Appendix G
Tier 3 or Wildlife Studies

Grassland Condition and Dakota Skipper/Poweshiek Skipperling Habitat Assessment

Grassland Condition and Dakota Skipper/Poweshiek Skipperling Habitat Assessment, Bitter Root Wind Farm

Yellow Medicine County, Minnesota and Deuel County, South Dakota

August 15-17, 2016

Prepared for:

Flying Cow Wind, LLC

at the request of

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INTRODUCTION

Flying Cow Wind, LLC is developing the Bitter Root Wind Farm (Project) in Yellow Medicine County, Minnesota and Deuel County, South Dakota (Figure 1). Western EcoSystems Technology, Inc. (WEST) provided assistance to the Project proponent by identifying areas of sensitive terrestrial natural resources, particularly prairies, for avoidance during planning the physical development of the Project. WEST followed-up on these iterative desktop evaluations with a ground-based field assessment of specific grassland habitats. The goal of the field assessment was to assess the presence and quality of prairie and native prairie habitats in the Project area by 1) evaluating areas of suspected native grassland and assess upland prairie quality and condition including dominant species of native grasses and forbs, and invasive plants, and 2) assessing if these habitats might be suitable for the federally threatened Dakota skipper (*Hesperia dacotae*) and federally endangered Poweshiek skipperling (*Oarisma poweshiek*). This report documents the GIS resources used iteratively through the desktop assessment process and the results of the field habitat assessment conducted at the Project on August 15-17, 2016.

STUDY AREA

The proposed Project is located in Yellow Medicine County, in southwest Minnesota, west of the town of Canby, and in eastern Deuel County, South Dakota (Figure 1). The Project falls in the Northern Glaciated Plains Level III Ecoregion and the Prairie Couteau Level IV Ecoregion (US Environmental Protection Agency [USEPA] 2016). The Northern Glaciated Plains ecoregion is a flat to gently rolling landscape of glacial drift. The region is transitional between tallgrass and shortgrass prairie and high concentrations of temporary and seasonal wetlands offer suitable habitat for waterfowl nesting and migration. The Prairie Coteau ecoregion is generally a higher elevation plateau with poorly defined drainage. This region, previously dominated by shortgrass and tallgrass prairies, seasonal and semi-permanent wetlands, mixed tall shrubs, and riparian and oak-aspen (*Quercus* spp.-*Populus* spp.) groves, has been extensively converted to farmland and cropland, livestock production, and pasture lands (USEPA 2016). Topography in the Prairie Coteau ecoregion is flat to gently rolling.

Based on the US Geological Survey (USGS) National Land Cover Database (NLCD [USGS NLCD 2011, Homer et al. 2015]), landcover within the Project area is primarily cultivated crops (45%), herbaceous (22%), and hay/pasture (21%) (Figure 1). Prairies and grasslands are frequently identified within the NLCD herbaceous and hay/pasture landcover classification in Minnesota. Prairies provide key breeding and foraging habitats for grassland birds and other species. The Minnesota Department of Commerce (MNDOC) and the Minnesota Department of Natural Resources (MNDNR) define native prairie as grasslands that have never been tilled and contain floristic qualities representative of prairie habitat (MNDNR 2011). Therefore, planted grasslands such as Conservation Reserve Program (CRP) parcels that are typically planted in previously tilled fields are not considered native prairie. However, agricultural grasslands, such as pasture and hayfields, may be considered native prairie if the land has not previously been tilled. The MNDOC and MNDNR therefore recommends that all grasslands, including hayfields,

pastures, and fallow lands, be evaluated as potentially harboring native prairie species (MNDNR 2011). The Minnesota Prairie Plan has identified areas within and near the Project area as core and corridor priority areas (Minnesota Prairie Plan Working Group 2011).

Prairie remnants provide important habitat for the Dakota skipper and Poweshiek skipperling, federally listed butterflies that are associated with wet to dry native prairies that have not been plowed; these butterflies are typically not found in overgrazed and degraded prairie (US Fish and Wildlife Service [USFWS] 2015). Habitats dominated by non-native grass are not suitable for these species (USFWS 2015, MNDNR 2016). Because most skippers (Family: Hesperiidae, which includes both the Dakota skipper and the Poweshiek skipperling) spend their whole life cycle in one prairie patch, impact avoidance of patches that contain these species is recommended given the protections afforded under the Endangered Species Act (ESA 1973).

METHODS

Desktop Analysis

This GIS-based desktop analysis was conducted using available GIS-based coverages geographically representing the distribution grassland and potential prairie areas within the Project. The goal of the survey was to identify areas of grassland which might be native prairie to maximize avoidance of these areas during planning for construction and operation of a wind energy facility. This approach was used based on an understanding of the MNDNR's priorities for preserving areas of unique or exceptional biodiversity, particularly native prairie, and public lands. These coverages were provided to the Project proponent in digital format in June 2016 to aid in further planning the Project layout. The GIS-based desktop screening used several sources of geo-referenced information to identify potential areas of good quality prairies, which are usually found on unplowed (unbroken) lands that have not been heavily grazed. The available coverages that were gathered for consideration include the following:

- NLCD cover types – Potential grasslands are identified typically within areas of hay/pasture and herbaceous cover (see Figure 1)
- Public Lands and Conservation Easements (see Figure 2)
- MNDNR's Sites of Biodiversity Significance – Specific land units identified by MNDNR as important native plant communities, rare plants and rare animals, and aggregations thereof (Minnesota Biological Survey [MBS]; see Figure 3)
- MNDNR Native Prairies – Areas identified by MNDNR as prairie from the Native Plant Communities (see Figure 4)
- Potentially Undisturbed Land – Land areas with no known history of tillage and/or land disturbance (SDSU Extension Undisturbed Land and MN DNR; see Figure 5)
- National Wetlands Inventory (NWI) – Wetland areas identified via remote sensing by the USFWS (see Figure 5)

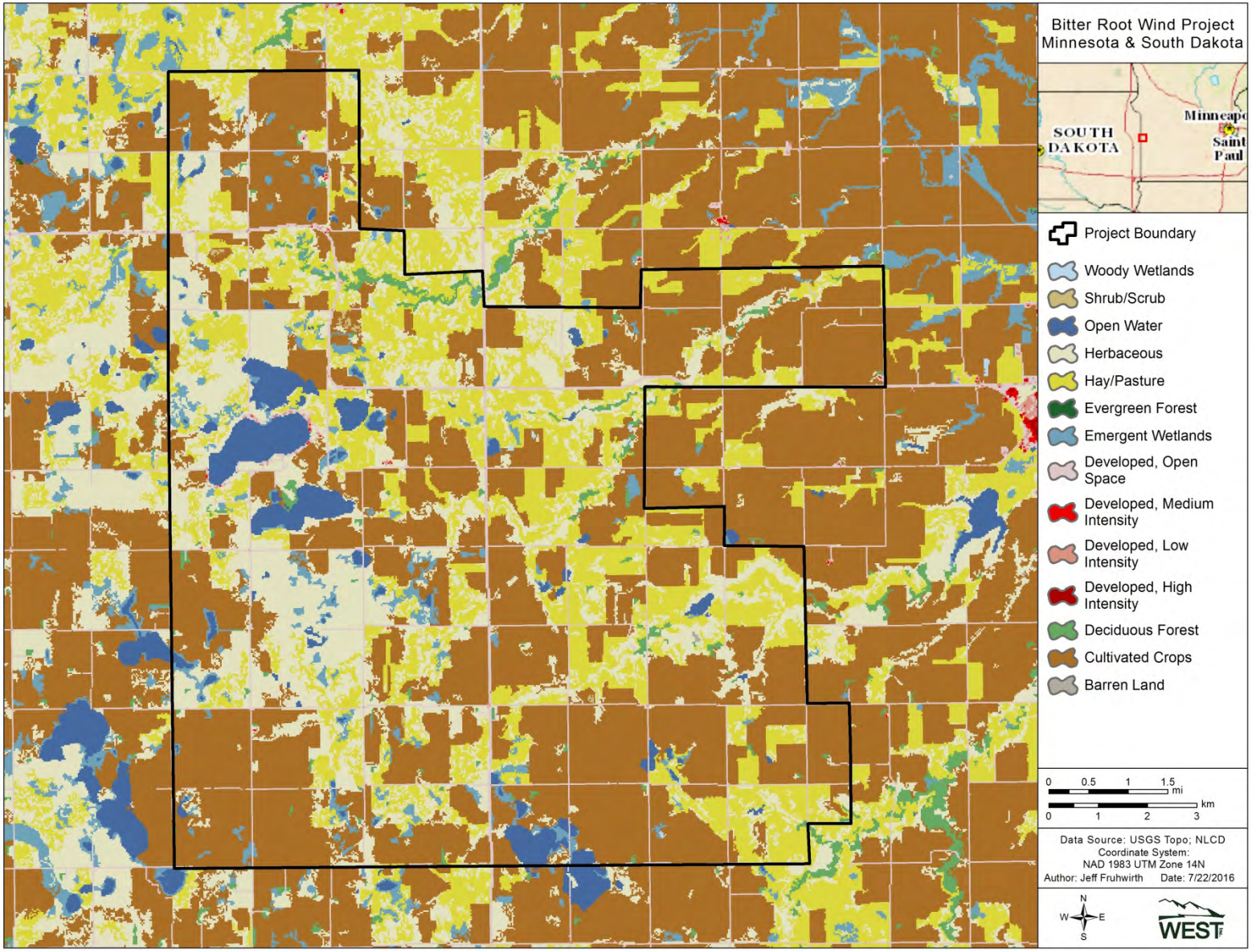

Figure 1. Land cover within the Bitter Root Wind Energy Project area.

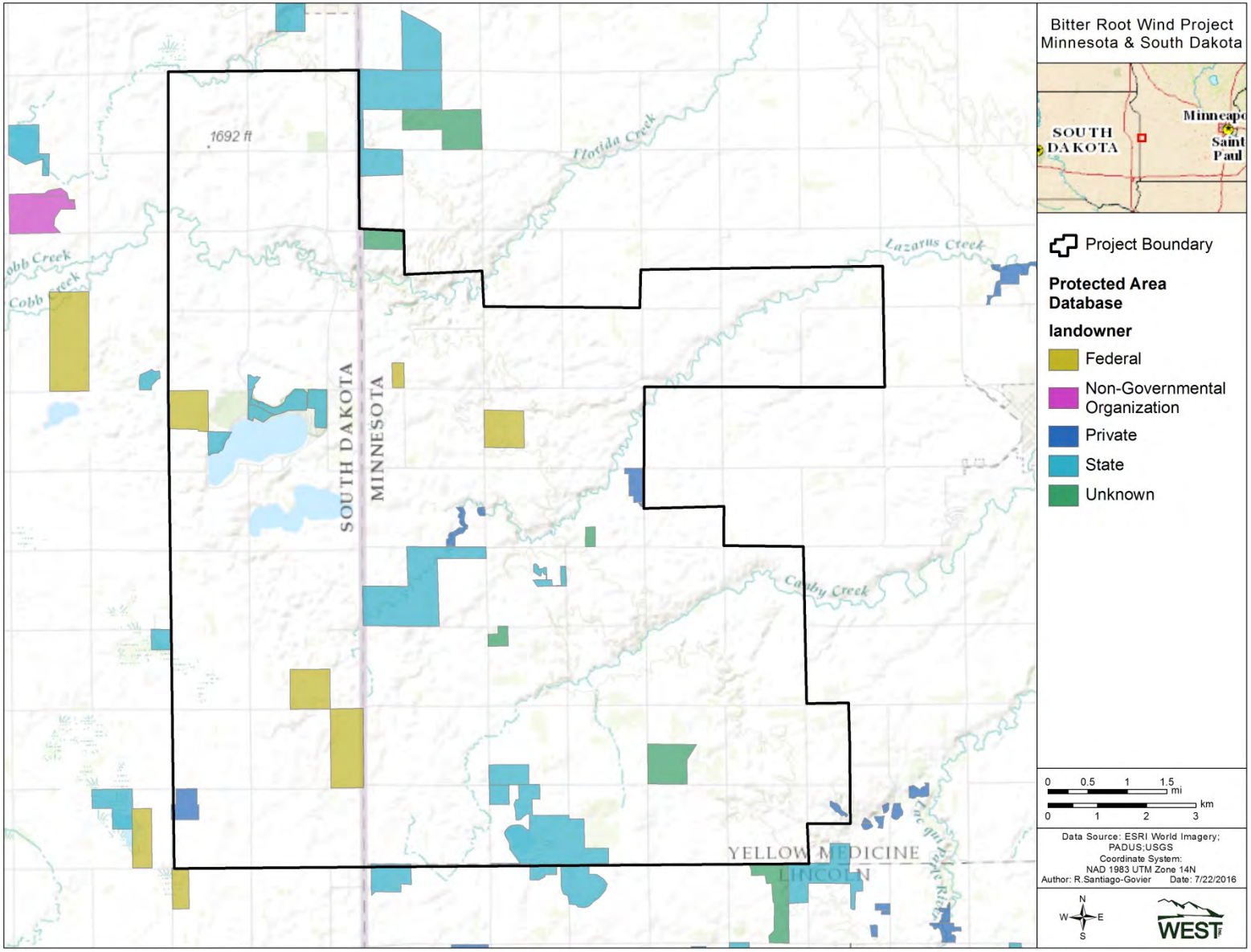

Figure 2. Public and private conservation lands, by ownership class, within the Bitter Root Wind Energy Project area.

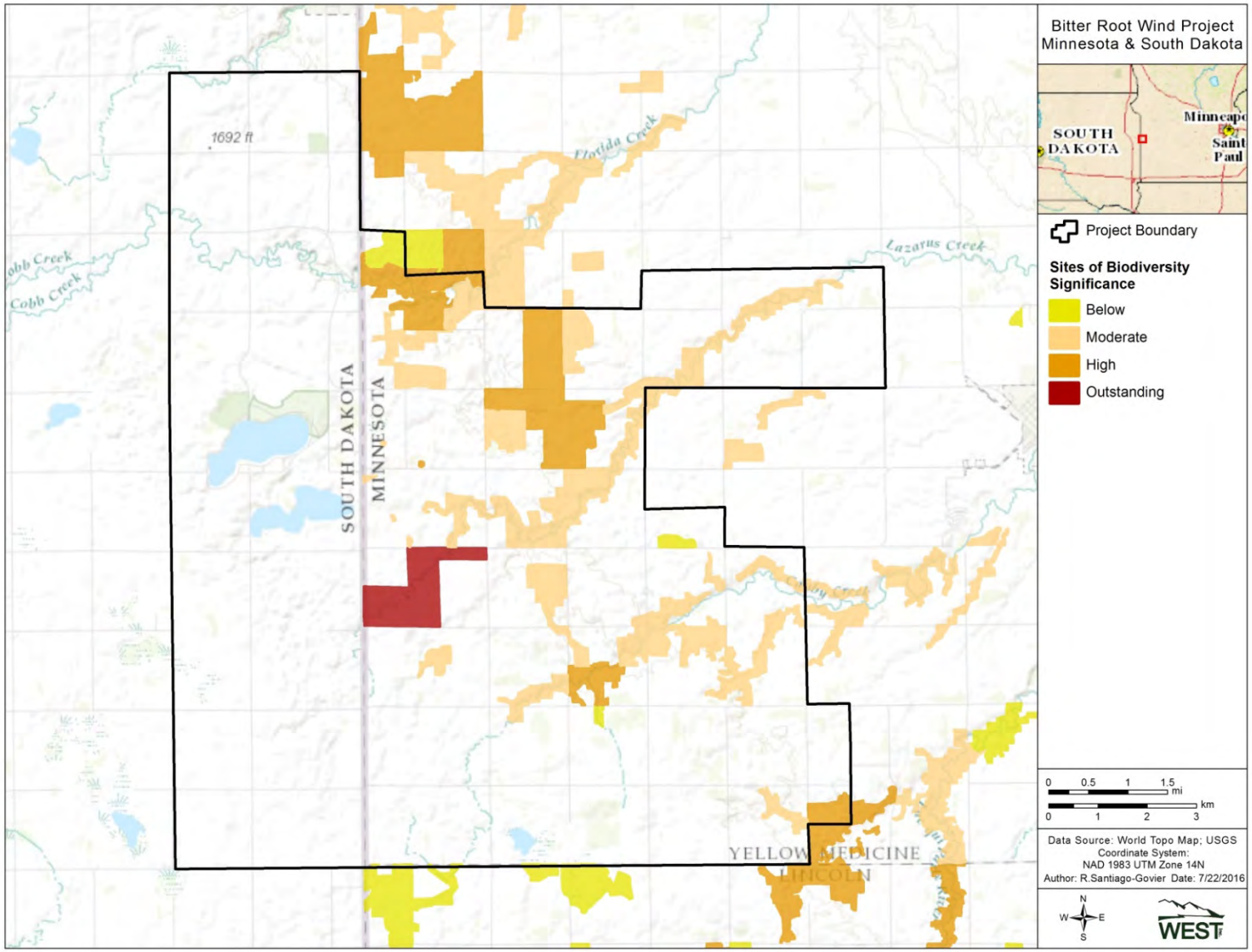

Figure 3. Sites of Biodiversity Significance, by significance level, within the Bitter Root Wind Energy Project area (coverage extent is for Minnesota and does not include South Dakota).

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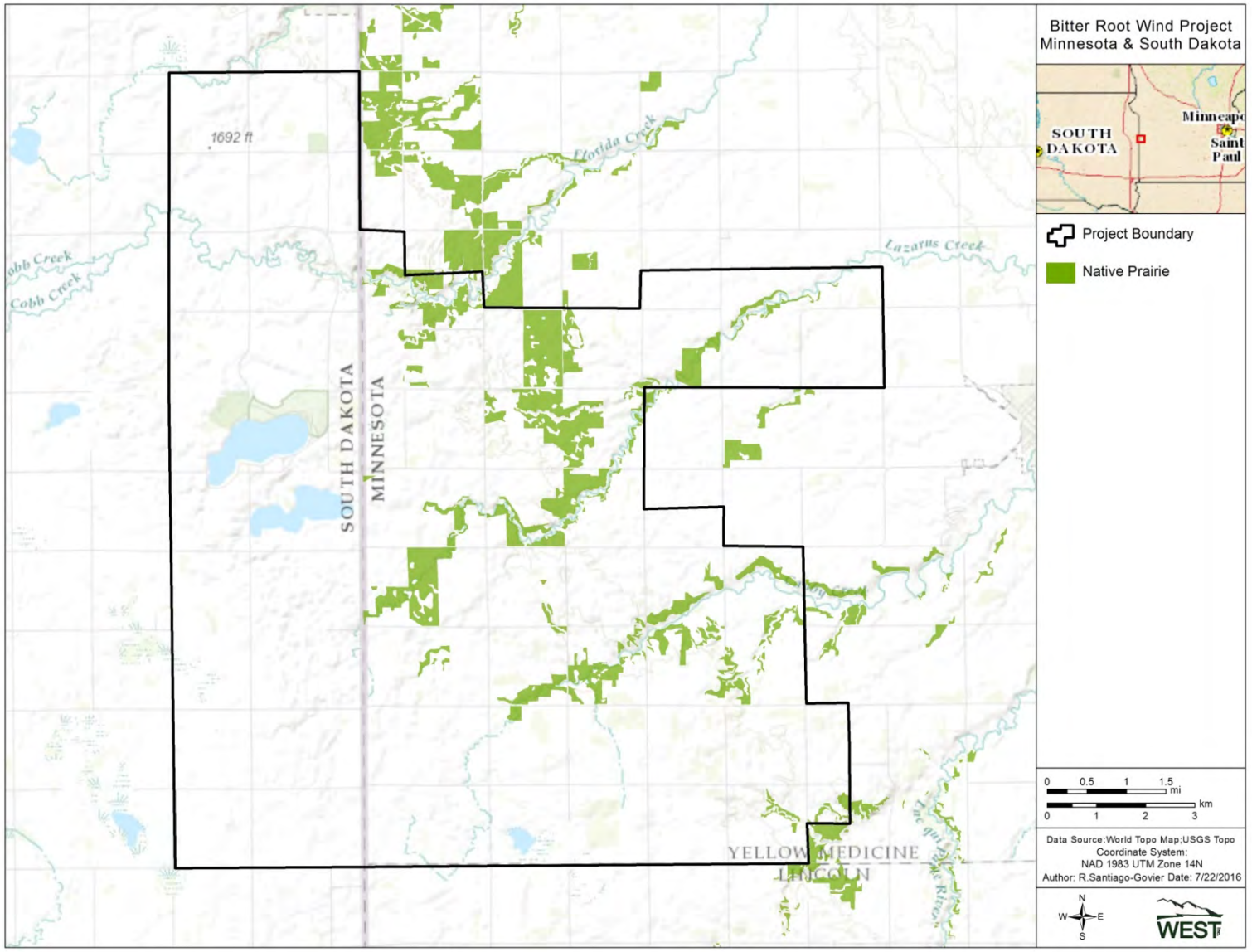

Figure 4. Minnesota DNR delineated prairie lands within the Bitter Root Wind Energy Project area (coverage extent is for Minnesota and does not include South Dakota).

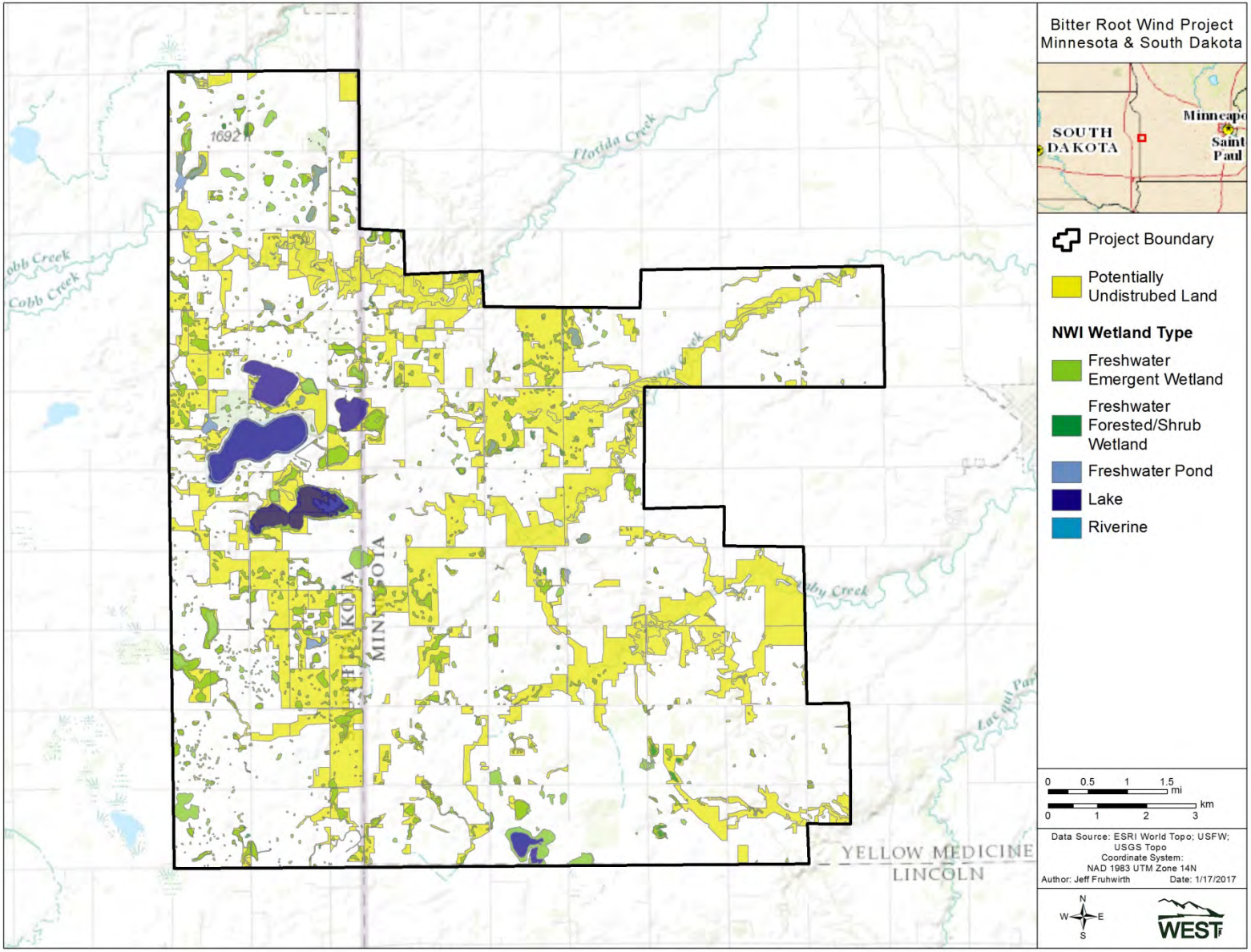

Figure 5. Areas of Potentially Undisturbed Land and NWI wetlands within the Bitter Root Wind Energy Project area.

Following initial desktop assessments and communication by WEST with the Project proponent in May and June 2016, the earlier turbine layout and collection system was revised to minimize potential conflicts with sensitive natural resources, including potential prairie habitats. In early August 2016, WEST again reviewed a revised turbine layout, identifying remaining probable prairie areas where development might be a concern using the GIS information listed above, as well as visual inspection of true-color satellite imagery (2015). Areas of probable prairie were included in a more intensive field-based assessment completed in August 2016.

When evaluating the potential for Project impacts to grasslands, WEST buffered the August 11, 2016, layout plan (hereafter, Layout 22) with the following buffers: a 125-meter (m; 410-foot [ft]) radius around turbine center points, and a 30.5-m (100-ft) buffer on either side of linear features such as access roads and collection lines. Grassland parcels found within these "potential impact corridors" were then examined closer using the above desktop resources. Sampling was focused on areas that were identified as "Dry Hill Prairie (Southern)" within Minnesota. If a grassland parcel was relatively narrow (for example, associated with a stream or wetland and less than 61 m [200 ft] wide) and crossed by a collection line (rather than an access road), WEST did not include the site in the assessment, as it was assumed that either wetland areas or soil disturbance impacts could be avoided through use of directional boring, if necessary. Similarly, if a potential grassland parcel was only partially within a potential impact corridor and could easily be avoided by Project facilities, WEST did not identify that site for further assessment.

