permit to do so.

F. **Data Collection.**

(1) The following data must be recorded for each search:
- (a) date,
- (b) start time,
- (c) end time,
- (d) interval since last search,
- (e) observer,
- (f) search method used,
- (g) Identifying information for the turbine or turbines searched, and,
- (h) weather data for each search, including the weather for the interval since the last search.

(2) All relevant data associated with each carcass or parts collection must be recorded, including:
- (a) date,
- (b) species,
- (c) sex and age (if known),
- (d) observer name and contact information,
- (e) turbine or pole number,
- (f) distance of carcass from turbine or pole,
- (g) azimuth from turbine (including GPS coordinates in decimal degrees),
- (h) habitat surrounding carcass (*e.g.*, bare ground, tall grass, shrubby)
- (i) condition and description of carcass with suspected cause of death if apparent (entire, partial, scavenged, wing severed from body, blood oozing from mouth from apparent blunt force trauma),
- (j) estimated time of death ($\leq$ 1 day, 2 days, etc.),
- (k) information on carcass disposition, and
- (l) any relevant notes or additional information.

(3) All carcasses and partial remains collected must be digitally photographed, bagged, and labeled with:
- (a) the date,
- (b) a unique specimen number,
- (c) the transect or subplot number, and
- (d) the turbine or pole number.

G. **Injured birds.** To provide treatment to injured birds, you must capture, stabilize and immediately transfer injured or sick migratory birds found at the location specified in Block 10, including eagles and Threatened or Endangered species, to a federally permitted migratory bird rehabilitator for care. The rehabilitator (or if not available, a licensed, practicing veterinarian) can decide to euthanize a migratory bird or eagle. Rehabilitation costs are your responsibility. See condition I for reporting instructions.

H. **Collection of live, non-injured migratory birds, eggs, or nests is not authorized by this permit.** You are not authorized to take, capture, harass or disturb Bald Eagles or Golden Eagles, or species listed as Threatened or Endangered under the U.S. Endangered Species Act (see 50 CFR 17.11).

I. **Reporting.**
(1) You must report bird injuries and deaths in accordance with the timeframes specified below. We request that you also report voluntarily comparable bat injury and mortality information. If you have an account with the U.S. Fish and Wildlife Service (Service) Bird Injury and Mortality Reporting System (BIMRS) for reporting wind industry incidents, you must report the incidents in BIMRS at: *https://birdreport.fws.gov/.* If you do not have a BIMRS account, you must report the incident to USFWS 5600 American Blvd. W, Bloomington, MN 55437 (612-713-5436).

(a) You must report any **Bald Eagle or Golden Eagle** found dead or injured to OLE by the **next available business day** (see Condition D for contact information) and your migratory bird permit office at USFWS 5600 American Blvd. W, Bloomington, MN 55437 (612-713-5436). Your report must include as much of the data as possible in F(2) above. You can provide information not available at the time of your initial report to OLE within 48 hours or as directed by the OLE officer.

(b) You must report any **Threatened or Endangered Species** found dead or injured within **48 hours.** The report must include as much of the data as possible in F(2) above. A list of Threatened and Endangered species by State may be found in the U.S. Fish and Wildlife Service's Threatened and Endangered Species System (TESS) database at: *http://www.fws.gov/endangered.*

(c) You must report bird mortalities or injuries to the Service in accordance with paragraph I(1) within **30 days** of the discovery for migratory birds other than Eagles and Threatened or Endangered species. Your report must include the information from condition F (2) above.

(d) You must report any emergency active nest relocation activity (per condition E) within **3 business days.** Your report must include the species and number of active nests, including eggs and nestlings, relevant site locations, method of relocation, and a complete description of the emergency circumstances warranting the relocation.

(2) You must submit an **Annual Report** of dead and injured birds collected (which you may generate from the BIMRS database if your

company holds an account) to your migratory bird permit issuing office by January 31 following each calendar year in which the permit is in effect. Your report must include at a minimum the following for each carcass or partial carcass collected and each live, injured migratory bird captured: species, date collected or captured, location, condition (live or dead), pole/turbine number, apparent cause of mortality, weather conditions when mortality/injury occurred, name and contact information of person collecting, and disposition of those carcasses or parts. The report form 3-202-17 is available at *http://www.fws.gov/forms/3-202-17.pdf.*

(3) **Banded Birds** (carcasses collected and injured birds) must be reported to the U.S. Geological Survey Bird Banding Laboratory at 1-800-327-2263 or *http://www.reportband.gov.* Information provided must include, as accurately as possible, species of bird, band number, date recovered, recovery location that can be narrowed down to a specific 10-minute block, and name and contact information of the person who recovered the carcass or bird.

J. **Disposition of Carcasses and Parts.**
(1) You must deliver **Bald Eagle and Golden Eagle** carcasses to the Service Office of Law Enforcement (OLE), to be forwarded to the National Eagle Repository (NER) in Colorado. However, with prior authorization from an OLE Special Agent you may ship carcasses directly to the NER (contact the NER at 303-287-2110 for shipping instructions). Disposition must be reported in your annual report to the issuing permit office and in BIMRS if you have a BIMRS account.

(2) You must transfer dead or injured **Threatened and Endangered Species** in accordance with instructions from your migratory bird permit issuing office. The disposition of these animals must be reported in your annual report to the issuing permit office and in BIMRS if you have a BIMRS account.

