EAGLE CONSERVATION PLAN FOR THE PIONEER WIND PARK WIND ENERGY FACILITY

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CONTENTS

1.0 INTRODUCTION 1
1.1 Regulatory Framework 1
1.1.1 Migratory Bird Treaty Act 1
1.1.2 Bald and Golden Eagle Protection Act 2
1.1.3 National Environmental Protection Act 2
1.1.4 State and Federal Permit Requirements 2
1.2 Project Background 4
1.3 Environmental Setting 8
1.4 Pioneer Wind Park I LLC Commitment to Environmental Protection 12
1.5 Agency Communication 12

2.0 INITIAL SITE ASSESSMENT (STAGE 1) 12

3.0 SITE SPECIFIC SURVEYS AND ASSESSMENTS (STAGE 2) 13
3.1 Raptor Nest Surveys 13
3.1.1 Methods 13
3.1.2 Eagle Results 15
3.1.3 Discussion 17
3.2 Eagle and other Raptor Surveys: Long-watch Surveys 17
3.2.1 Methods 17
3.2.2 Eagle Results 19
3.2.3 Discussion 23
3.3 Other Avian Use Surveys: 20 Minute Point Counts 24
3.3.1 Methods 24
3.3.2 Eagle Results from Avian Use Surveys 26
3.3.3 Discussion 26
3.4 February 2010 Winter Bird Survey 26
3.4.1 Methods 26
3.4.2 Eagle Results 27
3.4.3 Discussion 27
3.5 Eagle Roost Site Surveys 27
3.5.1 Methods 27
3.5.2 Results 29
3.5.3 Discussion 29
3.6 Greater Sage-Grouse Lek Surveys 29
3.6.1 Methods 29
3.6.2 Results 31
3.6.3 Discussion 31
3.7 Prey Base 31
3.8 Eagle Use 33

4.0 AVOIDANCE AND MINIMIZATION OF RISKS DURING PROJECT PLANNING/DESIGN PHASE (STAGE 4) 36
4.1 Pre-Construction 36
4.1.1 Siting the Project Layout 36
4.1.2 Additional Pre-construction BMPs and Conservation Measures 39

5.0 ASSESSING EAGLE RISK AND PREDICTING FATALITIES (STAGE 3) 39
5.1 Assessing Golden Eagle Risk 39
5.1.1 Nesting and Breeding 40
5.1.2 Concentration Areas (Communal roosts, foraging areas, migration corridors, and migration stopovers) 42
5.1.3 Eagle Risk Factors 42
5.2 Fatality Predictions 49
5.2.1 Re-evaluation of Risk Considering Reduction in Turbines 52
5.3 Categorizing Site according to Risk 53

6.0 ADDITIONAL AVOIDANCE AND MINIMIZATION OF RISKS, ACP'S, AND COMPENSATORY MITIGATION 54
6.1 During Construction 54
6.2 During Operation 55
6.3 Upfront Compensatory Mitigation 57
6.4 Cumulative Impacts 58
6.4.1 Population Status and Local Area Population Thresholds 58

7.0 POST-CONSTRUCTION MONITORING (STAGE 5) 59
7.1 Fatality Monitoring 60
7.2 Avian Use Surveys 60
7.3 Golden and Bald Eagle Nest Surveys 60
7.4 Reporting 61
7.5 Wildlife Incident Report and Handling System 61

8.0 ADAPTIVE MANAGEMENT PROCESS 62
8.1 Adaptive Management Process 62
8.2 Agency Interaction 64

9.0 CONCLUSION 64

10.0 LITERATURE CITED 64

TABLES

Table 1. List of Potential Federal, State, and Local Permit Requirements. 3

Table 2. Estimated Temporary and Permanent Acres of Impact Associated with Pioneer Wind Park Project Features, Converse County, Wyoming. 5

Table3a. Land Use/Habitat types present within the Pioneer Wind Park Project Area, Converse County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006). 8

Table3b. Estimated Temporary and Permanent Acres of Impact by Major Land-Use/Habitat Types Associated with Pioneer Wind Park Project Features, Converse, County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006). 9

Table 4a. Number of groups, observations, survey hours, and observations per hour for golden eagles by month and overall during Eagle and other Raptor Surveys (Long Watch Surveys)

within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 through November 2011. 20

Table 4b. Number of groups, observations, survey hours, and observations per hour for bald eagles by month and overall during Eagle and other Raptor Surveys (Long Watch Surveys) within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 through November 2011 21

Table 5. Golden eagle observations recorded during avian use surveys within the Pioneer Wind Park Project, Converse County, Wyoming. 26

Table 6. Risk factors listed in the Eagle Conservation Plan Guidance and a discussion of these factors for the Pioneer Wind Park Project, Converse County, Wyoming. 47

Table 7. Estimated Exposure Rate (λ) for golden and bald eagles from eagle observations made during Raptor Point Count surveys at the Pioneer Wind Park Project, Converse County, Wyoming. 50

Table 8. Expansion Factors (ε) for the originally proposed turbine layout at the Pioneer Wind Park Project, Converse County, Wyoming. Turbine Hazardous Area = pi * turbine radius expressed in km2. Expansion factor = Line 9 x Line 11 x Line 12. 51

Table 9. Collision Probability (C) calculated as Line 14/(Line 14 + Line 15)). 51

Table 10. Eagle fatalities per year (F) given the originally proposed 62 turbine layout. 52

Table 11. Updated expansion Factors (ε) for the final 46 turbine layout with a 43.5 meter rotor radius at the Pioneer Wind Park Project, Converse County, Wyoming. Turbine Hazardous Area = pi * turbine radius expressed in km2. Expansion factor = Line 9 x Line 11 x Line 12. 52

Table 12. Updated eagle fatalities per year (F) given the final 46 turbine layout with a 43.5 meter rotor radius for the Pioneer Wind Park Project, Converse County, Wyoming. 53

Table 13. Summary of Potential Conservation Measures to be implemented if a Threshold is reached using a Step-wise Approach. 62

FIGURES

Figure 1. General location of the Pioneer Wind Park Project Area, Converse County, Wyoming. 6

Figure 2. Proposed Pioneer Wind Park Project, Converse County, Wyoming. 7

Figure 3. Digital elevation map of the Pioneer Wind Park Project Area, Converse County, Wyoming. 10

Figure 4. Land use/land cover within the Pioneer Wind Park Project Area, Converse County, Wyoming. 11

Figure 5. Location of aerial helicopter raptor nest survey route flown on May 13, 2011 within the Pioneer Wind Park Project Area and surrounding survey buffer, Converse County, Wyoming. 14

Figure 6. Location of bald and golden eagle nests identified in the vicinity of the Pioneer Wind Park Project, Converse County, Wyoming during baseline studies conducted in 2010 and 2011. 16

Figure 7. Location of Eagle and other Raptor Survey (Long Watch Survey) Stations and associated 800-m radius plots within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. 18

Figure 8. Total number of survey hours for each Eagle and other Raptor Survey (Long Watch Survey) Station (per season and overall) conducted during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011. 19

Figure 9a. Golden eagle observations per survey hours per month during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011. 22

Figure 9b. Bald eagle observations per survey hours per month during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011. 23

Figure 10. Location of other Avian Use Survey Stations within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. 25

Figure 11. Location of aerial eagle roost survey route conducted on March 3, 2011 within the vicinity of the Pioneer Wind Park Project Area, Converse County, Wyoming. 28

Figure 12. Location of fixed-wing transects flown to search for greater sage-grouse leks in the vicinity of the Pioneer Wind Park Project Area, Converse, County, Wyoming. 30

Figure 13. Prairie dog colonies, greater sage grouse leks, and mule deer crucial winter in the vicinity of the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. 32

Figure 14. Mapped golden eagle flight paths from 1,787 hours of eagle and other raptor surveys conducted from April 2010 through November 2011 within the Pioneer Wind Park Project Area, Converse County, Wyoming. 34

Figure 15. Mapped bald eagle flight paths from 1,787 hours of eagle and other raptor surveys conducted from April 2010 through November 2011 within the Pioneer Wind Park Project Area, Converse County, Wyoming. 35

Figure 16. Illustration of the progression in turbine layouts, showing efforts to avoid locating turbines in areas of highest eagle and raptor use areas based on baseline data, resulting in the final proposed layout with 46 turbines for the Pioneer Wind Park Project, Converse County, Wyoming. 38

Figure 17. Approximate golden eagle territories for the golden eagle nests that have been identified in the vicinity of the Pioneer Wind Park Project, Converse County, Wyoming. A buffer distance of 3.74 miles was used based on half the maximum inter-nest distance between nest #2 and nests #3 and #4. The density of golden eagle use, derived from flight path data collected at long watch survey points is also shown in hundred-meter-square grid cells. 41

Figure 18. Slope calculations (in degrees) for the Pioneer Wind Park Project Area, Converse County, Wyoming. Steep slopes with a west or southwesterly aspect (direction) may be more risky for eagles as these areas would be more likely to have conditions suitable for strong updrafts of wind. 44

Figure 19. Aspect (in degrees) of the Pioneer Wind Park Project Area, Converse County, Wyoming. Steep slopes with a west or southwesterly aspect (direction) may be more risky for eagles as these areas would be more likely to have conditions suitable for strong updrafts of wind. 45

APPENDICES

Appendix A: Bird and Bat Conservation Strategy for the Pioneer Wind Park Wind Energy Facility.

Appendix B: Chronology of Agency Communication.

Appendix C: Baseline Wildlife Studies Conducted within the Pioneer Project.

1.0 INTRODUCTION

Pioneer Wind Park I, LLC (PWPI) has developed this Eagle Conservation Plan (ECP) to document compliance with the regulatory requirements for a programmatic eagle take permit and the associated National Environmental Protection Act (NEPA) process at the Pioneer Wind Park (the "Project"). The ECP provides detailed information on siting, configuration, construction, and operational alternatives that avoid and minimize take of eagles to the point where any remaining take is unavoidable. This ECP supports an application for a programmatic eagle take permit for remaining unavoidable take and commits to mitigation that meets the statutory preservation standard for bald and golden eagles. Throughout the process of developing this ECP, PWPI has been in regular communication with U.S. Fish and Wildlife Service (USFWS) personnel (Wyoming Ecological Services Field Office and the Region 6 Migratory Bird Management Office).

The 2013 USFWS Eagle Conservation Plan Guidance, Version 2 (ECPG) provides guidance for conserving bald and golden eagles during siting, construction, and operations of wind energy facilities through a staged approach similar to the tiered approach in the 2012 USFWS Land-based Wind Energy Guidelines (WEG). Additionally, USFWS region 6 has developed a regional guidance memo "Final Outline and Components of an Eagle Conservation Plan (ECP) for Wind Development Recommendations from USFWS Region 6". Both the USFWS ECPG and the region 6 guidance memo were followed in developing the Project ECP. The ECPG emphasizes the importance of implementing avoidance and minimization measures throughout all phases of wind energy development and operations. The ECPG has been developed to assist project developers and operators in complying with regulatory requirements and avoiding non-purposeful take (i.e. incidental take) of eagles at wind energy facilities, while also providing guidance to inform the collection of biological data needed to support permit applications for facilities that may pose a risk to eagles.

In addition to this ECP, PWPI has developed a Conservation Plan (SWCA 2014) in coordination with the Wyoming Game and Fish Department (WGFD) and landowners within the Project area. PWPI is also working with the USFWS to develop a Bird and Bat Conservation Strategy (BBCS; Appendix A) for the Project based on the USFWS 2012 WEG.

1.1 Regulatory Framework

1.1.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a Service permit or regulatory authorization, are a violation of the MBTA. The MBTA states, "Unless and except as permitted by regulations… it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill… possess, offer for sale, sell …purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird ….[The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior."16 U.S.C. 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one

thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

1.1.2 Bald and Golden Eagle Protection Act

Under authority of the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668–668d, bald eagles and golden eagles are afforded additional legal protection. BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. 16 U.S.C. 668. BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," 16 U.S.C. 668c, and includes criminal and civil penalties for violating the statute. See 16 U.S.C. 668. The Service further defined the term "disturb" as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior.

In 2009, the Service promulgated a final rule on two new permit regulations that specifically authorize under BGEPA the non-purposeful (i.e., incidental) take of eagles and eagle nests in certain situations. See 50 CFR 22.26 & 22.27. The permits authorize limited take of bald and golden eagles; authorizing individuals, companies, government agencies and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities. To facilitate issuance of eagle take permits for wind energy facilities the Service finalized the ECPG. If eagles are identified as a potential risk at a project site, developers are strongly encouraged to follow the ECPG. The ECPG describes specific actions that are recommended to achieve compliance with the regulatory requirements in BGEPA for an eagle take permit, as described in 50 CFR 22.26 and 22.27. The ECP Guidance provides a national framework for assessing and mitigating risk specific to eagles through development of ECPs and issuance of programmatic eagle take permits for eagles at wind facilities. In communication with USFWS, PWPI has developed this ECP to avoid and minimize potential impacts to eagles, to mitigate for unavoidable impacts, and to support a permit application.

1.1.3 National Environmental Protection Act

The National Environmental Policy Act (NEPA) [42 U.S.C. 4321 et seq.] establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals within the federal agencies. The Act requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. All federal agencies are required to prepare detailed statements assessing the environmental impact of and alternatives to major federal actions significantly affecting the environment. Issuance of an eagle take permit by the USFWS constitutes a federal action and thus requires an assessment of the potential environmental impacts associated with the action and alternatives under NEPA. As a result, the USFWS must complete a NEPA analysis before it can issue an eagle permit.

1.1.4 State and Federal Permit Requirements

In the State of Wyoming, an "Industrial Facility" is required to obtain an industrial siting permit pursuant to Wyo. Stat. Ann. § 35-12-109 prior to constructing and operating the facility. The proposed Project meets the definition of an "Industrial Facility" in that the Project has an estimated construction cost of at least $178,300,000.00 and consists of 30 or more wind turbines. PWPI submitted an application for an industrial siting permit for the Project in February of 2011 and the permit was granted in July of 2011. As part of the application process, PWPI committed to obtaining all permits required for construction of the Project (Table 1).

Table 1. List of Potential Federal, State, and Local Permit Requirements.

Jurisdiction	Permit/Decision	Status/Agent
Federal		
Federal Aviation Administration	Notice of Proposed Construction or Alteration	Completed
U.S. Army Corps of Engineers	Clean Water Act (CWA) Section 404 - Individual or Nationwide Permit	Completed
U.S. Environmental Protection Agency (EPA)	Spill Prevention Control and Countermeasures (SPCC) Plan – Construction	Completed
	SPCC Plan –Operation	Pending final design/EPC will file prior to operation
Federal Communications Commission	Private Operational Fixed Microwave License	Completed
State		
Wyoming State of Engineer's Office	Permits to appropriate groundwater (use, storage, dewatering) or water stored in impoundments or reservoirs, Wyoming statutes (W.S.) 41-3-901 through 41-3-398, as amended (Form U.W. 5)	Pending final design/PWPI will file prior to use of groundwater, if and as necessary
Wyoming Department of Environmental Quality	Wyoming Industrial Development and Siting Act / Industrial Siting Council Order	Completed
	Wyoming Pollutant Discharge Elimination System (WyPDES) – Large Construction General Permit (WYR10-0000)	Completed
	General Permit for Temporary Discharge	Pending final design/EPC will file before construction begins, if and as necessary
	Permit to Construct Small Wastewater Facilities (Septic Tanks and Leach fields)	Pending final design, depending on size of septic tank needed for O&M Building/EPC will file prior to building construction
	Section 401 Water Quality Certification	Completed
	Air Quality Division - Temporary / Portable Source Air Permit	Completed
	Water Quality Division - Temporary Increase in Turbidity Permit	Pending final design/PWPI will file prior to construction, if and as necessary
Wyoming Department of Transportation	Port of Entry Permit for Oversized/Overweight Loads	Completed
	Road Use Agreement	Completed

Table 1. List of Potential Federal, State, and Local Permit Requirements.

Jurisdiction	Permit/Decision	Status/Agent
Local		
Converse County	Right-of-Way Encroachment for collector line crossing of Mormon Canyon Road	Completed
	Road Use Agreement	Completed
	Wind Energy Conversion System (WECS) Use Permit	Completed

1.2 Project Background

The proposed PWPI wind-energy facility is located in Converse County, Wyoming near the town of Glenrock (Figure 1). In July of 2011, the Project was permitted through the Wyoming Industrial Siting Council. The Project as originally proposed and permitted by the ISC included the Pioneer Wind Park I (PWP I) Project consisting of 31 General Electric (GE) 1.6-megawatt (MW) wind turbine generators (WTGs) for a total nameplate capacity of 49.6 MW and the Pioneer Wind Park II (PWP II) Project consisting of 31 GE 1.6 MW WTGs for a total nameplate capacity of 49.6 MW. Combined, there were 62 proposed WTG locations with a total nameplate capacity of approximately 99 MW that were permitted for development. On June 24, 2013, the ISC approved a reduction in the number of turbines to 46 1.85 MW WTG's with a total net output of 80 MW (Figure 2). In addition to the WTGs, other proposed Project facilities would include access roads to each WTG location, underground power collection lines linking the WTG to a Project substation, the Project substation, approximately 5 miles of 230-kilovolt (kV) transmission line connecting the Project to the regional electrical grid, operation and maintenance facilities, one permanent meteorological tower, radar towers, and a communication tower. Proposed new Project access roads include approximately 10.50 miles. The Project will result in both permanent and temporary loss of habitats. This ECP defines permanent habitat loss as acres of lost habitat that will be removed for the operating life of the Project and temporary habitat loss as acres of lost habitat that will be removed during construction but, will be reclaimed and/or allowed to rejuvenate through succession following the construction period. Rough estimates of permanent and temporary acres of habitat loss for major project components are provided in Table 2. The Project area (area contained within the red polygon depicted on Figures 1 and 2 below) encompasses approximately 25,268 acres and is located entirely on private land and Wyoming State School Trust Lands (approx. 3,107 acres of state lands are located within the Project area). The total area estimated for temporary and permanent habitat loss by the Project is approximately 283.6 acres (10.58 acres of state lands), a majority of which is temporary, or approximately 1% of the total Project area. However, actual loss of habitat is not the only type of potential impact associated with the Project. Other types of potential impacts include habitat fragmentation, displacement, avoidance, and collision with infrastructure (see Section 5.0 below for additional discussion of other types of impacts beyond temporary and permanent habitat loss). Construction of the Project substations commenced in February of 2016. Construction of turbines, roads, and collection systems is anticipated to occur throughout 2016, with an estimated in-service date of mid to late October 2016.

Table 2. Estimated Temporary and Permanent Acres of Impact Associated with Pioneer Wind Park Project Features, Converse County, Wyoming.