Based on this screening, 25 transects were identified in grassland parcels within Layout 22, indicating potential conflict with part of turbine, access road, or collection line construction, and requiring further ground-based assessment (Table 1, Figure 6). Of these parcels, 24 of the 25 transects were identified by desktop methods as occurring on potentially undisturbed lands; transect 22 was within an area of possibly disturbed, but still native, grassland. Additionally, 10 of the transects on private lands in Minnesota were located in areas ranked by the MCBS as areas of Moderate to High Biodiversity. Sites ranked as Moderate are typically moderately disturbed native plant communities, or are in landscapes that have strong potential for recovery of native plant communities. Sites ranked as High contain very good quality occurrences of the rarest species, including rare native plant communities, or occurrences of important functional landscapes. No facilities in Layout 22 were located in sites identified by the MNDNR's MBS as sites of Outstanding biodiversity significance, although comparison reference sites were sampled within the Sioux Nation Wildlife Management Area (WMA).

Table 1. Grassland condition sampling transects and features derived during desktop assessment prior to field surveys at the Bitter Root Wind Farm.

Transect	State	Unit/Township	Potentially Undisturbed lands	Minnesota - Native Prairie Plant Community	MBS Biodiversity Level
1r	MN	Sioux Nation WMA[1]	Yes	yes	Outstanding
2r	MN	Sioux Nation WMA	Yes	yes	Outstanding
3r	MN	Sioux Nation WMA	Yes	yes	Outstanding
4r	MN	Sioux Nation WMA	Yes	yes	Outstanding
5r	MN	Sioux Nation WMA	Yes	yes	Outstanding
6r	MN	Sioux Nation WMA	Yes	yes	Outstanding
7	SD	Norden	Yes	-	-
8	SD	Norden	yes	-	-
9	SD	Norden	yes	-	-
10	MN	Florida 30	yes	yes	High
11	MN	Florida 30	yes	yes	High
12	MN	Florida 30	yes	yes	High
13	SD	Norden	yes	-	-
14	SD	Norden	yes	-	-
15	SD	Norden	yes	-	-
16	MN	Fortier 20	yes	yes	Moderate
17	MN	Fortier 21	yes	yes	Moderate
18	MN	Fortier 21	yes	yes	Moderate
19	MN	Fortier 9	yes	yes	Moderate
20	MN	Fortier 9	yes	yes	Moderate
21	MN	Fortier 9	yes	yes	Moderate
22	MN	Fortier 9	no	yes	Moderate
23	MN	Fortier 9	yes	yes	Moderate
24	MN	Fortier 9	yes	yes	Moderate
25	MN	Fortier 9	yes	yes	Moderate

[1] Wildlife Management Area

r Reference sites, were within the Project area boundary but not within the current facility layout.

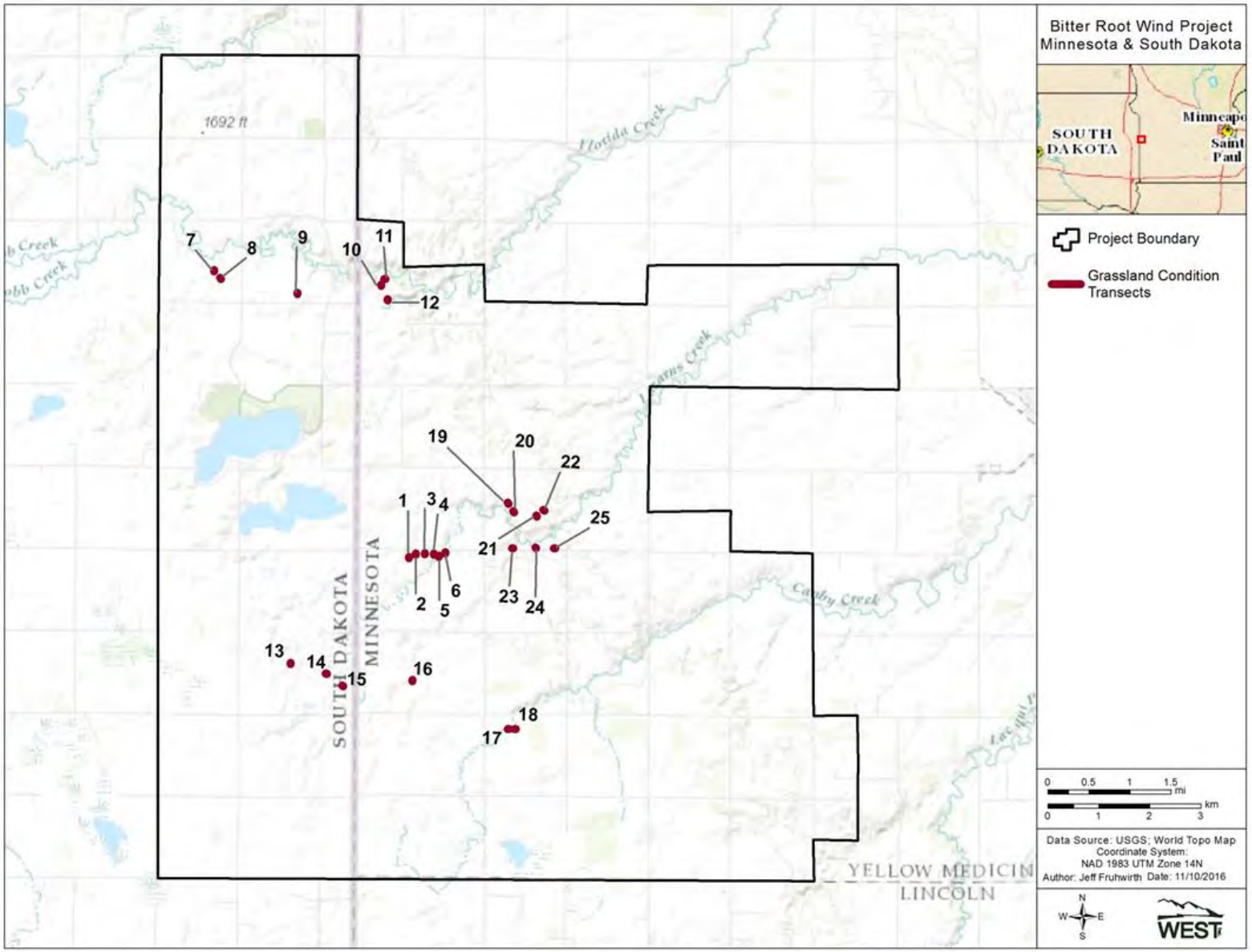

Figure 6. Locations of grassland transects evaluated within the Bitter Root Wind Farm, August 2016.

Grassland Condition

For assessing grassland quality and condition, WEST used a transect approach developed by the MNDNR, USFWS, and The Nature Conservancy (Vacek et al. 2012) to assess plant community and compositional change in response to land management changes; data collection and assessment followed the method for Option A. Option A is the simplest of the three hierarchical assessment approaches, and standard methods are used by all partners to evaluate presence of invasive species and quality grassland species, grassland structure and community type. Grassland plant group assignments compositionally describe the proportion of invasive species, shrub abundance, and proportion of grasses and forbs (Table 2), and identify key native and invasive species (Table 3).

Table 2. Prairie condition plant groups (Vacek et al. 2012) observed during sampling within the Bitter Root Wind Farm, August 2016. Shading indicates comparable levels of native-invasive species

			Remaining After Shrubs	
Plant Group	**Type of species**	**Shrubs**	**Grasses**	**Forbes**
110	50-75% native	<50%	>75%	<25%
111	50-75% native	<50%	25-75%	25-75%
120	50-75% invasive	<50%	>75%	<25%
121	50-75% invasive	<50%	25-75%	25-75%
122	50-75% invasive	<50%	<25%	>75%
130	>75% invasive	<50%	>75%	>75%
131	>75% invasive	<50%	25-75%	25-75%
132	>75% invasive	<50%	<25%	>75%
900	>75% other (e.g., rock pile or mammal mound)			

Table 3. Native (Tier 1) and invasive species observed during grassland surveys in the Bitter Root Wind Farm, August 2016.

Common Name *	Scientific Name	6-Letter Code
Native Species (Tier 1)		
leadplant	*Amorpha canescens*	AMOCAN
white prairie clover	*Dalea candida*	DALCAN
sneezeweed	*Helenium autumnale*	HELAUT
rough blazing star	*Liatris aspera*	LIAASP
northern plains blazing star	*Liatris ligulistylis*	LIALIG
prairie phlox	*Phlox pilosa*	PHLPIL
golden Alexanders	*Zizia aurea*	ZIZAUR
Invasive Species		
redtop	*Agrostis gigantea/stolonifera*	AGRGIG
smooth brome	*Bromus inermis*	BROINE
musk thistle	*Carduus nutans*	CARNUT
Canada thistle	*Cirsium arvense*	CIRARV **
bull thistle	*Cirsium vulgare*	CIRVUL
quack-grass	*Elytrigia repens*	ELYREP
leafy spurge	*Euphorbia esula*	EUPESU
alfalfa	*Medicago sativa*	MEDSAT
sweet clovers	*Melilotus alba & M. officinalis*	MELISP
parsnip	*Pastinaca sativa*	PASSAT
timothy	*Phleum pratense*	PHLPRA
Canada & Kentucky bluegrass	*Poa compressa, P. pratensis*	POAPCX/POAPRA
red & alsike clovers	*Trifolium pratense, T. hybridum*	TRIPRA

* Species follow lists developed in Grassland Condition Protocols (Vacek et al. 2012)
** previously *Cirsium canadensis* CIRCAN

Based on Layout 22, 25 transects were placed in the Dry Hill Prairie native community type within the Project footprint, with six transects placed at a reference site, the Sioux Nation WMA. Reference sites were located within the Project boundary, although not within the current layout; these sites were chosen as reference sites with documented high quality prairie as comparison sites for other transects identified as within areas of higher biodiversity. Each transect was 25 m (82 ft) long, with data collected in accordance with methods identified by Vacek et al. (2012; Option A). Placement of transects differed from the designated approach by constraining sampling to areas of potential soil disturbance during construction within Layout 22. Sampling at the reference sites was similar to those described in the original protocol.

The plant communities for the length of the 25-m transect were assessed within a 0.1 m x 0.5 m (0.3 ft x 1.6 ft) quadrat every 0.5 m along the transect, measuring litter depth at 5-m (16-ft) intervals, and visual obstruction at the 12.5-m (41.0-ft) midpoint. At the completion of the quadrats, indicators species were searched for within 1.5 m of the each side of the transect, such that the search area was 3m x 25m (9.8 ft x 82 ft). At each transect, WEST documented habitat conditions with a photograph.

Data was entered into an Access database designed for this Project. Following data entry, and a quality assurance review, data was summarized as percent of cover types, dominant invasive species, and Tier 1 prairie species for each transect.

Dakota Skipper/Poweshiek Skipperling Habitat Assessment

High quality, ungrazed native grasslands provide habitat for the Dakota skipper and Poweshiek skipperling. According to MNDNR Natural Heritage records, there are documented observations of Dakota Skipper within the Project boundary at the Sioux Nation WMA, an area also identified as retaining "Outstanding Biodiversity." In order to assess the current suitability of grassland habitats for hosting the Dakota skipper or Poweshiek skipperling during the grassland condition survey efforts, WEST documented features in the field that that would suggest the habitat was potential habitat for these butterfly species, as indicated by the primary constituent elements in the critical habitat designation (USFWS 2015). Features biologists were looking for included the following:

Presence of areas of the following native grasses and forbes:

- plants typical of native bluestem prairie (*Lilium philadelphicum*, *Camanula rotunifolia*, and *Zygadenus elegans*);
- plants typical of upland prairie (bluestem grasses, needlegrasses, *Echinacea pallida*, *E. angustifolia*, *Gaillardia* spp.);
- one or both native grasses (*Schizachrium scoparium*, *Sporobolus heterolepis*); and
- preferred nectar plants within patch or nearby (*Ratibida columnifera*, *Camanula rotundifolia*, *Dalea candida*, *Erigeron* spp., *Gaillardia* spp., *Rudebeckia hirta*, *Echinacea angustifolia*, *Calylophus serrulatus*, *Astragalus crassicarpus*).

Absence of the following invasive species and disturbances:

- invasive thistles (*Cirsium arvense*, *C. vulgare*);
- introduced/invasive grasses (bluegrass *Poa* spp., timothy (*Phleum pratense*), reed canary grass (*Phalaris arundinacea*), or monocultures of brome (*Bromus* spp.);
- planted red clover (*Trifolium* spp), or invasive yellow sweet clover (*Melilotus officinalis*);
- extensive bird's-foot trefoil (*Lotus corniculatus*), or mullen (*Verbascum thapsus*); and
- evidence of grazing, particularly overgrazing.

During the grassland condition surveys, WEST biologists assigned a qualitative score to areas near sampled transects indicating their potential as Dakota skipper and Poweshiek skipperling habitat by rating each transect (based on the features indicated above) during prairie condition transect-based surveys and observations of the area. Ratings were ordinal, from Low (1) - none

of the typical native plant community observed, or evidence of grazing, to High (5) – plants and community features are consistent with native plant community (including larval host plants and nectar sources).

RESULTS

Field-based assessments by WEST biologists for grassland condition and Dakota skipper/Poweshiek skipperling occurred on August 15-17, 2016. The summary of the results is presented below, and photos from the field evaluation are included in Appendix A.

Grassland Condition

Based on the field assessment, many of the grasslands assessed may be native prairie, although the grassland habitat condition indicates variable to degraded grassland quality, with the exception of the reference sites at the Sioux Nation WMA. Of the 16 sampled transects within proposed Layout 22, 13 transects had the majority of prairie condition assessments reflecting more than 75% invasive species (Table 4), with three to seven invasive species present per transect (Table 5), limited Tier 1 native species (Table 6), and little, if any, plant litter. Only three survey transects (survey transects 14, 15, 24) and the reference transects (transects 1-6) were dominated by quadrats with less than 75% invasive species coverage. All transects on private lands appear to have histories of frequent grazing and haying.

Table 4. Percent of plant groups per 25-meter transect observed within Bitter Root Wind Farm, August 2016.

		Plant Groups									
		50-75% native		50-75% invasive			>75% invasive				
Transect	Sampled	110	111	120	121	122	130	131	132	900	Comments
1r	Yes			96%	4%						Poison ivy
2r	Yes			98%	2%						Extensive poison ivy
3r	Yes			64%	34%	2%					
4r	Yes			100%							Indian grass
5r	Yes		22%	78%							Little bluestem, big bluestem
6r	Yes		30%	70%							
7	No										No access; should be surveyed if developed
8	No										No access; should be surveyed if developed
9	No										No need to survey; narrow strip of wetland vegetation between cornfield and wetland
10	Yes						88%	12%			Heavily grazed pasture dominated by introduced sp., No litter accumulation, Avg veg ht ~ 3"
11	Yes						100%				
12	Yes						100%				Grazing pasture with steep slopes to ephemeral creek bed (wooded). Highly invaded with introduced species. Dominated by BROINE, POAPCX, PHLPRA, and CERVAL.
13	Yes			2%	34%		48%	16%			Highly disturbed pasture (idle) between two ag fields; dominated by introduced sp.
14	Yes			100%							Very heavily grazed pasture. Avg veg ht ~ 2-3". Difficult to ID veg due to land practice.
15	Yes	4%		92%						4%	Very heavily grazed pasture. Avg veg ht ~ 3". Difficult to ID veg. No litter due to land use.
16	Yes						100%				Heavily grazed pasture dominated by introduced species.
17	Yes						100%				Very heavily grazed pasture. Avg veg ht ~3". Dominated by BROINE, POAPRA.
18	Yes			16%	2%		68%	12%	2%		Grassland is a very heavily grazed pasture. Avg veg ht ~4". No litter accumulation due to annual grazing and land practice/use.
19	Yes						96%	4%			
20	Yes						60%	40%			Well grazed pasture. Musk and bull thistle, litter=(0-0.5)
21	Yes						100%				
22	Yes						90%	10%			
23	Yes						34%	62%		4%	Grazed – herbicide dead-standing thistles.
24	Yes			40%	60%						Grazed; rock outcrops multiple *Liatris* spp.
25	Yes						40%	60%			

r Reference sites, were within the Project area boundary but not within the current facility layout

Table 5. Percent of plots, by transect where invasive species (by 6-letter codes) are present (% of plots) and dominant (more than 50%, [% of plots]) at the Bitter Root Wind Farm, August 2016.

	Invasive Species												
Transect	**AGRGIG**	**BROINE**	**CARNUT**	**CIRARV**	**CIRVUL**	**ELYREP**	**EUPESU**	**MEDSAT**	**MELISP**	**PASSAT**	**PHLPRA**	**POAPCX**	**TRIPRA**
1r	34%	84% [44%]		2%						2%		84%	
2r		100% [70%]		14%								42% [2%]	
3r		88%		48%								22%	
4r		100% [48%]		10%					12%			36%	
5r		100% [78%]							12%			10%	
6r		100% [70%]							28%			6%	
10		100% [100%]									32%	100%	
11		100% [98%]			10%		56%				8%	100% [2%]	
12		100% [96%]			34%						96%	100%	
13		96% [22%]							72% [12%]		20%	98% [2%]	28%
14		100% [28%]				20%					2%	100% [60%]	
15		26% [2%]				14%						98% [76%]	
16		100% [88%]							50%			100%	30%
17		92% [26%]										100% [74%]	
18		90% [40%]		66% [2%]							6%	100% [34%]	
19		100% [64%]			2%	4%			8%		2%	88%	
20		98% [26%]			30%				30%		22%	96%	
21		100% [14%]					38%		2%		82%	100%	
22		100%	2%	42%		24%	64%				8%	100%	
23	2%	94% [26%]		58%		18%			2%		72%	88%	
24		82% [4%]							6%			98%	
25		100% [90%]						76% [2%]					

r Reference sites, (shaded grey) were within the Project area boundary but not within the current facility layout

Table 6. Presence of high quality (Tier 1) native grassland species (by 6-letter species codes) observed by transect at the Bitter Root Wind Farm, August 2016.

Transect	AMOCAN	DALCAN	HELAUT	LIAASP	LIALIG	PHLPIL	ZIZAUR
1r	Yes		Yes	Yes			
2r	Yes						
3r	Yes	Yes	Yes	Yes			
4r	Yes			Yes			
5r	Yes			Yes		Yes	
6r	Yes						Yes
24				Yes	Yes		

r Reference sites, (shaded grey) were within the Project area boundary but not within the current facility layout

In general, from the desktop analysis and observations in the field, it appeared that the majority of the grassland transects evaluated by WEST are likely unbroken land (i.e., have never been tilled), although it should be noted that cattle grazing on many of these sites was extensive (Table 7), and some transects are being treated with herbicides to control weeds, particularly thistles. Transect 25, for example, while not clearly tilled (broken), has alfalfa and brome grasses for hay growing through much of area, and elsewhere in the parcel.

As development continues, WEST recommends that additional assessments (desktop analysis and field surveys, if necessary) occur if impacts are proposed in potential grassland habitats that were not examined as part of this assessment, in order to determine if additional pre-construction assessment is warranted. Additionally, if impacts are proposed within grasslands that are listed as possibly undisturbed (Table 7), further assessment may be warranted, including examining historical aerial photographs prior to 1990, or obtaining CRP enrollment information from the landowners to determine if any of the areas had been previously tilled. Impacts to previously undisturbed grasslands will likely require development of a Native Prairie Protection Plan.

Dakota Skipper/Poweshiek Skipperling Habitat Assessment

Only the reference grassland transects at the Sioux Nation WMA were identified during the pre-screening assessment to retain features of Dakota skipper habitat. Based on the field assessments, none of the private lands surveyed for Layout 22 retained habitats or features consistent with either Dakota Skipper or Poweshiek skipperling habitat, and all had indicators of disturbance, particularly intensive cattle grazing and invasive species (Appendix A, Table 7).

Based on WEST's assessment, none of the evaluated private land sites where development is planned are of adequate quality to merit Dakota skipper/Poweshiek skipperling flight surveys. If the layout changes, WEST recommends that additional assessment (desktop analysis and field surveys, if necessary) occur if any temporary or permanent impacts are proposed for grassland habitats that were not examined as part of this assessment, in order to determine if suitable butterfly habitat may be affected.

Table 7. Evidence of Dakota skipper and Poweshiek skipperling habitat based on field and desktop analysis at the Bitter Root Wind Farm, August 2016. Transects shaded in gray indicate reference sites.

Transect	Habitat Quality Rating*	Potential Undisturbed Land? (GIS)	Evidence of Soil Disturbance (Airphotos)	Evidence of Cattle Grazing	Dakota Skipper Habitat?	Poweshiek Skipperling Habitat?
1 – 6**	3-4	Yes	No	No	Maybe	No
10	1	Yes	No	Heavy	No	No
11	1	Yes	No	Yes	No	No
12	1	Yes	No	Severe	No	No
13	1	Yes	Maybe	Yes - Idle	No	No
14	1	Yes	No	Very Heavy	No	No
15	1	Yes	No	Very Heavy	No	No
16	1	Yes	Maybe	Heavy	No	No
17	1	Yes	No	Very Heavy	No	No
18	1	Yes	No	Very Heavy	No	No
19	1	Yes	No	Terracing	No	No
20	1	Yes	No	Terracing	No	No
21	1	Yes	No	Heavy	No	No
22	1	No	Maybe	Terracing	No	No
23	1	Yes	No	Severe	No	No
24	1	Yes	No	Heavy	No	No
25	1	No	Maybe	Yes + Hay	No	No

*Habitat ratings are rated from Low (1) - none of typical native plant community observed, and/or evidence of grazing to High (5) – plants and community features are consistent with native plant community

** Site documented with Dakota skippers in past; current status unknown. Typical host/nectar plants not observed in surveyed area.

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Appendix A. Photos of Grassland Transect Areas

Photo 1. Transect 4, Sioux Nation WMA, Habitat Rating = 4.

Photo 2. Transect 19, Overgrazed pasture with terracing; extensive invasive species. Habitat Rating = 1.

Photo 3. Transect 21 in foreground, mowed grassland with multiple invasive species; Habitat Rating = 1. Transect 22 in backgound, heavily grazed active pasture, and multiple invasive species – potentially disturbed sod in surveyed area. Habitat Rating = 1.

Photo 4. Transect 16, heavily grazed grassland with Habitat Rating = 1, possible previously-disturbed land based on air photos.

Photo 5. Transect 10, grassland grazed, vegetation height ~3 inches, multiple invasive species, no litter. Habitat Rating = 1.

Photo 6. Transect 17, heavily grazed pasture. Habitat Score = 1.

Photo 7. Transect 18, grazed pasture with brome, blue grass and thistle. Habitat Score = 1.

Avian Use Study

Avian Use Study
Bitter Root Wind Energy Project
Yellow Medicine County, Minnesota, and
Deuel County, South Dakota

Final Report

March 2016 – January 2017

Prepared for:

Flying Cow Wind, LLC

Prepared by:
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June 30, 2017

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1 INTRODUCTION

Flying Cow Wind, LLC is considering the development of the Bitter Root Wind Energy Project (Project) in Yellow Medicine County, Minnesota, and Deuel County, South Dakota (Figure 1). To support development of the Project, Bitter Root contracted Western EcoSystems Technology, Inc. (WEST) to conduct pre-construction baseline surveys to estimate temporal and spatial avian use of the Project area. The methods for this study were consistent with the U.S. Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), the USFWS *Land-Based Wind Energy Guidelines* (USFWS 2012), and Minnesota Department of Natural Resource's (MNDNR) and the Minnesota Department of Commerce's (MNDOC) *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (MNDNR 2012).

Study objectives were to assess: 1) species composition, relative abundance, and diversity; 2) overall use, percent of use, and frequency of occurrence; 3) flight height and; 4) spatial use for large and small birds. Additional objectives were to document use of the Project area by threatened, endangered, and sensitive bird species and eagles. The following report describes the results of the avian use study that was conducted at the Project area from March 3, 2016 – January 23, 2017.

2 STUDY AREA

The Project area encompasses approximately 16,706 hectares (41,281 acres) in Yellow Medicine County, Minnesota, and Deuel County, South Dakota (Figure 1). The Project area is bounded to the south by the Yellow Medicine County and Lincoln County line, is bisected by the Minnesota/South Dakota State line (105th Street) north to south, and is situated approximately 3.2 kilometers (2.0 miles) west of the city of Canby, Minnesota. The Project area is in the Northern Glaciated Plains Level III Ecoregion and the Prairie Coteau Level IV Ecoregion (U.S. Environmental Protection Agency 2016). The Northern Glaciated Plains Ecoregion is flat to gently rolling landscape of glacial drift. The region is transitional between tallgrass and shortgrass prairie and high concentrations of temporary and seasonal wetlands offer suitable habitat for waterfowl nesting and migration. The Prairie Coteau Ecoregion is generally a higher elevation plateau with poorly defined drainage. Many lakes and a mix of row crops and pasture are present in this region and within the Project area.