(3) **Migratory Bird** carcasses and parts (other than those of Eagles and Threatened and Endangered species) must be stored at the facilities at the location specified in Block 10 until the end of the calendar year in which they were collected. Unless otherwise specified by the permit issuing office or OLE, carcasses and parts may be:
(a) used for searcher efficiency and scavenger removal trials;
(b) turned over to the State wildlife agency regulating migratory bird mortality monitoring activities associated with wind energy; or,
(c) with additional authorization from the permit issuing office, donated to a public scientific or educational institution or to an individual or entity authorized by federal permit to acquire and possess migratory bird specimens.

All dead specimens and parts (except Eagles and Threatened and Endangered species) that you do not transfer to another authorized party must be disposed of by such means as are necessary to ensure that they are not exposed to animals in the wild, such as by burning or burying them.

K. **Renewal.** In addition to an updated monitoring protocol, any renewal request for this permit must include information on the fatality rates of affected species or fatality patterns, analysis of those rates/patterns, whether any adjustments or measures were taken to avoid or minimize mortalities, if so, and preliminary results of those modifications.

L. **Subpermittees.**
(1) Any person who is employed by or under contract to the permittee for the activities specified in this permit or is otherwise designated by the permittee as a subpermittee in writing may exercise the authority of this permit.

(2) Subpermittees must be at least 18 years of age. As the permittee, you are legally responsible for ensuring that your subpermittees are adequately trained and adhere to the terms of your permit. You are responsible for maintaining current records of who you have designated as a subpermittee, including copies of letters you have provided.

M. **Carrying your permit.** You and any subpermittees must carry a legible copy of this permit and display it upon request whenever you are exercising its authority. Subpermittees must also carry your written subpermittee designation letter.

N. **Records.** You must maintain records in accordance with 50 CFR 13.46 and 50 CFR 21.27 and this permit. You must keep all required records and collected wildlife parts relating to permitted activities at the location you identified in writing to the migratory bird permit issuing office.

O. **Personal use.** This permit does not authorize personal use of any migratory birds, parts, nests or eggs salvaged, transported, or temporarily possessed under the authority of this permit.

P. **Other permissions.** This permit does not authorize you to conduct activities on Federal, State, tribal, or other public or private property without additional prior written permits or permission from the agency/landowner.

Q. **Applicable laws.** You may not conduct the activities authorized by this permit if doing so would violate the laws of the applicable State, county, municipal or tribal government or any other applicable law.

R. **Site inspections.** Acceptance of this permit authorizes the Director's agent to enter the wind development property at any reasonable hour as necessary to inspect the wildlife, records, turbines, property, and associated infrastructure for wildlife impacted by the wind development, and for compliance with the terms of this permit and governing regulations.

This permit does not, nor shall it be construed to, authorize lethal take or injury of migratory birds or limit or preclude the U.S. Fish and Wildlife Service from exercising its authority under any law, statute, or regulation, or from taking enforcement action against any individual, company, or agency. This permit is not intended to relieve any individual, company, or agency of its obligations to comply with *any applicable Federal, State, Tribal, or local law, statute, or regulation.*

Illinois
Department of
Natural Resources
One Natural Resources Way · Springfield, Illinois 62702-1271 www.dnr.illinois.gov

All 3 sites

PERMIT FOR POSSESSION OF ENDANGERED OR THREATENED SPECIES

Permit type: S Permit No. 15-031 is issued to: Brad Romano and the associates listed in Attachment A (Shoener Environmental, Inc.) 239 Main Street, Suite 301, Dickson City, PA 18519 to allow **surveys, collection, salvage, possession, and storage** of the following animals or animal products of endangered or threatened species or federal endangered plants:

SPECIES	ITEM	QUANTITY
1. All State Listed Bat Species	Carcass	As Encountered
2. All State Listed Bird Species	Carcass	As Encountered

Permit version: Original X Renewal __ Amended __

Special conditions: This permit is valid for the following locations: Bishop Hill Wind Energy Facility (Henry County), Grand Ridge Wind Facility (LaSalle County), and California Ridge Wind Energy Facility (Champaign and Vermillion Counties). Carcasses found outside of the search area will be treated similar to those found within the search area. Vegetation within the search area will be maintained at a suitable low height (less than 6 inches) for the duration of the study with mowing to occur (if necessary) within 24 hours after carcass collections. The applicant will notify the IDNR of the results of the carcass removal trials and efficiency trials and any subsequent changes to the monitoring schedule on a **quarterly basis.** If listed species are encountered, the IDNR will be notified within 72 hours of positive ID (preferably with photographs of diagnostic characteristics and geographic location) at mike.moomey@illinois.gov Annual reporting criteria for the permit will consist of a spreadsheet of all collected specimens that includes all the information contained within the data sheets. All carcasses will be maintained frozen individually in sealed bags containing the completed data sheets and after identification.. Upon completion of the study or at any time during, all specimens will be turned over to the IDNR upon request. IDNR contacts are; mike.moomey@illinois.gov and john.wilker@illinois.gov. Applicants must utilize appropriate decontamination procedures to prevent the spread of disease between individuals and sites and every effort should be made to prevent the spread of exotic or invasive plants/plant propagules.

Standard conditions:

- **Reporting**- Annual reports must be submitted by January 31 of each year. Changes in inventory of specimens must be reported within 5 days. Changes in personal information or affiliation must be reported within 10 days.
- **Propagation**- Propagation requires a permit for such a purpose, only available under Scientific and Zoological/Botanical permits.
- **Disposal or Transfer**- Applicants must obtain a permit prior to transfer or disposal of specimens.
- **Facilities**: Holding facilities must meet the standards set forth by the Federal Animal Welfare Act.
- **Temporary holding**: Specimens allowed under limited permits may be held temporarily (up to 90 days) by other persons only after written consent of the director.
- **Revocation**: Permits may be revoked if false information was used to obtained permit, reports were not submitted, facility standards were not met, or applicant violates state or federal laws.