Project Feature	Temporary Habitat Acres Lost	Permanent Habitat Acres Lost
Wind Turbine Generators	0	46
Access Roads	51.0	29.8
Crane Pads and Paths	103.6	0
Laydown Area	16.6	0
230 kv Transmission Line	15.7	<0.1
Collector System	10.9	0
O&M Building	0	1.0
Parking Lot	0	1.0
Substations	2.5	3.5
Permanent MET, Radar, Communication Towers	1.0	1.0
TOTAL	**201.3**	**82.3**

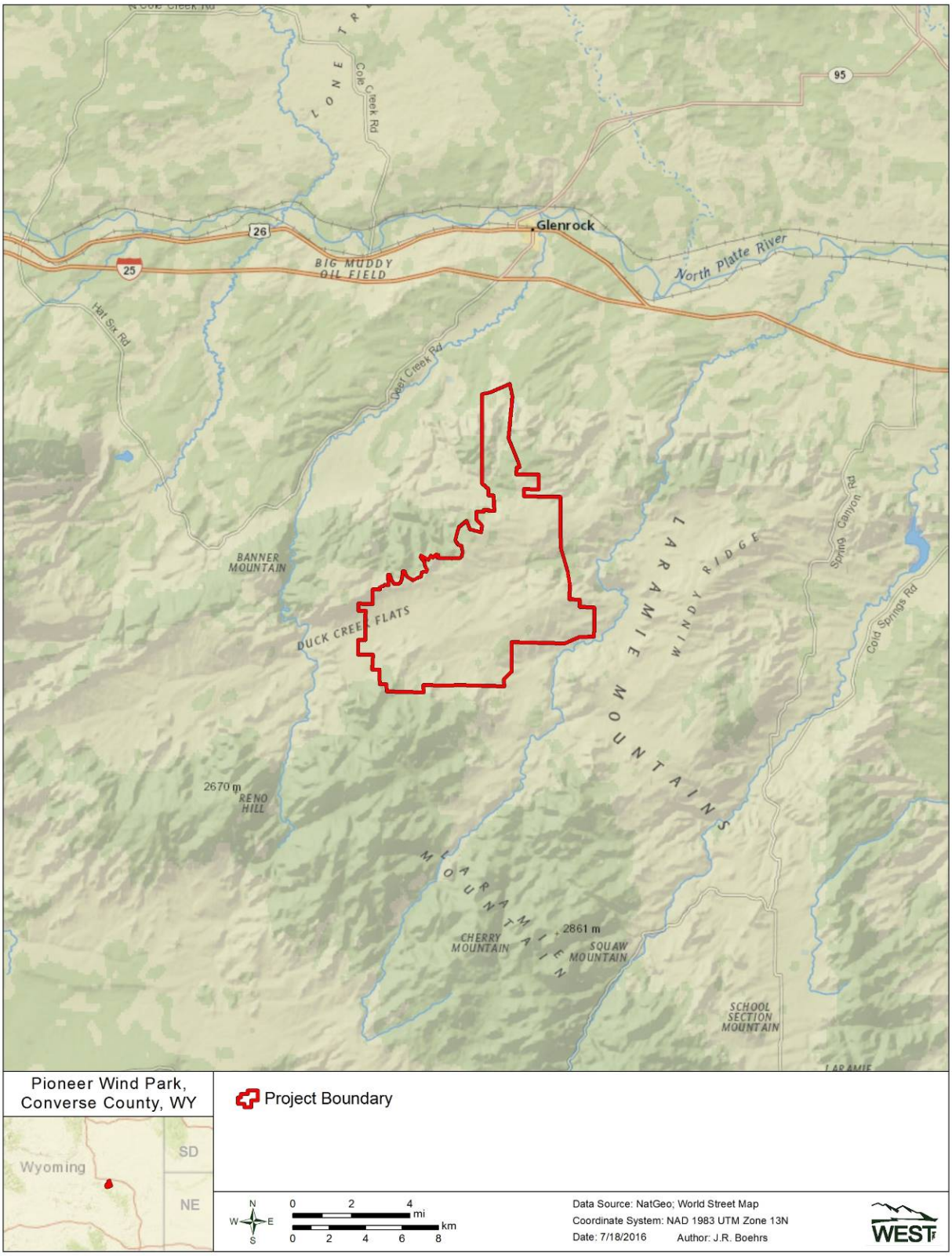


Figure 1. General location of the Pioneer Wind Park Project Area, Converse County, Wyoming.

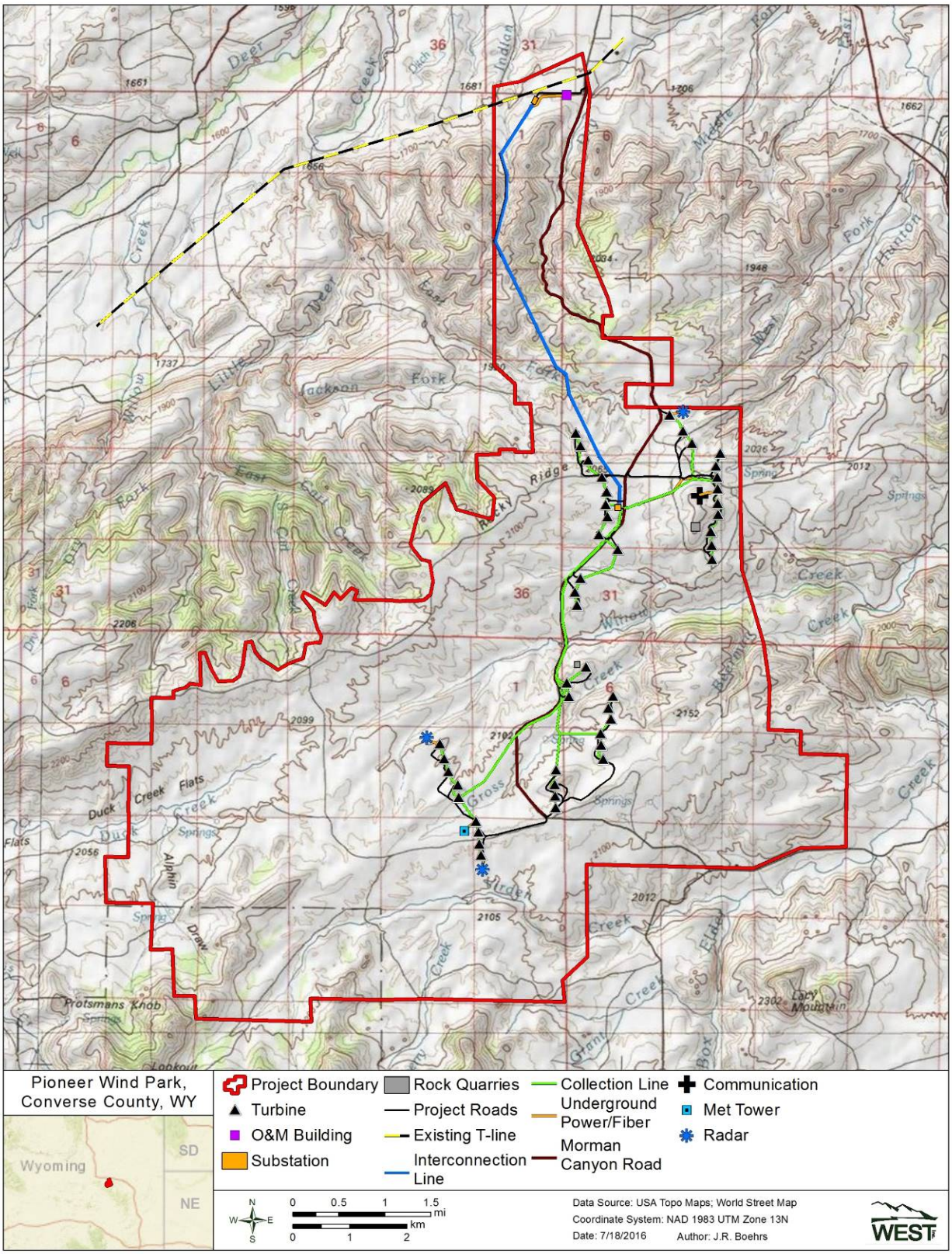


Figure 2. Proposed Pioneer Wind Park Project, Converse County, Wyoming.

1.3 Environmental Setting

The Project is located in the foothills of the Laramie Mountains, with elevations ranging from approximately 5,500 to 7,600 feet (Figures 2 and 3). The topography ranges from gently rolling slopes to abrupt canyons and ridges. Combined, the Project area consists of approximately 25,268 acres (approx. 40 square miles [mi^2]) and is located entirely on private lands and Wyoming State School Trust Lands. There are no federally owned or managed lands located within the Project footprint (in this ECP, the Project footprint refers to the actual location of Project features and infrastructure). The dominant land use is livestock grazing, although there are two open-pit rock quarries located within the Project area. Livestock grazing within the Project is primarily domestic cattle grazing (aside from cattle, a small number of domestic horses may also be grazed in the area) with the majority of cattle grazing occurring in late spring through the fall season. Very little, if any, calving occurs in areas proposed for turbine locations. The northern existing rock quarry (see northern quarry location on Figure 2 above) experiences modest seasonal activity (June through October), primarily associated with landowners hauling gravel for road construction or repairs. There are no permanent lights at the quarry location. A second quarry site has also been permitted and began activity in 2016 (see southern quarry location in Figure 2 above).

The Project area contains a number of drainage features including: Dry Creek, East Fork of Little Deer Creek, Willow Creek, Hunton Creek, Gross Creek, Virden Creek, and Duck Creek (Figure 2). According to the National Land Cover Dataset (USGS NLCD 2006; Table 3a; Figure 4), the Project area is dominated by shrub/sage-steppe (approx. 18,177 acres; 72%). Evergreen forest (approx. 2,978 acres) and grassland (approx. 2,915 acres) each comprising approximately 12% of the Project area. All other landcover types comprise less than five percent of the total Project area (Table 3a; Figure 4). Based on the USGS NLCD 2006, there is very little (0.85 acres; <0.01%) developed land within the Project area and the density of human habitation in the vicinity of the Project is very low, consisting primarily of homesteads or buildings for ranching operations (in addition to the existing rock quarries discussed above).

Table3a. Land Use/Habitat types present within the Pioneer Wind Park Project Area, Converse County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006).

Cover Type	Acreage	% Composition
Developed; Open Space	0.85	<0.01%
Barren	3.28	0.01%
Deciduous Forest	234.31	0.93%
Evergreen Forest	2,978.20	11.79%
Shrub/Sage-steppe	18,177.35	71.94%
Grassland	2,915.44	11.54%
Pasture/Hay	38.93	0.15%
Woody Wetlands	419.62	1.66%
Emergent Wetlands	500.41	1.98%
Total	**25,268.39**	**100.00%**

Descriptions of the various land cover types contained within the 2006 NLCD have been modified from the Anderson Land Cover Classification System and are available at: http://www.mrlc.gov/nlcd06_leg.php.

Table 3a above illustrates the major land use/habitat types present within the Project. However, as illustrated above in Table 2, the Project footprint is only estimated to permanently impact 82.3 acres and temporarily impact 201.3 acres. Based on the USGS National Land Cover Data Set (2006), an estimate of the major land-use/habitat types that will actually be impacted by the Project footprint is provided in

Table 3b. The rough estimates are provided to give a general idea of the type of habitats that may be impacted (i.e. primarily shrub/sage-steppe and grassland),as the dataset is intended for use at the landscape scale.

Table3b. Estimated Temporary and Permanent Acres of Impact by Major Land-Use/Habitat Types Associated with Pioneer Wind Park Project Features, Converse, County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006).

Project Feature	Shrub/sage-steppe		Grassland		Forest		Wetlands	
	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost
Wind Turbines	-	36.1	-	9.9	-	-	-	-
Access Roads	39.9	22.0	10.6	5.3	-	2.5	0.5	<0.1
Crane Pads/Paths	78.4	-	24.8	-	<0.1	-	0.4	-
Laydown Area	15.7	-	0.9	-	-	-	-	-
230 kV Trans. Line	8.8	<0.1	1.6	<0.1	5.3	<0.1	-	-
Collector System	7.4	-	3.4	-	<0.1	-	0.1	-
O&M Building	-	1.0	-	-	-	-	-	-
Parking Lot	-	0.8	-	0. 2	-	-	-	-
Substations	2.5	3.5	-	-	-	-	-	-
Permanent MET, Radar, Comm. towers	0.8	0.8	0.2	0.2	-	-	-	-
Total	**153.5**	**64.2**	**41.5**	**15.6**	**5.3**	**2.5**	**1.0**	**<0.1**

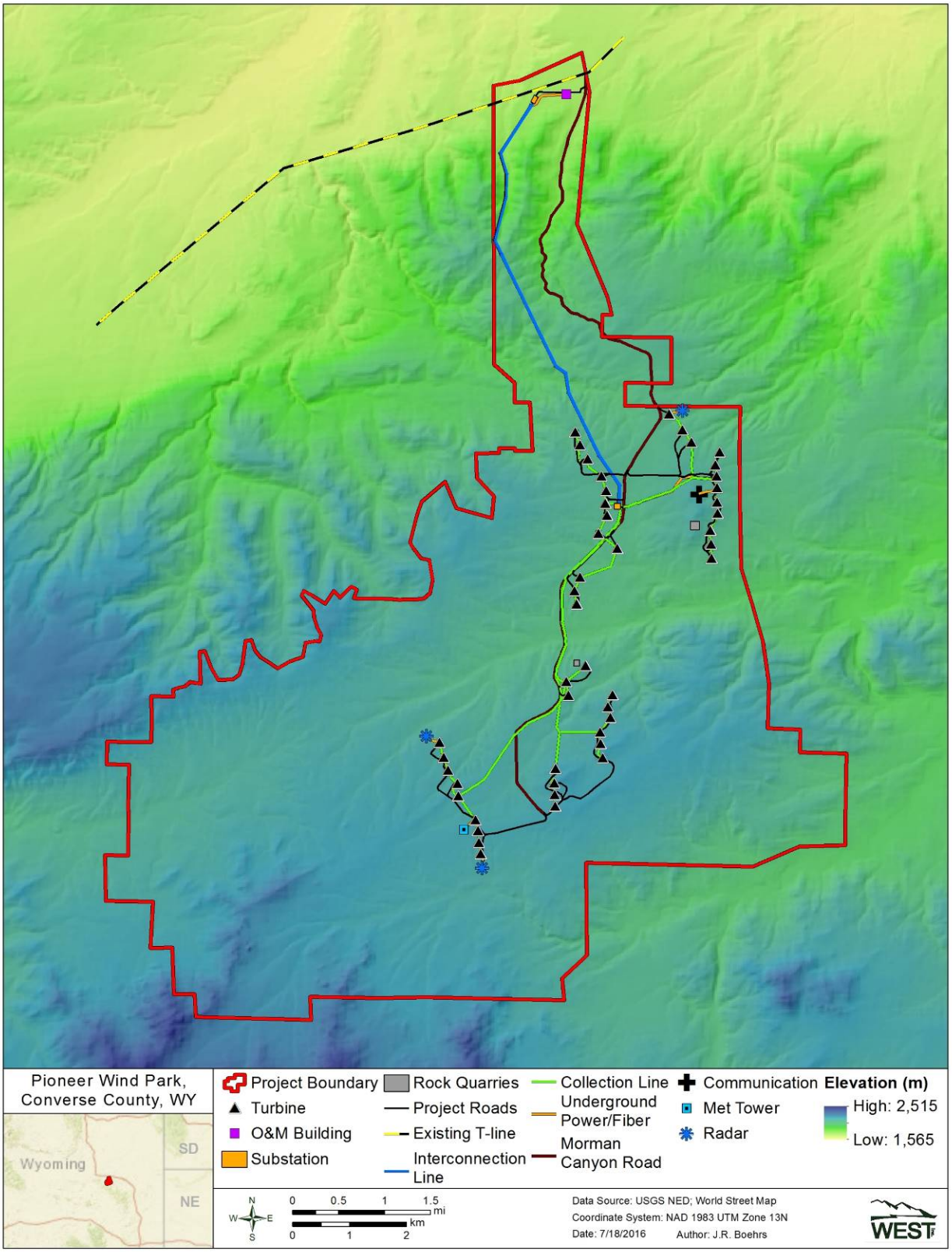


Figure 3. Digital elevation map of the Pioneer Wind Park Project Area, Converse County, Wyoming.

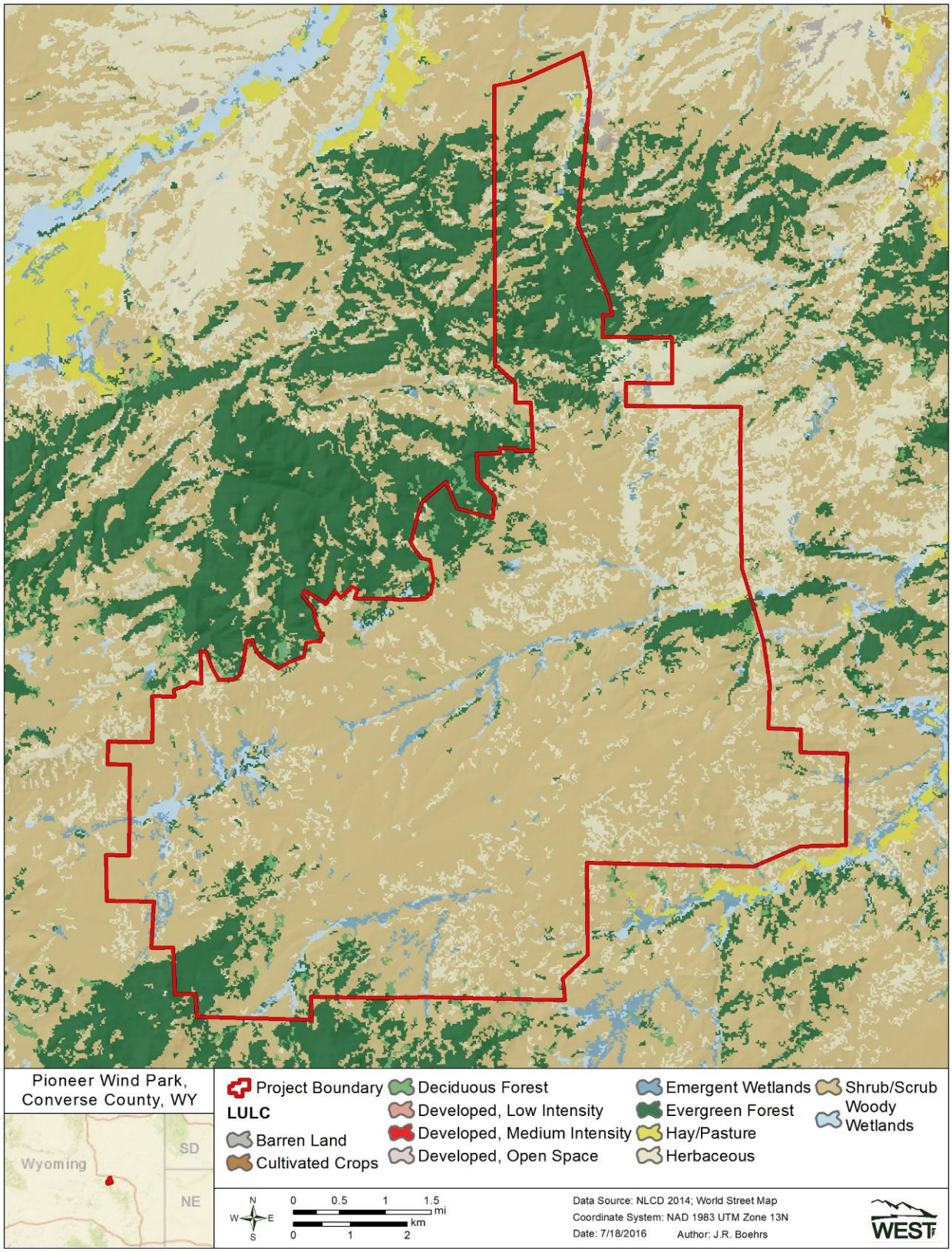


Figure 4. Land use/land cover within the Pioneer Wind Park Project Area, Converse County, Wyoming.