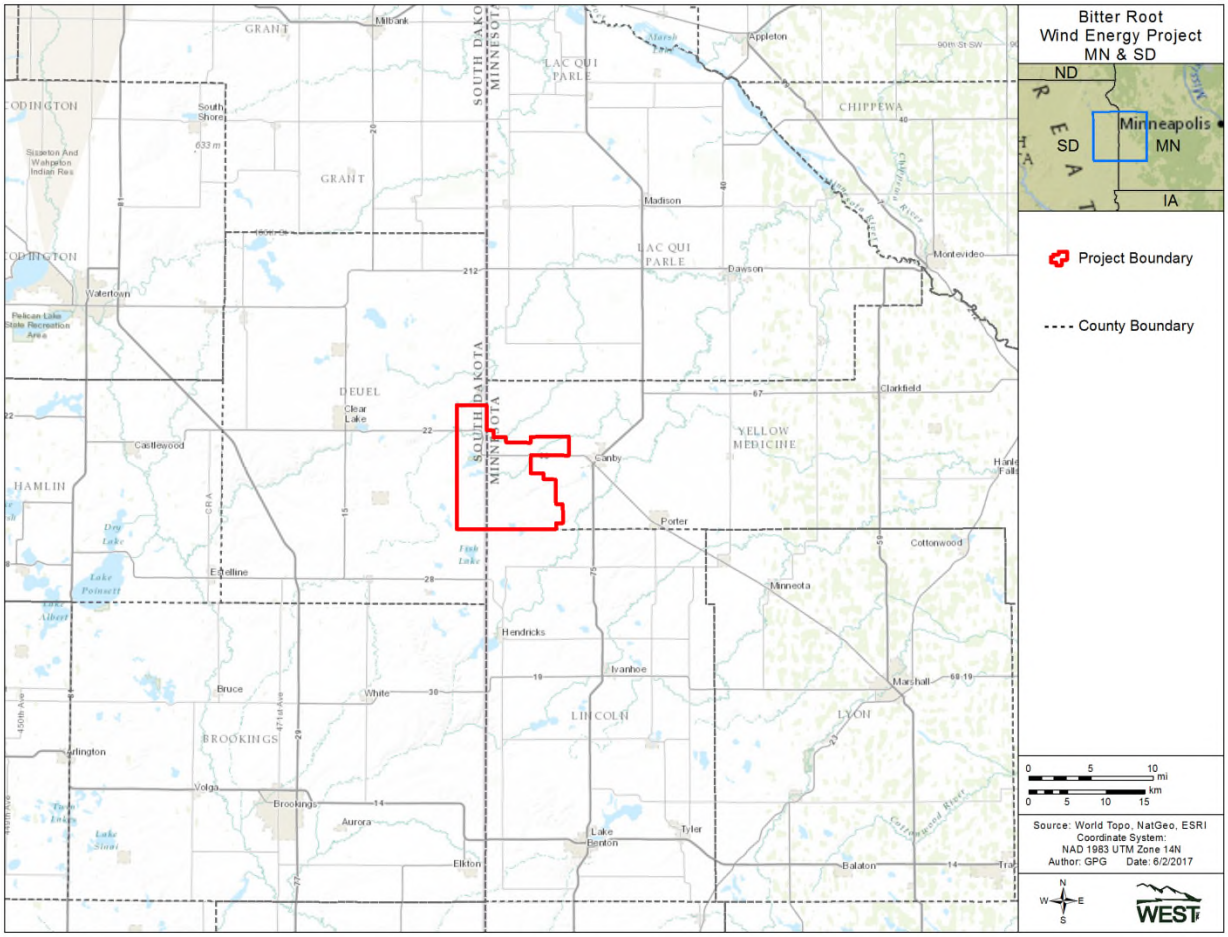

Figure 1. Location of the Bitter Root Wind Energy Project in Yellow Medicine County, Minnesota, and Deuel County, South Dakota.

According to the U.S. Geological Survey (USGS) National Land Cover Database (NLCD; USGS NLCD 2011, Homer et al. 2015), the majority (45%) of the Project area consists of cultivated croplands, followed by herbaceous cover (22%), and hay/pasture (21%). Developed open space and open water each make up approximately 4% of the Project area. Other land cover types include emergent herbaceous wetlands, deciduous forest, developed low intensity, shrub/scrub, woody wetlands, developed medium intensity, barren land, and developed high intensity space (Table 1 and Figure 2). The Northern Tallgrass Prairie National Wildlife Refuge is located in the southwestern portion of the Project. This includes tracts of remnant northern tallgrass prairie that are currently managed by the USFWS, as part of the National Wildlife Refuge System. Several other smaller prairie potholes are located outside of the Project area (Figure 2).

Table 1. Land cover types within the Bitter Root Wind Energy Project area (U.S. Geological Survey National Land Cover Database 2011, Homer et al. 2015).

Cover Type	Acres	% Composition
Cultivated Crops	18,523	44.9
Herbaceous	8,998	21.8
Hay/Pasture	8,659	21.0
Developed, Open Space	1,655	4.0
Open Water	1,615	3.9
Emergent Herbaceous Wetlands	1,207	2.9
Deciduous Forest	516	1.3
Developed, Low Intensity	45	0.1
Shrub/Scrub	27	<0.1
Woody Wetlands	23	<0.1
Developed, Medium Intensity	6	<0.1
Barren Land	6	<0.1
Developed, High Intensity	<1	<0.1
Total[1]	**41,281**	**100**

[1]Sums of values may not add to total value shown, due to rounding.

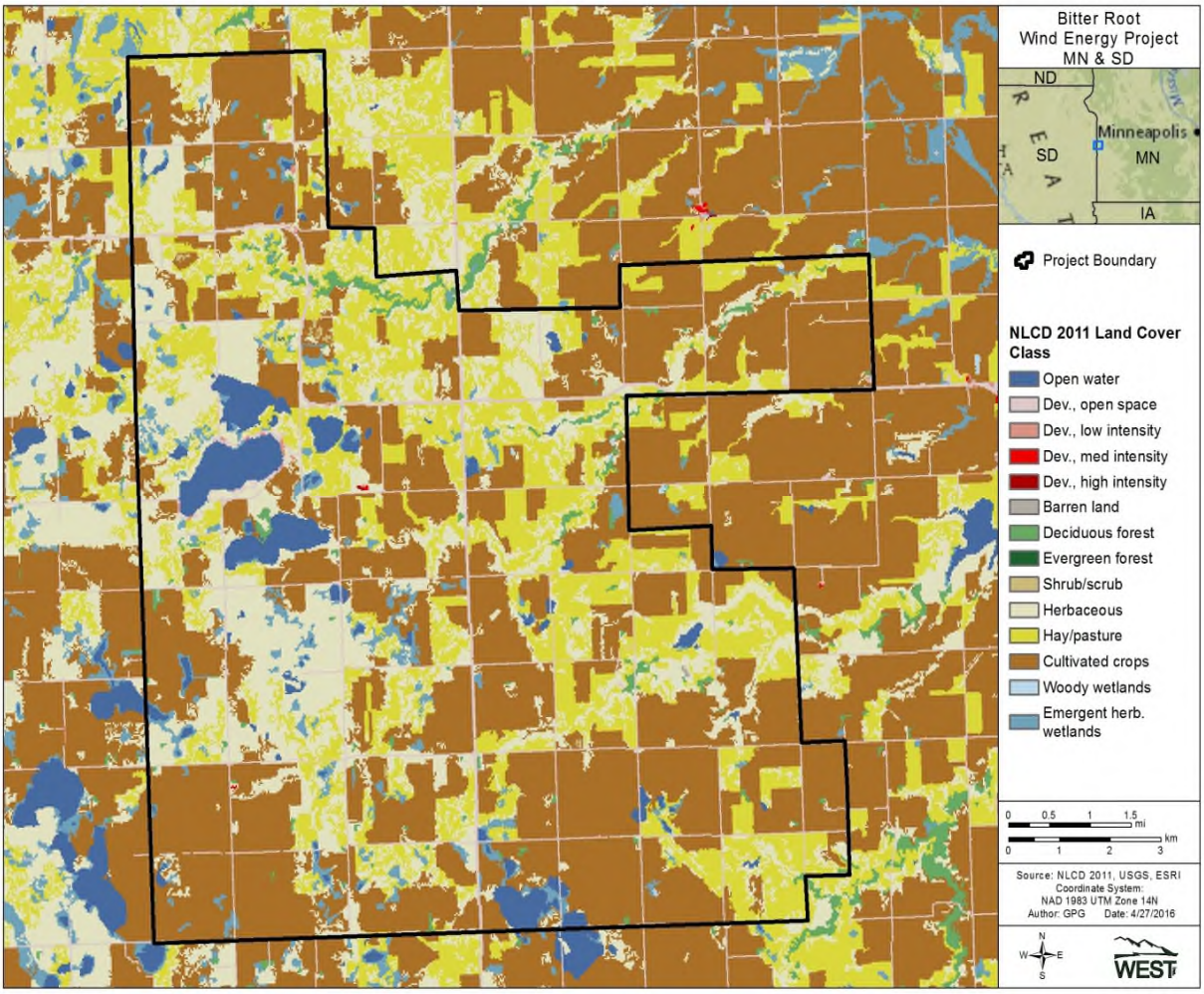

Figure 2. The land cover types within and adjacent to the Bitter Root Wind Energy Project area in Yellow Medicine County, Minnesota, and Deuel County, South Dakota (U.S. Geological Survey National Land Cover Database 2011, Homer et al. 2015).

3 METHODS

3.1 Bird Use Surveys

Bird use surveys were conducted using methods described by Reynolds et al. (1980). Twenty-one[1] observation points consisting of 800-meter (m; 2,625-foot [ft]) radius circular plots were established within the Project area. Circular plots covered approximately 31% of the Project area (Figure 3). Observation points (the center of the 800-m [2,625-ft] plot) were separated by at least 1,600 m (5,249 ft) to avoid overlap and were located along public roads using a systematic sampling scheme with a random start in ArcGIS (a Geographic Information System software program).

[1] A Project area boundary change in October 2016 resulted in three additional survey points added to the survey effort (points 19, 20, and 21), therefore these three points were not surveyed an equal number of times as points 1 – 18.

Bird use surveys were conducted once per month during spring (March 3 – May 25, 2016), summer (June 9 – August 26, 2016), fall (September 1 – October 31, 2016) and winter (November 11, 2016 – January 23, 2017). Surveys were conducted during daylight hours; survey periods were varied to approximately cover all daylight hours during a season. Observation points were planned to be surveyed the same number of times.[2]

Point count surveys were conducted for 60 minutes (min), with all small and large birds recorded for the first 10 min, then only large birds being recorded for the remaining 50 min of each 60-min survey. All large and small birds seen were recorded during each survey using a unique observation number, regardless of distance. In some cases, observations represented repeated sightings of the same individual. Observations of large birds outside the 800-m (2,625-ft) plot, and of small birds outside the 100-m (328-ft) plot, were recorded. These data were included in the development of species composition, relative abundance, and species diversity metrics, but were not included in analyses of avian use and flight heights. Large birds included the subtypes waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers.

[2] Surveys were missed on occasion due to poor visibility as a result of weather conditions or site access issues (e.g., muddy roads).

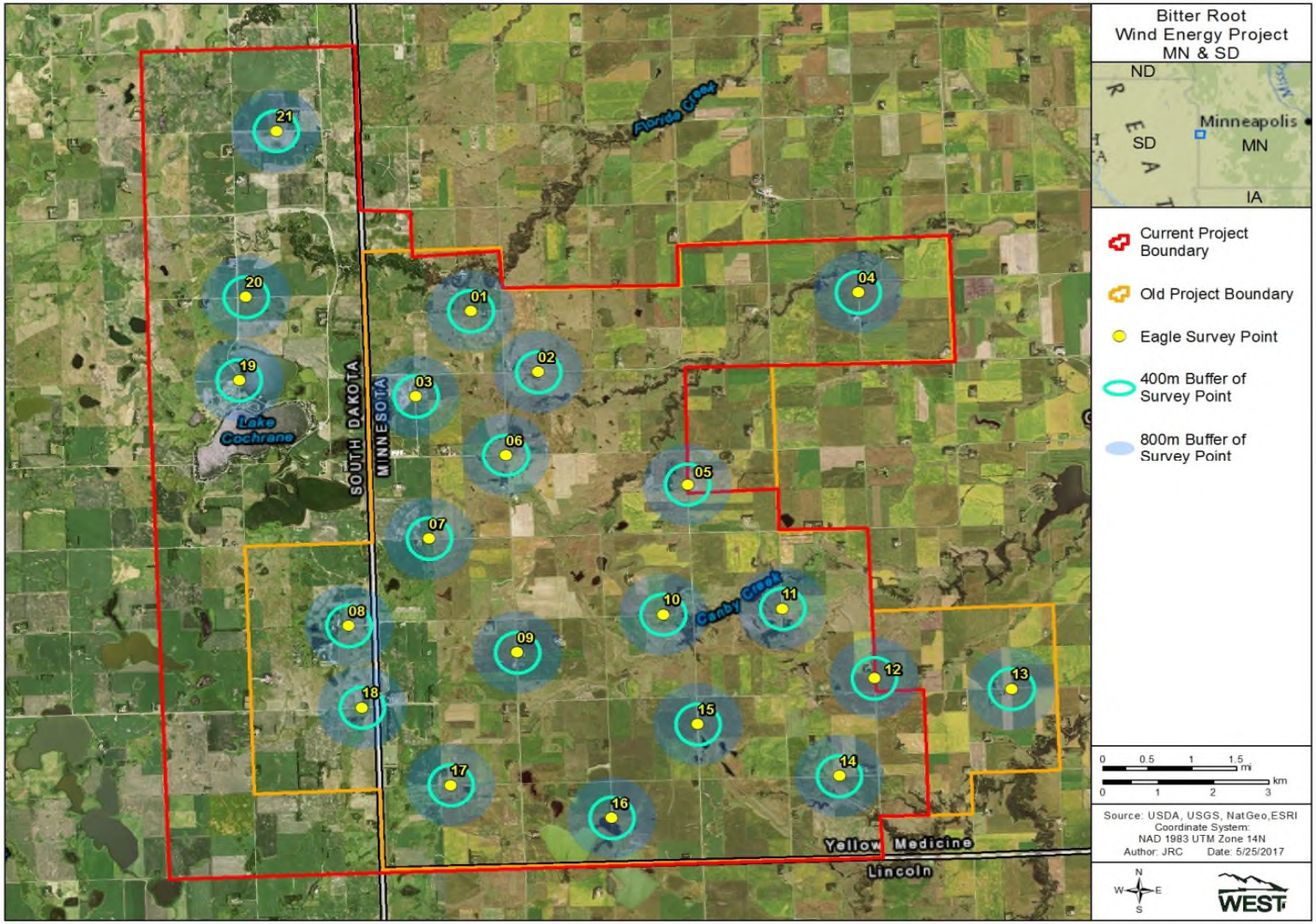

Figure 3. Locations of fixed-point avian use survey plots in the Bitter Root Wind Energy Project area where survey were conducted from March 3, 2016 – January 23, 2017.

The following information was recorded during each bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Species (or best possible identification)
- Number of individuals
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground
- Flight direction
- Activity (flying compared to perched)

Approximate flight height, flight direction, and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights were also recorded.

For bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) observations, flight height, distance, and activity (i.e., flying or perched) were recorded during each one-min interval the eagle was within the 800-m (2,625-ft) plot and at or below 200 m (656 ft) above ground level, per the ECPG (USFWS 2013). The perch locations and flight paths of eagles were mapped to qualitatively assess areas of eagle use within the Project area.

3.2 Incidental Wildlife Observations

Incidental wildlife observations were recorded to provide information on wildlife use of the Project area outside of those observed during standardized surveys. Biologists recorded all sensitive species, rare species, or unusual behaviors observed outside of standardized survey plots. Sensitive species include those listed on the federal Endangered Species Act; and the Migratory Bird Treaty Act. Incidental observations were recorded in a similar fashion to standardized surveys; the observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, and flight height above ground (for bird species) were recorded. Biologists recorded the location of sensitive species by Universal Transverse Mercator coordinates using a hand-held Global Positioning System unit.

3.3 Wetland Bird Use Surveys

Three 800-m (2,625-ft) radius circular plots adjacent to or within close proximity to wetlands and/or waterbodies were established within the Project area (Figure 4). Based on available wetland/water resources in the Project area, Point 1 was situated east of Lake Cochrane, in the northwest quadrant of the Project area; Point 2 was situated near Canby Creek, in the southeast quadrant of the Project area; and Point 3 was located in the southeast quadrant of the Project area, just north of the Bohemian State Wildlife Management Area.

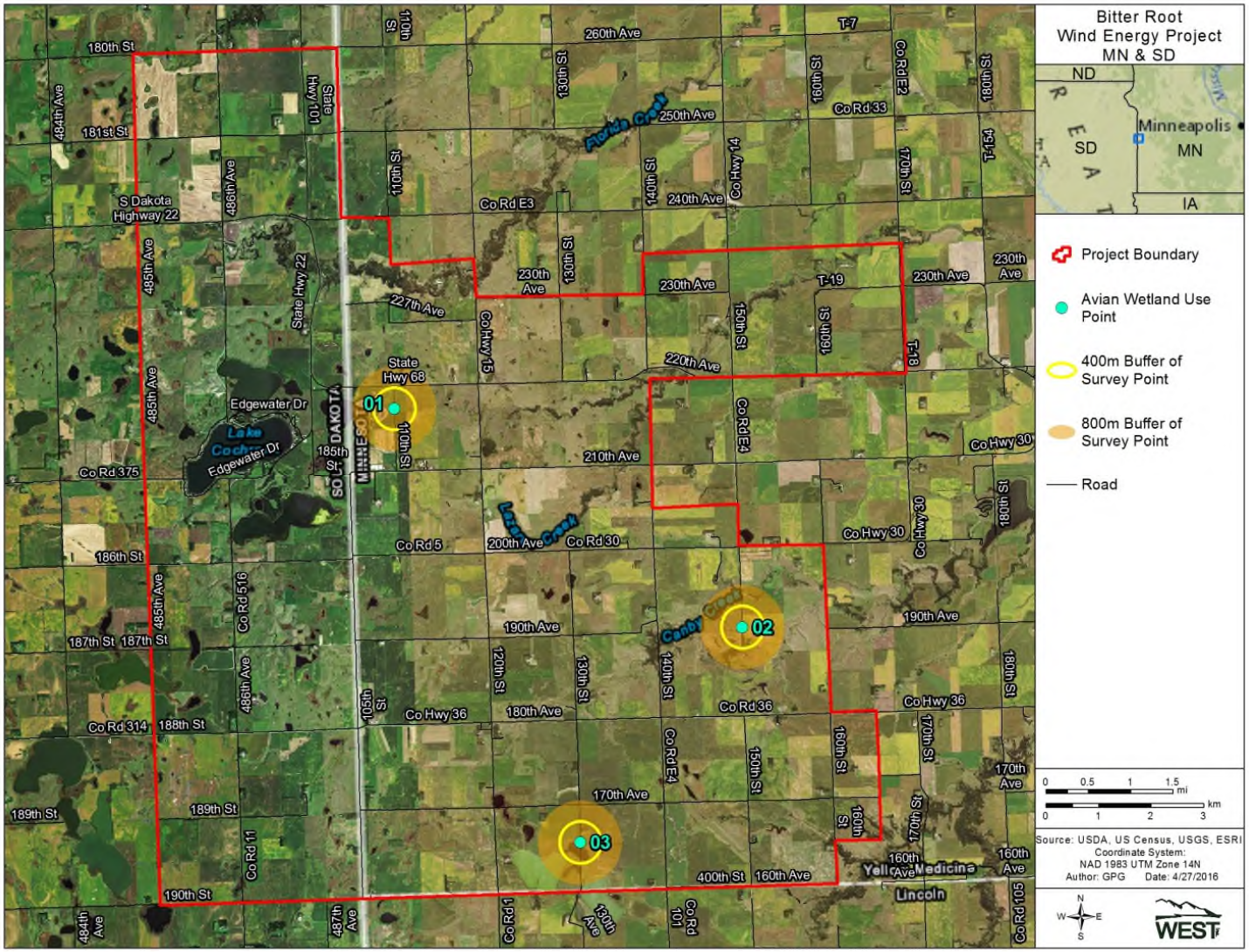

Figure 4. Location of wetland bird use survey plots in the proposed Bitter Root Wind Energy Project area where surveys were conducted from March 16 – May 15, 2016.

The sampling protocol was designed to document bird use during spring migration and the early nesting season for wetland bird species[3] with at least one survey conducted to coincide with ice out (i.e., when the majority of waterbodies are free of ice) and peak waterfowl migration (MNDNR 2012). Wetland bird use surveys were conducted three times at intervals approximately one month apart during spring (March 16, April 15, and May 15, 2016). Each plot was surveyed once per visit. Biologists conducted wetland bird use surveys during the morning hours, between approximately dawn and 12:00 p.m.

Wetland birds and other large birds were recorded during wetland bird use surveys during 60-min observation periods. Observations of wetland and large birds outside the 800-m (2,625-ft) plots were recorded and included in the development of species composition, relative abundance, and species diversity metrics, but were not included in analyses of avian use and flight heights.

The following information was recorded during each wetland bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Species (or best possible identification)
- Number of individuals
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground
- Flight direction
- Activity (flying compared to perched)

Approximate flight height, flight direction, and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights also were recorded.

Perches, on-water locations (i.e., birds observed swimming or floating on water), and flight paths of waterfowl, waterbirds, eagles, and other diurnal raptors were mapped to qualitatively show on maps the flight paths that were documented, flight locations within the wetland bird use plots, and flight direction (e.g., north/south, east/west). Aerial imagery was used to aid in recording locations of observations as accurately as possible.

3 The wetland bird use surveys were conducted to establish avian use around lakes or wetlands with an open water component. Although these surveys were designed to emphasize use by waterfowl and shorebirds, the wetland bird use surveys are not limited to these groups of birds.

3.4 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 data technician then compared a sample of records from an electronic database to the raw data forms and corrected any errors. 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.

A Microsoft® SQL Server database was developed to store, organize, and 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 and electronic data files were retained for reference. QA/QC measurements implemented for report writing included review of the final document by a technical editor, statistician, peer (research biologist), project manager, and senior manager.

4 DATA ANALYSIS

4.1 Species Composition, Relative Abundance, and Diversity

Species composition (i.e., species and bird types observed during the surveys) and relative abundance (i.e., number of observations and groups of each species and bird type by season), and diversity (i.e., total number of species observed within each season) were compiled for all birds observed during the bird use surveys, irrespective of distance from observer (i.e., includes incidental observations). In addition, percent composition for each bird type was calculated by total percent of bird observations and total percent of bird observations by season to assess percent composition of bird types based on all bird observations, regardless of distance from observer.

4.2 Bird Use, Percent of Use, and Frequency of Occurrence

Large bird use was calculated as the number of observations/800-m (2,625-ft) plot/60-min survey; and small bird use was calculated as numbers of observations/100-m (328-ft) plot/10-min survey. Bird use was calculated by season by first summing the number of birds seen within each plot during a visit, then averaging the number of birds/plot across plots within each visit, and finally by averaging the number of birds/visit across visits within the season. Overall bird use was calculated as a weighted average of seasonal values by the number of calendar days in each season (as defined by the season dates). Percent of use was calculated as the proportion of large bird use that was attributable to a particular bird type or species, and frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed.

4.3 Flight Height

Flight height data were used to identify the bird species and estimated bird use within an estimated rotor swept height (RSH) ranging from 25–150 m (82–492 ft) above ground level. The group's (a single bird or a flock of two or more) flight height when first observed were used to calculate the percentage of the different groups flying at different height categories: below the RSH at 0–25 m (0–82 ft), RSH at 25–150 m (82–492 ft), and greater than the RSH at 150 m (492 ft).

4.4 Spatial Use

Spatial use was evaluated by comparing large bird use among plots. In addition, eagle and diurnal raptor flight paths were mapped to qualitatively show flight locations and flight direction within the survey plots. Aerial imagery was used to aid in recording observations accurately.

5 RESULTS

5.1 Fixed-Point Bird Use Surveys

A total of 210, 60-min fixed-point bird use surveys were conducted at 21 survey points in the Project area during 11 visits (two in the fall, and three each in the spring, summer, and winter).

5.1.1 Species Composition, Relative Abundance, and Diversity

A total of 22,863 observations in 1,719 groups of birds were observed during the fixed-point bird use surveys (Appendix A). For large birds, 17,687 observations were recorded in 1,261 separate groups (Appendix A). The most commonly recorded large bird types were waterfowl (12,033 observations), which included 9,758 waterfowl observations in spring, 1,154 observations in fall, 862 observations in winter, and 259 observations in summer (Appendix A). The majority of waterfowl observations were unidentified duck (3,541 observations in 114 groups), with most of the observations (2,915 observations in 79 groups) recorded during spring (Appendix A). The second most-represented bird type was gulls/terns with 3,356 observations in 82 groups. Franklin's gulls (*Leucophaeus pipixcan*) were the most commonly observed gull/tern, with 2,136 observations in 14 groups. Almost all Franklin's gull observations (2,134 observations in 13 groups) were recorded in fall (Appendix A). Small bird observations were dominated by passerine species (5,141 observations in 444 groups; Appendix A).

Seven identified raptor species were recorded during the fixed-point bird use surveys, as well as unidentified accipiters, Buteos, hawks, and raptors. During the study, 319 diurnal raptor observations in 277 groups were recorded, representing 1.8% of all large bird observations (Appendix A). Twenty-six bald eagles were observed, including eight in the spring, two in the summer, 11 in the fall, and five in the winter. In total, bald eagles accounted for 8.2% of diurnal raptor observations and 0.2% of large bird observations.

Ninety-six identified species of birds were recorded during fixed-point bird use surveys of which 42 identified species were large birds; species diversity for large birds was highest during spring

(3.72 species/800-m plot/60-min survey), followed by fall (2.55), summer (2.44), and winter (0.68; Table 2). Small bird diversity was highest during summer (4.35 species/100-m plot/10-min survey), followed by spring (2.13), fall (1.46), and winter (0.51; Table 2).

Table 2. Summary of species richness (species/plot[a]/survey[b]), and sample size by season and overall during the fixed-point bird use surveys at the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

Season	Visits	Surveys Conducted	Unique Species	Species Richness	
				Large Birds	Small Birds
Spring	3	54	67	3.72	2.13
Summer	3	54	65	2.44	4.35
Fall	2	39	38	2.55	1.46
Winter	3	63	21	0.68	0.51
Overall	**11**	**210**	**96**	**2.26**	**2.07**

[a.] 800-m radius for large birds; 100-m radius for small birds
[b.] per 60-min survey for large birds; per 10-min survey for small birds

5.1.2 Bird Seasonal Use, Percent of Use, and Frequency of Occurrence

Large bird use, as determined by the number of birds/800-m plot/60-min survey, was higher in spring (85.35) and fall (82.81) compared to summer (11.19) and winter (8.46). High use in spring was largely influenced by the large numbers of waterfowl observed (Table 3 and Appendix B). High use in fall was largely influenced by the large numbers of gulls/terns (particularly Franklin's gulls) observed (Table 3 and Appendix B).

5.1.2.1 Loons/Grebes

Use by loons/grebes was highest during fall (0.11 observations/800-m plot/60-min survey) compared to 0.02 in both spring and summer; loons/grebes were not observed during winter (Table 3 and Appendix B). Loons/grebes accounted for 0.2% of large bird use in summer, 0.1% in fall, less than 0.1% in spring (Table 2 and Appendix B). Unidentified grebe was the most frequently observed loons/grebes species in fall, unidentified loons were the next most frequently observed in summer, and common loons (*Gavia immer*) were observed only in spring (Appendix B). The frequency of observing loons/grebes was slightly higher during fall, when observations were recorded during 2.8% of surveys, compared to 1.9% of surveys in both summer and spring (Table 3).