THIS PERMIT IF VOID IF IT CONTAINS ANY STRIKE-OUTS, OVERWRITES OR OTHER ALTERATIONS AND IS NON-TRANSFERABLE

ITEMS LISTED ON THIS PERMIT MAY BE SOLD, GIVEN AWAY OR OTHERWISE DISPOSED OF ONLY WITH PERMISSION OF THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Signed: ____________________
Dr. Jim Herkert
Office Director
IDNR Office of Resource Conservation

Date issued: 5/18/15 Expiration Date: December 31, 2015

*This permit is issued pursuant to the Illinois Endangered Species Protection Act and authorizes only those activities listed above. This permit does NOT exempt the permittee from compliance with any other federal, state, or local law, statute, ordinance, or regulation. As a permit holder, the individual/agency acknowledges that all collections of Federal and State listed species be reported to the Endangered Species Program Manager (IL. DNR-Division of Natural Heritage) within 10 davs of collection.

ATTACHMENT A
Brad Romano (Shoener Environmental)
Permit #15-031

The following associates are authorized to work under the direction of the applicant:

Michael David
Jessica Noe,
Carlyle Meekins
Heath Smith
Suzie Marlow
Tom Wallenfeldt
Brian Good
William Chrisman
Gordon Lee
Zackary Sisk

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Bishop Hill

Last Name: **Romano** First Name: **W. Brad** Permit Number: **NH15.5850**

Issued: **8/24/2015** **Expires: 12/31/2015**

Business Name: Shoener Environmental, Inc.

Street Address: 239 Main Street, Suite 301

City: Dickson City State: PA Zip Code: 18519

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all individuals listed may legally capture, handle, collect data and/or obtain biological samples, by scientifically accepted and approved methods, for projects and species listed below [as listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL) strictly for scientific, educational and/or zoological purposes]. Permitted activities include; salvage of avian and chiropteran carcasses (quantities as encountered) utilizing visual observation teams daily, identification to species and general data collection. Salvage carcasses in excellent condition of Hoary (Lasiurus cinereus), and Silver-haired (Lasionycteris noctovagans) bats may be utilized for searcher efficiency and/or carcass removal trials after proper documentation to include photographs. If listed species are encountered, the IDNR will be notified within 72 hours of positive ID (preferably with photographs of diagnostic characteristics and geographic location) at mike.moomey@illinois.gov . Carcasses found outside of the search area will be treated similar to those found within the search area. Bird carcasses encountered will be treated and reported similar to bats. The applicant will notify the IDNR of the results of the carcass removal trials and efficiency trials and any subsequent changes to the monitoring schedule on a quarterly basis. All carcasses will be maintained frozen individually in sealed bags containing the completed data sheets (or copies). All carcasses will be maintained at the same facility and housed together and not separated. The IDNR reserves the right to inspect the specimens upon request for identification purposes. Upon completion of the study or at any time during, all specimens will be turned over to the IDNR upon request. Upon completion of the study, the specimens not turned over to the IDNR will be donated to the collection facility at an approved Zoological or Scientific institution, incinerated, or buried. The applicant will notify the IDNR within 72 hours if greater than 10 birds or bats are found during any single search. Annual reporting criteria for the permit will be submitted on a quarterly basis with a final report within 30 days of the completion of the study and consist of a spreadsheet of all collected specimens containing all information collected for each specimen including species identification and disposition of sample. Possession of a valid scientific collection permit does not grant access for permitted activities as other permits may be required. A federal permit is required for all projects involving federally regulated species, including migratory birds. Any permitted activities conducted on State-owned properties require prior approval and possession of an IDNR Research / Site Permit. Any permitted activities conducted on sites Dedicated or Registered through the Illinois Nature Preserves Commission require prior approval and possession of an INPC Research Permit. Applicants must utilize appropriate decontamination procedures to prevent the spread of disease between individuals and sites and every effort should be made to prevent the spread of exotic or invasive plants/plant propagules.
Authorization: Henry county
Individuals working under direction of applicant include: Michael David, Jessica Noe, Carlyle Meekins, Heath Smith, Suzie Marlow, Tom Wallenfeldt, Brian Good, William Chrisman, Gordon Lee, Zackary Sisk and temporary employees (names on file in Springfield).

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: [signature] Approved By: [signature] Date: 8-27-15

(Permit not valid unless signed) Office of Resource Conservation

TERMS FOR SCIENTIFIC PERMIT

1. Under no circumstances shall a scientific permit be used in lieu of sport or commercial licenses.
2. All taking shall be performed by or under the direct supervision of the permittee. Permitte must be present with persons involved in actual taking.
3. All gear left unattended must be tagged bearing name and scientific permit number of permittee.
4. Permittee must be at least eighteen (18) years of age.
5. Permits are not transferable and PERMITTE SHALL CARRY PERMIT AT ALL TIMES WHEN TAKING FAUNA.
6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provsions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Last Name: **Romano** First Name: **W. Brad** Permit Number: **NH15.5850**

Issued: **5/7/2015** **Expires: 12/31/2015**

Business Name: Shoener Environmental, Inc.