1.4 Pioneer Wind Park I LLC Commitment to Environmental Protection

PWPI is committed to developing the Project in an environmentally responsible manner. Throughout the development of the Project, PWPI has sought to minimize its potential impacts on the environment to the greatest extent practicable. PWPI has adhered to the WGFD guidelines and set-backs with respect to sensitive resources. PWPI has and will continue to work with the USFWS to develop the Project in a manner that avoids and minimizes impacts to bald and golden eagles and other migratory birds as evidenced through the development of this ECP.

1.5 Agency Communication

Beginning in 2010, PWPI has regularly communicated with the USFWS and the WGFD about the Project. A chronology of agency communication is provided in Appendix B. Communication has included many phone calls, e-mails, and in-person meetings throughout the development of the Project. A number of meetings have been held to discuss the proposed Project, including a site visit that was attended by USFWS and WGFD. Study designs for the two years of baseline data collection were developed with input from USFWS and WGFD, and the results of the studies have been provided to USFWS and WGFD. PWPI utilized recommendations from USFWS to aid in determining a final turbine layout, with the intent of avoiding and minimizing impacts to eagles and other raptor species (e.g. PWPI removed nine turbines from the project in response to USFWS comments; see Section 4.0 below). A number of in-person meetings have been held to discuss the development of the Project's ECP as well as the eagle permit process. PWPI intends to continue working with USFWS to avoid and minimize impacts to migratory birds including eagles (PWPI is currently developing a BBCS in communication with USFWS).

2.0 INITIAL SITE ASSESSMENT (STAGE 1)

SWCA Environmental Consultants (SWCA) conducted a Critical Issues Analysis (CIA) for the Project. The analysis included a desktop review of existing data with respect to the Project area, and was presented to the WGFD and the Wyoming ISC in March of 2010. A number of biological data sources were utilized including: 1) USGS LANDFIRE Existing Vegetation Type GIS data; 2) National Wetlands Inventory; 3) Wyoming Natural Diversity Database; and 4) WGFD (online data and conversations with Casper and Lander Field Office Staff). In addition to the desktop review, SWCA biologists conducted a site visit on January 28, 2010.

The analysis indicated that the Project was dominated by shrublands and grasslands, with other vegetative cover types including coniferous forest, riparian areas, hardwood, and agricultural areas. The following information was identified during the preliminary site evaluations: 1) NWI data indicated that some wetlands were present within the various drainage features within the Project area, but that those areas could likely be avoided during Project siting; 2) crucial winter range for mule deer was identified in the northern portion of the Project area; 3) two historic WGFD greater sage-grouse (*Centrocercus urophasianus*) leks were identified with the Project area; 4) in a search for any historical records of raptor species of special concern, three historical records of bald eagle (*Haliaeetus leucocephalus*) were identified from 1990 to 1993 within the general vicinity of the Project; and 5) no threatened or endangered bird or bat species were identified as potentially occurring with the Project area.

The preliminary site evaluation and site-specific characterization determined that while some species or habitats of potential concern may be present in the vicinity of the Project area, available information did

not suggest that the Project should be abandoned at this stage due to a high probability of significant adverse impacts that could not be avoided or minimized. As such, PWPI decided to pursue additional site-specific baseline studies to further inform potential risk within the Project area.

3.0 SITE SPECIFIC SURVEYS AND ASSESSMENTS (STAGE 2)

PWPI contracted with SWCA to conduct baseline wildlife studies within the Project area. Protocols for the baseline wildlife studies were developed in communication with the USFWS and WGFD. Baseline wildlife studies were initiated in April of 2010 and were completed in March of 2012 (see below for specific dates for the various studies). This section provides a brief summary of the baseline wildlife studies that apply to eagles including: 1) raptor nest surveys; 2) raptor point counts; 3) migratory bird surveys; 4) February 2010 winter survey; 5) roost surveys; and 6) prey base mapping. The information is based on the baseline data provided by SWCA as well as SWCA's final baseline wildlife report, which has been included in Appendix C.

3.1 Raptor Nest Surveys

3.1.1 Methods

Raptor nest survey methods were coordinated with the agencies (WGFD and USFWS). Both ground-based and aerial raptor nest surveys were conducted within the Project area (Appendix C). On April 27 and May 9, 2010 as well as on April 1, 2011, SWCA opportunistically scanned for raptor nest structures while conducting greater sage-grouse (*Centrocercus urophasianus*) lek surveys from a fixed-wing aircraft (see Section 3.6.1, Figure 12 for an illustration of the survey coverage provided by the fixed-wing transects). The aerial lek surveys allowed coverage of at least a 3-mile buffer of final proposed turbine locations and up to six miles in some cases (Figure 12). While the main focus of the fixed-wing surveys was to search for greater sage-grouse leks and this likely influenced the ability to detect raptor nests, the lek surveys did provide extensive coverage over the Project area and surrounding buffer. Additional ground and aerial surveys provide further data on raptor nests in the vicinity of the Project as well. On June 21, 22, 23, and 30, 2010, mid-day nest searches were also conducted from the ground by personnel hiking meandering transects focused on any patches of woodland that appeared suitable for raptor nests.

A formal aerial helicopter survey for raptor nests occurred on May 13, 2011 (Figure 5). During this survey, the Project area and an associated 1-mile buffer were surveyed for all raptor species, and the Project area and an associated 3-mile buffer were surveyed for golden eagle nests (see Figure 5 for actual survey route flown during the aerial helicopter raptor nest search). The aerial helicopter raptor nest search allowed for the identification of nest locations, as well as a determination of status (active/inactive) of each nest at the time of the survey. A second aerial helicopter nest search was not conducted to confirm occupancy status, but, as discussed in Section 3.1.2, below, additional observational work in the vicinity of the Project area during baseline studies provided additional data on the likelihood of nest occupancy. As described in the final baseline report, nests observed incidentally over the course of the baseline studies were also recorded (Appendix C).

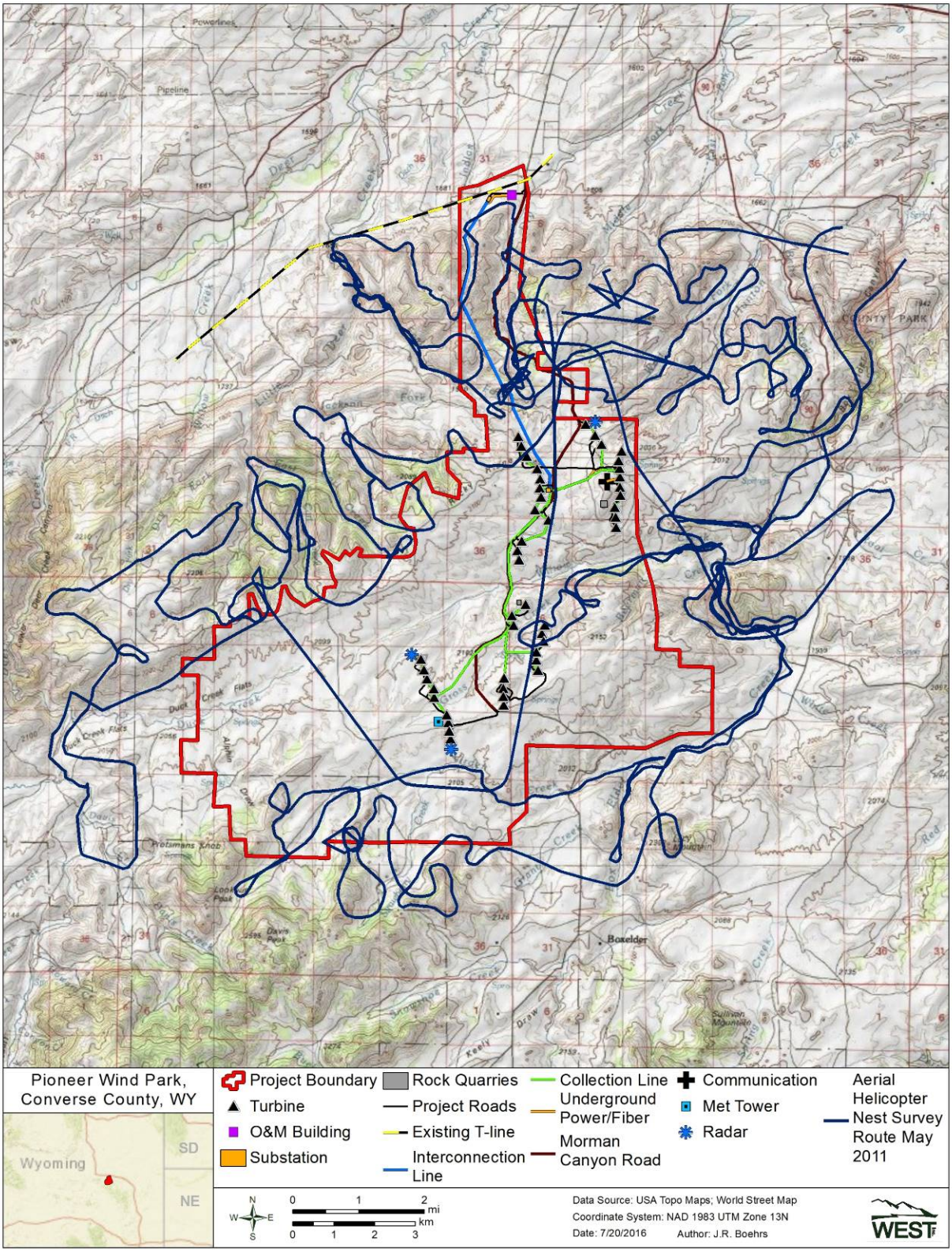
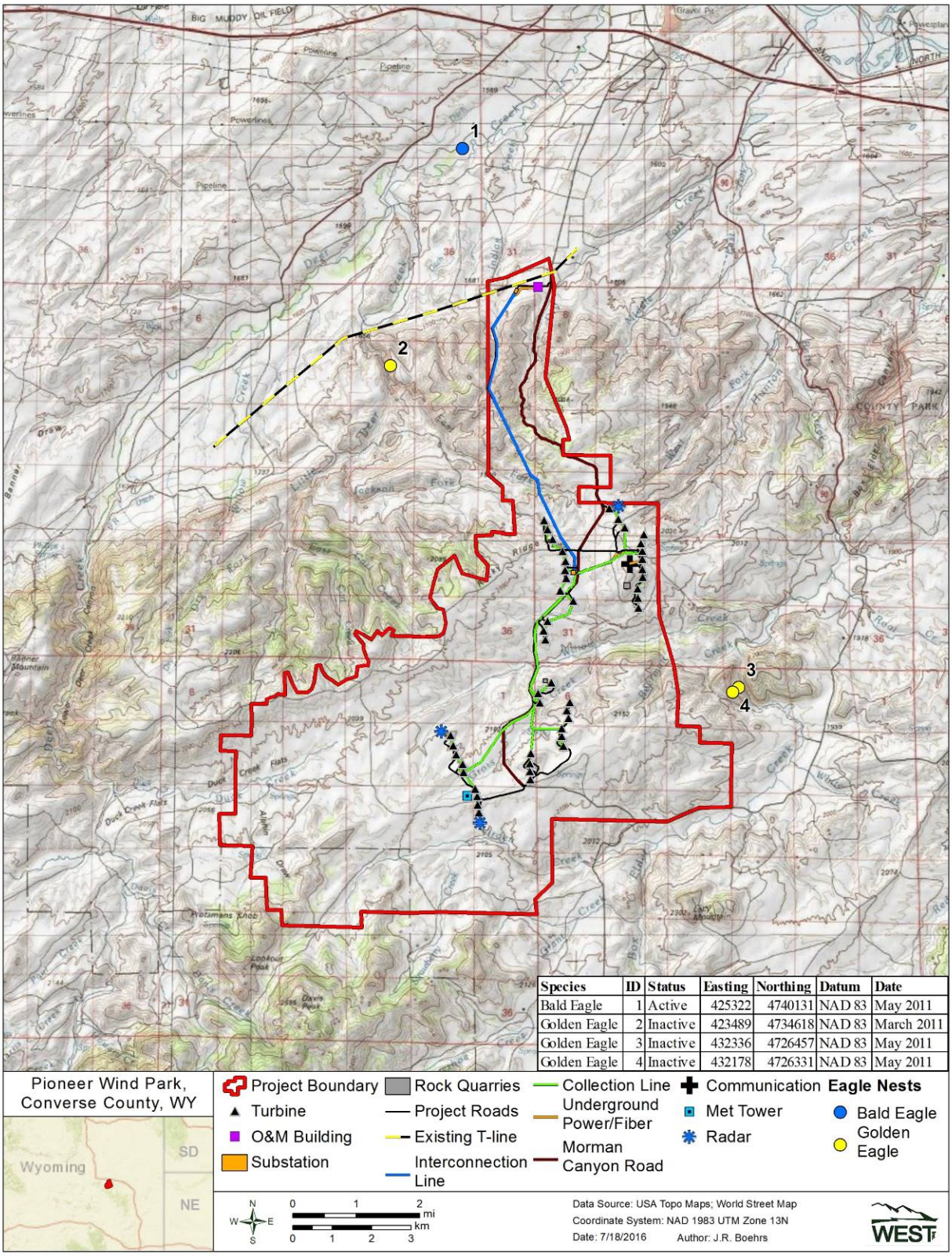


Figure 5. Location of aerial helicopter raptor nest survey route flown on May 13, 2011 within the Pioneer Wind Park Project Area and surrounding survey buffer, Converse County, Wyoming.

3.1.2 Eagle Results

Surveys identified three golden eagles nests and one bald eagle nest. All four nests are outside the project area (Figure 6). The bald eagle nest was observed outside of the aerial nest survey area with two adults siting on the nest during the eagle roost surveys conducted in March of 2011 and was considered active in 2011. Since the bald eagle nest was outside of the raptor nest survey area, follow-up visits to document success/productivity of the bald eagle nest were not conducted. No golden eagles were observed in proximity to the three nests observed during the aerial helicopter survey on May 13, 2011. All three golden eagle nests were therefore considered inactive at the time of the survey (Appendix C). However, significant golden eagle activity was recorded near the southeastern nest sites during spring and summer during long watch raptor surveys (see Section 3.2 below). Follow-up visits to these nests could not be conducted as the nests were located on private land where access was not available. The two southern golden eagle nests (located approximately 0.13 miles from each other) are likely alternate nest sites for one eagle territory and are located approximately 1.97 and 1.99 miles from the nearest proposed turbine location (Figure 6; refer to Section 4.0 below for details of Project siting relative to baseline data collection). The remaining golden eagle nest is located approximately 3.42 miles from the nearest turbine (Figure 6). The one identified bald eagle nest is located approximately 5.98 miles from the nearest turbine location.



Species	ID	Status	Easting	Northing	Datum	Date
Bald Eagle	1	Active	425322	4740131	NAD 83	May 2011
Golden Eagle	2	Inactive	423489	4734618	NAD 83	March 2011
Golden Eagle	3	Inactive	432336	4726457	NAD 83	May 2011
Golden Eagle	4	Inactive	432178	4726331	NAD 83	May 2011

Figure 6. Location of bald and golden eagle nests identified in the vicinity of the Pioneer Wind Park Project, Converse County, Wyoming during baseline studies conducted in 2010 and 2011.

3.1.3 Discussion

The methods used for conducting raptor nest searches in 2010 and 2011 in the vicinity of the Project were limited in their ability to determine nest occupancy status for the reasons discussed in Section 3.1.1 above. However, collectively, the various raptor nest survey efforts and other observational surveys conducted during the baseline studies provide detailed information on raptors (and eagles) nesting in the vicinity of the Project. No eagle nests were identified within the Project area, but there are three golden eagle nests (two territories) and one bald eagle nest that were identified within a 3-mile buffer of the Project area boundary. Based on the locations of the identified golden eagle nests, it appears that two golden eagle territories exist within the 3-mile buffer surrounding the Project area. Although the golden eagle nests were identified as inactive during the aerial helicopter survey conducted on May 13, 2011, an adult golden eagle was observed via spotting scope perched on a cliff near nests 3 and 4 on August 26, 2011 suggesting the territory may have been occupied. Furthermore, the Raptor Point data (see Section 3.2. below) suggests that golden eagles were frequently observed flying in the vicinity of nests 2 and 3, which also suggests that the territory may have been occupied during the 2011 nesting season. It is possible that both golden eagle territories may become occupied in subsequent years. It has therefore been assumed for purposes of this ECP that each of the identified golden eagle nests are occupied. One active/occupied bald eagle nest was identified in March of 2011 within the 3-mile buffer surrounding the Project area; however the nest is located approximately 5.98 miles from the nearest turbine location. Success/productivity was not determined for the active bald eagle nest in 2011.