5.1.2.2 Waterbirds

Waterbird use was highest during summer (3.65 observations/800-m plot/60-min survey), followed by spring (0.94) and fall (0.63); waterbirds were not observed during winter (Table 3 and Appendix B). Waterbirds accounted for 32.6% of large bird use in summer, 1.1% in spring, and 0.8% in fall (Table 2 and Appendix B). American white pelican (*Pelecanus erythrorhynchos*) was the most frequently observed waterbird species in summer (26.8% of large bird observations), followed by great blue heron (*Ardea herodias*; 4.1%), and double-crested cormorant (*Phalacrocorax auritus*; 0.8%), great egret (*Ardea alba*; 0.5%), green heron (*Butorides virescens*; 0.2%), and yellow-crowned night heron (*Nyctanassa violacea*; 0.2%; Appendix B). Waterbirds were observed more frequently during summer (37.0% of surveys), followed by spring (18.5%) and fall (15.9%; Table 3).

5.1.2.3 Waterfowl

Waterfowl use was highest during spring (73.50 observations/800-m plot/60-min survey), followed by fall (12.28), winter (5.65), and summer (3.96; Table 3 and Appendix B). Waterfowl accounted for most large bird use in spring (86.1%), winter (66.8%), and summer (35.4%), but was second to gulls/terns in fall (14.8%; Table 3 and Appendix B). Canada goose (*Branta canadensis*) observations accounted for the majority (65.3%) of large bird use in winter (Appendix B). Waterfowl were observed more frequently during spring (64.8% of surveys), followed by fall (37.7%), summer (25.9%), and winter (11.1%; Table 3 and Appendix B). Canada goose was the most frequently observed waterfowl species in spring (37.0% of surveys) and winter (9.5%), while mallard (*Anas platyrhynchos*) was the most frequently observed waterfowl species during fall (20.6%) and summer (14.8%; Appendix B).

5.1.2.4 Shorebirds

Shorebird use in the Project area was highest in fall (0.63 observations/800-m plot/60-min survey), followed by spring (0.33) and summer (0.11); shorebirds were not observed during winter (Table 3 and Appendix B). Shorebirds comprised 0.8% of large bird use in fall, 1.0% in summer, and 0.4% in spring (Table 3). Shorebirds were observed during 24.1% of spring surveys, 7.5% of fall surveys, and 3.7% of summer surveys (Table 3). Killdeer (*Charadrius vociferus*) were the most common shorebird species recorded in all seasons.

5.1.2.5 Gulls/Terns

Mean use of the Project area by gulls/terns was highest in fall (64.89 observations/800-plot/60-min survey), compared to summer (1.76) and spring (0.52); gulls/terns were not observed during winter (Table 3 and Appendix B). Gulls/terns accounted for 78.4% of large bird use in fall (primarily Franklin's gull [65.5%] followed by unidentified gull [7.2% of large bird use]), 15.7% of large bird use in summer, and 0.6% of large bird use during spring. Gull/terns were observed during 9.3% of spring surveys, 20.4% of summer surveys, and 31.7% of fall surveys (Table 3).

5.1.2.6 Rails/Coots

Mean use of the Project area by rails and coots was highest in spring (7.76 observations/800-m plot/60-min survey), compared to summer (0.11); rails/coots were not recorded in the area during fall or winter (Table 3 and Appendix B). Rails/coots accounted for 9.1% of large bird use during spring and 1.0% of large bird use in summer (Table 3 and Appendix B). The frequency of rail/coot observations ranged from 5.6% during summer surveys to 7.4% during spring surveys (Table 3).

5.1.2.7 Diurnal Raptors

Mean use of the Project area by diurnal raptors was highest during fall (1.10 observations/800-m plot/60-min survey), compared to summer (0.61), spring (0.48), and winter (0.14; Table 3 and Appendix B). Diurnal raptors comprised 5.5% of large bird use in summer, 1.3% in fall, 1.7% in winter, and 0.6% in spring. Diurnal raptors were observed most frequently during fall (58.3% of

surveys) followed by summer (35.2%), spring (29.6%), and winter (14.3%; Table 3 and Appendix B).

Use of the Project area by *Buteos* species was highest in fall (0.88 observations/800-m plot/60-min survey), compared to summer (0.30), spring (0.26), and winter (0.11; Table 3 and Appendix B). *Buteo* species were observed during 45.6% of fall surveys (largely reflecting red-tailed hawk [*Buteo jamaicensis*] observations), 22.2% of summer surveys, 14.8% of spring surveys, and 11.1% of winter surveys (Table 3 and Appendix B).

Use of the Project area by northern harriers (*Circus cyaneus*) was highest in spring (0.20 observations/800-m plot/60-min survey) and slightly lower in summer (0.17) and fall (0.10; Table 3 and Appendix B). No northern harriers were observed in winter. Northern harriers were observed most frequently during spring (14.8% of surveys), followed by summer (13.0% of surveys), and fall (7.5% of surveys).

Use of the Project area by eagles was low (0.02 observations/800-m plot/60-min survey) during winter and no eagles recorded within survey plots during any other season (Table 3 and Appendix B). Eagles were observed within survey plots area during 1.6% of winter surveys (Table 3 and Appendix B).

Falcon use (i.e., American kestrels [*Falco sparverius*]) was highest in summer (0.09 observations/800-m plot/60-min survey) and lower during spring (0.02), fall (0.05), and winter (0.02; Table 3 and Appendix B). Falcons were observed during 7.4% of summer surveys, 5.2% of fall surveys, 1.9% of spring surveys, and 1.6% of winter surveys (Appendix B).

5.1.2.8 Owls

Owl use (i.e., great horned owls [*Bubo virginianus*]) was limited to 0.03 observations/800-m plot/60-min survey in winter, with no owls recorded during spring, summer, or fall (Table 3 and Appendix B). Owls accounted for 0.4% of large bird use in winter and were observed during 3.2% of the winter surveys (Table 3 and Appendix B).

5.1.2.9 Vultures

Vulture use (i.e., turkey vultures [*Cathartes aura*]) was highest in fall (0.61 observations/800-m plot/60-min survey), and lower in spring (0.28) and summer (0.26); vultures were not recorded during winter (Table 3 and Appendix B). Vultures accounted for 2.3% of large bird use in summer, 0.7% in fall, and 0.3% in spring. Vultures were observed during 18.5% of summer surveys, 13.9% of fall surveys, and 11.1% of spring surveys (Table 3 and Appendix B).

5.1.2.10 Upland Game Birds

Mean use of the Project area by upland game birds was higher in spring (0.61 observations/800-m plot/60-min survey) and winter (0.57), compared to summer (0.13) and fall (0.11; Table 3 and Appendix B). Upland game birds represented a high of 6.8% of large bird use in winter, followed by 1.2% in summer, 0.7% in spring, and 0.1% during fall (Table 3 and Appendix B). Upland game birds were observed during 27.8% of spring surveys, 11.1% of

summer and winter surveys, and 10.7% of fall surveys (Table 3 and Appendix B). Ring-necked pheasants (*Phasianus colchicus*) represented the majority of use by upland game birds, which was highest in the spring (0.59), followed by wild turkey (*Meleagris gallopavo*), which was highest during winter (0.05; Appendix B).

5.1.2.11 Doves/Pigeons

Use of the Project area by doves and pigeons was highest during winter (1.60 observations/800-m plot/60-min survey), followed by spring (0.30), summer (0.30), and fall (0.12; Table 3 and Appendix B). Doves/pigeons represented 18.9% of large bird use in winter, 2.6% in summer, 0.1% in fall, and 0.3% in spring. Doves/pigeons were observed during 14.8% of summer surveys, 13.0% of spring surveys, 7.9% of winter surveys, and 5.2% of fall surveys (Table 3 and Appendix B). Doves and pigeons included both mourning doves (*Zenaida macroura*) and rock pigeons (*Columba livia*).

5.1.2.12 Large Corvids

Mean use of the Project area by large corvids (i.e., American crow [*Corvus brachyrhynchos*]) was highest in fall (2.33 observations/800-m plot/60-min survey), followed by spring (0.61), winter (0.46), and summer (0.20; Table 3 and Appendix B). Large corvids represented a high of 5.4% of large bird use in winter, 2.8% in fall, 1.8% in summer, and 0.7% in spring (Table 3 and Appendix B). Large corvids were observed during 35.2% of spring, 19.8% of fall, 14.8% of summer, and 15.9% of winter surveys (Table 3 and Appendix B).

5.1.2.13 Goatsuckers

Mean use of the Project area by goatsuckers (i.e., common nighthawk [*Chordeiles minor*]) over the study was limited to 0.07 observations/800-m plot/60-min survey in summer, with no observations made during any other season (Table 3 and Appendix B). Goatsuckers were observed during 3.7% of summer surveys (Table 3 and Appendix B).

5.1.2.14 Passerines

Mean use of the Project area by passerines was highest during fall (61.16 3 observations/100-m plot/10-min survey) during winter, followed by spring (11.41), summer (8.98), and winter (7.03; Table 3 and Appendix B). Passerines represented 100.0% of small bird use in fall, 99.8% in winter, 99.2% in summer, and 96.9% in spring. Passerines were observed most frequently during summer (92.6% of surveys) followed by fall (67.5%), spring (64.8%), and winter (39.7%; Table 3 and Appendix B).

5.1.2.15 Woodpeckers

Mean use of the Project area by woodpeckers over the study ranged from 0.02 observations/100-m plot/10-min survey during winter, to 0.03 in fall, 0.07 in summer, and 0.09 in spring (Table 3 and Appendix B). Woodpeckers comprised 0.8% of small bird use in summer and spring, 0.2% in winter, and less than 0.1 in fall. Woodpeckers were observed most frequently during spring (7.4% of surveys) followed by summer (5.6%), fall (2.8%), and winter (1.6%; Table 3 and Appendix B).

Table 3. Mean bird use (number of birds/plot[a]/survey[b]), percent of total use (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Loons/Grebes	0.02	0.02	0.11	0	<0.1	0.2	0.1	0	1.9	1.9	2.8	0
Waterbirds	0.94	3.65	0.63	0	1.1	32.6	0.8	0	18.5	37	15.9	0
Waterfowl	73.5	3.96	12.28	5.65	86.1	35.4	14.8	66.8	64.8	25.9	37.7	11.1
Shorebirds	0.33	0.11	0.63	0	0.4	1	0.8	0	24.1	3.7	7.5	0
Gulls/Terns	0.52	1.76	64.89	0	0.6	15.7	78.4	0	9.3	20.4	31.7	0
Rails/Coots	7.76	0.11	0	0	9.1	1	0	0	7.4	5.6	0	0
Diurnal Raptors	0.48	0.61	1.10	0.14	0.6	5.5	1.3	1.7	29.6	35.2	58.3	14.3
Accipiters	*0*	*0.02*	*0.02*	*0*	*0*	*0.2*	*<0.1*	*0*	*0*	*1.9*	*2.4*	*0*
Buteos	*0.26*	*0.30*	*0.88*	*0.11*	*0.3*	*2.6*	*1.1*	*1.3*	*14.8*	*22.2*	*45.6*	*11.1*
Northern Harrier	*0.20*	*0.17*	*0.10*	*0*	*0.2*	*1.5*	*0.1*	*0*	*14.8*	*13*	*7.5*	*0*
Eagles	*0*	*0*	*0*	*0.02*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*1.6*
Falcons	*0.02*	*0.09*	*0.05*	*0.02*	*<0.1*	*0.8*	*<0.1*	*0.2*	*1.9*	*7.4*	*5.2*	*1.6*
Other Raptors	*0*	*0.04*	*0.05*	*0*	*0*	*0.3*	*<0.1*	*0*	*0*	*3.7*	*4.8*	*0*
Owls	0	0	0	0.03	0	0	0	0.4	0	0	0	3.2
Vultures	0.28	0.26	0.61	0	0.3	2.3	0.7	0	11.1	18.5	13.9	0
Upland Game Birds	0.61	0.13	0.11	0.57	0.7	1.2	0.1	6.8	27.8	11.1	10.7	11.1
Doves/Pigeons	0.30	0.30	0.12	1.6	0.3	2.6	0.1	18.9	13	14.8	5.2	7.9
Large Corvids	0.61	0.20	2.33	0.46	0.7	1.8	2.8	5.4	35.2	14.8	19.8	15.9
Goatsuckers	0	0.07	0	0	0	0.7	0	0	0	3.7	0	0
Large Birds Overall	**85.35**	**11.19**	**82.81**	**8.46**	**100.0**	**100.0**	**100.0**	**100.0**				
Passerines	11.41	8.98	61.16	7.03	96.9	99.2	100	99.8	64.8	92.6	67.5	39.7
Woodpeckers	0.09	0.07	0.03	0.02	0.8	0.8	<0.1	0.2	7.4	5.6	2.8	1.6
Unidentified Birds	0.28	0	0	0	2.4	0	0	0	1.9	0	0	0
Small Birds Overall	**11.78**	**9.06**	**61.19**	**7.05**	**100.0**	**100.0**	**100.0**	**100.0**				

[a] 800-m radius plot for large birds; 100-m for small birds
[b] per 60-min survey for large birds; 10-min survey for small birds

5.1.3 Flight Height Characteristics

During the fixed-point bird use study, 442 groups (4,414 observations) of large birds were observed within the 800-m (2,625-ft) survey plots, with 49.0% of these observed flying (Table 4 and Appendix C). Of large birds observed flying, 59.5% were at heights within the estimated RSH (Table 4). Large bird types that were most often recorded in the RSH included: eagles and falcons (100.0% of flying observations), vultures (87.5%), gulls/terns (72.7%), large corvids (72.6%), and shorebirds (71.4%; Table 4). Buteo species were also frequently observed flying within the RSH (60.4%; Table 4). Bird types that were most often recorded flying at heights below the RSH included rails/coots (100.0% of flying observations), upland game birds (100.0%), doves/pigeons (83.1%), loons/grebes (80.0%), and waterfowl (60.1%; Table 4). The most commonly recorded group of flying large birds was waterfowl (37 groups; 28.2% of all groups flying), and the majority of flying large bird observations were also waterfowl (567 observations; 50.4% of all flying observations; Table 4). Two-hundred and forty-seven groups (3,315 observations) of small birds were observed flying within the survey plots, of which 241 groups (3,309 observations) were passerines, which accounted for 78.6% of passerines observed within plots. The minority (21.4%) of flying passerines observed on the plots were observed below the RSH (Table 4).

Table 4. Flight height characteristics by bird type[a] and raptor subtype during fixed-point[c] bird use surveys at the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0–25 m	25–150 m[b]	>150 m
Loons/Grebes	2	5	25.50	83.3	80.0	20.0	0
Waterbirds	62	157	47.08	57.9	45.9	49.7	4.5
Waterfowl	153	1,251	24.46	24.9	60.1	35.7	4.2
Shorebirds	13	42	22.46	84.0	28.6	71.4	0
Gulls/Terns	50	2,588	35.74	96.9	27.3	72.7	0
Rails/Coots	2	3	2.00	0.7	100.0	0	0
Diurnal Raptors	80	84	46.65	75.0	41.7	51.2	7.1
Accipiters	*2*	*2*	*35.00*	*100.0*	*50.0*	*50.0*	*0*
Buteos	*49*	*53*	*56.51*	*73.6*	*30.2*	*60.4*	*9.4*
Northern Harrier	*22*	*22*	*17.86*	*91.7*	*77.3*	*22.7*	*0*
Eagles	*1*	*1*	*60.00*	*100.0*	*0*	*100.0*	*0*
Falcons	*2*	*2*	*30.00*	*22.2*	*0*	*100.0*	*0*
Other Raptors	*4*	*4*	*95.00*	*100.0*	*25.0*	*50.0*	*25.0*
Owls	0	0	0	0	0	0	0
Vultures	28	48	56.61	94.1	10.4	87.5	2.1
Upland Game Birds	5	31	1.20	38.8	100.0	0	0
Doves/Pigeons	15	77	24.67	55.8	83.1	16.9	0
Large Corvids	30	124	24.03	72.9	27.4	72.6	0
Goatsuckers	2	4	25.00	100.0	50.0	50.0	0
Large Birds Overall	**442**	**4,414**	**34.52**	**49.0**	**39.0**	**59.5**	**1.5**
Passerines	241	3,309	15.98	82.0	21.4	78.6	0
Woodpeckers	6	6	16.33	54.5	66.7	33.3	0
Unidentified Birds	0	0	0	0	0	0	0
Small Birds Overall	**247**	**3,315**	**15.98**	**81.6**	**21.5**	**78.5**	**0**

[a.] 800-m radius plot for large birds; 100-m for small birds
[b.] likely "rotor swept height" for potential collision with a turbine blade, or 25–150 m (82–492 ft) above ground level
[c.] per 60-min survey for large birds; per 10-min survey for small birds
Note: obs = observations

5.1.4 Large Bird Spatial Use

For large bird species combined, mean bird use was highest at Point 16 (387.82 observations/800-m plot/60-min survey), largely due to the large numbers of ducks recorded on this survey plot. Large bird use ranged from 0.75 – 126.09 observations/800 m-plot/60-min survey at other survey points (Appendix D).

Loons/grebes were observed at three observation points (Appendix D). Loons/grebes use was highest at Point 16 (0.36 observations/800-m plot/60-min survey), followed by points 3 and 4 (0.09; Appendix D).

Waterbirds were observed at 14 observation points (Appendix D). Waterbird use was highest at Point 3 (10.55 observations/800-m plot/60-min survey), followed by Point 16 (8.36). At the other 12 survey points, mean waterbird use ranged from 0.09 – 1.00 observations/800-m plot/60-min survey (Appendix D).

Waterfowl were observed at 20 of the 21 survey points (Appendix D). Due to the large number of ducks observed at Point 16, waterfowl use was considerably higher at Point 16, with a mean of 217.00 observations/800-m plot/60-min survey. Mean waterfowl use was also relatively high at points 20 (124.75 observations/800-m plot/60-min survey), 3 (104.27), and 15 (48.82; Appendix D).

Shorebird use was observed at 12 of 21 observation points (Appendix D). Shorebird use was highest at Point 13 (2.18 observations/800-m plot/60-min survey; Appendix D). Mean use by shorebirds was low at other survey points, ranging from 0.09 – 0.82 observations/800-m plot/60-min survey at points where use was documented (Appendix D).

Gulls/terns use was observed at 12 of 21 observation points (Appendix D). Gull/tern use was highest at Point 16 (122.91 observations/800-m plot/60-min survey; Appendix D). Mean use by gulls/terns at the other survey points ranged from 0.09 – 54.73 observations/800-m plot/60-min (Appendix D).

Rails/coots use was observed at four of 21 observation points (Appendix D). Rail/coot use was highest at Point 16 (37.64 observations/800-m plot/60-min survey; Appendix D). Mean use by rails/coots was low at other survey points, ranging from 0.09 – 0.73 observations/800-m plot/60-min survey (Appendix D).

Diurnal raptor use was observed at 18 of 21 observation points (Appendix D). Mean diurnal raptor use was highest at Point 8 (1.73 observations/800-m plot/60-min survey). Mean use ranged from 0.09 – 1.00 at other survey points (Appendix D). Accipiters were only observed at Point 8 (0.09 observations/800-m plot/60-min survey). *Buteo* species were observed at 16 of 21 survey points, with highest use at Point 8 (1.45 observations/800-m plot/60-min survey; Appendix D). Northern harriers were observed at seven of 21 points, with highest use at Point 5 (0.73 observations/800-m plot/60-min survey; Appendix D). Eagle use was observed at one of

21 observation points (Point 13; Figure 5), with a mean of 0.09 observations/800-m plot/60-min survey; Figure 4 and Appendix D). Falcon use was observed at five of 21 points and mean use was highest at points 5 and 11 (0.27 observations/800-m plot/60-min survey; Appendix D).

Owl use was documented at points 5 and 9 (Appendix D). Mean use was low (0.09 observations/800-m plot/60-min survey) for both points.

Vulture use was documented at 15 of 21 survey points (Appendix D). Vulture use was highest at Point 9 (0.91 observations/800-m plot/60-min survey; Appendix D). Vulture use ranged from 0.09 – 0.73 at the remaining five survey points (Appendix D).

Upland game bird use was detected at 13 of 21 survey points (Appendix D). Mean use by upland game birds ranged from 0.09 – 3.27 observations/800-m plot/60-min survey (Appendix D). Use by upland game birds was highest at Point 5.

Dove/pigeon use was documented at 11 of 21 survey points (Appendix D). Mean use by doves/pigeons ranged from 0.09 – 10.55 observations/800-m plot/60-min survey (Appendix D). Dove/pigeon use was highest at Point 1 (10.55 observations/800-m plot/60-min survey).

Large corvid use was observed at 18 of 21 observation points (Appendix D). Mean use by large corvids ranged from 0.09 – 4.18 observations/800-m plot/60-min survey (Appendix D). Large corvid use was highest at Point 8 (4.18; Appendix D).

Goatsucker use was only observed at Point 2, with mean use (0.36 observations/800-m plot/10-min survey; Appendix D).

Figure 6[4] presents mapped bald eagle flight paths recorded from each survey point, with the highest number of flight paths documented in the west-central portion of the Project area in proximity to the Lake Cochrane/South Slough complex and tributaries of Lazarus Creek; and outside of the Project area to the southeast (Figure 6).

Passerine use was observed at all 21 observation points, ranging from 0.50 – 125.27 observations/100-m plot/10-min survey (Appendix D). Passerine use was higher at points 18 (125.27) and 1 (110.64) compared to the other points (Appendix D).

Woodpecker use was observed at five of 21 survey points (Appendix D). Mean use ranged from 0.09 – 0.45 observations/100-m plot/10-min survey (Appendix D). Woodpecker use was highest at Point 5, compared to the four remaining survey points.

[4] Flight paths and perch locations on Figure 6 may represent more than one eagle using the same flight path or perch location.

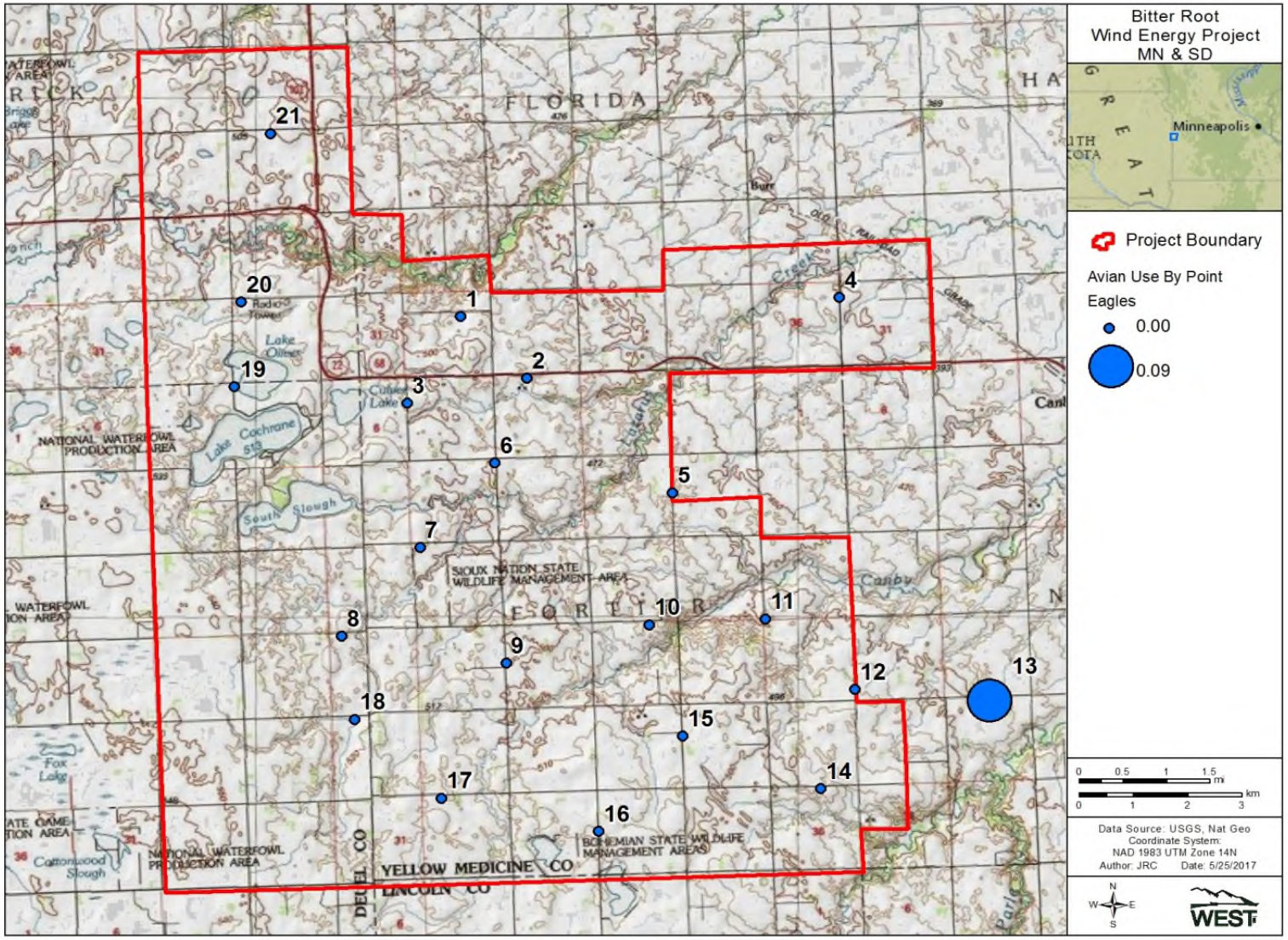

Figure 5. Eagle use by observation point during fixed-point bird use surveys at the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

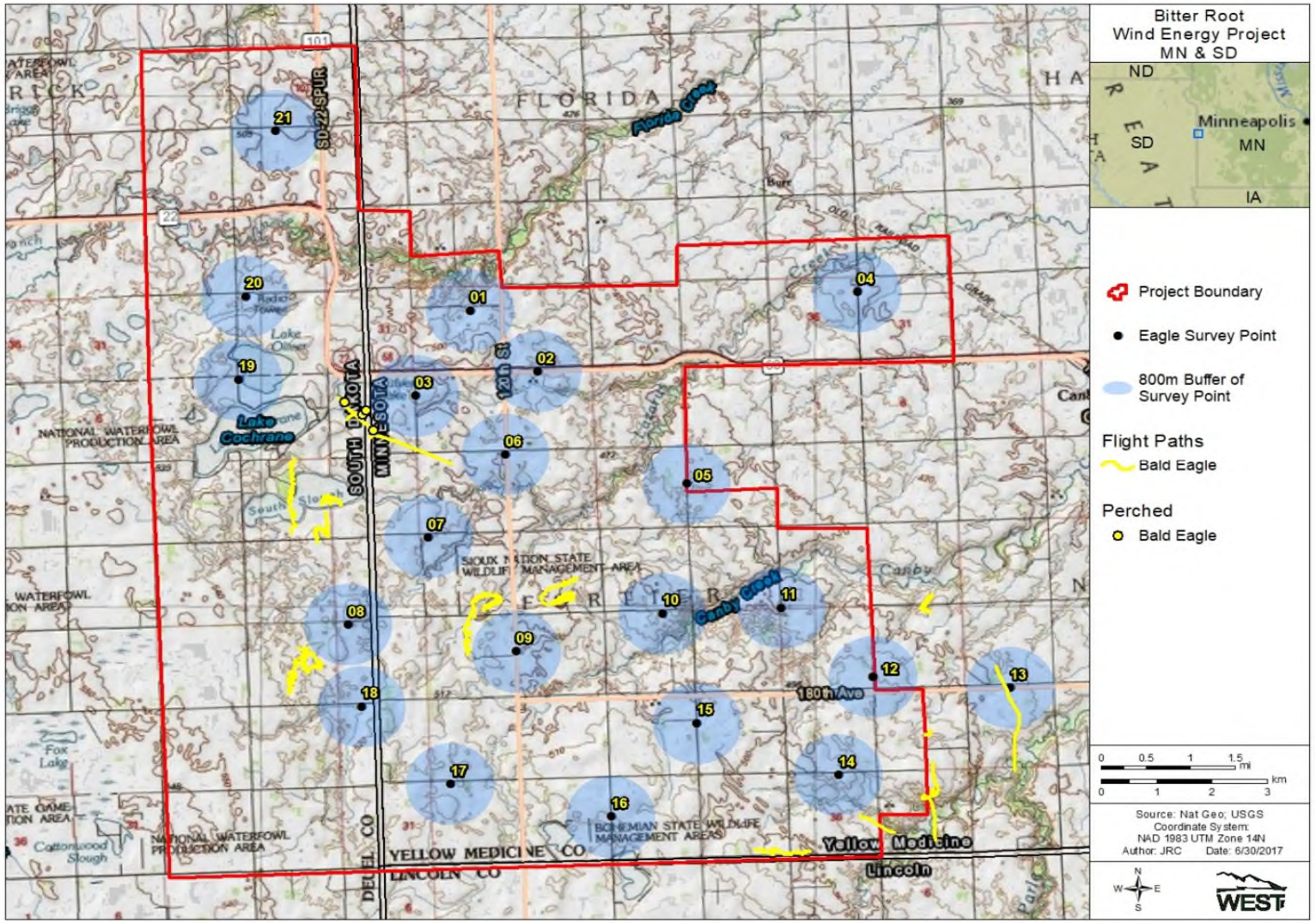

Figure 6. Bald eagle flight paths recorded during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

5.2 Wetland Bird Use Surveys

Nine 60-min wetland bird use surveys were conducted during three visits between March 16 and May 15, 2016.