Bishop

Street Address: 239 Main Street, Suite 301

City: Dickson City State: PA Zip Code: 18519

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all individuals listed may legally capture, handle, collect data and/or obtain biological samples, by scientifically accepted and approved methods, for projects and species listed below [as listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL) strictly for scientific, educational and/or zoological purposes]. Permitted activities include; salvage of avian and chiropteran carcasses (quantities as encountered) utilizing visual observation teams daily, identification to species and general data collection. Salvaged carcasses must be maintained and not utilized for searcher efficiency and or carcass removal trials. If listed species are encountered, the IDNR will be notified within 72 hours of positive ID (preferably with photographs of diagnostic characteristics and geographic location) at mike.moomey@illinois.gov . Carcasses found outside of the search area will be treated similar to those found within the search area. Bird carcasses encountered will be treated and reported similar to bats. The applicant will notify the IDNR of the results of the carcass removal trials and efficiency trials and any subsequent changes to the monitoring schedule on a quarterly basis. All carcasses will be maintained frozen individually in sealed bags containing the completed data sheets (or copies). All carcasses will be maintained at the same facility and housed together and not separated. The IDNR reserves the right to inspect the specimens upon request for identification purposes. Upon completion of the study or at any time during, all specimens will be turned over to the IDNR upon request. Upon completion of the study, the specimens not turned over to the IDNR will be donated to the collection facility at an approved Zoological or Scientific institution, incinerated, or buried. The applicant will notify the IDNR within 72 hours if greater than 10 birds or bats are found during any single search. Annual reporting criteria for the permit will be submitted on a quarterly basis with a final report within 30 days of the completion of the study and consist of a spreadsheet of all collected specimens containing all information collected for each specimen including species identification and disposition of sample. Possession of a valid scientific collection permit does not grant access for permitted activities as other permits may be required. A federal permit is required for all projects involving federally regulated species, including migratory birds. Any permitted activities conducted on State-owned properties require prior approval and possession of an IDNR Research / Site Permit. Any permitted activities conducted on sites Dedicated or Registered through the Illinois Nature Preserves Commission require prior approval and possession of an INPC Research Permit. Applicants must utilize appropriate decontamination procedures to prevent the spread of disease between individuals and sites and every effort should be made to prevent the spread of exotic or invasive plants/plant propagules.

Authorization: Henry county

Individuals working under direction of applicant include: Michael David, Jessica Noe, Carlyle Meekins, Heath Smith, Suzie Marlow, Tom Wallenfeldt, Brian Good, William Chrisman, Gordon Lee, Zackary Sisk and temporary employees (names on file in Springfield).

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: [signature] Approved By: [signature] Date: 5-11-15

(Permit not valid unless signed) Office of Resource Conservation

TERMS FOR SCIENTIFIC PERMIT

1. Under no circumstances shall a scientific permit be used in lieu of sport or commercial licenses.
2. All taking shall be performed by or under the direct supervision of the permittee. Permitte must be present with persons involved in actual taking.
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6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provsions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

The Department of Natural Resources is an equal opportunity employer.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Last Name: **Romano** First Name: **W. Brad** Permit Number: **NH15.5898**

Issued: **4/27/2015** **Expires: 12/31/2015**

Business Name: Shoener Environmental, Inc.

Street Address: 239 Main Street, Suite 301

City: Dickson City State: PA Zip Code: 18519

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all individuals listed may legally capture, handle, collect data and/or obtain biological samples, by scientifically accepted and approved methods, for projects and species listed below [as listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL) strictly for scientific, educational and/or zoological purposes]. Permitted activities include; possession of up to 950 previously salvaged non-listed bat carcasses and up to 170 bird (chicken and pigeon) carcasses for use in searcher efficiency trials. Carcasses for the trial will be clearly marked and maintained separate from all other carcasses. Proof of specimen origin (invoices, transfer slips, etc.) should be maintained with carcasses. Any carcass remaining after the study should be donated to a zoological or scientific institution or buried. Annual reporting criteria for this permit will constitute a quarterly report (June, Sept. and Dec.) detailing results of efficiency trials and any changes made to the monitoring schedule as a result of trials. Possession of a valid scientific collection permit does not grant access for permitted activities as other permits may be required. A federal permit is required for all projects involving federally regulated species, including migratory birds. If endangered and threatened species are incidentally captured, handled or identified during the permitted activity, the occurrence needs to be documented (preferably with photographs of diagnostic characteristics and geographic location) and reported via email to Tara Kieninger at: tara.kieninger@illinois.gov and DNR.ETPermit@illinois.gov within (72) hours. The specimen cannot be removed and should be released on site immediately. Intentional capture, handling and/or collection of endangered or threatened species require prior approval and possession of an Endangered or Threatened Species Permit. Any permitted activities conducted on State-owned properties require prior approval and possession of an IDNR Research / Site Permit. Any permitted activities conducted on sites Dedicated or Registered through the Illinois Nature Preserves Commission require prior approval and possession of an INPC Research Permit. Applicants must utilize appropriate decontamination procedures to prevent the spread of disease between individuals and sites and every effort should be made to prevent the spread of exotic or invasive plants/plant propagules.
Authorization: Henry, Vermilion and Champaign counties
Individuals working under direction of applicant include: Michael David, Jessica Noe, Carlyle Meekins, Heath Smith, Suzie Marlow

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: [signature] Approved By: [signature] Date: 4-27-15

(Permit not valid unless signed) Office of Resource Conservation

TERMS FOR SCIENTIFIC PERMIT

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11. By january 31 of next year, an annual report of the permitee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

The Department of Natural Resources is an equal opportunity employer.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compliled Statues to:

Last Name: **Romano** First Name: **W. Brad** Permit Number: **NH15.5898**

Issued: **5/28/2015** **Expires: 12/31/2015**

Business Name: Shoener Environmental, Inc.