3.2 Eagle and other Raptor Surveys: Long-watch Surveys

3.2.1 Methods

Protocols for the baseline studies were developed prior to release of the USFWS ECP guidance; however, they were developed in communication with USFWS and WGFD. Over the two years of baseline studies, 166 surveys were conducted at four stations (51 surveys at station RRM, 51 surveys at station P2RM, 49 surveys at station P1RM1, and 15 surveys at station P1RM2; Figure 7). The four stations and an associated 800-meter (m) buffer provided coverage of approximately 11% of the area within a 1 km buffer of turbine locations. The four stations were selected to maximize viewsheds and visibility over the Project area. Stations RRM, P2RM, and P1RM1 were surveyed from April 2010 through November 2011, while Station P1RM2 was surveyed from August 2010 through January 2011. Surveys were generally conducted once a week, and the duration of surveys was up to 12 daylight hours. Surveyors recorded all raptor species observed during surveys (regardless of distance) as well as the number of individuals, age, sex, initial, maximum, and minimum flight heights, flight direction, flight behavior, and time of observation (Appendix C). Flight paths were mapped on topographic maps and then digitized into a GIS format. Observers used landscape features, topography, meteorological (MET) towers, and roads to aid in estimating distances and for mapping of observations recorded during the eagle and other raptor surveys (long watch surveys).

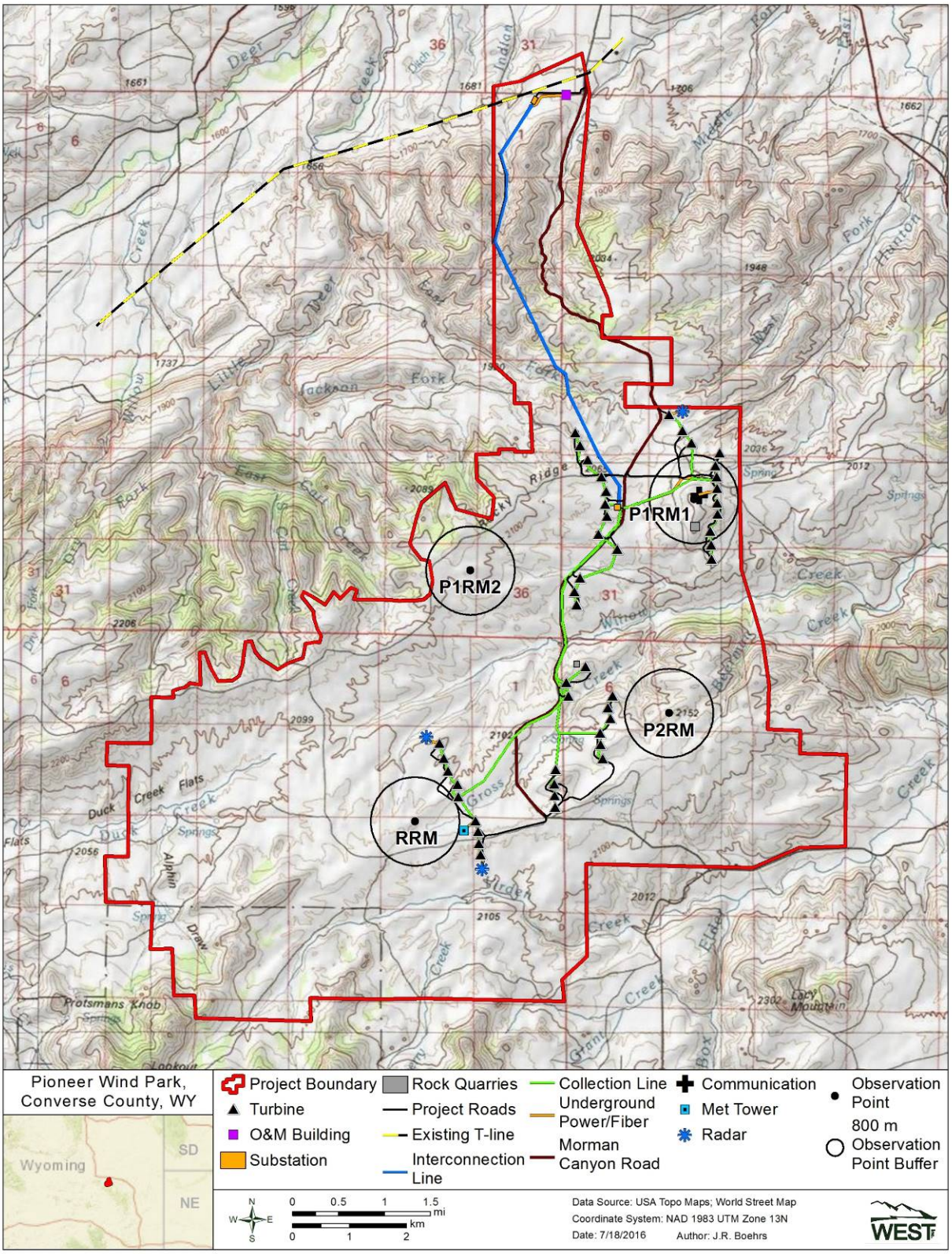


Figure 7. Location of Eagle and other Raptor Survey (Long Watch Survey) Stations and associated 800-m radius plots within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming.

3.2.2 Eagle Results

During the two years of baseline surveys, a total of 1,787 observation hours (967.26 hours in fall; 379.36 in spring; 350.59 in summer; and 89.13 in winter) were conducted across all eagle and other raptor survey stations (average of 10.8 hours per survey; Figure 8; Appendix C). Without marked birds, it is impossible to distinguish among observations, and as such, some of the observations are likely repeat observations of the same individuals. For this reason, while sightings can indicate intensity of use of a surveyed area, they are not a measure of the local population or eagle density in the vicinity of the project. Golden eagle was the most commonly recorded species over the two years of baseline surveys (623 observations made with 713 sightings of individuals [some of which are likely repeat observations of the same individuals]; 26% of all raptors detected). Of the 713 golden eagle sightings, 363 were classified as adults, 237 as unknown age class, 97 as juvenile and 16 as sub-adults. There were 55 bald eagle observations (62 sightings of individuals [some of which are likely repeat observations of the same individuals]) recorded during surveys (2% of all raptors detected; Appendix C). Of the 62 sightings of bald eagles, 37 were classified as adults, 13 as juvenile, 10 were unknown, and two were sub-adults. In addition, nine individual unidentified eagle sightings in eight observations were recorded over the two years of baseline surveys.

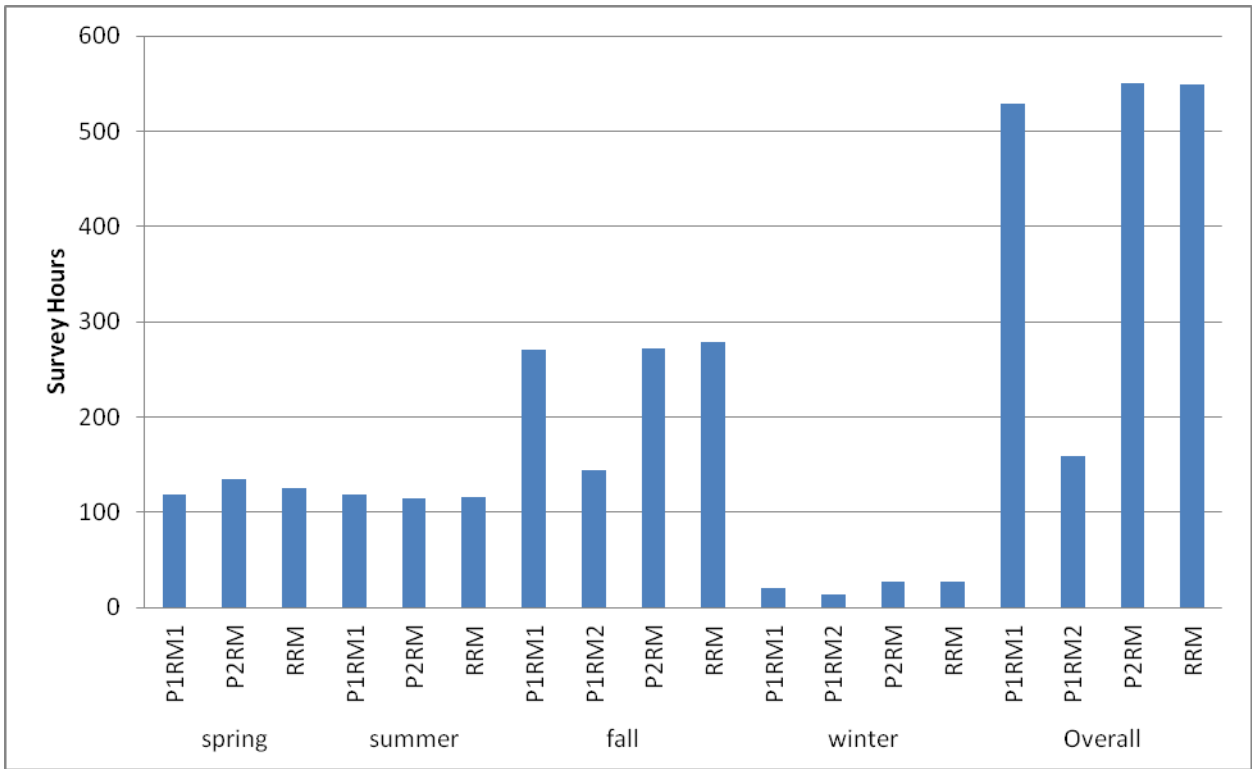


Figure 8. Total number of survey hours for each Eagle and other Raptor Survey (Long Watch Survey) Station (per season and overall) conducted during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011.

An analysis of seasonal patterns in eagle observations was conducted by looking at the raw counts (regardless of distance from survey point, or flight height) of the number of eagles observed during surveys. Golden eagle observations start to increase in mid-August/early September and continue through November (Table 4a; Figure 9a). During both 2010 and 2011, golden eagle use (observations/hour) was highest in October (0.71 and 0.77, respectively; Table 4a; Figure 9a). Bald eagle observations peaked in mid to late October for both 2010 and 2011 (Table 4b, Figure 9b). From October 15 to October 21, 2010

there were 11 groups of bald eagles with 14 individuals observed, with the peak on October 20, 2010, when 5 groups with 6 individuals were observed. From October 19 to October 31, 2011 there were 17 groups of bald eagles with 20 individuals observed, and the peak occurred on October 19, 2011 when 8 groups with 10 individuals were observed.

Table 4a. Number of groups, observations, survey hours, and observations per hour for golden eagles by month and overall during Eagle and other Raptor Surveys (Long Watch Surveys) within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 through November 2011.

Month	# grps	# obs	# Survey Hours	# obs/hr
April 2010	1	1	13	0.08
May 2010	11	12	88	0.14
June 2010	8	9	160	0.06
July 2010	0	0	12	0.00
August 2010	12	12	108	0.11
September 2010	47	55	209	0.26
October 2010	116	131	184	0.71
November 2010	46	48	77	0.62
December 2010	0	0	22	0.00
January 2011	1	1	26	0.04
February 2011	4	4	27	0.15
March 2011	19	20	49	0.41
April 2011	36	39	125	0.31
May 2011	47	54	119	0.45
June 2011	52	65	178	0.37
August 2011	46	52	83	0.63
September 2011	82	104	156	0.67
October 2011	73	82	106	0.77
November 2011	22	24	45	0.53
Totals	**623**	**713**	**1,787**	**0.40**

*Irrespective of distance from observer.

Table 4b. Number of groups, observations, survey hours, and observations per hour for bald eagles by month and overall during Eagle and other Raptor Surveys (Long Watch Surveys) within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 through November 2011.

Month	# grps	# obs	# Survey Hours	# obs/hr
April 2010	0	0	13	0.00
May 2010	1	1	88	0.01
June 2010	3	3	160	0.02
July 2010	0	0	12	0.00
August 2010	0	0	108	0.00
September 2010	5	6	209	0.03
October 2010	15	18	184	0.10
November 2010	1	1	77	0.01
December 2010	0	0	22	0.00
January 2011	1	1	26	0.04
February 2011	0	0	27	0.00
March 2011	2	2	49	0.04
April 2011	1	1	125	0.01
May 2011	0	0	119	0.00
June 2011	1	1	178	0.01
August 2011	3	3	83	0.04
September 2011	0	0	156	0.00
October 2011	17	20	106	0.19
November 2011	5	5	45	0.11
Totals	**55**	**62**	**1,787**	**0.03**

*Irrespective of distance from observer.

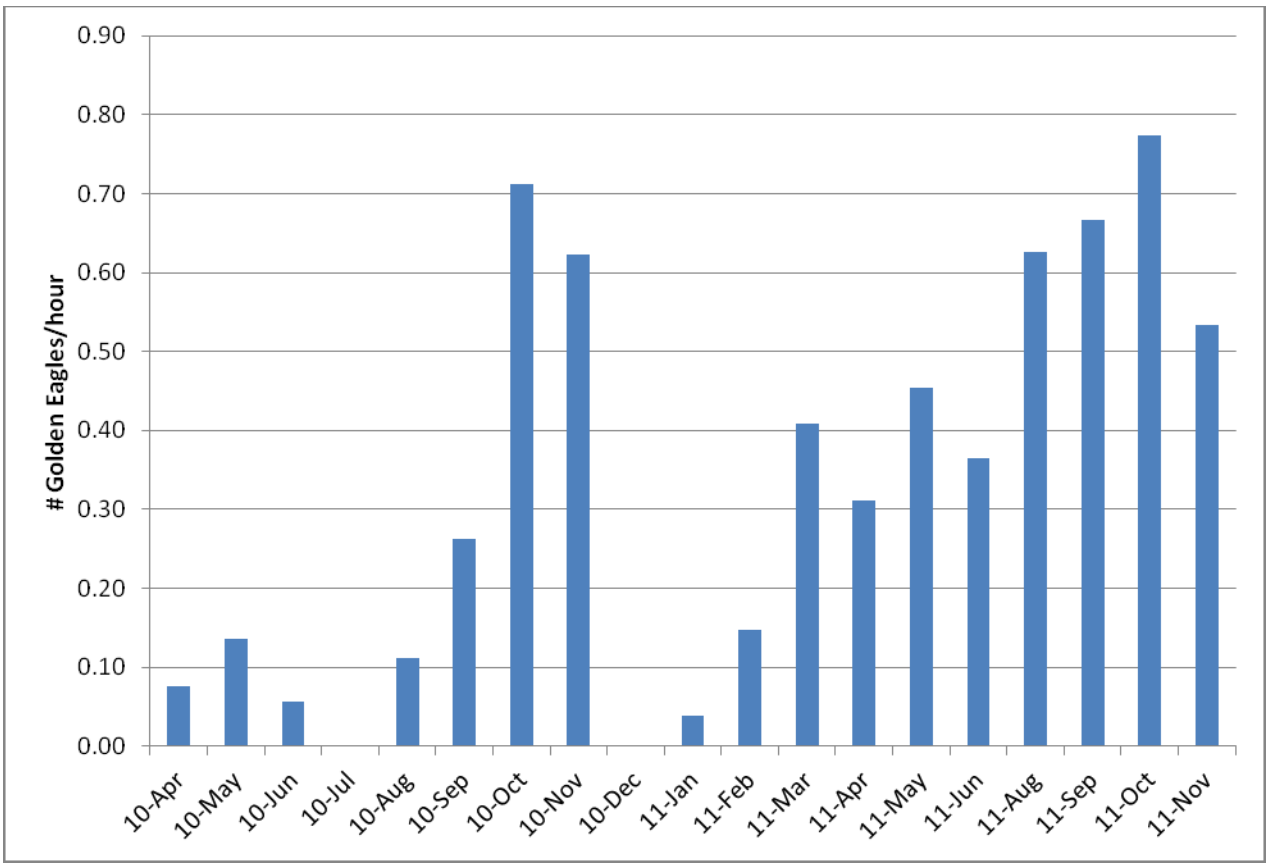


Figure 9a. Golden eagle observations per survey hours per month during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011.

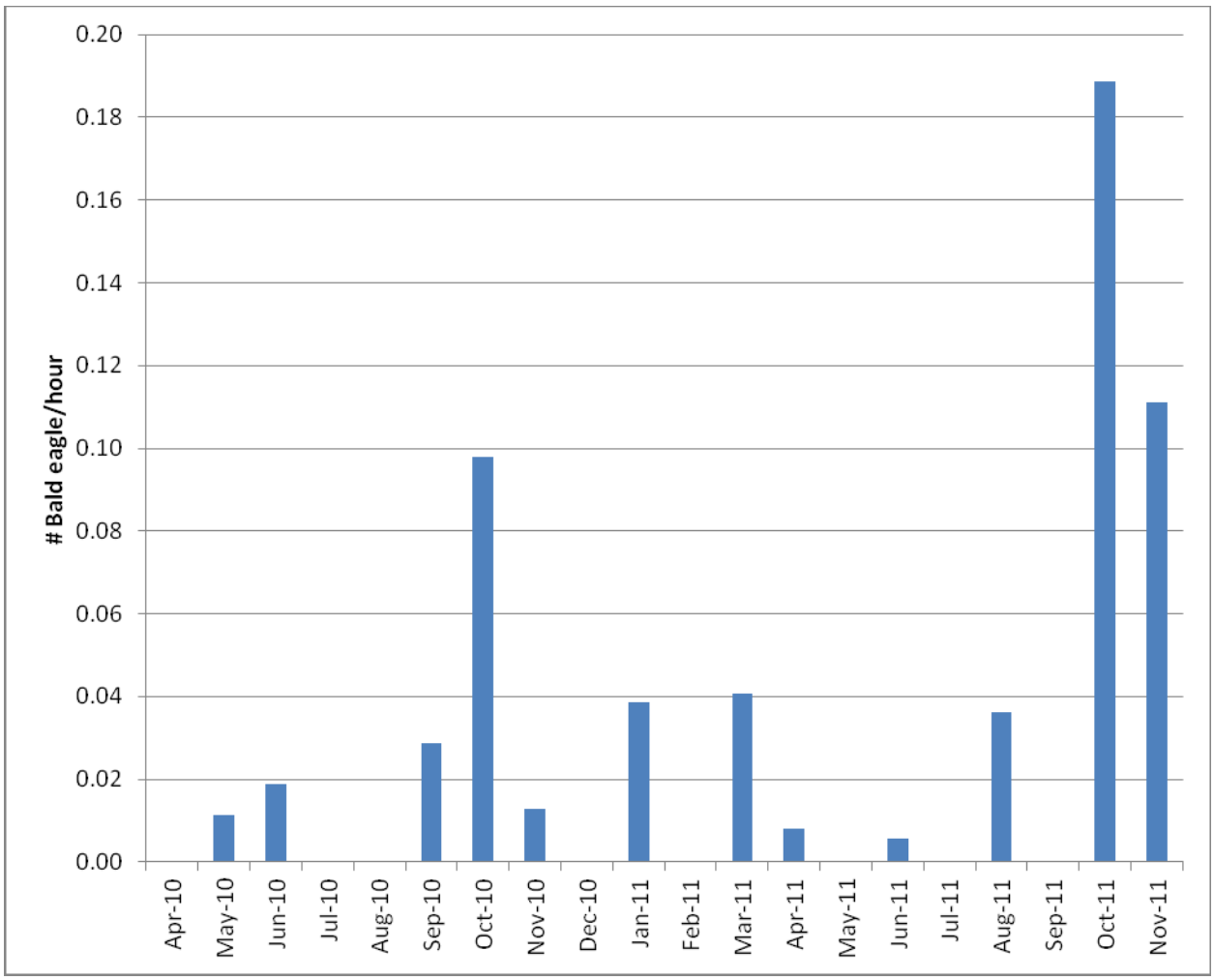


Figure 9b. Bald eagle observations per survey hours per month during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011.