5.2.1 Bird Species Composition, Relative Abundance, and Diversity

A total of 10,539 large bird observations in 242 separate groups were recorded during the wetland bird use surveys (Table 5). The most commonly recorded large bird subtype was waterfowl, which included 16 species and represented 97.1% of all observations. The majority (80.5%) of all waterfowl observations were identified as snow goose (*Chen caerulescens*; 35.0%; 3,585 observations) or unidentified duck (45.5%; 4,654 observations; Table 5). Mallard were the most abundant duck species identified, accounting for 4.8% of all waterfowl observations (Table 5). Diurnal raptors accounted for 0.1% of all large birds observed (7 observations) during wetland bird use surveys. Bald eagles accounted for 14.3% of all raptor observations (one observation) observed during wetland bird use surveys. The waterbird subtype accounted for 1.4% of birds observed, with American white pelicans accounting for 61.2% of all waterbird observations (90 observations; Table 5). Thirty-seven large bird species were observed over the course of wetland bird use surveys.

Table 5. Summary of observations by bird type and species for birds observed during wetland bird use surveys at the Bitter Root Wind Energy Project from March 16 – May 15, 2016.

		Total		
Bird Type/Species	**Scientific Name**	**# groups**	**# obs**	**% obs**
Loons/Grebes		**3**	**4**	**<0.1**
pied-billed grebe	*Podilymbus podiceps*	2	3	<0.1
western grebe	*Aechmophorus occidentalis*	1	1	<0.1
Waterbirds		**20**	**147**	**1.4**
American bittern	*Botaurus lentiginosus*	1	2	<0.1
American white pelican	*Pelecanus erythrorhynchos*	9	90	0.9
double-crested cormorant	*Phalacrocorax auritus*	5	23	0.2
great blue heron	*Ardea herodias*	1	1	<0.1
great egret	*Ardea alba*	2	2	<0.1
unidentified waterbird	NA	2	29	0.3
Waterfowl		**193**	**10,232**	**97.1**
American wigeon	*Anas americana*	1	6	0.1
blue-winged teal	*Anas discors*	4	10	0.1
bufflehead	*Bucephala albeola*	1	1	<0.1
Canada goose	*Branta canadensis*	46	542	5.2
canvasback	*Aythya valisineria*	5	16	0.2
common goldeneye	*Bucephala clangula*	8	155	1.5
gadwall	*Anas strepera*	3	34	0.3
hooded merganser	*Lophodytes cucullatus*	2	7	0.1
mallard	*Anas platyrhynchos*	42	488	4.6
northern pintail	*Anas acuta*	2	5	<0.1
northern shoveler	*Anas clypeata*	6	43	0.4
redhead	*Aythya americana*	3	36	0.3
Ross' goose	*Chen rossii*	1	1	<0.1
ruddy duck	*Oxyura jamaicensis*	1	5	<0.1
snow goose	*Chen caerulescens*	10	3,585	34.1
unidentified duck	NA	51	4,654	44.3

Table 5. Summary of observations by bird type and species for birds observed during wetland bird use surveys at the Bitter Root Wind Energy Project from March 16 – May 15, 2016.

		Total		
Bird Type/Species	**Scientific Name**	**# groups**	**# obs**	**% obs**
unidentified goose	NA	2	300	2.9
unidentified scaup	*Aythya* spp.	2	140	1.3
unidentified waterfowl	NA	1	200	1.9
wood duck	*Aix sponsa*	2	4	<0.1
Shorebirds		**2**	**2**	**<0.1**
killdeer	*Charadrius vociferus*	2	2	<0.1
Gulls/Terns		**10**	**58**	**0.6**
Forster's tern	*Sterna forsteri*	1	3	<0.1
ring-billed gull	*Larus delawarensis*	4	17	0.2
unidentified gull	NA	5	38	0.4
Rails/Coots		**3**	**81**	**0.8**
American coot	*Fulica americana*	2	80	0.8
sora	*Porzana carolina*	1	1	<0.1
Diurnal Raptors		**6**	**7**	**0.1**
Buteos		*5*	*6*	0.1
red-tailed hawk	*Buteo jamaicensis*	4	5	<0.1
Swainson's hawk	*Buteo swainsoni*	1	1	<0.1
Eagles		*1*	*1*	<0.1
bald eagle	*Haliaeetus leucocephalus*	1	1	<0.1
Vultures		**1**	**1**	**<0.1**
turkey vulture	*Cathartes aura*	1	1	<0.1
Upland Game Birds		**2**	**5**	**<0.1**
ring-necked pheasant	*Phasianus colchicus*	2	5	<0.1
Large Corvids		**2**	**2**	**<0.1**
American crow	*Corvus brachyrhynchos*	2	2	<0.1
Overall		**242**	**10,539**	

Note: obs = observations

5.2.2 Bird Use, Percent of Use, and Frequency of Occurrence

Bird use estimates, percent of use, and frequency of occurrence for all large bird types observed during wetland bird use surveys are reported in Table 6. Large bird use was 678.22 observations /800-m plot/60-minute during wetland bird use surveys (Table 6). Bird use during the wetland bird surveys was led by waterfowl species, which represented 95.6% of birds using the area (Table 6).

Table 6. Bird use (mean number of observations/plot/survey), percent of total use (%), and frequency of occurrence (%) for each bird type and subtype of birds observed during wetland bird use surveys at the Bitter Root Wind Energy Project from March 16 – May 15, 2016.

Bird Type	Bird Use	% of Use	% Frequency
Loons/Grebes	0.44	<0.1	33.3
Waterbirds	13.33	2.0	44.4
Waterfowl	648.67	95.6	100.0
Shorebirds	0.22	<0.1	22.2
Gulls/Terns	5.44	0.8	55.6
Rails/Coots	9.00	1.3	22.2
Diurnal Raptors	0.33	<0.1	22.2
Buteos	0.33	<0.1	22.2
Upland Game Birds	0.56	<0.1	22.2
Large Corvids	0.22	<0.1	11.1
Overall	**678.22**	**100**	

5.2.2.1 Loons/Grebes

Loons/grebes use was 0.44 observation/800-m plot/60-min survey. Loons/grebes accounted for less than 0.1% of overall use and were observed during 33.3% of wetland bird use surveys (Table 6).

5.2.2.2 Waterbirds

Waterbird use was 13.33 observations/800-m plot/60-min survey. Waterbirds accounted for less than 0.1% of overall use and were observed during 44.4% of wetland bird use surveys (Table 6).

5.2.2.3 Waterfowl

Waterfowl use was higher (648.67 observations/800-m plot/60-min survey) than any other bird type recorded (Table 6). Waterfowl represented 95.6% of overall use and waterfowl were observed during every wetland bird survey (100.0%; Table 6).

5.2.2.4 Shorebirds

Shorebird use was 0.22 observation/800-m plot/60-min survey and represented <0.1% of overall use (Table 6). Shorebirds were observed during 22.2% of the wetland bird use surveys (Table 6).

5.2.2.5 Gulls/Terns

Gulls/terns use was 5.44 observations/800-m plot/60-min survey. Gulls/terns accounted for 0.8% of overall use and were observed during 55.6% of wetland bird use surveys (Table 6).

5.2.2.6 Rails/Coots

Rail/coot use was 9.00 observations/800-m plot/60-min survey and represented 1.3% of overall use (Table 6). Rails/Coots were observed during 22.2% of the wetland bird use surveys (Table 6).

5.2.2.7 Diurnal Raptors

Diurnal raptor use was 0.33 observation/800-m plots/60-min survey (Table 6), including both red-tailed hawks (0.22 observation/800-m plot/60-min survey) and Swainson's hawks (*Buteo swainsoni;* 0.11 observation/800-m plot/60-min survey). Diurnal raptors comprised less than 0.1% of overall use during the wetland bird survey, with red-tailed hawks representing 71.4% of diurnal raptors observed. Diurnal raptors were observed during 22.2% of wetland bird use surveys (Table 6).

5.2.2.8 Upland Game Birds

Upland game bird use was 0.56 observation/800-m plot/60-min survey. Upland game birds accounted for less than 0.1% of overall use and were observed during 22.2% of wetland bird use surveys (Table 6).

5.2.2.9 Large Corvids

Large corvid use was 0.22 observation/800-m plot/60-min survey and comprised <0.1% of overall use (Table 6). Large corvids were observed during 11.1% of the wetland bird use surveys (Table 6).

5.2.3 Flight Height Characteristics

A total of 1,323 large bird observations in 119 groups were observed flying within 800-m (2,625-ft) plots. Of these, 20.4% were recorded in the estimated RSH. Waterfowl were the most commonly recorded bird type within survey plots (1,231 observations in 99 groups), with 20.8% of flying waterfowl within the estimated RSH (Table 7). Only two observations of diurnal raptors were recorded within survey plots, and none were within the RSH (Table 7).

Table 7. Flight height characteristics by large bird type and raptor subtype of large birds observed during wetland bird use surveys at the Bitter Root Wind Energy Project from March 16 – May 15, 2016.

			Mean Flight Height of Groups			% of Groups within Flight Height Categories		
Bird Type	**# Groups Flying**	**# Obs Flying**	**Height meters (m)**	**Height feet (ft)**	**% of Total Obs Flying**	**0 - 25 m (0 - 82 ft)**	**25 - 150 m (82 - 492 ft)[2]**	**> 150 m (> 492 ft)**
Loons/Grebes	0	0	0	0	0	0	0	0
Waterbirds	8	40	14.8	48.4	33.3	80.0	20.0	0
Waterfowl	99	1,231	19.4	63.8	21.1	46.7	20.8	32.5
Shorebirds	1	1	10.0	32.8	50.0	100.0	0	0
Gulls/Terns	9	49	16.7	54.7	100	87.8	12.2	0
Rails/Coots	0	0	0	0	0	0	0	0
Diurnal Raptors	2	2	12.5	41.0	66.7	100.0	0	0
Buteos	2	2	12.5	41.0	66.7	100.0	0	0
Upland Game Birds	0	0	0	0	0	0	0	0
Large Corvids	0	0	0	0	0	0	0	0
Large Birds Overall	**119**	**1,323**	**18.7**	**61.4**	**21.7**	**49.4**	**20.4**	**30.2**

[1] likely rotor-swept height is 25–150 m (82–492 ft) above ground level
Note: Obs = observations

5.2.4 Wetland Bird Spatial Use

Waterfowl were observed at all three observation points, with bird use highest at Point 1 (1,482.00 observations/800-m plot/60-min survey) followed by Point 3 (306.33 observations/800-m plot/60-min survey) and Point 2 (157.67 observations/800-m plot/60-m survey; Table 8 and Appendix E). Waterbird use was highest at Point 3 (29.33 observations/800-m plot/60-min survey) followed by Point 2 (7.67 observations/800-m plot/60-min survey) and Point 1 (3.0 observations/800-m plot/60-min survey; Table 8 and Appendix E). Shorebirds were observed only at Point 2 (0.67 observation/800-m plot/60-min survey), but not at Point 1 or Point 3 (Table 8 and Appendix E). Rails/Coots were observed only at Point 3 (27.00 observations/800-m plot/60-min survey; Table 8 and Appendix E). Diurnal raptors were observed at points 1 and 2, with use higher at Point 2 (0.67 observation/800-m plot/60-min survey) compared to Point 1 (0.33 observation/800-m plot/60-min survey; Table 8 and Appendix E). All diurnal raptors observed within the 800-m plots were Buteos (Table 8 and Appendix E). Large corvids were only observed at Point 2 (0.67 observation/800-m plot/60-min survey; Table 8 and Appendix E).

Table 8. Bird use (mean number of observations/800-m plot/60-min survey) by point for large bird types and raptor subtypes during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.

	Survey Point		
Bird Type	**1**	**2**	**3**
Loons/Grebes	0.67	0.33	0.33
Waterbirds	3.00	7.67	29.33
Waterfowl	1482.00	157.67	306.33
Shorebirds	0	0.67	0
Gulls/Terns	10.00	0	6.33
Rails/Coots	0	0	27.00
Diurnal Raptors	0.33	0.67	0
Buteos	0.33	0.67	0
Upland Game Birds	0	0.67	1.00
Large Corvids	0	0.67	0
Overall	**1,496.00**	**168.33**	**370.33**

5.3 Threatened, Endangered, and Sensitive Species Observations

No federal threatened or endangered species were observed during the bird use surveys or incidentally; however, 12 sensitive species were observed (Table 9). American white pelican, a state-listed Species of Greatest Conservation Need in South Dakota and Species of Special Concern in Minnesota, comprised the majority of sensitive species observations, with 554 observations. Other notable observations of sensitive species included 50 observations of bald eagles, which are a Species of Greatest Conservation Need in South Dakota and protected under the BGEPA (1940), and 42 observations of great blue herons (*Ardea herodias*), which are a level 4 state listed species in South Dakota (Table 9). Three other sensitive diurnal raptor species were observed during fixed-point surveys, including osprey (*Pandion haliaetus*; one observation), sharp-shinned hawk (*Accipiter striatus;* one observation) and Swainson's hawk (four observations; Table 9). One diurnal raptor (northern harrier) was observed incidentally (Table 9). Additional sensitive species were observed during bird use surveys, including common loon (one observation), common merganser (*Mergus merganser*; two observations), great egret (*Ardea alba*; 10 observations), green heron (*Butorides virescens*; one observation), trumpeter swan (*Cygnus buccinators*; four observations), and yellow-crowned night heron (*Nyctanassa violacea*; one observation; Table 9).

Table 9. Summary of sensitive species observed at the Bitter Root Wind Energy Project area during fixed-point bird use surveys (FP) and as incidental wildlife observations (Inc.) from March 03, 2016 – January 23, 2017.

		Status		FP		Inc.		Total	
Species	**Scientific Name**	**MN**	**SD**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**
American white pelican	*Pelecanus erythrorhynchos*	SSC	SGCN, S3	98	554	0	0	98	554
bald eagle	*Haliaeetus leucocephalus*	BGEPA	BGEPA, SGCN, S1	26	26	20	24	46	50
common loon	*Gavia immer*		S1	1	1	0	0	1	1
common merganser	*Mergus merganser*		S2	1	2	0	0	1	2
great blue heron	*Ardea herodias*		S4	34	42	0	0	34	42
great egret	*Ardea alba*		S3	6	10	0	0	6	10
green heron	*Butorides virescens*		S2	1	1	0	0	1	1
osprey	*Pandion haliaetus*		ST, SGCN, S1	0	0	1	1	1	1
sharp-shinned hawk	*Accipiter striatus*		S3	1	1	0	0	1	1
Swainson's hawk	*Buteo swainsoni*		S4	4	4	0	0	4	4
trumpeter swan	*Cygnus buccinator*	SSC	S3	0	0	2	4	2	4
yellow-crowned night heron	*Nyctanassa violacea*		SU	1	1	0	0	1	1
Total	**12 species**			**173**	**642**	**23**	**29**	**196**	**671**

SGCN = Species of Greatest Conservation Need (South Dakota Wildlife Action Plan 2014), S1 = State Critically Imperiled, S2 = State Imperiled , S3 = State Very Rare, S4 = Rare in parts of range , SU = State Status Uncertain (South Dakota Department of Game, Fish, and Parks[SDDGFP] Natural Heritage Program 2016), ST = State Threatened (SDGFP 2016), SSC = Species of Special Concern (MNDNR 2013),BGEPA = Bald and Golden Eagle Protection Act (BGEPA 1940)

Note: grps = groups, obs = observations

5.4 Incidental Observations

Nine bird species were incidentally observed outside of the standardized fixed-point use surveys, totaling 1,037 observations within 30 separate groups (Table 10). These included 24 observations of bald eagles in 20 groups.

Table 10. Wildlife species incidentally observed outside of the standardized fixed point use surveys at the Bitter Root Wind Energy Project site from March 3, 2016 – January 23, 2017.

Species	Scientific Name	# grps	# obs
mallard	*Anas platyrhynchos*	1	2
snow goose	*Chen caerulescens*	1	1,000
trumpeter swan	*Cygnus buccinator*	2	4
American avocet	*Recurvirostra americana*	1	1
bald eagle	*Haliaeetus leucocephalus*	20	24
osprey	*Pandion haliaetus*	1	1
red-tailed hawk	*Buteo jamaicensis*	2	2
great horned owl	*Bubo virginianus*	1	1
horned lark	*Eremophila alpestris*	1	2
Bird Subtotal	**9 species**	**30**	**1,037**

Note: obs = observations, grps = groups

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Appendix A. All Bird Types and Species Observed at the Bitter Root Wind Energy Project during Fixed-Point Bird Use Surveys from March 3, 2016 – January 23, 2017

Appendix A. Summary of individuals and group observations by bird type and species for fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Loons/Grebes		**1**	**1**	**1**	**1**	**1**	**4**	**0**	**0**	**3**	**6**
common loon	*Gavia immer*	1	1	0	0	0	0	0	0	1	1
unidentified grebe		0	0	0	0	1	4	0	0	1	4
unidentified loon	*Gavia* spp.	0	0	1	1	0	0	0	0	1	1
Waterbirds		**28**	**83**	**106**	**500**	**25**	**199**	**0**	**0**	**159**	**782**
American white pelican	*Pelecanus erythrorhynchos*	15	62	73	374	10	118	0	0	98	554
double-crested cormorant	*Phalacrocorax auritus*	3	8	10	94	4	67	0	0	17	169
great blue heron	*Ardea herodias*	8	8	19	27	7	7	0	0	34	42
great egret	*Ardea alba*	0	0	2	3	4	7	0	0	6	10
green heron	*Butorides virescens*	0	0	1	1	0	0	0	0	1	1
unidentified waterbird	NA	2	5	0	0	0	0	0	0	2	5
yellow-crowned night heron	*Nyctanassa violacea*	0	0	1	1	0	0	0	0	1	1
Waterfowl		**257**	**9758**	**48**	**259**	**66**	**1154**	**23**	**862**	**394**	**12033**
American black duck	*Anas rubripes*	1	1	0	0	0	0	0	0	1	1
American wigeon	*Anas americana*	1	1	0	0	0	0	0	0	1	1
blue-winged teal	*Anas discors*	18	302	6	20	0	0	0	0	24	322
bufflehead	*Bucephala albeola*	3	6	0	0	1	8	0	0	4	14
cackling goose	*Branta hutchinsii*	1	3	0	0	0	0	0	0	1	3
Canada goose	*Branta canadensis*	50	460	13	66	29	778	14	412	106	1716
canvasback	*Aythya valisineria*	5	703	0	0	0	0	0	0	5	703
common goldeneye	*Bucephala clangula*	1	10	0	0	0	0	0	0	1	10
common merganser	*Mergus merganser*	1	2	0	0	0	0	0	0	1	2
gadwall	*Anas strepera*	3	108	0	0	0	0	0	0	3	108
greater scaup	*Aythya marila*	2	58	0	0	0	0	0	0	2	58
green-winged teal	*Anas crecca*	2	5	0	0	3	21	0	0	5	26
lesser scaup	*Aythya affinis*	1	5	0	0	0	0	0	0	1	5
mallard	*Anas platyrhynchos*	44	587	14	140	14	79	2	2	74	808
northern pintail	*Anas acuta*	2	6	0	0	0	0	0	0	2	6
northern shoveler	*Anas clypeata*	13	118	0	0	0	0	1	6	14	124
redhead	*Aythya americana*	4	106	0	0	0	0	0	0	4	106
ring-necked duck	*Aythya collaris*	2	33	0	0	0	0	0	0	2	33
ruddy duck	*Oxyura jamaicensis*	1	10	0	0	0	0	0	0	1	10
snow goose	*Chen caerulescens*	1	1200	0	0	0	0	0	0	1	1200
unidentified duck	NA	79	2915	14	30	16	204	5	392	114	3541
unidentified goose	NA	2	4	0	0	2	62	0	0	4	66

Appendix A. Summary of individuals and group observations by bird type and species for fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified scaup	*Aythya* spp.	5	160	0	0	0	0	0	0	5	160
unidentified waterfowl	NA	15	2955	0	0	0	0	1	50	16	3005
wood duck	*Aix sponsa*	0	0	1	3	1	2	0	0	2	5
Shorebirds		**13**	**18**	**2**	**6**	**4**	**26**	**0**	**0**	**19**	**50**
killdeer	*Charadrius vociferus*	12	15	1	3	1	22	0	0	14	40
unidentified shorebird	NA	0	0	1	3	2	2	0	0	3	5
unidentified yellowlegs	*Tringa* spp.	0	0	0	0	1	2	0	0	1	2
Wilson's snipe	*Gallinago delicata*	1	3	0	0	0	0	0	0	1	3
Gulls/Terns		**16**	**107**	**19**	**101**	**47**	**3148**	**0**	**0**	**82**	**3356**
Franklin's gull	*Leucophaeus pipixcan*	0	0	1	2	13	2134	0	0	14	2136
Herring gull	*Larus argentatus*	2	21	17	98	10	50	0	0	29	169
ring-billed gull	*Larus delawarensis*	1	1	0	0	7	288	0	0	8	289
unidentified gull	NA	13	85	1	1	17	676	0	0	31	762
Rails/Coots		**5**	**419**	**3**	**6**	**0**	**0**	**0**	**0**	**8**	**425**
American coot	*Fulica americana*	4	418	2	5	0	0	0	0	6	423
sora	*Porzana carolina*	1	1	1	1	0	0	0	0	2	2
Diurnal Raptors		**83**	**88**	**63**	**68**	**102**	**133**	**29**	**30**	**277**	**319**
Accipiters		*2*	*2*	*1*	*1*	*1*	*1*	*0*	*0*	*4*	*4*
sharp-shinned hawk	*Accipiter striatus*	0	0	0	0	1	1	0	0	1	1
unidentified accipiter	*Accipiter* spp.	2	2	1	1	0	0	0	0	3	3
Buteos		*27*	*31*	*33*	*34*	*60*	*83*	*15*	*15*	*135*	*163*
red-tailed hawk	*Buteo jamaicensis*	24	26	26	27	50	53	9	9	109	115
rough-legged hawk	*Buteo lagopus*	0	0	0	0	0	0	2	2	2	2
Swainson's hawk	*Buteo swainsoni*	1	1	3	3	0	0	0	0	4	4
unidentified Buteo	*Buteo* spp.	2	4	4	4	10	30	4	4	20	42
Northern Harrier		*13*	*13*	*10*	*10*	*4*	*4*	*0*	*0*	*27*	*27*
northern harrier	*Circus cyaneus*	13	13	10	10	4	4	0	0	27	27
Eagles		*8*	*8*	*2*	*2*	*11*	*11*	*5*	*5*	*26*	*26*
bald eagle	*Haliaeetus leucocephalus*	8	8	2	2	11	11	5	5	26	26
Falcons		*1*	*1*	*4*	*5*	*2*	*2*	*1*	*1*	*8*	*9*
American kestrel	*Falco sparverius*	1	1	4	5	2	2	1	1	8	9
Other Raptors		*32*	*33*	*13*	*16*	*24*	*32*	*8*	*9*	*77*	*90*
unidentified hawk	NA	5	6	4	5	12	14	4	4	25	29
unidentified raptor	NA	27	27	9	11	12	18	4	5	52	61
Owls		**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**