Street Address: 239 Main Street, Suite 301

City: Dickson City State: PA Zip Code: 18519

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all individuals listed may legally capture, handle, collect data and/or obtain biological samples, by scientifically accepted and approved methods, for projects and species listed below [as listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL) strictly for scientific, educational and/or zoological purposes]. Permitted activities include: possession of up to 950 previously salvaged non-listed bat carcasses and up to 170 bird (chicken and pigeon) carcasses for use in searcher efficiency trials. Carcasses for the trial will be clearly marked and maintained separate from all other carcasses. Proof of specimen origin (invoices, transfer slips, etc.) should be maintained with carcasses. Any carcass remaining after the study should be donated to a zoological or scientific institution or buried. Annual reporting criteria for this permit will constitute a quarterly report (June, Sept. and Dec.) detailing results of efficiency trials and any changes made to the monitoring schedule as a result of trials. Possession of a valid scientific collection permit does not grant access for permitted activities as other permits may be required. A federal permit is required for all projects involving federally regulated species, including migratory birds. If endangered and threatened species are incidentally captured, handled or identified during the permitted activity, the occurrence needs to be documented (preferably with photographs of diagnostic characteristics and geographic location) and reported via email to Tara Kieninger at: tara.kieninger@illinois.gov and DNR.ETPermit@illinois.gov within (72) hours. The specimen cannot be removed and should be released on site immediately. Intentional capture, handling and/or collection of endangered or threatened species require prior approval and possession of an Endangered or Threatened Species Permit. Any permitted activities conducted on State-owned properties require prior approval and possession of an IDNR Research / Site Permit. Any permitted activities conducted on sites Dedicated or Registered through the Illinois Nature Preserves Commission require prior approval and possession of an INPC Research Permit. Applicants must utilize appropriate decontamination procedures to prevent the spread of disease between individuals and sites and every effort should be made to prevent the spread of exotic or invasive plants/plant propagules.
Authorization: Henry, LaSalle, Vermilion and Champaign counties
Individuals working under direction of applicant include: Michael David, Jessica Noe, Carlyle Meekins, Heath Smith, Suzie Marlow

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: ____________ Approved By: ____________ Date: 6/1/15

(Permit not valid unless signed) Office of Resource Conservation

TERMS FOR SCIENTIFIC PERMIT

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6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provsions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

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Appendix F. Black-billed Cuckoo Breeding Survey and Habitat Assessment – Proposed Study Plan

Black-billed Cuckoo Breeding Survey and Habitat Assessment Proposed Study Plan

1 Introduction

The objective of the black-billed cuckoo (BBCU) study is to conduct presence/absence surveys and assess habitat conditions on Illinois state-owned lands so that the results can be used by the Illinois Department of Natural Resources (DNR) in management decisions.

The most robust bird dataset in Illinois is the breeding bird survey (BBS), and 45 routes are located within the state. BBCU are recorded on BBS routes occasionally, and the BBS results suggest the species is uncommon in Illinois. However, BBS routes typically travel public roads, and based on the location of most BBS routes in Illinois, potential BBCU habitat is unlikely surveyed by the BBS. Thus, surveys designed to target potential BBCU habitat will provide important information to the DNR about the habitat and presence or absence of BBCU on state-owned and managed lands.

1.1 Life History

Generally, BBCUs initiate nesting in the Midwestern U.S. from late May to late June, but active nests have been recorded as late as mid-September (Eastman 1991). Clutch size for BBCU is most often 2 to 3 eggs; rarely 4 or 5. Eggs are usually laid every second day, but intervals of 1 to 4 days have been reported. Because incubation begins after the first egg is laid, estimates of length of incubation are variable, and range from 10 to 14 days (Hughes 2001).

1.2 Habitat Use

Habitat preferences of the BBCU are not well studied likely as a result of the species' reclusive habits. Spencer (1943) studied six nests and found nesting habitat ranged from an 'open wooded area' (two nests) to second growth forest and thickets (four nests). BBCUs use a wide range of habitats but are most commonly associated with forest edges, fencerows, riparian areas and shrublands (Spencer 1943, Hughes 2001). Kleen et al. (2004) describes the species as more likely to utilize "older, more wooded side of woodland edges" and is "less likely to be found near suburbia than the yellow-billed cuckoo." Trends in habitat use across breeding bird atlas records suggest that BBCUs will nest in habitat associated with water or marshy areas and use trees that typically form thickets such as willow, alder, birch and beech (Hughes 2001). Little is known about the about the territorial behavior of the BBCU (Hughes 2001), but Freeman and Merriam (1986) hypothesized that home range size is 2 to 5 hectares (ha; 5 to 12.4 acres).

BBCU nests are typically placed 3 to 6 feet above the ground, but nest height varies. In Ontario, nests were observed as high as 40 feet above ground, but 50% of nests (117 out of 233) were placed between 3 to 5 feet above ground (Peck and James 1983). Studies in Michigan and North Dakota report nests averaged 5 feet above ground (Spencer 1943, Stewart 1975).

2 Methods

As a BBCU-specific survey protocol is not available, the survey methods in the study plan have been adapted from the western yellow-billed cuckoo survey protocol (Halterman et al. 2015) and revised to be consistent with BBCU life history and habitat requirements. The timing of this protocol is intended to assess BBCU presence and document habitat conditions in survey locations. Accurate population determination is beyond the scope of this protocol, but conducting surveys during the peak of breeding activity will increase the probability of detecting any BBCUs that are present. A call playback is used during each survey to detect BBCU that might have been otherwise overlooked.