3.2.3 Discussion

While only four observation stations were surveyed during the eagle and other raptor surveys (providing coverage of approximately 11% of the area within a 1 km buffer of final turbine locations or approximately 8% of a minimum convex polygon surrounding final turbine locations), the locations of the points were selected to maximize the viewshed or coverage across the Project area. The locations of observation stations were selected prior to finalizing the turbine layout, which also influenced the amount of coverage within a 1 km buffer of the final turbine locations. Prominent topographic features, other landscape features, MET towers, and roads enabled the observers to accurately map the locations of eagle observations and plot the various distances away from survey points. Both bald and golden eagle observations per hour peaked in October (Figure 9). The peak in the fall season also corresponds with increased survey effort in the fall which may be influencing the pattern in eagle observations observed, however, accounting for effort (i.e. standardizing the observations by survey hour) should help to address this potential bias. SWCA conducted a flight occurrence analysis utilizing mapped flight paths from the eagle and other raptor surveys to help identify areas within the Project area that may be more risky for eagles (Appendix C). The analysis was conducted by including mapped flight paths for observations that were recorded flying at heights between 38 m to 122 m AGL (the likely rotor-swept-zone; RSZ) and

overlaying those flight paths on a 100 X100 m grid cell. Each cell within the grid was assigned a numeric value when a unique flight path intersected the cell. Each flight path was counted only one time per cell (i.e. a single mapped flight path was not counted more than once per cell regardless of the number of times it intersected the cell). Based on a flight occurrence analysis for flights within the RSZ, SWCA determined that golden eagles are primarily using an approximately 5-square mile area along the Willow Creek canyon and associated ridgelines, and to a much lesser degree, the ridgelines on the western periphery of the Project area (see Section 4.0 below for figures that illustrate the locations of these areas relative to proposed turbine locations and other infrastructure). No obvious use patterns were detected for bald eagles by SWCA. A more detailed description of the flight occurrence analysis conducted by SWCA is included in Section 2.2., page 17 of the final baseline biological report attached in Appendix C. A similar analysis (with similar results) was conducted to help inform final turbine siting decisions with the intent of avoiding and minimizing risk to eagles (see Section 4.0 below).

3.3 Other Avian Use Surveys: 20 Minute Point Counts

3.3.1 Methods

A total of 22 fixed-point avian use survey stations were established and 945 avian use surveys were conducted resulting in a total of 281.67 hours of survey effort during baseline wildlife studies (Figure 10; Appendix C). The major purpose of these surveys was to record other avian use (i.e. non-eagle use *or non-eagle and non-raptor use*) for the Project area but some eagle observations were recorded during these avian surveys as well. During the first year of studies, plots were surveyed weekly from May 13 to June 30, 2010 and August 18 to 13 November, 2010. Plots were surveyed twice in the winter (January 12 to 14, 2011 and February 28 to March 2, 2011). During the second year of studies, plots were surveyed weekly from April 5 to June 30, 2011 and August 17 to November 12, 2011. Two winter surveys were conducted on February 14 to 15 and February 28 to March 1, 2012 (Appendix C).

Surveys were conducted from sunrise to no later than four to five hours after sunrise. With the exception of the spring 2011 surveys, survey duration was 20-minutes at each station and all birds detected within 200 m of the point location were recorded. During the spring of 2011, surveys were conducted using 10-minute count durations, instead of the 20-minute duration used during other seasons. Data collected included: species, number of individuals, age, sex, distance from observer (a rangefinder was used to help estimate distance during avian use surveys), activity, flight height, flight direction, time, and whether the bird/flock was inside the survey plot at initiation of the point count or moved into the plot during the survey.

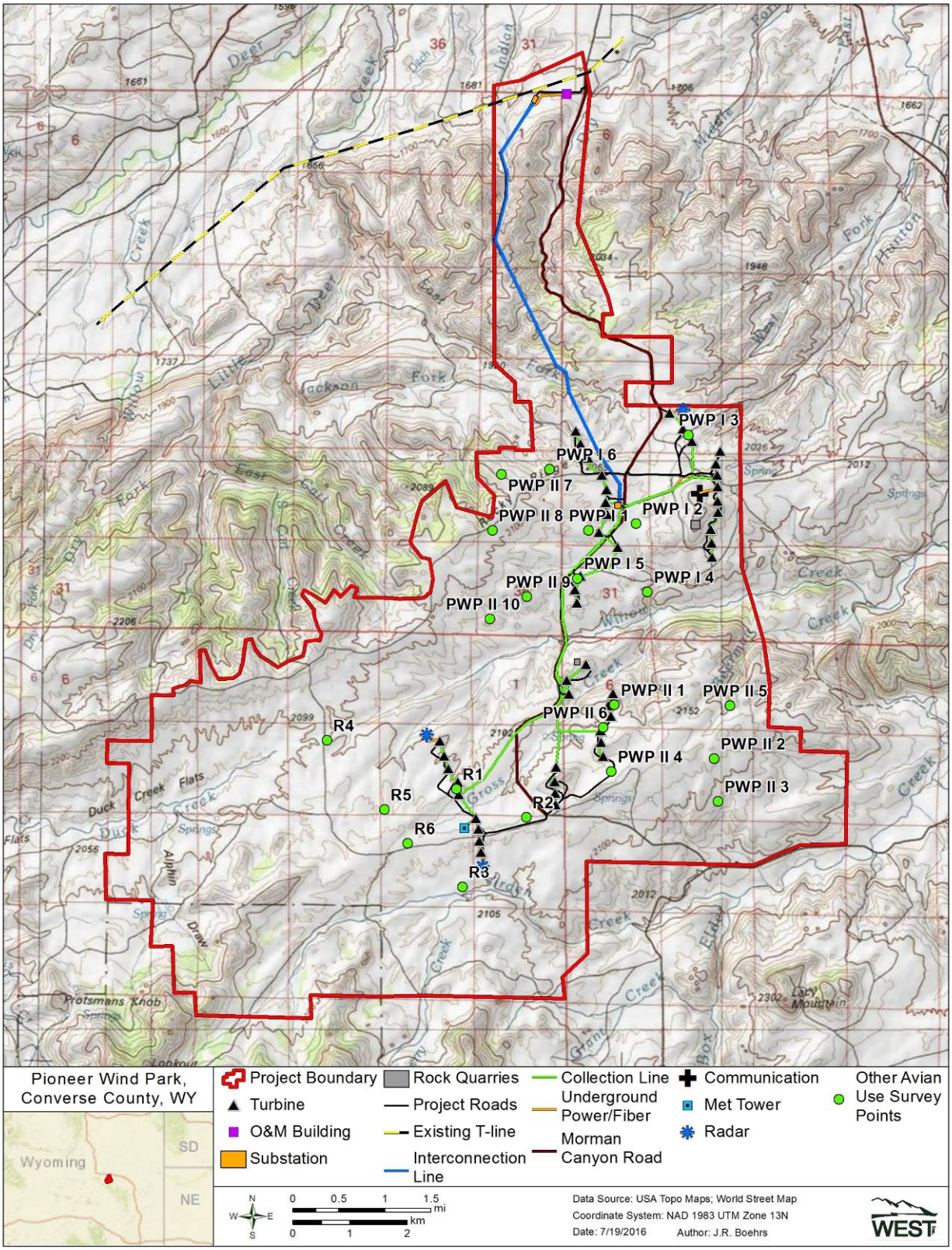


Figure 10. Location of other Avian Use Survey Stations within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming.

3.3.2 Eagle Results from Avian Use Surveys

Based on the avian use surveys conducted within the Project area, use estimates (# observations/plot/survey) were less than one per survey for both bald and golden eagles (Appendix C). A total of 11 golden eagle observations (six adults, two juveniles, two sub-adults, and one unknown age class) were recorded during avian use surveys (Table 5). Of the 11 golden eagle observations, 10 were observed flying below 200 m and one was perched. During these same avian use surveys only one sub-adult bald eagle was recorded and it was flying above 200 m.

Table 5. Golden eagle observations recorded during avian use surveys within the Pioneer Wind Park Project, Converse County, Wyoming.

Survey Point	Date	Time	Species	Number Birds	Bird Age	Behavior
R-3	6/3/2010	10:05	GOEA	1	AD	Circle Soaring
P1-4	10/4/2010	10:54	GOEA	1	2Y	Powered Flight
P2-3	11/5/2010	11:39	GOEA	1	AD	Soaring
P1-7	11/5/2010	10:46	GOEA	1	IM	Soaring
P1-2	4/8/2011	8:56	GOEA	1	IM	Flushed
P1-2	4/8/2011	8:57	GOEA	1	AD	Flushed
R-1	4/15/2011	8:01	GOEA	1	AD	Flushed
R-2	5/6/2011	9:27	GOEA	1	AD	Flushed
P1-3	11/4/2011	13:43	GOEA	1	AD	Gliding
P2-1	2/15/2012	14:15	GOEA	1	UNK	Perched
P2-1	2/15/2012	14:01	GOEA	1	2Y	Powered Flight

*Observations are presented irrespective of distance from observer.

3.3.3 Discussion

The number of golden eagles recorded during avian use surveys was similar in the spring (five observations) compared to the fall (four observations; Table 5). The two remaining golden eagle observations were recorded in the winter season. However, sampling effort varied by season with the fewest surveys conducted in the winter and this likely influenced the number of golden eagles observed by season. None of the avian use survey stations had more than two eagle observations recorded during avian use surveys and as such, areas of greater eagle use were not apparent from the avian use survey results. The eleven golden eagle observations were recorded at nine of the 22 avian use survey stations, with stations P1-2 and P2-1 having two observations each and the remaining stations having only one observation (Table 5; Figure 10). The one bald eagle observation was recorded in the fall. While still providing useful data on eagle use within the Project, the study design (including the timing of surveys [sunrise to 4 to 5 hours after sunrise] and the survey plot size [200 m radius]) is better suited for passerine surveys/small bird counts than for raptors.

3.4 February 2010 Winter Bird Survey

3.4.1 Methods

In addition to the eagle and other raptor surveys conducted in the winter of 2010 – 2011, SWCA visited the Project area on February 24, 2010 to assess winter bird species composition and relative abundance (Appendix C). One 4.5 hour survey was conducted by driving on County-maintained roads (Boxelder Creek and Mormon Canyon) and snowshoeing in the northern portion of the study area. All bird observations were identified as to species, and observers recorded the number of individuals and their location. Access into some portions of the Project area were limited due to snow cover, and only the portions along Mormon Canyon and Boxelder Creek Roads were surveyed.

3.4.2 Eagle Results

Three golden eagles were observed on the Ridgelines along Mormon Canyon and no bald eagle observations were recorded (Appendix C).

3.4.3 Discussion

The utility of this survey is rather limited due to effort (only one day). However, the survey did confirm the presence of eagles in the vicinity of the Project during winter. Additional data on eagle use in the winter was collected during eagle and other raptor surveys from December 2010 through March 2011, during avian use surveys conducted on January 12 to 14, 2011 and February 28 and March 2, 2011, and during eagle roost site surveys conducted on February 28, and March 1, 2, 3 and 4, 2011 (see Sections 3.2 and 3.3 above and Section 3.5 below).

3.5 Eagle Roost Site Surveys

3.5.1 Methods

SWCA conducted one aerial fixed-wing survey to search for undocumented eagle roosts in all areas identified as potential roost habitat within the Project area and an associated 3-mile buffer from the edge of the Project area boundary on March 3, 2011 (Appendix C; Figure 11). The aerial survey was conducted from 0700 to 1700 (10 hours). Two biologists were used to conduct the survey. The aerial roost survey was conducted along suitable habitat (primarily along riparian corridors, canyons, and other topographic depressions protected from wind and adverse weather conditions with stands of mature trees suitable for roosting eagles [Appendix C]). Roost surveys were also conducted from the ground along selected riparian corridors and canyons (areas were selected for ground surveys based on the suitability of habitat for eagle roosting as well as public driving access) in the search area on February 28, and March 1, 2, and 4, 2011. The ground based surveys were conducted from public roadways and were conducted for approximately 1.5 hours per survey either right after sunrise or right before sunset.

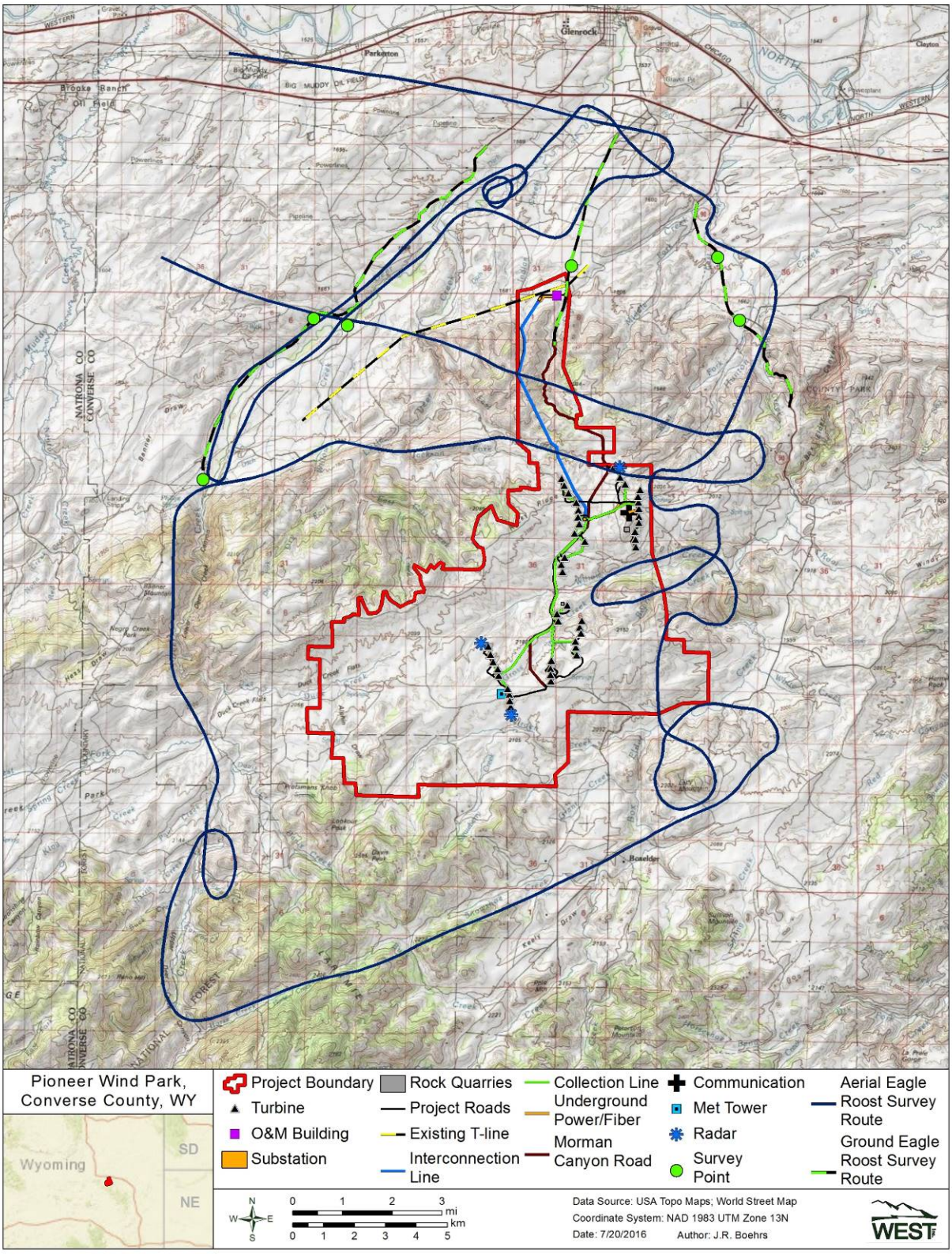


Figure 11. Location of aerial eagle roost survey route conducted on March 3, 2011 within the vicinity of the Pioneer Wind Park Project Area, Converse County, Wyoming.

3.5.2 Results

No eagle roosts were identified during the eagle roost surveys conducted by SWCA (Appendix C). One juvenile golden eagle was observed soaring along Deer Creek outside of the 3-mile survey buffer; however, the golden eagle was not observed within the search area and was not observed perched (Appendix C).

3.5.3 Discussion

No concentrated winter roost sites were identified for bald or golden eagles during the surveys and there is no communal winter roost habitat in the Project footprint. However, given the level of survey effort, the time of day of the aerial survey, and the time of year of surveys, it is possible that a small number of eagles may occasionally roost within the vicinity of the Project area given that eagles do occur in the area throughout the year as determined during the baseline studies.

3.6 Greater Sage-Grouse Lek Surveys

3.6.1 Methods

Information on greater sage-grouse lek surveys is provided in the ECP because some of these surveys were also used to opportunistically search for eagle and other raptor nests. Another reason is that sage-grouse are a prey species for eagles;eagles are attracted to leks where breeding grouse congregate in spring and often (in lower numbers) again in fall.

SWCA conducted three aerial (fixed-wing) surveys within the Project area and the area within 2 miles of the Project area boundary, to search for greater sage-grouse leks, on April 27 and May 9, 2010, and again on April 1, 2011 (Appendix C). Surveys were conducted by two observers under acceptable time and weather parameters for lek surveys established by WGFD. Surveys were conducted by flying north-south-oriented transects separated by 0.6 miles at an average altitude of 200 feet above ground level (AGL; Figure 12).

In addition to the aerial searches, a minimum of three ground-based counts were conducted at two historic lek locations and one new lek location in the study area between April 16 and May 15, 2010 and between April 12 and May 18, 2011, following WGFD protocols (Appendix C).