Appendix A. Summary of individuals and group observations by bird type and species for fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
great horned owl	*Bubo virginianus*	0	0	0	0	0	0	2	2	2	2
Vultures		**38**	**56**	**69**	**101**	**39**	**71**	**0**	**0**	**146**	**228**
turkey vulture	*Cathartes aura*	38	56	69	101	39	71	0	0	146	228
Upland Game Birds		**17**	**33**	**6**	**7**	**4**	**4**	**9**	**38**	**36**	**82**
ring-necked pheasant	*Phasianus colchicus*	16	32	6	7	4	4	6	33	32	76
wild turkey	*Meleagris gallopavo*	1	1	0	0	0	0	3	5	4	6
Doves/Pigeons		**7**	**16**	**9**	**16**	**2**	**5**	**5**	**101**	**23**	**138**
mourning dove	*Zenaida macroura*	3	7	8	14	0	0	0	0	11	21
rock pigeon	*Columba livia*	4	9	1	2	2	5	5	101	12	117
Large Corvids		**41**	**55**	**17**	**37**	**21**	**109**	**31**	**61**	**110**	**262**
American crow	*Corvus brachyrhynchos*	41	55	17	37	21	109	31	61	110	262
Goatsuckers		**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**2**	**4**
common nighthawk	*Chordeiles minor*	0	0	2	4	0	0	0	0	2	4
Passerines		**114**	**1,019**	**238**	**485**	**57**	**3,193**	**35**	**444**	**444**	**5,141**
American goldfinch	*Spinus tristis*	1	2	27	67	7	12	0	0	35	81
American robin	*Turdus migratorius*	9	18	10	14	1	3	1	1	21	36
American tree sparrow	*Spizella arborea*	0	0	0	0	0	0	2	18	2	18
Baltimore oriole	*Icterus galbula*	0	0	2	2	0	0	0	0	2	2
barn swallow	*Hirundo rustica*	4	11	17	33	7	38	0	0	28	82
blue jay	*Cyanocitta cristata*	3	9	1	2	2	3	4	5	10	19
bobolink	*Dolichonyx oryzivorus*	2	6	6	11	0	0	0	0	8	17
Brewer's blackbird	*Euphagus cyanocephalus*	1	3	0	0	0	0	0	0	1	3
brown-headed cowbird	*Molothrus ater*	5	14	10	24	0	0	0	0	15	38
brown thrasher	*Toxostoma rufum*	1	1	1	1	0	0	0	0	2	2
chipping sparrow	*Spizella passerina*	0	0	4	7	0	0	0	0	4	7
clay-colored sparrow	*Spizella pallida*	3	5	10	12	0	0	0	0	13	17
cliff swallow	*Petrochelidon pyrrhonota*	2	5	13	54	0	0	0	0	15	59
common grackle	*Quiscalus quiscula*	11	105	15	39	3	5	0	0	29	149
common yellowthroat	*Geothlypis trichas*	0	0	9	17	1	2	0	0	10	19
dark-eyed junco	*Junco hyemalis*	0	0	0	0	1	3	0	0	1	3
dickcissel	*Spiza americana*	0	0	5	12	0	0	0	0	5	12
eastern bluebird	*Sialia sialis*	1	2	1	1	0	0	0	0	2	3
eastern kingbird	*Tyrannus tyrannus*	0	0	12	18	0	0	0	0	12	18
European starling	*Sturnus vulgaris*	5	626	2	3	5	3,010	0	0	12	3,639
grasshopper sparrow	*Ammodramus savannarum*	2	3	8	13	0	0	0	0	10	16

Appendix A. Summary of individuals and group observations by bird type and species for fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
gray catbird	*Dumetella carolinensis*	0	0	1	1	1	1	0	0	2	2
horned lark	*Eremophila alpestris*	7	12	7	10	1	1	5	39	20	62
house sparrow	*Passer domesticus*	2	3	1	3	0	0	0	0	3	6
indigo bunting	*Passerina cyanea*	0	0	1	1	0	0	0	0	1	1
Lapland longspur	*Calcarius lapponicus*	2	5	0	0	0	0	2	3	4	8
lark sparrow	*Chondestes grammacus*	1	1	0	0	0	0	0	0	1	1
marsh wren	*Cistothorus palustris*	0	0	1	4	1	1	0	0	2	5
red-winged blackbird	*Agelaius phoeniceus*	16	78	15	41	2	20	3	330	36	469
Savannah sparrow	*Passerculus sandwichensis*	0	0	2	3	0	0	0	0	2	3
sedge wren	*Cistothorus platensis*	0	0	6	8	0	0	0	0	6	8
snow bunting	*Plectrophenax nivalis*	0	0	0	0	0	0	1	1	1	1
song sparrow	*Melospiza melodia*	3	4	3	3	0	0	0	0	6	7
tree swallow	*Tachycineta bicolor*	0	0	2	2	0	0	0	0	2	2
unidentified Icterid		0	0	1	1	1	53	0	0	2	54
unidentified passerine		6	56	15	21	12	25	13	42	46	144
unidentified sparrow		5	7	13	26	6	8	3	4	27	45
unidentified swallow		1	1	0	0	1	2	0	0	2	3
vesper sparrow	*Pooecetes gramineus*	5	8	5	5	0	0	0	0	10	13
western kingbird	*Tyrannus verticalis*	0	0	1	2	0	0	0	0	1	2
western meadowlark	*Sturnella neglecta*	13	26	8	16	4	5	1	1	26	48
white-eyed vireo	*Vireo griseus*	0	0	1	1	0	0	0	0	1	1
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	3	8	2	7	1	1	0	0	6	16
Woodpeckers		**5**	**5**	**4**	**5**	**1**	**1**	**1**	**1**	**11**	**12**
hairy woodpecker	*Picoides villosus*	0	0	1	2	0	0	0	0	1	2
northern flicker	*Colaptes auratus*	4	4	1	1	1	1	0	0	6	6
red-bellied woodpecker	*Melanerpes carolinus*	1	1	0	0	0	0	0	0	1	1
red-headed woodpecker	*Melanerpes erythrocephalus*	0	0	1	1	0	0	1	1	2	2
yellow-bellied sapsucker	*Sphyrapicus varius*	0	0	1	1	0	0	0	0	1	1
Unidentified Birds		**2**	**16**	**0**	**0**	**1**	**7**	**0**	**0**	**3**	**23**
unidentified bird		2	16	0	0	1	7	0	0	3	23
Overall		**627**	**11,674**	**587**	**1,596**	**370**	**8,054**	**135**	**1,539**	**1,719**	**22,863**

Note: grps = groups, obs = observations

Appendix B. Mean Use, Percent of Use, and Frequency of Occurrence for Large and Small Birds Observed during Fixed-Point Bird Use Surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Loons/Grebes	**0.02**	**0.02**	**0.11**	**0**	**<0.1**	**0.2**	**0.1**	**0**	**1.9**	**1.9**	**2.8**	**0**
common loon	0.02	0	0	0	<0.1	0	0	0	1.9	0	0	0
unidentified grebe	0	0	0.11	0	0	0	0.1	0	0	0	2.8	0
unidentified loon	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
Waterbirds	**0.94**	**3.65**	**0.63**	**0**	**1.1**	**32.6**	**0.8**	**0**	**18.5**	**37.0**	**15.9**	**0**
American white pelican	0.61	3.00	0.36	0	0.7	26.8	0.4	0	9.3	18.5	5.6	0
double-crested cormorant	0.13	0.09	0	0	0.2	0.8	0	0	1.9	7.4	0	0
great blue heron	0.11	0.46	0.16	0	0.1	4.1	0.2	0	9.3	16.7	13.1	0
great egret	0	0.06	0.11	0	0	0.5	0.1	0	0	3.7	5.2	0
green heron	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
unidentified waterbird	0.09	0	0	0	0.1	0	0	0	3.7	0	0	0
yellow-crowned night heron	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
Waterfowl	**73.50**	**3.96**	**12.28**	**5.65**	**86.1**	**35.4**	**14.8**	**66.8**	**64.8**	**25.9**	**37.7**	**11.1**
American black duck	0.02	0	0	0	<0.1	0	0	0	1.9	0	0	0
American wigeon	0.02	0	0	0	<0.1	0	0	0	1.9	0	0	0
blue-winged teal	5.59	0.37	0	0	6.6	3.3	0	0	18.5	9.3	0	0
bufflehead	0.11	0	0.19	0	0.1	0	0.2	0	5.6	0	2.4	0
cackling goose	0.06	0	0	0	<0.1	0	0	0	1.9	0	0	0
Canada goose	8.26	0.65	8.17	5.52	9.7	5.8	9.9	65.3	37.0	11.1	15.5	9.5
canvasback	5.61	0	0	0	6.6	0	0	0	3.7	0	0	0
common goldeneye	0.19	0	0	0	0.2	0	0	0	1.9	0	0	0
common merganser	0.04	0	0	0	<0.1	0	0	0	1.9	0	0	0
gadwall	2.00	0	0	0	2.3	0	0	0	3.7	0	0	0
greater scaup	1.07	0	0	0	1.3	0	0	0	3.7	0	0	0
green-winged teal	0.09	0	0.58	0	0.1	0	0.7	0	3.7	0	5.2	0
lesser scaup	0.09	0	0	0	0.1	0	0	0	1.9	0	0	0
mallard	10.83	2.59	2.17	0.03	12.7	23.2	2.6	0.4	35.2	14.8	20.6	3.2
northern pintail	0.11	0	0	0	0.1	0	0	0	1.9	0	0	0
northern shoveler	2.19	0	0	0.10	2.6	0	0	1.1	11.1	0	0	1.6
redhead	1.96	0	0	0	2.3	0	0	0	5.6	0	0	0
ring-necked duck	0.61	0	0	0	0.7	0	0	0	3.7	0	0	0
ruddy duck	0.19	0	0	0	0.2	0	0	0	1.9	0	0	0
unidentified duck	31.5	0.30	1.12	0	36.9	2.6	1.3	0	31.5	11.1	12.7	0
unidentified scaup	2.96	0	0	0	3.5	0	0	0	3.7	0	0	0
wood duck	0	0.06	0.06	0	0	0.5	<0.1	0	0	1.9	2.8	0

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Shorebirds	**0.33**	**0.11**	**0.63**	**0**	**0.4**	**1.0**	**0.8**	**0**	**24.1**	**3.7**	**7.5**	**0**
killdeer	0.28	0.06	0.52	0	0.3	0.5	0.6	0	22.2	1.9	2.4	0
unidentified shorebird	0	0.06	0.05	0	0	0.5	<0.1	0	0	1.9	4.8	0
unidentified yellowlegs	0	0	0.06	0	0	0	<0.1	0	0	0	2.8	0
Wilson's snipe	0.06	0	0	0	<0.1	0	0	0	1.9	0	0	0
Gulls/Terns	**0.52**	**1.76**	**64.89**	**0**	**0.6**	**15.7**	**78.4**	**0**	**9.3**	**20.4**	**31.7**	**0**
Franklin's gull	0	0.04	54.2	0	0	0.3	65.5	0	0	1.9	15.9	0
Herring gull	0.39	1.72	0.28	0	0.5	15.4	0.3	0	3.7	18.5	11.1	0
ring-billed gull	0.02	0	4.48	0	<0.1	0	5.4	0	1.9	0	7.1	0
unidentified gull	0.11	0	5.94	0	0.1	0	7.2	0	5.6	0	7.9	0
Rails/Coots	**7.76**	**0.11**	**0**	**0**	**9.1**	**1.0**	**0**	**0**	**7.4**	**5.6**	**0**	**0**
American coot	7.74	0.09	0	0	9.1	0.8	0	0	5.6	3.7	0	0
sora	0.02	0.02	0	0	<0.1	0.2	0	0	1.9	1.9	0	0
Diurnal Raptors	**0.48**	**0.61**	**1.10**	**0.14**	**0.6**	**5.5**	**1.3**	**1.7**	**29.6**	**35.2**	**58.3**	**14.3**
Accipiters	*0*	*0.02*	*0.02*	*0*	*0*	*0.2*	*<0.1*	*0*	*0*	*1.9*	*2.4*	*0*
sharp-shinned hawk	0	0	0.02	0	0	0	<0.1	0	0	0	2.4	0
unidentified accipiter	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
Buteos	*0.26*	*0.30*	*0.88*	*0.11*	*0.3*	*2.6*	*1.1*	*1.3*	*14.8*	*22.2*	*45.6*	*11.1*
red-tailed hawk	0.24	0.22	0.86	0.08	0.3	2.0	1.0	0.9	14.8	18.5	45.6	7.9
rough-legged hawk	0	0	0	0.03	0	0	0	0.4	0	0	0	3.2
Swainson's hawk	0.02	0.06	0	0	<0.1	0.5	0	0	1.9	3.7	0	0
unidentified Buteo	0	0.02	0.02	0	0	0.2	<0.1	0	0	1.9	2.4	0
Northern Harrier	0.20	0.17	0.10	0	0.2	1.5	0.1	0	14.8	13.0	7.5	0
northern harrier	0.20	0.17	0.10	0	0.2	1.5	0.1	0	14.8	13.0	7.5	0
Eagles	*0*	*0*	*0*	*0.02*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*1.6*
bald eagle	0	0	0	0.02	0	0	0	0.2	0	0	0	1.6
Falcons	*0.02*	*0.09*	*0.05*	*0.02*	*<0.1*	*0.8*	*<0.1*	*0.2*	*1.9*	*7.4*	*5.2*	*1.6*
American kestrel	0.02	0.09	0.05	0.02	<0.1	0.8	<0.1	0.2	1.9	7.4	5.2	1.6
Other Raptors	*0*	*0.04*	*0.05*	*0*	*0*	*0.3*	*<0.1*	*0*	*0*	*3.7*	*4.8*	*0*
unidentified hawk	0	0.04	0.05	0	0	0.3	<0.1	0	0	3.7	4.8	0
Owls	**0**	**0**	**0**	**0.03**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0**	**3.2**
great horned owl	0	0	0	0.03	0	0	0	0.4	0	0	0	3.2
Vultures	**0.28**	**0.26**	**0.61**	**0**	**0.3**	**2.3**	**0.7**	**0**	**11.1**	**18.5**	**13.9**	**0**
turkey vulture	0.28	0.26	0.61	0	0.3	2.3	0.7	0	11.1	18.5	13.9	0
Upland Game Birds	**0.61**	**0.13**	**0.11**	**0.57**	**0.7**	**1.2**	**0.1**	**6.8**	**27.8**	**11.1**	**10.7**	**11.1**

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
ring-necked pheasant	0.59	0.13	0.11	0.52	0.7	1.2	0.1	6.2	27.8	11.1	10.7	9.5
wild turkey	0.02	0	0	0.05	<0.1	0	0	0.6	1.9	0	0	3.2
Doves/Pigeons	**0.30**	**0.30**	**0.12**	**1.60**	**0.3**	**2.6**	**0.1**	**18.9**	**13.0**	**14.8**	**5.2**	**7.9**
mourning dove	0.13	0.26	0	0	0.2	2.3	0	0	5.6	14.8	0	0
rock pigeon	0.17	0.04	0.12	1.60	0.2	0.3	0.1	18.9	7.4	1.9	5.2	7.9
Large Corvids	**0.61**	**0.20**	**2.33**	**0.46**	**0.7**	**1.8**	**2.8**	**5.4**	**35.2**	**14.8**	**19.8**	**15.9**
American crow	0.61	0.20	2.33	0.46	0.7	1.8	2.8	5.4	35.2	14.8	19.8	15.9
Goatsuckers	**0**	**0.07**	**0**	**0**	**0**	**0.7**	**0**	**0**	**0**	**3.7**	**0**	**0**
common nighthawk	0	0.07	0	0	0	0.7	0	0	0	3.7	0	0
Overall	**85.35**	**11.19**	**82.81**	**8.46**	**100.0**	**100.0**	**100.0**	**100.0**				

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**11.41**	**8.98**	**61.16**	**7.03**	**96.9**	**99.2**	**100**	**99.8**	**64.8**	**92.6**	**67.5**	**39.7**
American goldfinch	0.04	1.24	0.33	0	0.3	13.7	0.5	0	1.9	50.0	19.0	0
American robin	0.33	0.26	0.08	0	2.8	2.9	0.1	0	16.7	18.5	2.8	0
American tree sparrow	0	0	0	0.29	0	0	0	4.1	0	0	0	3.2
Baltimore oriole	0	0.04	0	0	0	0.4	0	0	0	3.7	0	0
barn swallow	0.20	0.61	1.04	0	1.7	6.7	1.7	0	7.4	31.5	19.0	0
blue jay	0.17	0.04	0.08	0.08	1.4	0.4	0.1	1.1	5.6	1.9	5.2	6.3
bobolink	0.11	0.20	0	0	0.9	2.2	0	0	3.7	11.1	0	0
brown-headed cowbird	0.26	0.44	0	0	2.2	4.9	0	0	9.3	18.5	0	0
brown thrasher	0.02	0.02	0	0	0.2	0.2	0	0	1.9	1.9	0	0
chipping sparrow	0	0.13	0	0	0	1.4	0	0	0	7.4	0	0
clay-colored sparrow	0.09	0.22	0	0	0.8	2.5	0	0	5.6	18.5	0	0
cliff swallow	0.09	1.00	0	0	0.8	11.0	0	0	3.7	24.1	0	0
common grackle	1.94	0.72	0.12	0	16.5	8.0	0.2	0	20.4	27.8	7.1	0
common yellowthroat	0	0.31	0.06	0	0	3.5	<0.1	0	0	16.7	2.8	0
dark-eyed junco	0	0	0.07	0	0	0	0.1	0	0	0	2.4	0
dickcissel	0	0.22	0	0	0	2.5	0	0	0	9.3	0	0
eastern bluebird	0.04	0.02	0	0	0.3	0.2	0	0	1.9	1.9	0	0
eastern kingbird	0	0.33	0	0	0	3.7	0	0	0	22.2	0	0
European starling	4.19	0.06	56.23	0	35.5	0.6	91.9	0	7.4	3.7	10.3	0
grasshopper sparrow	0.06	0.24	0	0	0.5	2.7	0	0	3.7	14.8	0	0
gray catbird	0	0.02	0.03	0	0	0.2	<0.1	0	0	1.9	2.8	0
horned lark	0.22	0.19	0.02	0.62	1.9	2.0	<0.1	8.8	13.0	13.0	2.4	7.9
house sparrow	0.06	0.06	0	0	0.5	0.6	0	0	3.7	1.9	0	0
indigo bunting	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
Lapland longspur	0.09	0	0	0.05	0.8	0	0	0.7	3.7	0	0	3.2
lark sparrow	0.02	0	0	0	0.2	0	0	0	1.9	0	0	0
marsh wren	0	0.07	0.03	0	0	0.8	<0.1	0	0	1.9	2.8	0
red-winged blackbird	1.44	0.76	0.56	5.24	12.3	8.4	0.9	74.3	29.6	27.8	5.6	1.6
Savannah sparrow	0	0.06	0	0	0	0.6	0	0	0	3.7	0	0
sedge wren	0	0.15	0	0	0	1.6	0	0	0	11.1	0	0
snow bunting	0	0	0	0.02	0	0	0	0.2	0	0	0	1.6
song sparrow	0.07	0.06	0	0	0.6	0.6	0	0	5.6	5.6	0	0
tree swallow	0	0.04	0	0	0	0.4	0	0	0	3.7	0	0
unidentified Icterid	0	0.02	1.47	0	0	0.2	2.4	0	0	1.9	2.8	0

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
unidentified passerine	1.04	0.39	0.63	0.67	8.8	4.3	1.0	9.5	7.4	18.5	27.4	19.0
unidentified sparrow	0.13	0.48	0.21	0.06	1.1	5.3	0.3	0.9	9.3	22.2	15.5	4.8
unidentified swallow	0.02	0	0.05	0	0.2	0	<0.1	0	1.9	0	2.4	0
vesper sparrow	0.15	0.09	0	0	1.3	1.0	0	0	9.3	9.3	0	0
western kingbird	0	0.04	0	0	0	0.4	0	0	0	1.9	0	0
western meadowlark	0.48	0.30	0.13	0.02	4.1	3.3	0.2	0.2	24.1	14.8	10.3	1.6
white-eyed vireo	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
yellow-headed blackbird	0.15	0.13	0.03	0	1.3	1.4	<0.1	0	5.6	3.7	2.8	0
Woodpeckers	**0.09**	**0.07**	**0.03**	**0.02**	**0.8**	**0.8**	**<0.1**	**0.2**	**7.4**	**5.6**	**2.8**	**1.6**
hairy woodpecker	0	0.04	0	0	0	0.4	0	0	0	1.9	0	0
northern flicker	0.07	0	0.03	0	0.6	0	<0.1	0	5.6	0	2.8	0
red-bellied woodpecker	0.02	0	0	0	0.2	0	0	0	1.9	0	0	0
red-headed woodpecker	0	0.02	0	0.02	0	0.2	0	0.2	0	1.9	0	1.6
yellow-bellied sapsucker	0	0.02	0	0	0	0.2	0	0	0	1.9	0	0
Unidentified Birds	**0.28**	**0**	**0**	**0**	**2.4**	**0**	**0**	**0**	**1.9**	**0**	**0**	**0**
unidentified large bird	0.28	0	0	0	2.4	0	0	0	1.9	0	0	0
Overall	**11.78**	**9.06**	**61.19**	**7.05**	**100.0**	**100.0**	**100.0**	**100.0**				

Appendix C. Flight Height Characteristics for Large and Small Birds during Fixed-Point Bird Use Surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017

Appendix C1. Flight characteristics for each large bird species[a] during the fixed-point[b] bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[c] based on initial obs	% Within RSH at anytime
Franklin's gull	14	10.55	100	76.6	8.08
unidentified duck	40	8.23	12.3	52.8	0.53
Canada goose	35	5.50	63.7	33.8	1.18
mallard	46	3.82	17.0	23.4	0.15
American coot	1	1.97	0.5	0	0
blue-winged teal	12	1.50	14.9	29.2	0.07
canvasback	1	1.41	1.0	0	0
unidentified gull	11	1.18	100	98.6	1.17
American white pelican	35	0.98	58.2	47.9	0.27
ring-billed gull	4	0.88	75.1	0	0
American crow	30	0.80	72.9	72.6	0.42
unidentified scaup	3	0.75	12.5	75.0	0.07
Herring gull	21	0.59	71.0	30.7	0.13
northern shoveler	7	0.58	41.9	28.8	0.07
rock pigeon	10	0.56	58.1	11.8	0.04
gadwall	0	0.50	0	0	0
redhead	1	0.49	0.9	0	0
ring-necked pheasant	5	0.36	40.8	0	0
red-tailed hawk	43	0.31	73.4	55.3	0.12
greater scaup	0	0.27	0	0	0
turkey vulture	28	0.25	94.1	87.5	0.21
killdeer	9	0.19	85.0	79.4	0.13
great blue heron	18	0.18	51.4	52.6	0.05
ring-necked duck	0	0.15	0	0	0
green-winged teal	2	0.14	26.9	0	0
northern harrier	22	0.11	91.7	22.7	0.02
mourning dove	5	0.10	42.9	55.6	0.02
bufflehead	1	0.07	14.3	0	0
double-crested cormorant	6	0.06	91.7	72.7	0.04
common goldeneye	1	0.05	100	0	0
ruddy duck	0	0.05	0	0	0
American kestrel	2	0.04	22.2	100	<0.01
northern pintail	2	0.03	100	0	0
great egret	1	0.03	14.3	100	<0.01
unidentified hawk	4	0.02	100	50.0	<0.01
unidentified shorebird	3	0.02	100	0	0
common nighthawk	2	0.02	100	50.0	<0.01
Swainson's hawk	2	0.02	50.0	100	<0.01
unidentified grebe	1	0.02	100	0	0
unidentified waterbird	1	0.02	80.0	0	0
wood duck	1	0.02	60.0	100	0.01
lesser scaup	0	0.02	0	0	0
wild turkey	0	0.02	0	0	0
cackling goose	1	0.01	100	100	0.01
Wilson's snipe	1	0.01	100	100	0.01
unidentified yellowlegs	0	0.01	0	0	0
rough-legged hawk	2	<0.01	100	100	<0.01
unidentified Buteo	2	<0.01	100	100	<0.01
bald eagle	1	<0.01	100	100	<0.01
common loon	1	<0.01	100	100	<0.01
green heron	1	<0.01	100	100	<0.01

Appendix C1. Flight characteristics for each large bird species[a] during the fixed-point[b] bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[c] based on initial obs	% Within RSH at anytime
sharp-shinned hawk	1	<0.01	100	100	<0.01
sora	1	<0.01	50.0	0	0
unidentified accipiter	1	<0.01	100	0	0
American black duck	0	<0.01	0	0	0
American wigeon	0	<0.01	0	0	0
common merganser	0	<0.01	0	0	0
great horned owl	0	<0.01	0	0	0
unidentified loon	0	<0.01	0	0	0
yellow-crowned night heron	0	<0.01	0	0	0

[a.] 800-m radius plot for large birds
[b.] per 60-min survey for large birds
[c.] likely "rotor swept height" for potential collision with a turbine blade, or 25–150 m (82–492 ft) above ground level
Note: Obs = observations, RSH = rotor-swept height

Appendix C2. Flight characteristics for each small bird species[a] during the fixed-point[b] bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

Species	Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[c] based on initial obs	% Within RSH at anytime
European starling	7	12.01	86.6	96.4	99.8
red-winged blackbird	31	2.24	97.9	59.3	91.9
unidentified passerine	15	0.68	69.4	72.0	95.0
unidentified Icterid	2	0.29	100	98.1	98.1
American goldfinch	25	0.39	72.8	62.7	83.1
common grackle	23	0.70	56.4	14.3	66.7
cliff swallow	15	0.28	100	16.9	79.7
barn swallow	26	0.41	75.6	12.9	50.0
blue jay	7	0.09	68.4	46.2	92.3
brown-headed cowbird	11	0.18	78.9	13.3	13.3
northern flicker	4	0.02	80.0	50.0	50.0
American robin	12	0.17	65.7	8.7	13.0
yellow-headed blackbird	4	0.08	75.0	16.7	50.0
unidentified sparrow	19	0.21	66.7	3.3	3.3
horned lark	4	0.29	56.5	2.9	2.9
western meadowlark	5	0.23	22.9	0	0
common yellowthroat	1	0.09	15.8	0	0
American tree sparrow	2	0.09	100	0	0
eastern kingbird	10	0.08	88.9	0	0
clay-colored sparrow	3	0.08	29.4	0	0
bobolink	3	0.08	41.2	0	0
grasshopper sparrow	0	0.07	0	0	0
unidentified large bird	0	0.07	0	0	0
vesper sparrow	1	0.06	15.4	0	0
dickcissel	1	0.06	50.0	0	0
Lapland longspur	1	0.04	25.0	0	0
sedge wren	0	0.04	0	0	0
song sparrow	0	0.03	0	0	0
chipping sparrow	3	0.03	85.7	0	0
house sparrow	0	0.03	0	0	0
marsh wren	0	0.02	0	0	0
Savannah sparrow	0	0.01	0	0	0
eastern bluebird	1	0.01	33.3	0	0
unidentified swallow	2	0.01	100	0	0
dark-eyed junco	1	0.01	100	0	0
gray catbird	0	0.01	0	0	0
red-headed woodpecker	1	<0.01	50.0	0	0
western kingbird	1	<0.01	100	0	100
tree swallow	2	<0.01	100	0	0
hairy woodpecker	0	<0.01	0	0	0
brown thrasher	1	<0.01	50.0	0	0
Baltimore oriole	1	<0.01	50.0	0	0
snow bunting	1	<0.01	100	0	0
yellow-bellied sapsucker	1	<0.01	100	0	0
white-eyed vireo	0	<0.01	0	0	0
red-bellied woodpecker	0	<0.01	0	0	0
lark sparrow	0	<0.01	0	0	0
indigo bunting	0	<0.01	0	0	0

Appendix C2. Flight characteristics for each small bird species[a] during the fixed-point[b] bird use surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017.