2.1 Survey Area

The survey area was selected based on two primary factors: 1) the land is Illinois state-owned, and 2) the land contains deciduous forest habitat in 5+ ha blocks. Based on conversations with the DNR, survey areas within the Vermilion River and Little Vermilion River Conservation Opportunity Area in eastern Illinois were considered because of the available Illinois state-owned land and deciduous forest associated with the Middle Fork Vermilion River.

The western unit of the Little Vermilion River Land and Water Reserve, located just south of the city of Georgetown, was selected for BBCU surveys and habitat assessment based on the size of deciduous forest habitat (Figures 1 and 2). To survey the habitat most likely used by BBCU, transects will be established within the reserve boundary resulting in approximately 2,800 meters of transects. Consistent with BBCU habitat preferences, forest interior will not be surveyed (see Section 2.3). The biologists will use the transects shown on Figure 2 to guide the survey, but may deviate from the transect to cover the perimeter habitat patches.

2.2 BBCU Survey Periods

BBCU are a reclusive species and are more often heard than observed visually. Thus, in order to determine if BBCU occupy a habitat patch, multiple visits are required with a call playback on the last visit. There are three survey periods, and four total surveys are conducted for the purpose of assessing whether BBCUs are present at a site; additionally a pre-survey site reconnaissance visit is also proposed. The number of surveys is similar to that used for yellow-billed cuckoo, where it has been found that four surveys will have a 95% probability of detecting yellow-billed cuckoos, when they are present at a site during the breeding season (McNeil et al. 2013, Carstensen et al. 2015).

Pre-survey Reconnaissance Period: May 21 - June 15. No surveys required. This spans the earliest time that BBCUs may arrive on breeding grounds, but most BBCUs present during this period are likely migrants. The pre-season reconnaissance site visit should be used for biologists to visit the site, examine the habitat and transect locations, and walk transects to determine if any issues with access exist.

Survey Period 1: June 16 - June 30. One survey is required. This survey occurs as migrating birds are passing through, and breeding birds arrive. Although many birds detected during this time may be migrants, surveys during this time will help with seasonal survey detection interpretation, and will also allow surveyors to familiarize themselves with all survey areas.

Survey Period 2: July 1 - July 31. Two surveys are required during this period, and should be spaced between 12 and 15 days apart. BBCUs encountered during this time are mostly breeders, though migrants, wandering individuals, and young of the year may be encountered. This is the period when breeding activity is most likely to be observed (e.g. copulation, food carries, alarm calls). Extra time should be taken to cautiously observe all BBCUs encountered during this time, while avoiding disrupting potentially breeding birds.

Survey Period 3: August 1 - August 15. One survey is required, and most breeding birds are finishing breeding activities and departing. BBCUs are typically much less vocal and responsive during this time than during Survey Period 2.

2.3 BBCU Survey Methods

Biologists will begin surveys as soon as there is enough light to safely walk (just before sunrise) and continue, depending on the temperature, wind, rain, background noise, and other environmental factors, until 1100. Surveys should not be conducted after temperatures reach 40 degrees C (104 F). If the detectability of BBCUs is being reduced by environmental factors (e.g. excessive heat, cold, wind, or noise), surveys planned for that day should be postponed until conditions improve.

BBCU use a wide range of habitats but are most commonly associated with forest edges, fencerows, riparian areas and shrublands (Spencer 1943, Hughes 2001). Thus, BBCU surveys will focus on areas of habitat exhibiting a complex understory structure and will not focus on forest interior. Within a study area all potentially suitable habitat patches should be surveyed. A patch is defined as an area of habitat 5 ha or greater in extent that is separated by at least 300 m from an adjacent patch of apparently suitable BBCU habitat. Little is known about BBCU territory size, but 5 ha is considered a typical size for BBCU patch occupancy (Freeman and Merriman (1986). Thus, an individual shrub may be less than 5 ha, but if a 5 ha area consists of a series of shrub patches, it should be considered a habitat patch. The surveyor can skip over areas of unsuitable habitat (e.g. agriculture) between patches

Surveys will focus on the edge of habitat patches, or if the habitat patch is comprised of shrubs, surveys should be conducted throughout the habitat patch. Biologists will arrive at the starting point of the transect and wait at least one minute to listen for unsolicited BBCU calls (i.e. BBCUs that may be calling before broadcast of the calls). If no BBCUs are heard during the initial listening period, surveyors will begin the first broadcast. The broadcast consists of five contact/cu-cu-cu-cu calls, each spaced one minute apart. For consistency and comparability of the data, only the call provided will be used. The recording should be played at approximately 70 decibels db.Biologists will listen and watch intently for responding BBCUs during and after each of the five broadcast calls. This includes watching for movement as silent birds may move closer to investigate. If no BBCU is detected at the broadcast-point after five broadcast calls, the biologists will continue 100 m along the transect and start a new broadcast as described above. In between broadcast calls, surveyors should be listening for BBCUs, and not be filling out the datasheet. BBCUs may respond by calling from a distance, so the surveyors will listen for these responses. BBCUs typically respond with the contact/cu-cu-cu-cu call. When a BBCU is detected, the biologist will terminate the broadcast, as it may divert the bird from normal breeding activity or attract the attention of predators. The surveyors will concentrate on observing the bird rather than immediately recording data. When recording data, all data for the detection(s) will be documented, including the compass bearing and estimated distance from the observer to the detected BBCU(s).