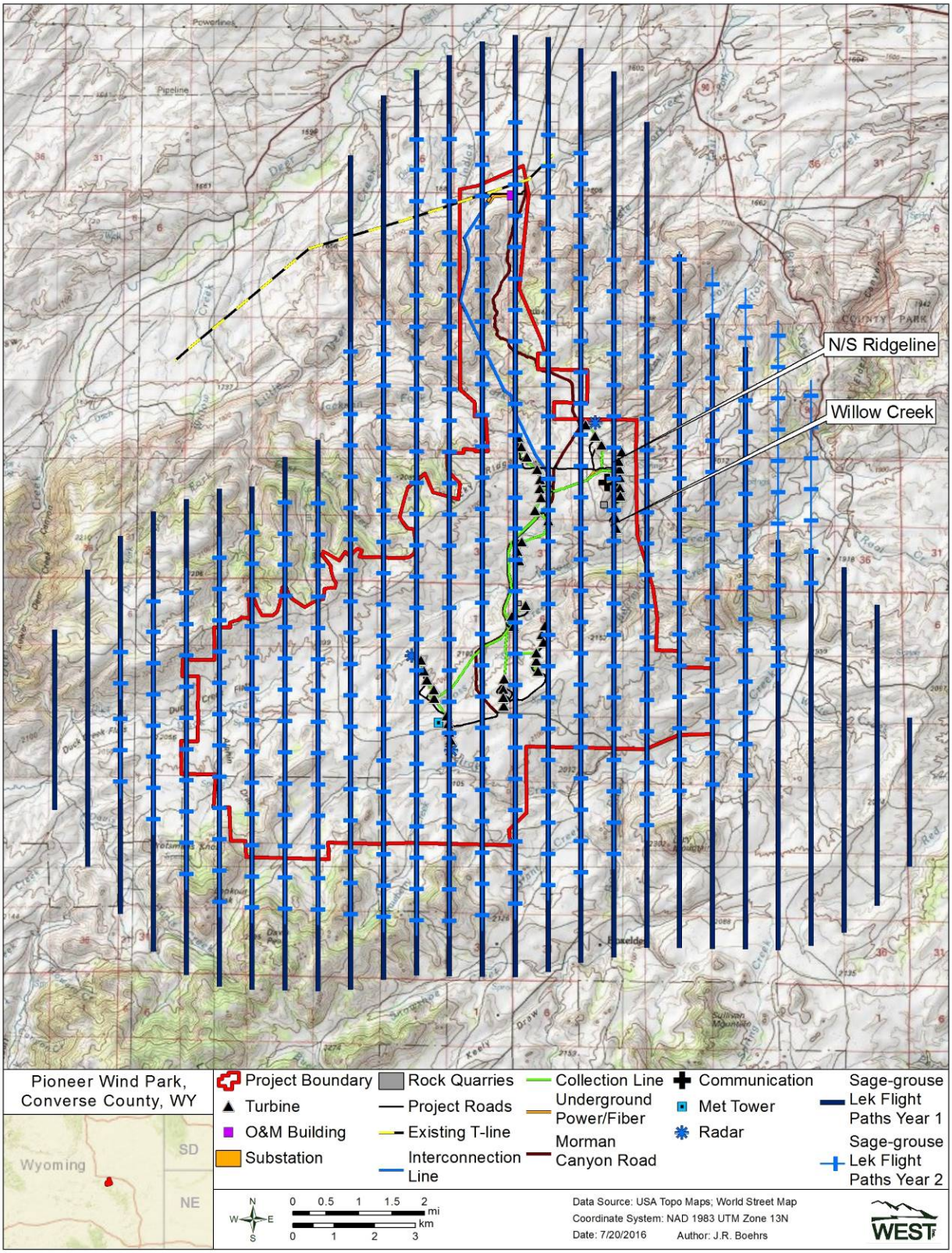


Figure 12. Location of fixed-wing transects flown to search for greater sage-grouse leks in the vicinity of the Pioneer Wind Park Project Area, Converse, County, Wyoming.

3.6.2 Results

No new lek locations were identified during any of the aerial searches within the study area. However, a new location with strutting grouse was identified incidentally while conducting avian use surveys, and was confirmed by a follow-up ground visit. Seven displaying adult males and two females were observed at this location. Over the two years of ground counts conducted at leks in the vicinity of the Project area, the maximum male counts from the ground ranged from seven males to 35 males (Appendix C).

3.6.3 Discussion

Methods for conducting greater sage-grouse lek surveys (both ground counts and aerial searches) were coordinated with the agencies (WGFD and USFWS) and the methods are in accordance with the WGFD's Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Two historic greater sage-grouse leks are located in the vicinity of the Project and a new location with strutting grouse was identified in the vicinity of the Project as well (Figure 13). Greater sage-grouse were also identified within the site during other survey efforts, and greater-sage grouse provide a potential prey source for raptors, including eagles.

3.7 Prey Base

All incidental wildlife observations that occurred while in the Project area conducting standardized surveys were recorded. This includes a variety of prey species for eagles such as greater sage-grouse (see Section 3.6 above), prairie dogs (five prairie dog colonies were identified and mapped during baseline studies), lagomorph species (recorded incidentally), big game species including elk, mule deer, and antelope (recorded incidentally) and ground squirrels (recorded incidentally). SWCA mapped prairie dog colonies within the Project by walking the perimeter of identified colonies and collecting UTM locations at outlying burrow locations. A 100 m buffer was applied to these UTM locations and turbines were sited outside of these areas (Figure 13). Crucial mule deer winter range exists within the northern portion of the Project and mule deer were observed within the Project area and in the vicinity of the crucial winter range during the baseline studies; however, raptor count surveys were conducted for 75 hours in December 2010, January 2011, and February 2011 and only 5 individual golden eagle observations and one individual bald eagle observation were recorded (see Section 3.2 above), suggesting that mule deer carcasses were not attracting a large number of eagles into the Project area during baseline studies. WGFD indicated that they foresee no Project-related management issue with wintering mule deer because the project elements in crucial winter habitat consist primarily of a transmission line corridor (WGFD letter dated April 27, 2010). WGFD did recommend that winter big game stipulations be applied during construction (no construction activities within big game winter range from November 15 through April 30). Livestock grazing within the Project is primarily domestic cattle grazing (although domestic horses may also occur in the area), with the majority of cattle grazing occurring in late spring through the fall season. Very little, if any, calving occurs in areas proposed for turbine locations. A figure depicting areas identified as having potential for concentrated prey is provided below (Figure 13). Eagle habitat is present throughout the Project area including shrub/steppe, grasslands, rock outcroppings, cliffs, and trees. Refer to Section 4.0 below for a description of how the baseline data including information on prey base were used to inform Project siting.

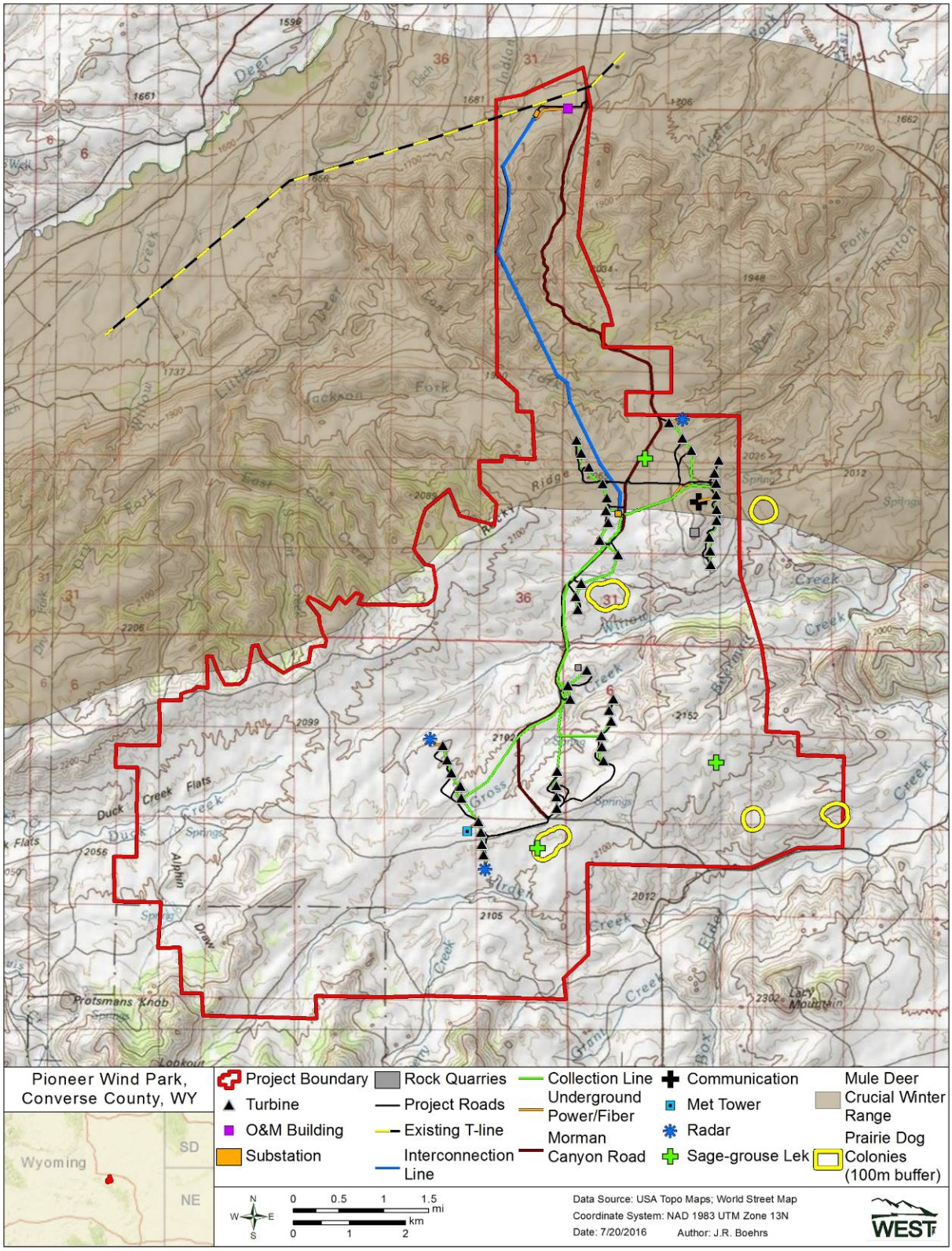


Figure 13. Prairie dog colonies, greater sage grouse leks, and mule deer crucial winter in the vicinity of the proposed Pioneer Wind Park Project Area, Converse County, Wyoming.

3.8 Eagle Use

A total of 1,787 observation hours were logged during eagle and other raptor surveys, and 713 individual golden eagle sightings (some of which are likely repeat observations of the same individuals) in 623 observations, 62 individual bald eagle sightings (some of which also likely are repeat observations of the same individuals) in 55 observations, and nine individual unidentified eagle sightings in eight observations were recorded. Irrespective of height, there were 68 golden eagles recorded within 800 m of eagle and other raptor survey stations (0.04 golden eagles/hour; 0.01 golden eagles/20-min survey), 10 bald eagles within 800 m of eagle and other raptor survey stations (0.01 bald eagles/hour; <0.01 bald eagles/20-min survey), and one unidentified eagle within 800 m of eagle and other raptor survey stations (<0.01 unidentified eagles/hour; <0.01 unidentified eagles/20-min survey). Flight paths were mapped and digitized for all eagle observations recorded during raptor point count surveys over an 18-month period (Figures 14 and 15).

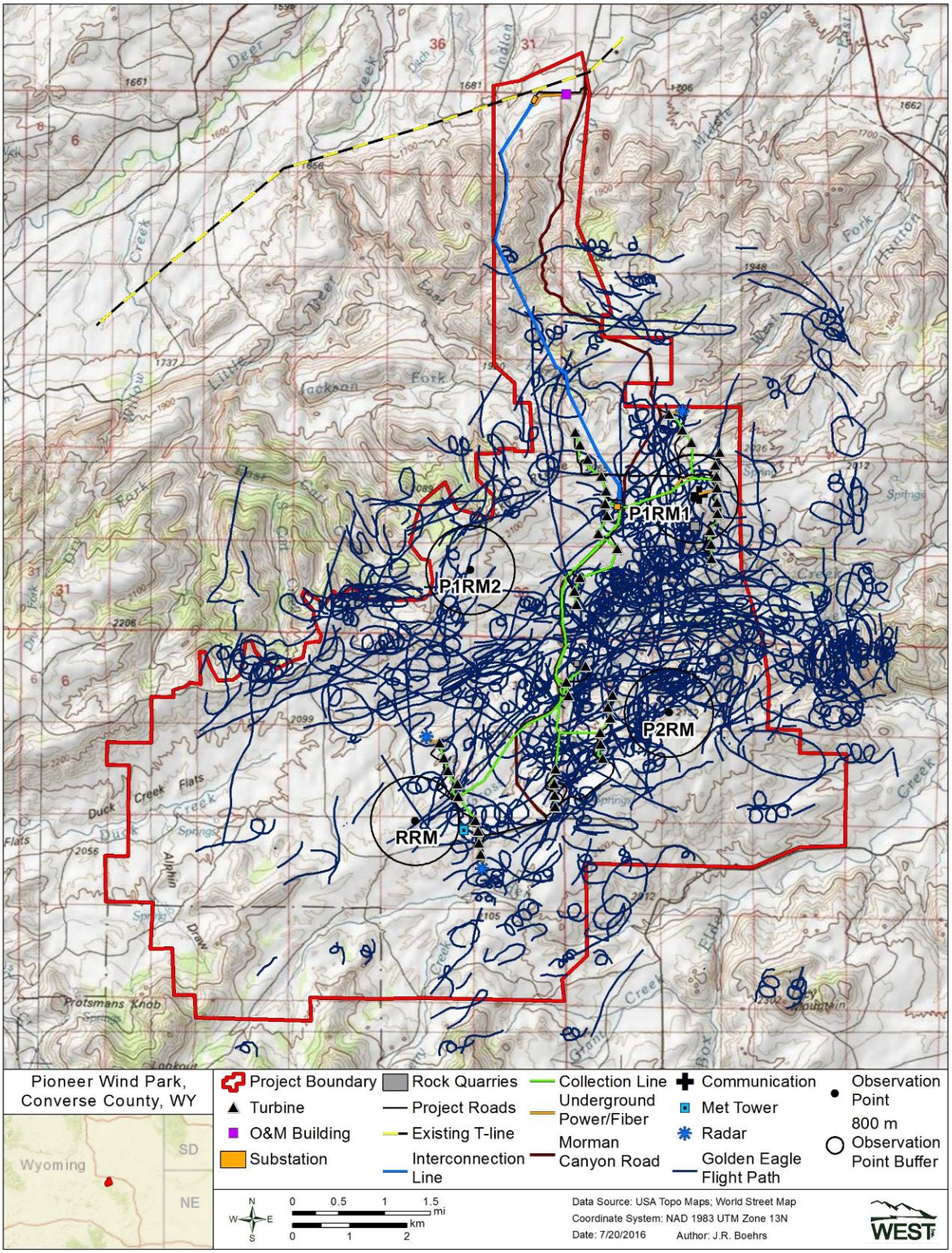


Figure 14. Mapped golden eagle flight paths from 1,787 hours of eagle and other raptor surveys conducted from April 2010 through November 2011 within the Pioneer Wind Park Project Area, Converse County, Wyoming.

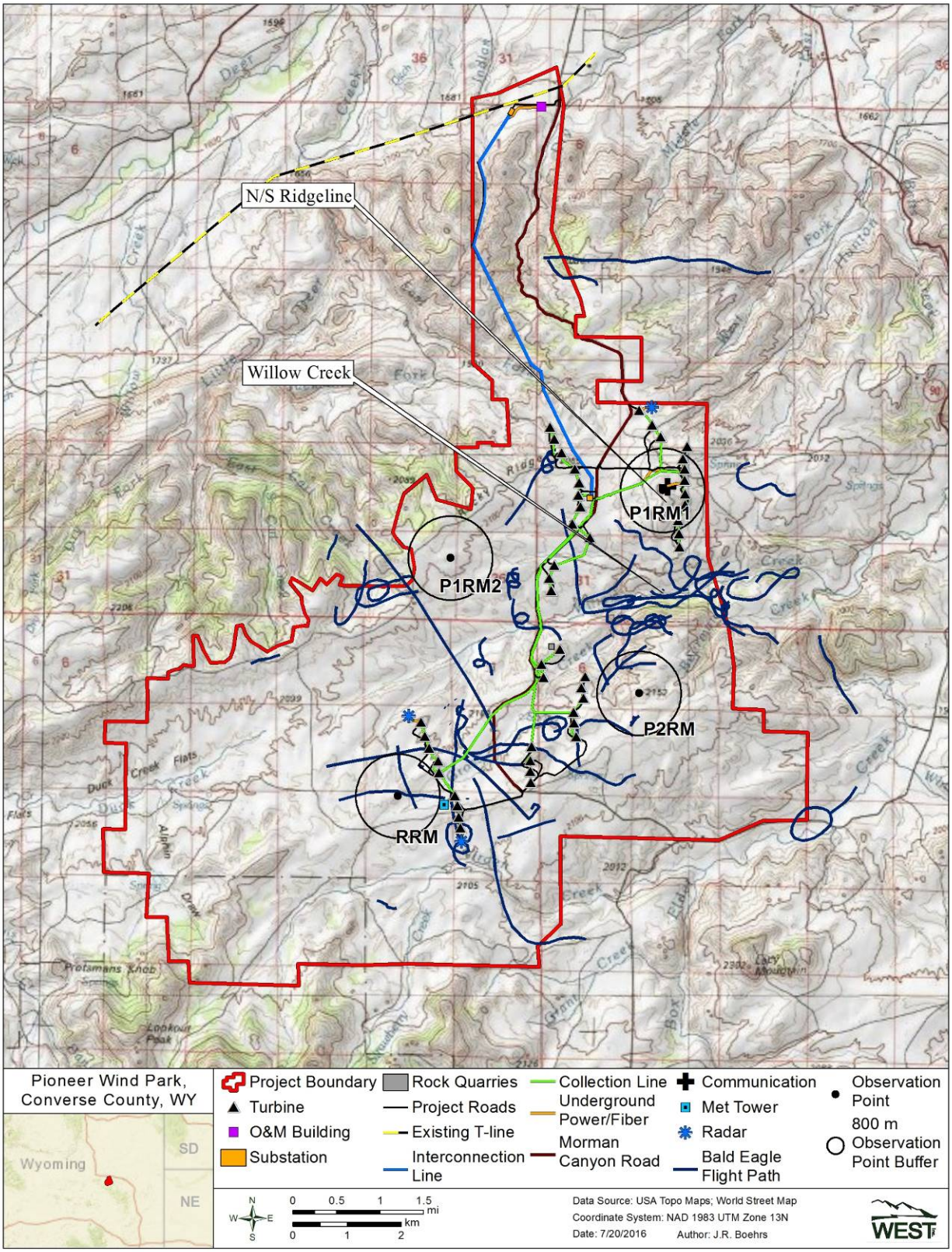


Figure 15. Mapped bald eagle flight paths from 1,787 hours of eagle and other raptor surveys conducted from April 2010 through November 2011 within the Pioneer Wind Park Project Area, Converse County, Wyoming.