Species	Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[c] based on initial obs	% Within RSH at anytime

[a] 100-m radius plot for small birds

[b] per 10-min survey for small birds

[c] likely "rotor swept height" for potential collision with a turbine blade, or 25–150 m (82–492 ft) above ground level

Note: Obs = observations, RSH = rotor-swept height

Appendix D. Mean Use by Point for All Birds, Major Bird Types, and Diurnal Raptor Subtypes during Fixed-Point Bird Use Surveys at the Bitter Root Wind Energy Project from March 3, 2016 – January 23, 2017

Appendix D1. Mean use (number of birds/plot[a]/survey[b]) by point for all birds, major bird types, and diurnal raptor subtypes observed at the Bitter Root Wind Energy Project during fixed-point bird use surveys from March 3, 2016 – January 23, 2017.

	Survey Point										
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Loons/Grebes	0	0	0.09	0.09	0	0	0	0	0	0	0
Waterbirds	0.27	0.91	10.55	0.27	0.27	0.91	0.09	1.00	0.09	0.18	0.73
Waterfowl	2.00	4.73	104.27	3.91	3.73	6.09	1.45	1.18	1.36	0	1.55
Shorebirds	0.27	0	0.27	0.09	0	0.09	0	0	0	0.09	0.09
Gulls/Terns	0.18	0	8.91	0	0	13.00	0	11.45	0.09	0	54.73
Rails/Coots	0	0	0.73	0	0	0.09	0	0.18	0	0	0
Diurnal Raptors	0.09	1.00	0.45	0.45	1.36	0.73	0.64	1.73	0.64	0.27	0.73
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.18*	*0*	*0*	*0*
Buteos	*0.09*	*0.73*	*0.09*	*0.45*	*0.27*	*0.18*	*0.55*	*1.45*	*0.64*	*0.27*	*0.45*
Northern Harrier	*0*	*0.18*	*0.36*	*0*	*0.73*	*0.36*	*0*	*0*	*0*	*0*	*0*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0*	*0.09*	*0*	*0*	*0.27*	*0.09*	*0*	*0*	*0*	*0*	*0.27*
Other Raptors	*0*	*0*	*0*	*0*	*0.09*	*0.09*	*0.09*	*0.09*	*0*	*0*	*0*
Owls	0	0	0	0	0.09	0	0	0	0.09	0	0
Vultures	0.18	0.09	0.27	0.09	0.64	0.73	0	0.09	0.91	0.09	0
Upland Game Birds	0.18	0	0.36	0.45	3.27	0	0.36	0	0	0.55	0
Doves/Pigeons	10.55	0	0	0	0.27	0.18	0	0.09	0.18	0	0.09
Large Corvids	0.82	0.09	0.18	1.18	0.09	0.09	0.09	4.18	3.36	1.27	0.55
Goatsuckers	0	0.36	0	0	0	0	0	0	0	0	0
All Large Birds	**14.55**	**7.18**	**126.09**	**6.55**	**9.73**	**21.91**	**2.64**	**19.91**	**6.73**	**2.45**	**58.45**
Passerines	110.64	7.73	5.64	1.91	3.91	8.27	39.09	7.64	4.45	6.50	1.28
Woodpeckers	0	0.18	0	0.09	0.45	0	0	0	0	0.00	0.00
Unidentified Birds	0	0	0	0	0	0	0	0	0		
All small birds	**110.64**	**7.91**	**5.64**	**2.00**	**4.36**	**8.27**	**39.09**	**7.64**	**4.45**	**6.50**	**1.28**

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

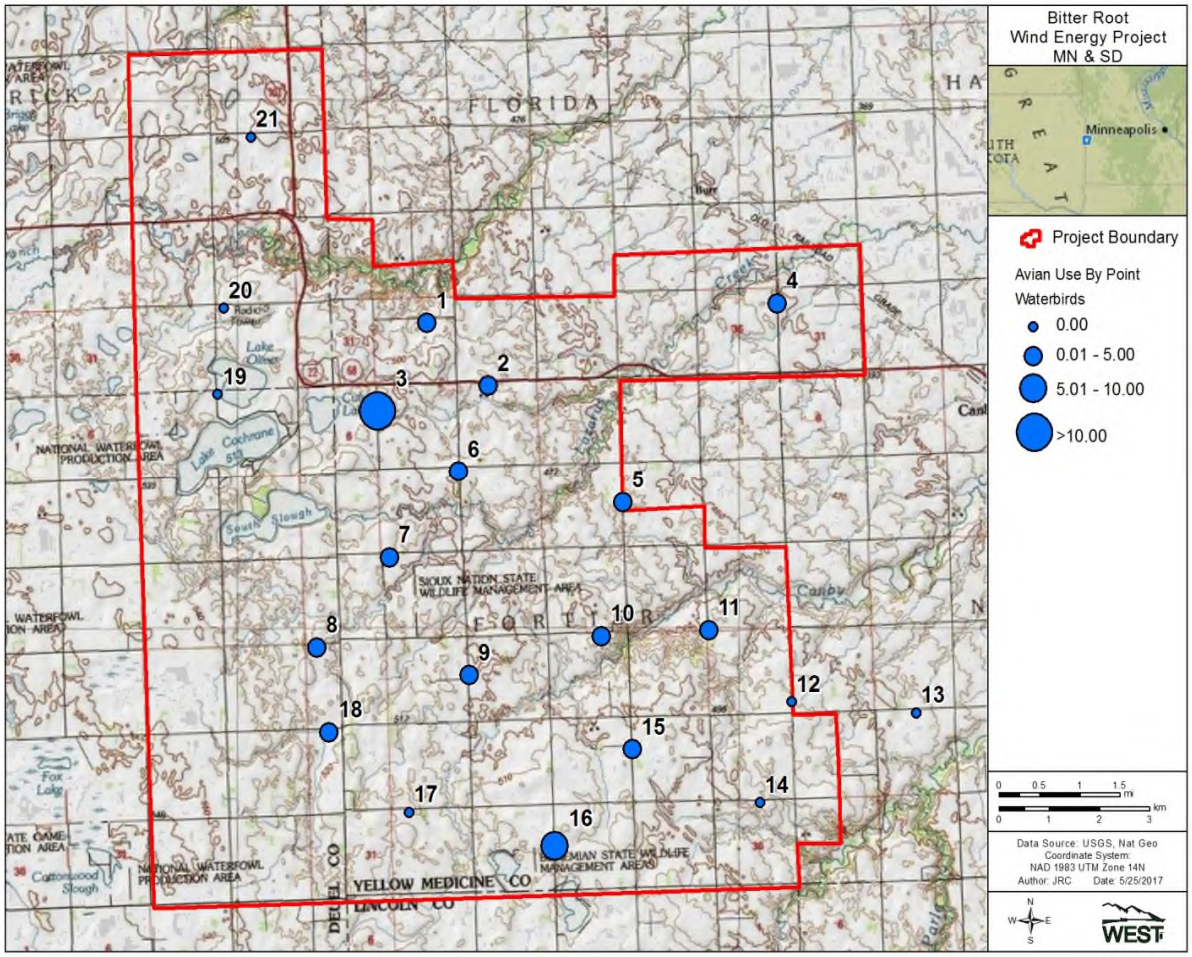
[b.] per 60-min survey for large birds; per 10-min survey for small birds

Appendix D1. Mean use (number of birds/plot[a]/survey[b]) by point for all birds, major bird types, and diurnal raptor subtypes observed at the Bitter Root Wind Energy Project during fixed-point bird use surveys from March 3, 2016 – January 23, 2017.

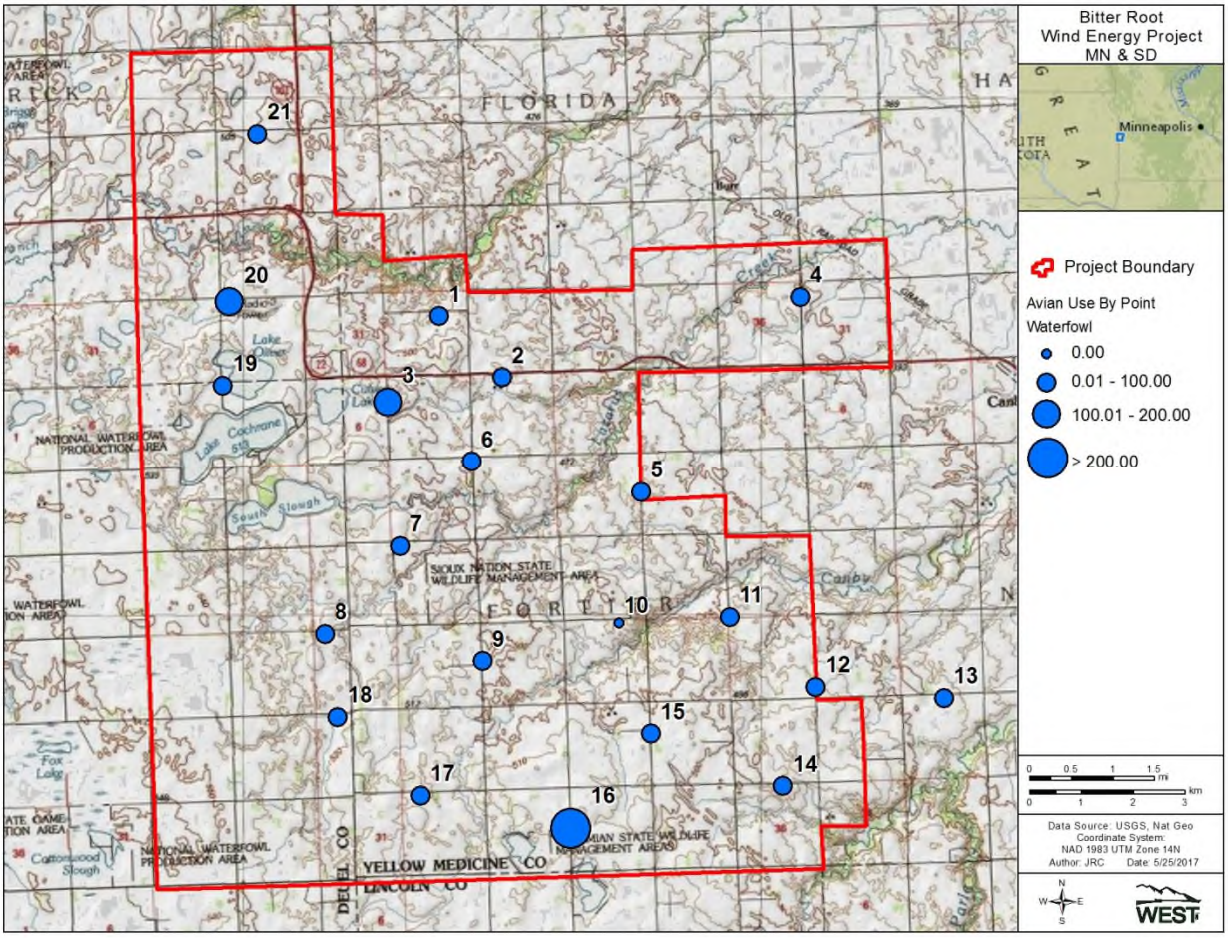
	Survey Point									
Bird Type	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Loons/Grebes	0	0	0	0	0.36	0	0	0	0	0
Waterbirds	0	0	0	0.36	8.36	0	0.64	0	0	0
Waterfowl	0.27	0.64	1.00	48.82	217	5.45	4.00	12.50	124.75	0.25
Shorebirds	0.09	2.18	0.09	0.82	0.18	0	0.27	0	0	0
Gulls/Terns	9.09	0	0.09	0.64	122.91	0	18.18	9.75	0	0
Rails/Coots	0	0	0	0	37.64	0	0	0	0	0
Diurnal Raptors	0.18	0.09	0.18	0	0.45	0.55	0.55	0.25	0	0
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.09*	*0*	*0.09*	*0*	*0.09*	*0.55*	*0.55*	*0*	*0*	*0*
Northern Harrier	*0*	*0*	*0.09*	*0*	*0.36*	*0*	*0*	*0.25*	*0*	*0*
Eagles	*0*	*0.09*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0.09*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Owls	0	0	0	0	0	0	0	0	0	0
Vultures	0.18	0.45	0.09	0.27	0	0.09	0.45	0	0	0
Upland Game Birds	0	0.36	0.36	0.45	0.55	0.18	0.09	0	0	0.25
Doves/Pigeons	0	0.18	0	0.09	0.27	0.09	0.55	0	0	0
Large Corvids	0.27	0.45	0.73	0	0.09	1.09	0.82	0	0	0.25
Goatsuckers	0	0	0	0	0	0	0	0	0	0
All Large Birds	**10.09**	**4.36**	**2.55**	**51.45**	**387.82**	**7.45**	**25.55**	**22.50**	**124.75**	**0.75**
Passerines	1.27	8.45	6.82	3.27	20.36	5.18	125.27	1.00	1.50	0.50
Woodpeckers	0	0.18	0	0	0	0.09	0	0	0	0
Unidentified Birds	0	0	0	0	1.36	0	0	0	0	0
All small birds	**1.27**	**8.64**	**6.82**	**3.27**	**21.73**	**5.27**	**125.27**	**1.00**	**1.50**	**0.50**

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

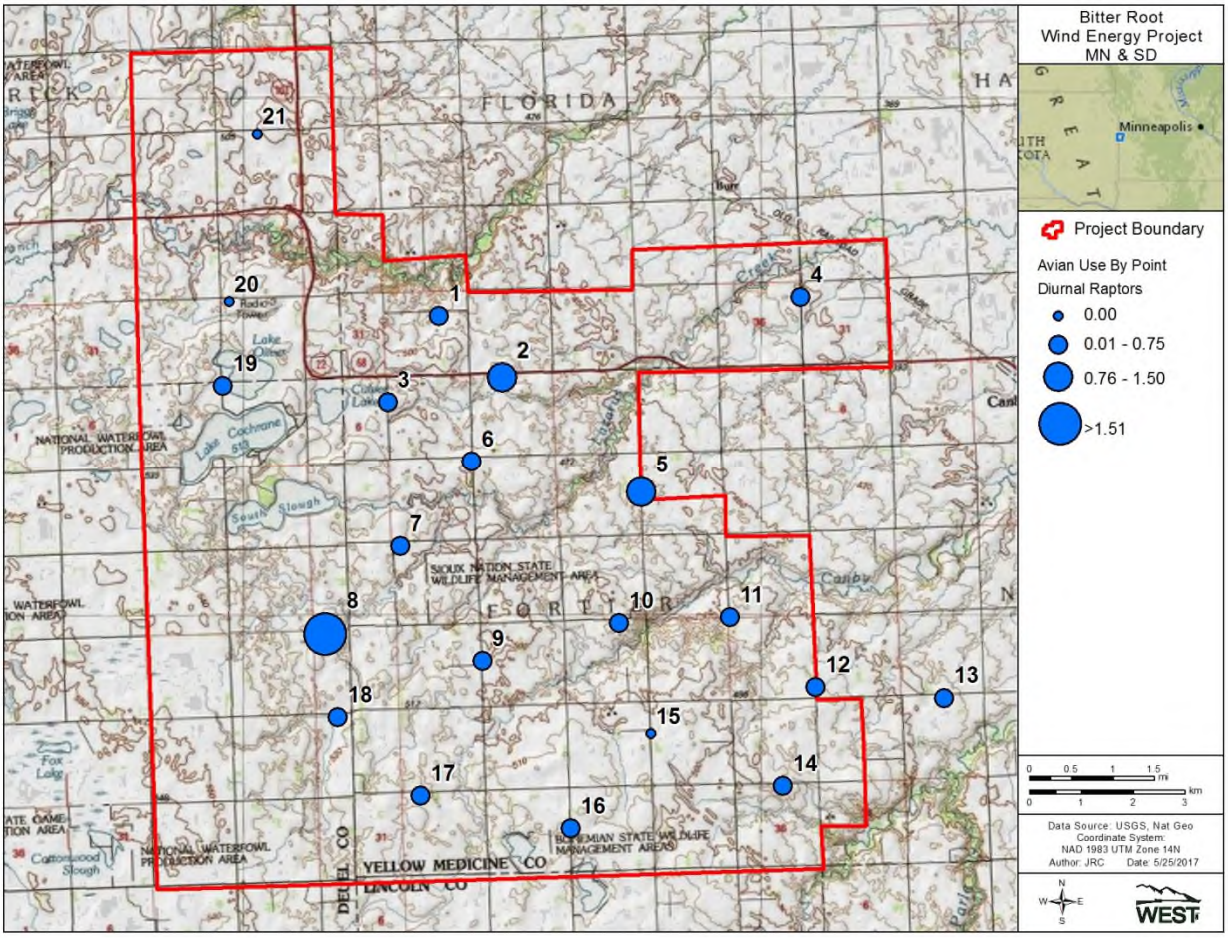
[b.] per 60-min survey for large birds; per 10-min survey for small birds



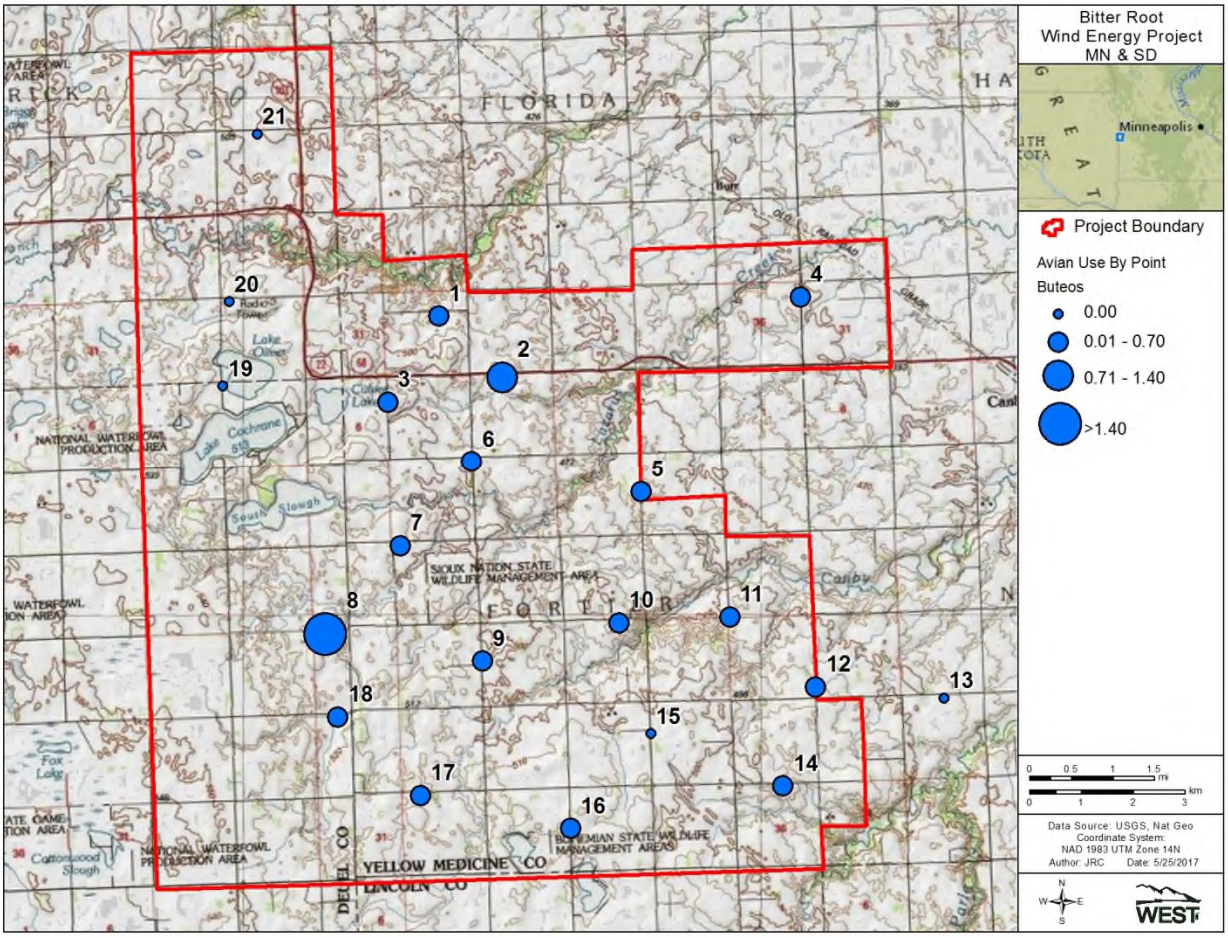
Appendix D2. Waterbird use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.



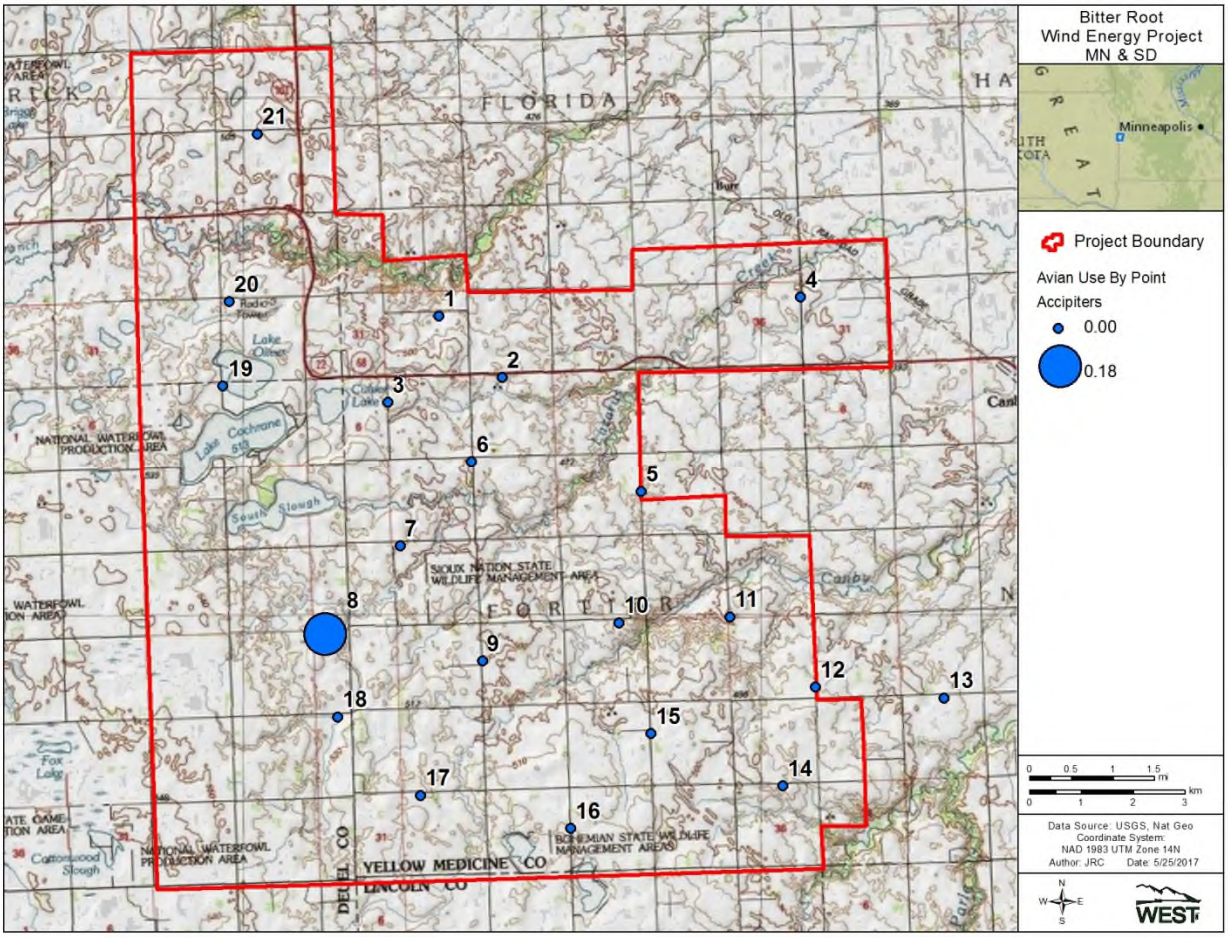
Appendix D2 (continued). Waterfowl use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.