After a BBCU has been detected and appropriate data collected, the surveyors will move 300 m further along the transect before resuming the survey. This will minimize the likelihood of detecting the same BBCU.

When a BBCU is encountered between broadcast points (i.e. an unsolicited detection is made while traveling to, from, or between broadcast points), the biologists will stop and record all information in the same manner as if the detection was made during a broadcast. No calls will be broadcast in this situation. After making observations and recording information regarding the detection(s), the surveyor will move 300 m from the point where the detection was made, along the transect and continue with the procedures for conducting a survey broadcast.

Data collected will include information descriptive of the survey (date, time, location, transect, broadcast point etc.), and information on any BBCU detections (time, type of vocalization, behavior and age). For a full description of data that should be recorded see Halterman et al. (2015).

2.4 Habitat Survey Methods

The objective of the habitat survey is to conduct a rapid assessment of habitat structure to determine if habitat is suitable for breeding BBCU. After the BBCU surveys are completed, biologists familiar with Illinois vegetation will walk the transect and record habitat data every 300 meters along the transect and at every point where a BBCU detection occurred. At each vegetation point, the observer will stand at the edge of the habitat and record three habitat metrics. The first habitat metric is to provide information on the *general forest structure* and the biologist will determine if there is a mature canopy with deciduous understory vegetation, mature canopy with no understory vegetation, or if the habitat is secondary deciduous growth or shrubland. The second habitat metric is the *understory canopy height* from the lowest growth to the top of the understory canopy. The third habitat metric is the *understory density* measured by the biologist estimating the percent cover of the understory from the survey point looking into the understory.

3 Data Analysis and Reporting

The data will be analyzed consistent with the objectives to determine presence/absence of BBCU at surveyed areas and to assess habitat suitability for BBCU. Three primary results are of interest from the survey: level of survey effort, number of BBCU detections, and habitat characteristics. As BBCU surveys are not conducted in Illinois, reporting the level of survey effort in terms of kilometers of transect and hours of survey will provide information so that the number of BBCU detections (if any) can be standardized to detections/kilometer. If BBCU are detected, data will be analyzed to determine the average time of detection, common behaviors, and location of detections. Habitat data will be analyzed to determine the proportion of survey points that contained understory vegetation suitable for BBCU nesting. A deciduous understory or shrubland between 0 – 2 meters above ground and percent cover of 60% or higher is considered to be suitable for breeding BBCU for this analysis.

After all surveys are completed, one report will be completed in standard scientific format with an introduction, methods, results, and discussion. Maps will be produced that show the location of the transects, broadcast stations and BBCU detections, if any. Further, a map showing suitable breeding BBCU along the transect will be included in the report.

4 Survey Benefits

The BBCU presence/absence surveys and habitat assessment will target Illinois state-owned land and use methods specific to detecting the BBCU. The surveys have value to the DNR even if BBCU are not detected for several reasons. First, the survey is designed specifically to determine presence/absence of BBCU and negative results provide more information regarding the species distribution in the study area than other types of broad-scale data (e.g., BBS). Second, vegetation data will determine the amount of suitable BBCU habitat in Illinois state-owned land, which can be used to inform habitat management decisions.