4.0 AVOIDANCE AND MINIMIZATION OF RISKS DURING PROJECT PLANNING/DESIGN PHASE (STAGE 4)

The site-specific eagle data collected for the Project suggest the site may receive a Category 2 designation according to the USFWS ECP Guidance. However, PWPI has and will continue to implement a variety of Best Management Practices (BMPs) and Conservation Measures to reduce the risk to eagles from the Project during all phases of the Project including pre-construction, construction, and operations. The following BMPs and conservation measures have either been implemented or are planned for the Project during the pre-construction phase. BMPs and conservation measures that will be implemented to reduce the potential risk to eagles at the Project during construction and operation of the Project are presented in Section 6.0 below.

4.1 Pre-Construction

4.1.1 Siting the Project Layout

In 2008, PWPI was exploring the opportunity of developing wind projects in Wyoming. PWPI first went to the State of Wyoming who was managing a met tower loan program. This program was designed to loan met towers to ranchers/landowners to either collect data to build its own turbine for on-site use or to attract large scale wind developers to develop their land to increase the value of their land—to improve the economics of ranching. In the case of the Project, PWPI thought the data that was collected by one of the landowners indicated that there was enough wind for a commercial scale wind farm. PWPI then began leasing land and commencing wildlife studies. Through that process, PWPI came up with an original turbine layout with the help of wind meteorologists. The original layout included turbines within approximately 1 mile of nests and nearby historic properties (Figure 16). PWPI submitted an application for a permit to the ISC which included this original turbine layout on February 2, 2011. After revisiting the layout and realizing the turbines' proximity to the eagle nests and cultural resources, PWPI updated its application to the ISC on April 1, 2011 and requested that the hearing address the newly developed layout (see alternative turbine layout in Figure 16). This new layout moved the whole southern string approximately 1.5 miles to the west so that the closest turbine to an eagle nest is now greater than 1.97 miles. Additionally, the flight paths from the eagle use surveys indicate that eagle use is heavier in other parts of the Project area compared to the area with turbines closest to the nest sites, and these turbines do not bisect direct flight paths from the nest site to areas of known concentrated prey (e.g prairie dog towns and sage grouse leks) within approximately 3 miles of the nests.

In addition to moving turbines further to the west, the site specific eagle and other raptor use information was utilized to help identify and remove turbines in areas believed to pose a higher risk to eagles and other raptors relative to other proposed turbine locations. A use-intensity grid was developed by overlaying mapped raptor flight paths on 100-m square grid cells within the Project area (similar to the flight occurrence analysis conducted by SWCA [see Section 3.3.2 or Appendix C]). The number of unique flight paths that intersected each pixel yields an index of the frequency of flight activity observed during surveys (Figures 16). The grid was then used to identify relatively higher risk areas for all raptors including eagles within the Project.

While PWPI had initially proposed in its Wyoming Industrial Siting Permit process a project comprised of 62 wind turbines, subsequent commercially-related factors as well as identified resource concerns (including eagles) required a reduction of the project size by 16 turbines. Based on the available information and recommendations from USFWS, PWPI removed the nine highest-priority turbine locations (those locations considered to pose the highest potential risk to eagles) from the layout (Figure 16). USFWS considered the following factors when evaluating relative risk of proposed turbine locations: 1) eagle/raptor use surveys that indicated preferred use areas; 2) location of nest sites; 3) prey base

features; 4) topographic uplift features; and 5) point counts with relatively more diverse and numerous migratory bird use. USFWS recommendations were to avoid placing turbines in areas of higher avian use in the Project area, which are also generally in areas of relatively more topographic relief. Applying these criteria, USFWS identified 17 high priority turbines and prioritized them into 5 tiers of decreasing risk. Of the nine first- and second-tier higher risk turbine locations, eight were located west of a prominent north/south ridgeline within the Project area that received higher levels of mapped raptor flight paths and included north-south movements as well as spiraling flights of eagles and other raptors (Figures 14 and 16). The spiraling movements documented by SWCA indicate eagles and other raptors may utilize this area to gain altitude through apparent uplifts along the north/south ridgeline. This is further supported through an assessment of slope and aspect within the Project relative to the prominent wind direction (see Section 5.1.3 below). The ninth, second-tier higher risk turbine removed at the recommendation of USFWS was located just east of a mapped prairie dog colony which would have resulted in turbines "boxing in" the mapped town. The turbine was also located between the mapped town and known golden eagle nest location, was near an avian use station where a high diversity of bird species use was recorded, and was somewhat off by itself relative to other turbine locations (Figure 16). In addition to the nine turbines that were removed based on USFWS recommendations, an additional seven turbines were removed from the layout further reducing the risk to eagles and resulting in a final layout (June 2013) of 46 turbines (Figure 16).

As noted, based on available data and discussions with the USFWS, PWPI is proposing numerous conservation measures to avoid and minimize predicted risk at the Project, including eliminating nine of the 17 turbine locations the Service designated as "highest priority" for removal. Although PWPI carefully considered the USFWS' recommendations, the eight third-, fourth- and fifth-tier turbines suggested for removal by USFWS were not removed from the layout. Unlike the first- and second-tier groups, most of these risk groupings focused more on risks to migratory birds than on risks to bald and golden eagles, with only the lowest priority group occurring near a cluster of eagle use. Because elimination of these turbine locations would have not met the number of MWh's needed to make the Project economical and to have a viable Project, PWPI instead removed 7 other turbines at different locations to reduce eagle risk while preserving the economic feasibility of the Project. Removing those turbines resulted in an increase of 0.0142 golden eagles and 0.0028 bald eagles per year in the USFWS Bayesian annual fatality prediction compared to removal of all 17 turbines requested by USFWS. Thus, consistent with the ECPG, PWPI has "avoided and minimized risks to the maximum degree achievable, thereby meeting the requirements for programmatic permits that remaining take is unavoidable." ECPG at viii. The remaining final 46 turbine layout is considered to pose a low risk to eagles based upon the USFWS Bayesian fatality prediction model which estimates the Project will take less than one eagle per year (see Section 5.2.1 below). Moreover, consistent with the ECPG, PWPI will mitigate the remaining unavoidable take by retrofitting high-risk power poles.

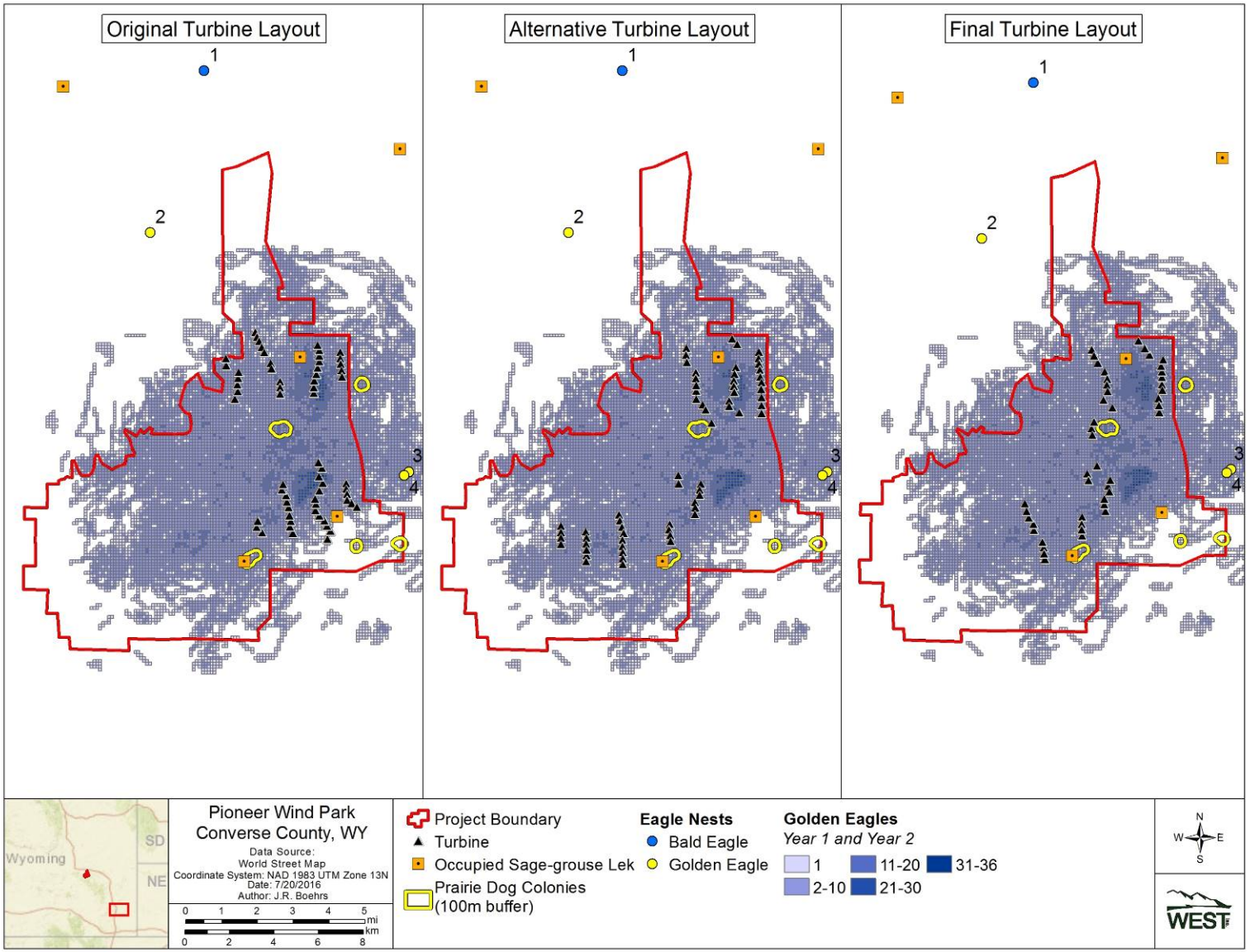


Figure 16. Illustration of the progression in turbine layouts, showing efforts to avoid locating turbines in areas of highest eagle and raptor use areas based on baseline data, resulting in the final proposed layout with 46 turbines for the Pioneer Wind Park Project, Converse County, Wyoming.

4.1.2 Additional Pre-construction BMPs and Conservation Measures

Other BMPs and Conservation Measures that were implemented during the pre-construction phase of the Project include:

- The area and intensity of disturbances (e.g. utilizing existing roads while traveling on site) was minimized during pre-construction monitoring and testing activities.
- Existing roads and transmission corridors have been incorporated into the site plans to the extent possible.
- Site plans minimized the extent of the road network needed for the Project.
- A dust control plan will be developed prior to construction.
- An erosion control plan will be developed prior to construction.
- A storm water pollution prevention plan will be developed prior to construction.
- To the extent possible, electrical collection lines will be buried underground.
- With the exception of the permanent MET and radar towers, no other lattice towers or structures that are attractive to birds for perching are included in plans for the facility.
- Wind Turbine Generators (WTGs) will feature tubular supports, rather than lattice supports, to minimize bird perching and nesting opportunities. External ladders and platforms will not be used on WTGs, to minimize perching and nesting opportunities for birds.
- No guy wires will be included on permanent MET towers.
- Lighting plans for the facility will be the minimum, according to FAA recommendations.
- All security lighting will be motion- or heat-activated, instead of being left on throughout the night.
- All security lighting will be down-shielded and related to infrastructure lights.
- The facility was not sited in any areas containing high concentrations of ponds, streams, or wetlands.
- Parking areas and laydown areas will not be located within 500 feet of perennial streams.
- A fire safety plan will be developed and implemented during all phases (construction, operations and decommissioning). Measures to reduce risk of fire hazards from vehicles and Project and contractor personnel will be implemented. An Emergency Response Plan will be developed and implemented during Project and/or transmission tie-line construction and operation. The plan will contain emergency fire precautions, notification procedures, and emergency response sequences. These measures will help reduce or avoid impacts to wildlife.
- A weed control plan has been developed, that is designed to prevent the spread of non-native and invasive plant species.
- The Project was sited outside of core greater-sage grouse areas and no turbines are located within ¼ mile of the three known greater-sage grouse leks (discussed in further detail Section 3.6 above).
- Turbines were not sited within at least 100 m any mapped prairie dog colonies.
- PWPI worked with the Wyoming Game and Fish Department (WGFD) and landowners to develop a wildlife conservation plan for the Project

5.0 ASSESSING EAGLE RISK AND PREDICTING FATALITIES (STAGE 3)

5.1 Assessing Golden Eagle Risk

In addition to the temporary and permanent habitat loss discussed above in Section 1.4, wind turbines, power lines, and meteorological towers all present additional collision risk to eagles and other wildlife

species (some of which are prey species for eagles). Road traffic on project roads creates another type of collision risk for eagles and other wildlife, especially if carcasses are present near the facility's roads. Power lines and the electrical substation also have some associated risk of electrocution for eagles and other wildlife. While construction of wind turbines and other project infrastructure will create a new zone or area of hazard to eagles and other wildlife and there will be some wildlife collisions with Project infrastructure, PWPI is committed to implementing the measures identified in this ECP and the Project's ABPP to avoid and minimize impacts to eagles and other wildlife. The following section focuses on evaluating collision risk to eagles.

5.1.1 Nesting and Breeding

Based on the various raptor nest survey efforts as well as the other observational studies conducted for the proposed Project, there were no eagle nests identified within the Project area. Three golden eagle nests (two territories) and one bald eagle nest were identified within the 3-mile buffer surrounding the Project area and occupied eagle territories may be present in any given year in the vicinity of the Project (Figure 6). Turbines have been sited greater than 1.97 miles from the nearest known golden eagle nest and 5.98 miles from the nearest known bald eagle nest.

The approach in the USFWS ECP Guidance calls for measuring nearest-neighbor distances from occupied nests to approximate territory size and to help determine the distance at which monitoring should be conducted to evaluate the potential for disturbance/displacement type impacts (see Section 7.3 below; USFWS 2013). There were no occupied golden eagle nests identified by SWCA within the Project area or any areas within 3 miles of the Project area boundary. However, the site specific baseline data collected during the raptor point surveys suggest that the golden eagle territory encompassing Nests 3 and 4 may have been occupied, given the level of eagle activity in the vicinity of the nests (Figure 17). Since both identified territories may become occupied in the future, the maximum distance between nest #2 and nests #3 and #4 were used to calculate inter-nest distance and approximate territory size. The maximum distance between nest #2 and nests #3 and #4 is 7.48 miles, so half that distance (3.74 miles) was the buffer used from nests to determine approximated territory overlap with the Project and to inform ongoing nest monitoring plans (Figure 17). The two approximated territories overlap proposed turbine locations (the approximate territory for nest #2 overlaps two turbine locations and the approximate territory for nests #3 and #4 overlaps 37 turbine locations); however, the final turbine layout has been sited outside of the higher eagle use areas that are located in the vicinity of Nests 3 and 4 with the intent of minimizing potential impacts to eagles (Figure 17). Since only one bald eagle nest was identified an inter-nest distance can't be calculated for that species.

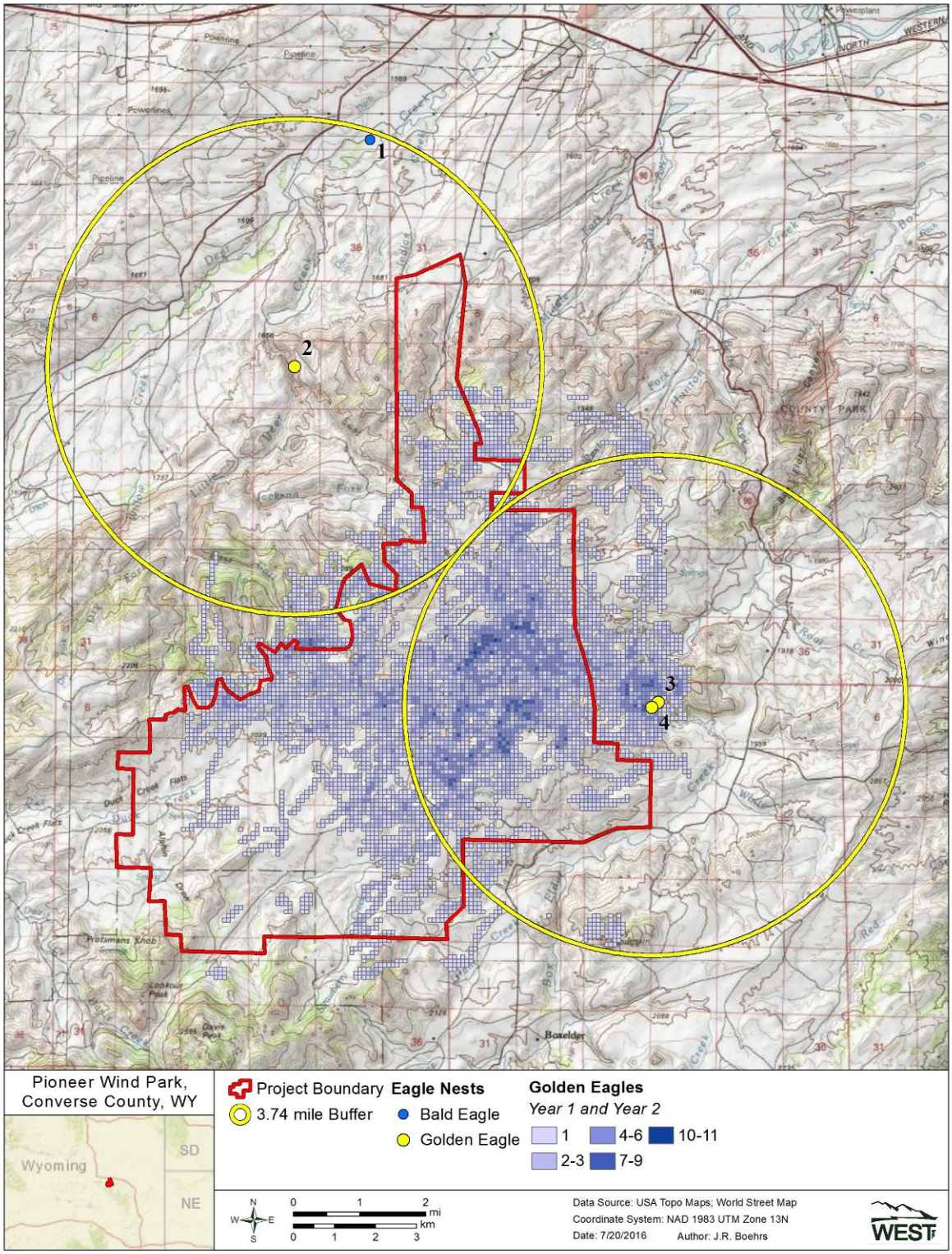


Figure 17. Approximate golden eagle territories for the golden eagle nests that have been identified in the vicinity of the Pioneer Wind Park Project, Converse County, Wyoming. A buffer distance of 3.74 miles was used based on half the maximum inter-nest distance between nest #2 and nests #3 and #4. The density of golden eagle use, derived from flight path data collected at long watch survey points is also shown in hundred-meter-square grid cells.