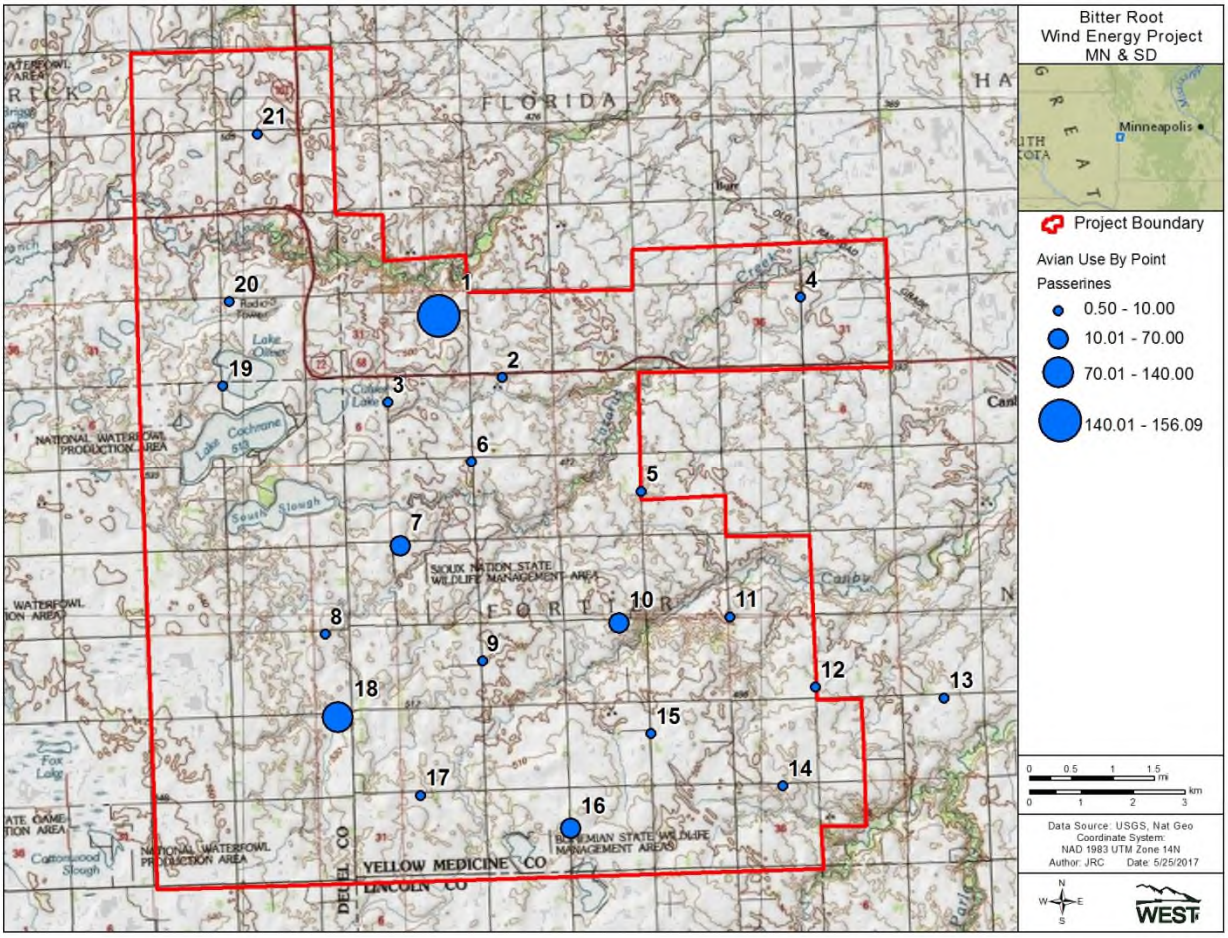
Appendix D2 (continued). Diurnal raptor use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.



Appendix D2 (continued). Buteo use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

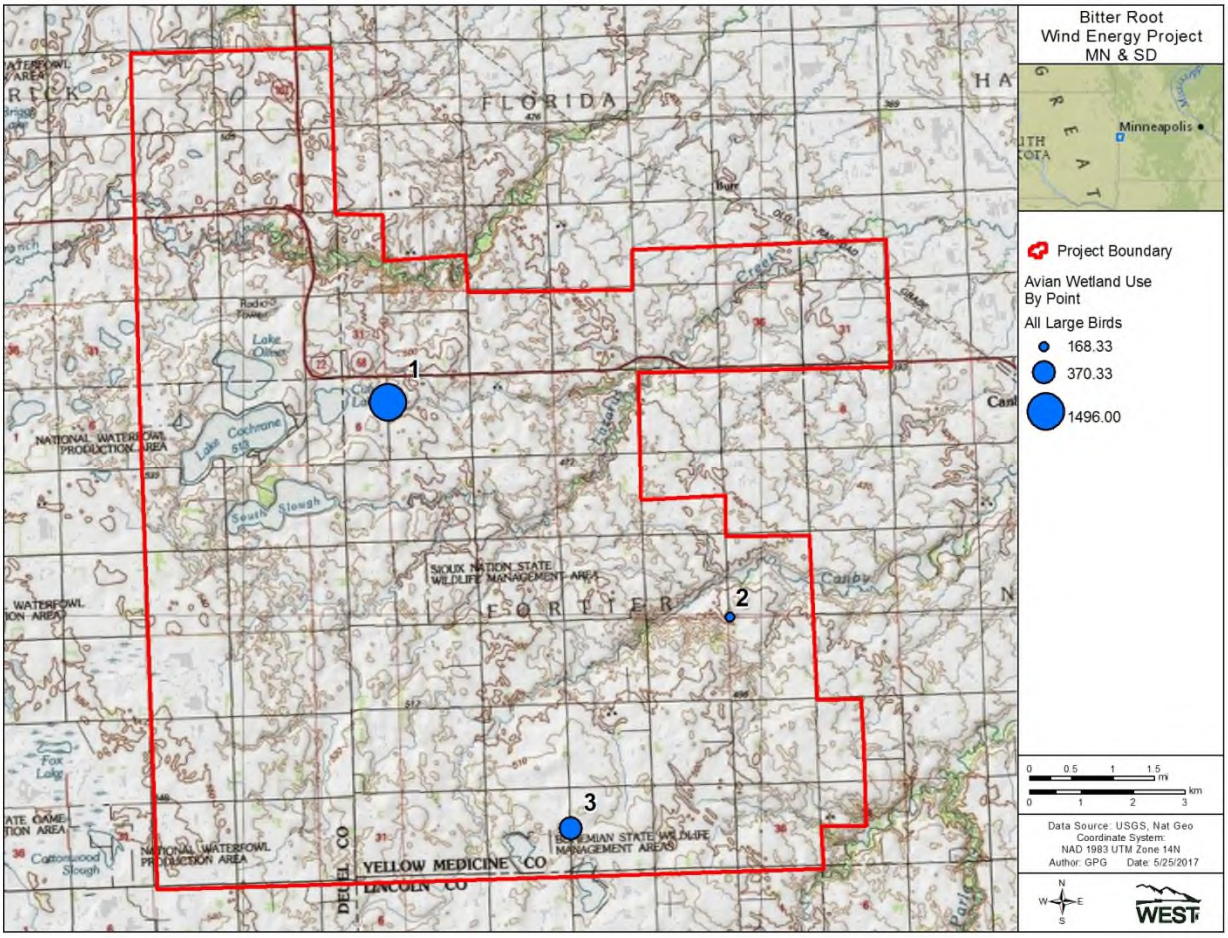


Appendix D2 (continued). Accipiter use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

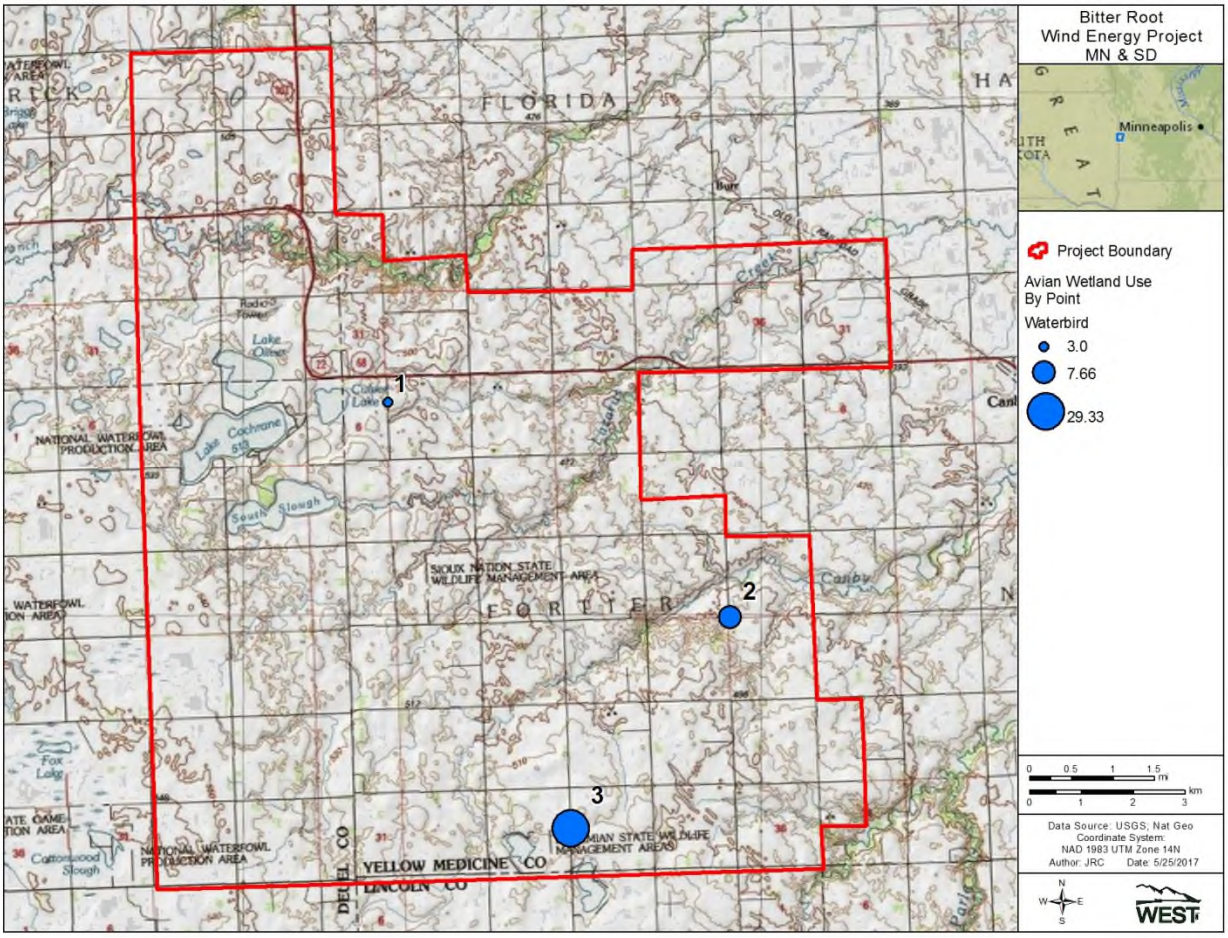


Appendix D2 (continued). Passerine use by observation point during bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.

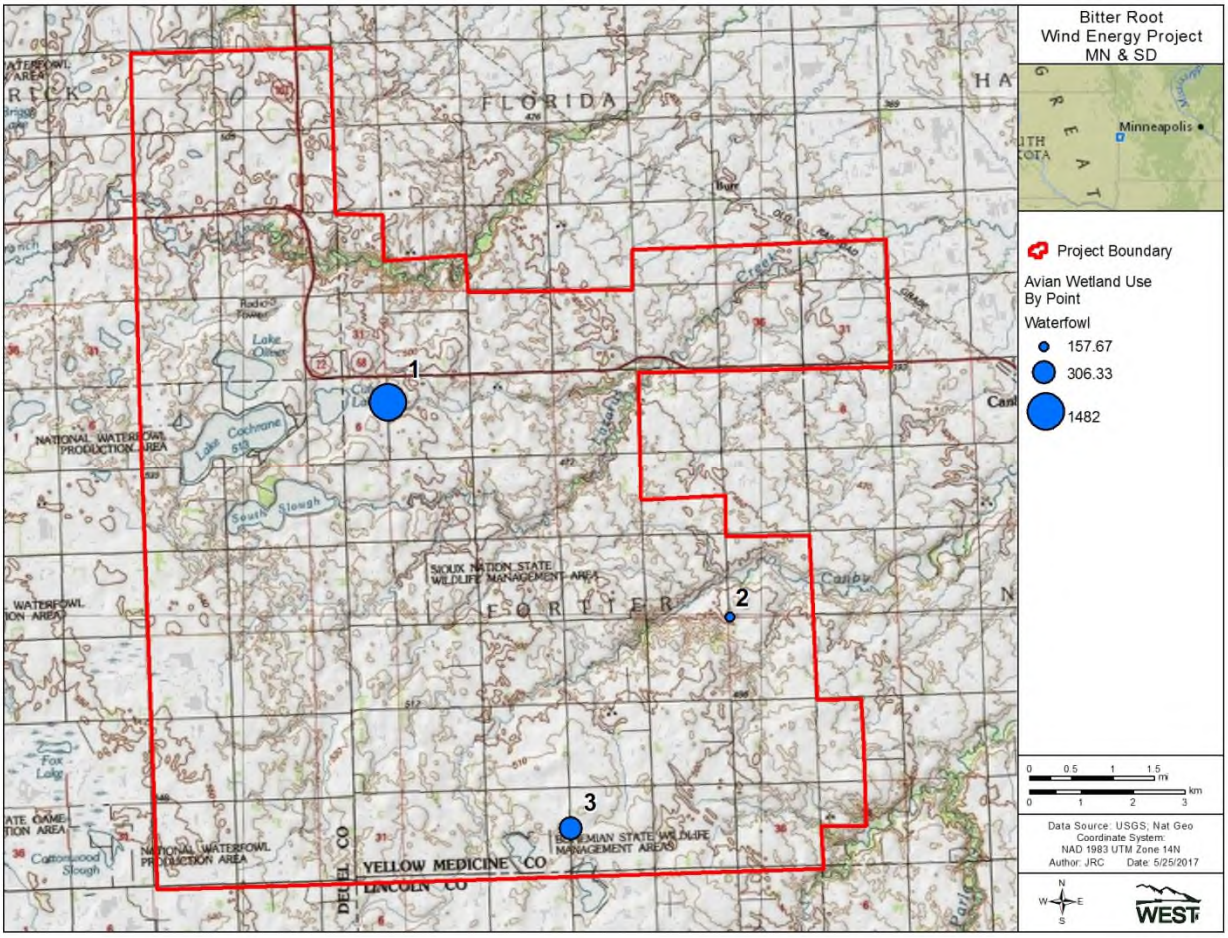
Appendix E. Mean Use by Point for All Birds, Major Bird Types, and Diurnal Raptor Subtypes during Wetland Bird Use Surveys at the Bitter Root Wind Energy Project from March 16 – May 15, 2017



Appendix E. Large bird use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.

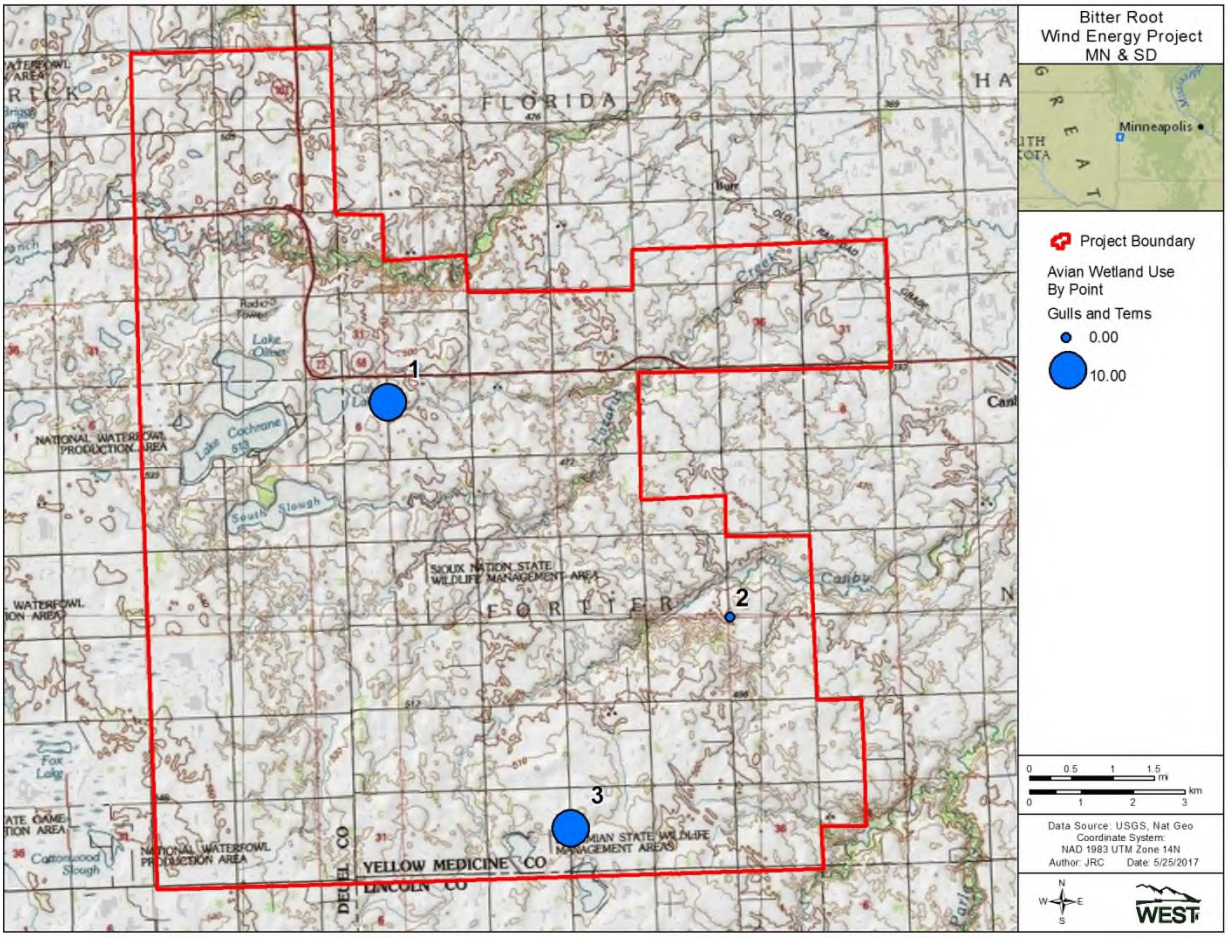


Appendix E (continued). Waterbird use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.

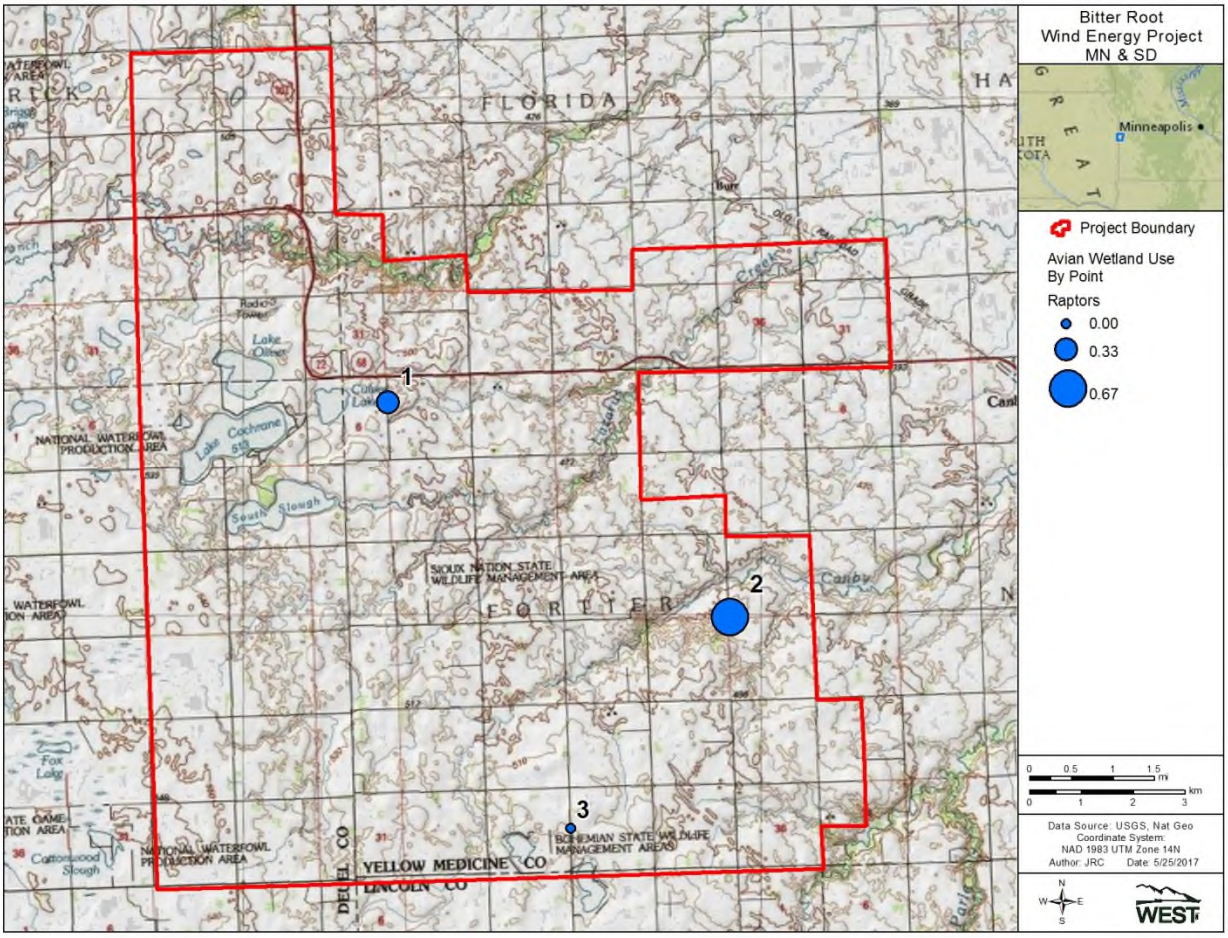


Appendix E (continued). Waterfowl use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.

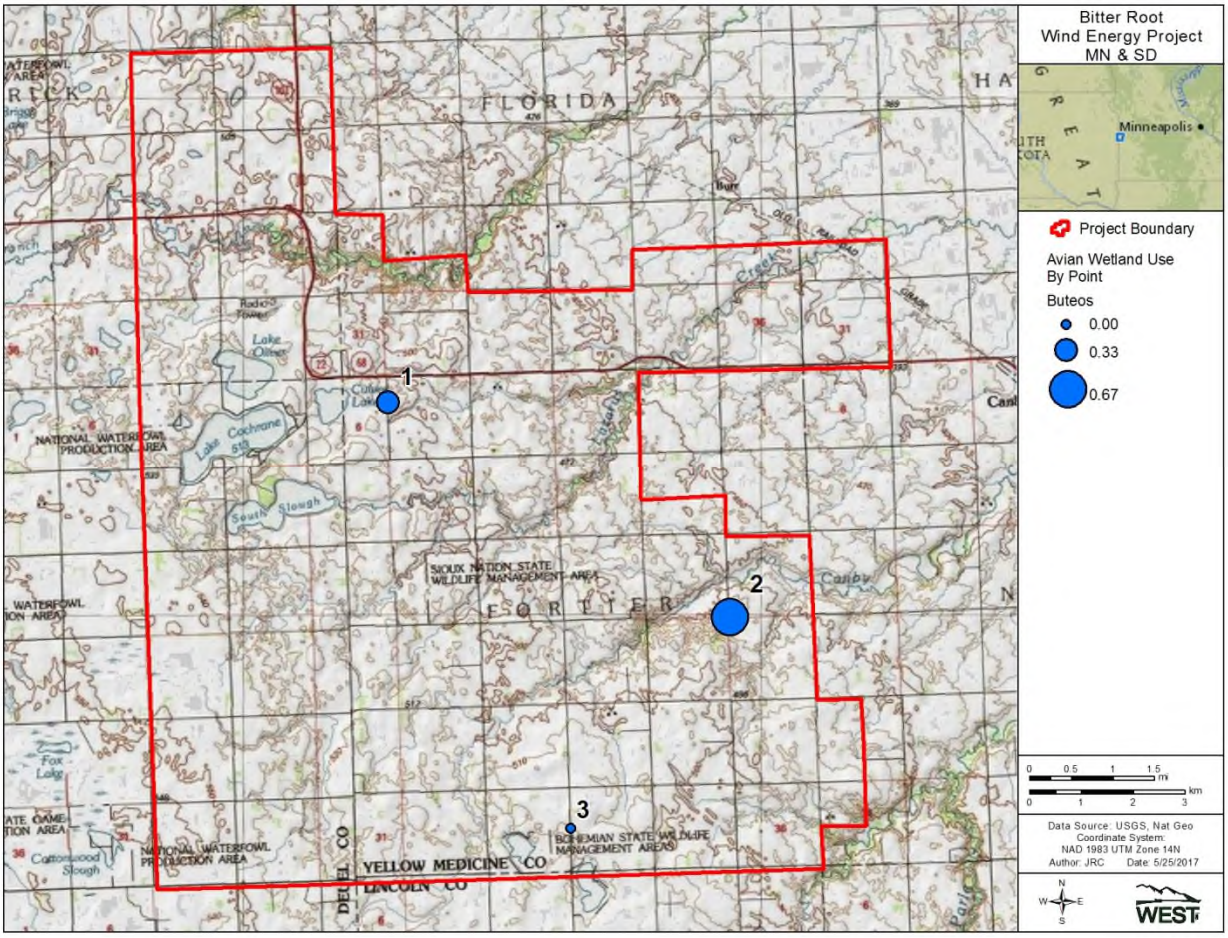
Appendix E (continued). Shorebird use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 3, 2016 – January 23, 2017.



Appendix E (continued). Gull/tern use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.



Appendix E (continued). Diurnal raptor use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.



Appendix E (continued). Buteo use by observation point during wetland bird use surveys conducted in the Bitter Root Wind Energy Project area from March 16 – May 15, 2016.