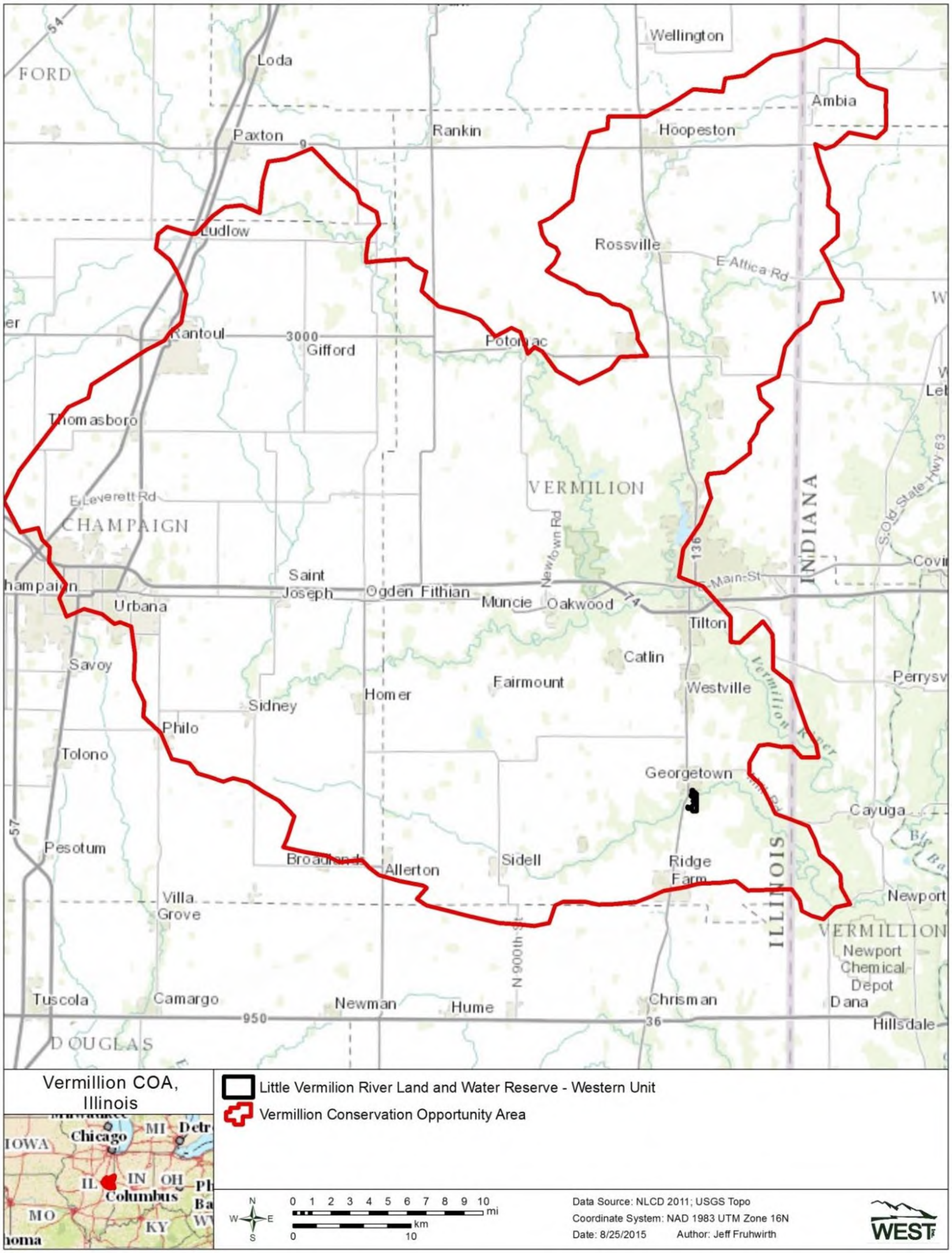

Figure 1. Location of Little Vermilion River Land and Water Reserve, for BBCU Presence/Absence Surveys

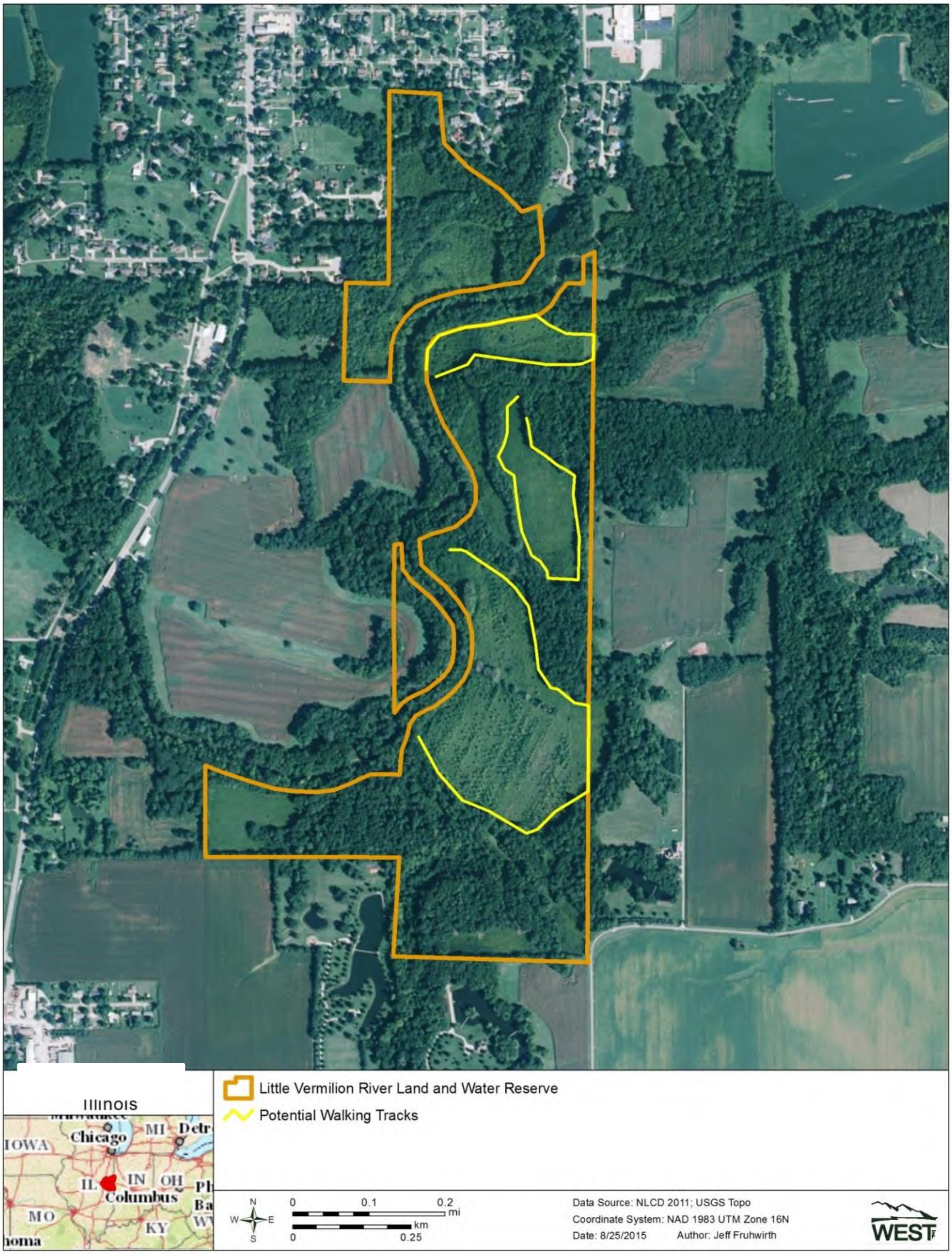

Figure 2. Proposed Survey Transects within the Little Vermilion River Land and Water Reserve, for BBCU Presence/Absence Surveys

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