5.1.2 Concentration Areas (Communal roosts, foraging areas, migration corridors, and migration stopovers)

The avian data collected to date suggests that both golden and bald eagles use the Project area year-round. Results of the eagle and other raptor surveys suggest that golden eagle use is highest in the fall, followed by the spring, summer and winter. Bald eagle use also appears to be highest in the fall, relative to the other seasons. Based on the eagle and other raptor surveys, there is the potential for both bald and golden eagles to migrate through the Project area and both bald and golden eagles were documented in the Project area during the breeding and winter seasons. No communal roosts were identified in the vicinity of the Project during the one aerial roost survey or the four days of ground surveys conducted in February/March 2011. Examples of foraging areas that exist within or in the vicinity of the Project include prairie dog colonies, sage grouse leks, and crucial mule deer winter range (Figure 13). Livestock grazing within the Project consists primarily of cattle grazing and no sheep grazing occurs within the Project. Cattle would largely be expected to be present in the spring, summer, and fall seasons, but not during the winter, due to snow conditions. Very little, if any, calving occurs in areas proposed for turbine locations with the majority of calving occurring at least 1.5 miles away from the Project footprint. Based on the flight occurrence analysis for flights within the rotor-swept zone, SWCA determined that golden eagles are primarily using an approximately 5-square mile area along the Willow Creek canyon and associated ridgelines and, to a much lesser degree, the ridgelines on the western periphery of the Project boundaries (Appendix C). The final turbine layout was determined by utilizing the site-specific baseline data (including the eagle and other raptor surveys, avian use surveys, raptor nest surveys, greater sage-grouse lek surveys, and incidental wildlife observations [e.g. prairie dog colony mapping]) to remove some of the turbines from areas with relatively higher potential risk (see Section 4.0 above). No obvious use patterns were detected for bald eagles by SWCA.

5.1.3 Eagle Risk Factors

An assessment of the factors known or thought to be associated with increased probability of collisions between eagles and other raptors and wind turbines (USFWS ECP guidance; USFWS 2013) for the Project is provided in Table 6 (located at the end of this section). The risk factors and the science behind the risk factors have been adopted from the USFWS ECP guidance (USFWS 2013). In addition to abundance, the two main risk factors identified in the USFWS ECP guidance are 1) the interaction of topographic features, season, and wind currents that create conditions for high-risk flight behavior near turbines; and 2) behavior that distracts eagles and presumably makes them less vigilant (e.g., active foraging or inter- and intra-specific interactions such as territorial defense).

TOPOGRAPHY AND WIND

The topography of the Project at a landscape scale is provided in Figures 1, 2 and 3. The Project is located on the northern or northeastern slope of the Laramie Range (Figure 1). Major topographic features include the Willow Creek drainage and associated tributaries as well as a prominent north-south oriented ridgeline in the northeastern portion of the Project. The prominent wind direction at the Project is oriented in a northeasterly direction (wind blows out of the southwest). Within the Project, steep slopes with a west or southwesterly aspect (direction) may be more risky for eagles as these areas would be more likely to have conditions suitable for strong updrafts of wind. It appears that west/southwesterly aspects along the Willow Creek drainage and the western/southwestern aspect of the prominent north/south oriented ridgeline in the northeastern portion of the Project may be more risky to eagles. The site specific baseline data collected during the raptor point surveys supports this conclusion (see Section 4.0 above). Topography and wind conditions were also taken into consideration when determining turbines to remove for the final 46 turbine layout to avoid and minimize impacts to raptors, including eagles (i.e. eight turbines were removed that would have been located west of the prominent north/south ridgeline and on

the upwind side of the ridge and one turbine was removed from the vicinity of the Willow Creek drainage; Figure 16).

The slope (steepness) and aspect (direction) of individual turbine locations were reviewed and assessed on an individual turbine basis within the Project area. Based on limited scientific study, it is assumed turbines sited on steeper slopes, especially on upwind sides of ridges, and turbines sited in saddles or low-lying areas, may be more risky (Barrios and Rodriguez 2004, De Lucas et al. 2008, Hoover and Morrison 2005, and Smallwood and Thelander 2004). The minimum and maximum slope for the 46 final turbine locations ranges from 0.39 to 13.33 degrees, with nine turbines that have a slope greater than 5 degrees. Of these nine turbines, only one has an aspect that would be considered as being upwind (between 180 and 315 degrees) based on the prevailing wind direction within the Project area (aspect of 305.93 degrees and slope of 8.0 degrees), suggesting that the final turbine layout has generally been sited in areas that would not be expected to create high risk conditions. Figures 18 and 19 show the currently proposed layout relative to slope and aspect.

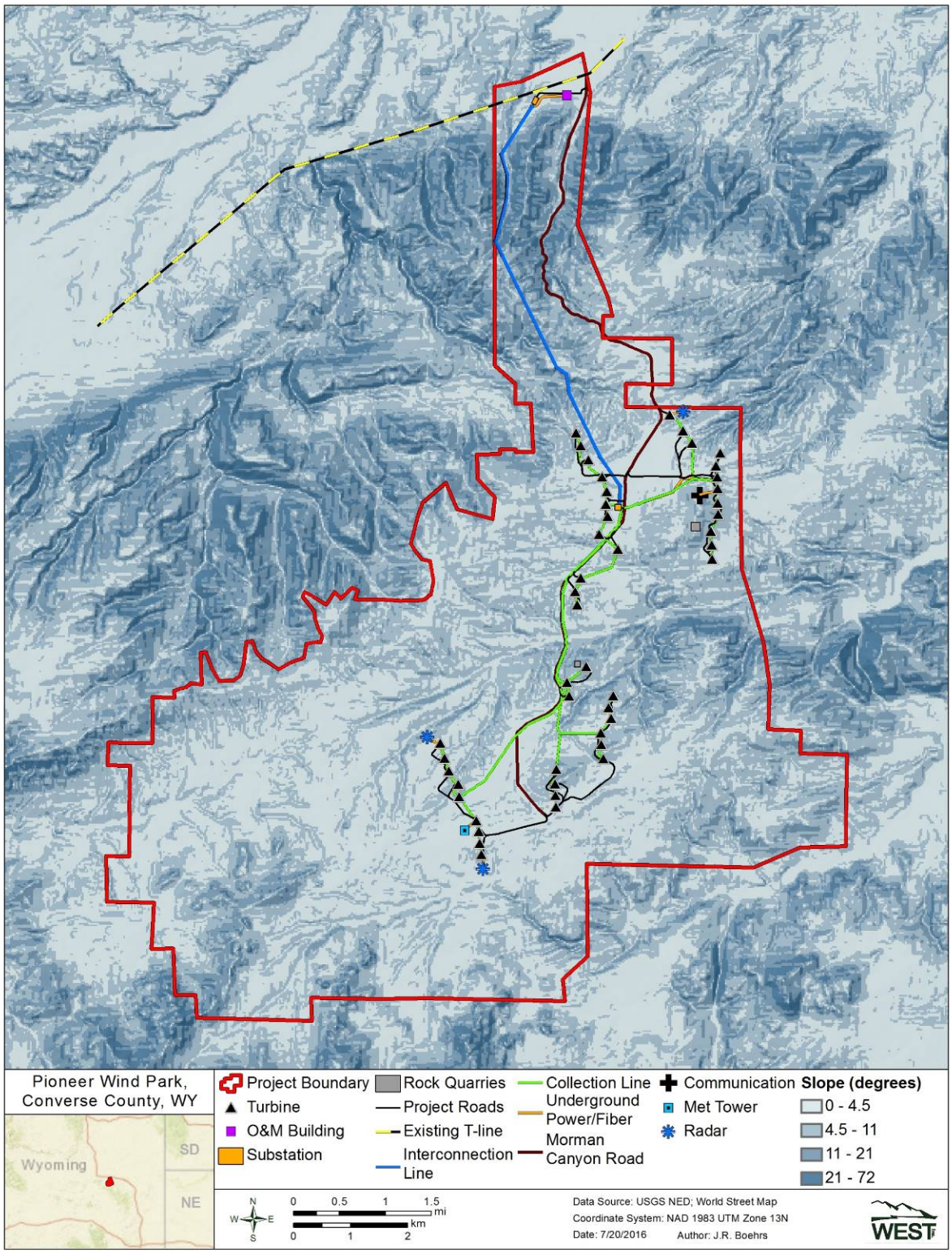


Figure 18. Slope calculations (in degrees) for the Pioneer Wind Park Project Area, Converse County, Wyoming. Steep slopes with a west or southwesterly aspect (direction) may be more risky for eagles as these areas would be more likely to have conditions suitable for strong updrafts of wind.

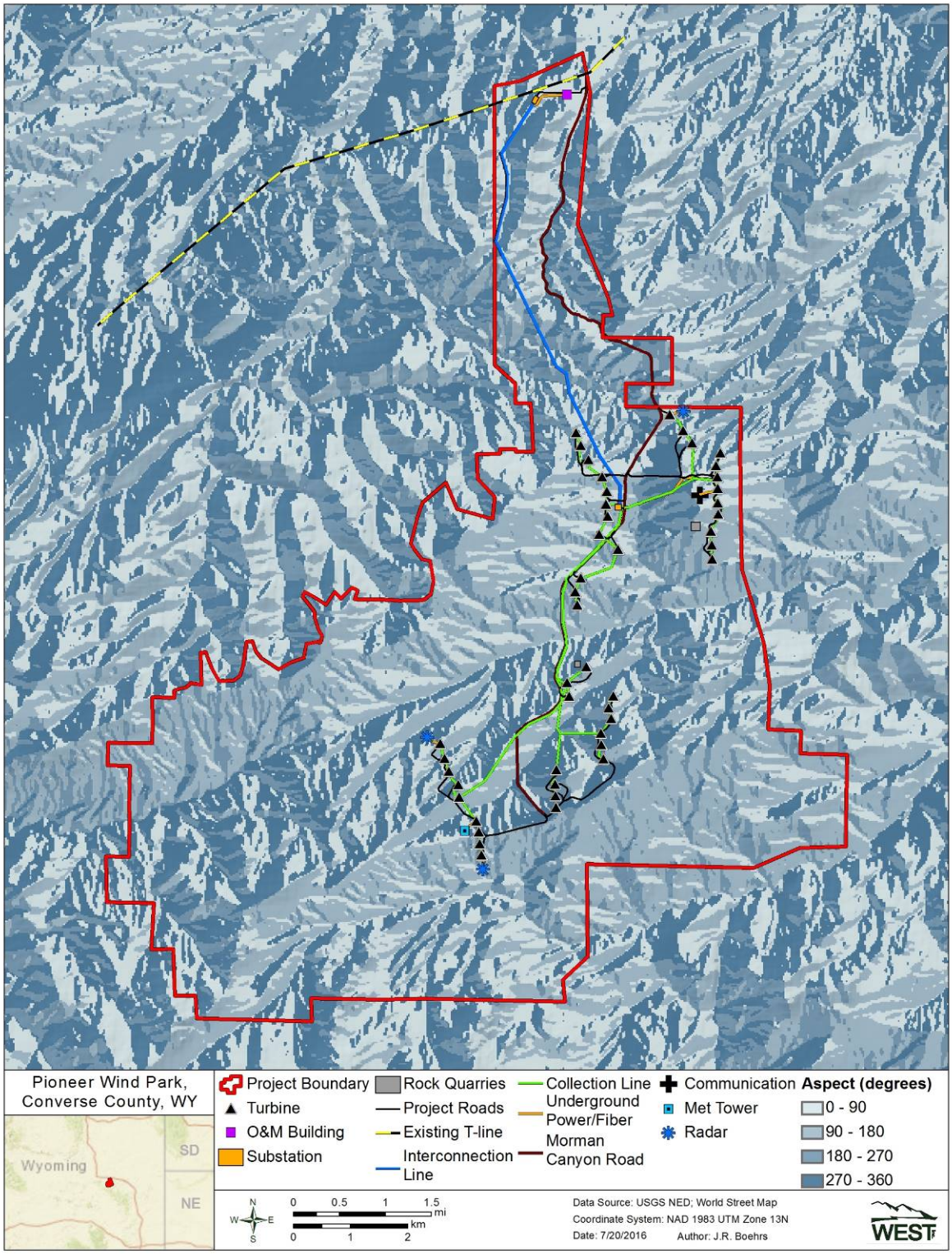


Figure 19. Aspect (in degrees) of the Pioneer Wind Park Project Area, Converse County, Wyoming. Steep slopes with a west or southwesterly aspect (direction) may be more risky for eagles as these areas would be more likely to have conditions suitable for strong updrafts of wind.

The results of the landscape-scale assessment of topography and wind as well as the individual turbine assessment suggest that topography and wind conditions at the Project might be a moderate risk to eagles overall in relation to facility and individual turbine siting since there are a few turbine locations sited on steep slopes and/or west – southwesterly aspects . However, turbines have been removed in some of the areas that may be suspected to pose higher risk to eagles (e.g. the west/southwest aspects along the north south oriented ridgeline in the north eastern portion of the Project [see Section 4.0 for a discussion; Figure 16]).

INTRA-SPECIFIC INTERACTIONS AND FORAGING BEHAVIOR

Assuming that intra-specific competition and territorial defense increases collision risk, these behaviors may occur within the Project based on the approximated territories associated with the two identified golden eagle territories that have been identified in the vicinity of the Project. While this potential risk factor is identified in the USFWS ECP Guidance (2013), we are not aware of any studies that have documented that intra-specific competition and territorial defense is or is not a risk factor.

There is the potential for eagles to forage within the Project. However, turbines have not been sited in close proximity to mapped prairie dog colonies (the closest turbine location to a mapped prairie dog colony is approx. 175 m and the next closest colony is approx. 334 m from the nearest turbine), nor have they been sited within ¼ mile of identified sage grouse leks, and they have been sited greater than 1.97 miles from the nearest known eagle nest. This should help to reduce risk to foraging eagles. Sixteen of the originally proposed turbine locations were within an area designated as crucial mule deer winter range. However, given the snow conditions that are typically present within the Project during the winter, as well as the relatively low abundance of eagles observed within the Project area during the winter, it seems unlikely that this area will receive increased use by eagles due to the presence of mule deer carcasses. Removal of carcasses within the site (see Section 6.2 below) will further reduce risk to foraging eagles within the Project.

Table 6. Risk factors listed in the Eagle Conservation Plan Guidance and a discussion of these factors for the Pioneer Wind Park Project, Converse County, Wyoming.

Risk Factor	Scientific Evidence/Support	Citations	Project Situation	Qualitative Assessment
Bird Density	Mixed findings; likely some relationship but other factors have overriding influence across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hunt (2002), Smallwood et al. (2009), Ferrer et al. (2011)	Golden eagle use (abundance) of the Project has been estimated to be 0.01 eagle obs./800-m plot/20-min survey and bald eagle use has been estimated to be (<0.01 eagle obs./800-m plot/20-min survey) based on site specific data collection to date	Low
Bird Age	Mixed findings. Higher number of fatalities among subadult and adult golden eagles in one area. Higher fatalities among adult white-tailed eagles in another	Hunt (2002), Nygard et al (2010)	Data collected to date suggest more adult eagle use at the Project.	Moderate
Proximity to Nests	White-tailed eagle nesting areas close to turbines have been observed to have low nest success and be abandoned over time.	Nygard et al (2010)	There is some overlap of turbines and approximated golden eagle territories, although there are no turbines located within 1.97miles of known golden eagle nests. There is no overlap with the known bald eagle nest and approximated territories and the known nest is located 5.98 miles from the nearest turbine. Eagle use patterns did not show high use around turbines located within approx. territories and turbines are not interposed between nest sites and a concentrated prey base.	Low to Moderate
Bird Residency Status	Mixed findings. Higher risk to resident adults in Egyptian vultures (*Neophron percnopterus*). Higher number of mortalities among subadults and floating adults in golden eagles in one other study.	Barrios and Rodriguez (2004), Hunt (2002)	Data collected to date is insufficient to address this potential risk factor, although fewer sub-adults were observed compared to adults or juveniles.	Unknown
Season	Mixed findings. In some cases for some species, risk appears higher in seasons with greater propensity to use slope soaring (fewer thermals) or kiting flight (windy weather) while hunting.	Barrios and Rodriguez (2004), De Lucas et al. (2008), Hoover and Morrison (2005), Smallwood et al. (2009)	Although eagle use appears to be higher in the fall season relative to other seasons, eagle use occurs throughout the year based on the site specific data collected to date.	Unknown
Flight Style	Species most at risk perform more frequent flights that can be described as kiting, hovering, and diving for prey.	Smallwood et al. (2009)	Potential for these flight behaviors within the Project.	Moderate, although removal of some of the turbines thought to be in more risky areas should help to minimize risk.

Table 6. Risk factors listed in the Eagle Conservation Plan Guidance and a discussion of these factors for the Pioneer Wind Park Project, Converse County, Wyoming.

Risk Factor	Scientific Evidence/Support	Citations	Project Situation	Qualitative Assessment
Interaction with Other Birds	Higher risk when interactive behavior is occurring.	Smallwood et al. (2009)	Based on ½ the average nearest-neighbor distance of the two identified golden eagle territories, there would be potential for territorial defense to occur where turbines are sited.	Moderate, needs further study to determine actual influence to risk
Active Hunting/Prey Availability	High risk when hunting close to turbines, across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2008), Hoover and Morrison (2005), Hunt (2002), Smallwood et al. (2009)	Presence of ground squirrel concentrations, prairie dog colonies, lagomorphs, various avian species and big game.	Moderate, although siting should help to minimize this as a risk factor.
Turbine Height	Mixed, contradictory findings across a range of species	Barclay et al. (2007), De Lucas et al. (2008)	62 of 79 (~78%) flying eagle observations within 800 m were recorded within the RSH at any time during Raptor Point Count Surveys	Moderate to High
Rotor Speed	Higher risk associated with higher blade-tip speed for golden eagles in one study, but this finding may not be generally applicable.	Chamberlain et al. (2006)	State of the art technology, low RPM's, more space between rotor sweeps, however tip speeds generally the same	Low
Rotor-swept Area	Meta-analysis found no effect, but variation among studies clouds interpretation	Barclay et al. (2007)	62 of 79 (~78%) flying eagle observations within 800 m were recorded within the RSH at any time during Raptor Point Count Surveys However, larger rotors generally have more space and time between sweeps	Unknown
Topography	Several studies show higher risk of collisions with turbines on ridge lines and on slopes. Also a higher risk in saddles that present low-energy ridge crossing points.	Barrios and Rodriguez (2004), De Lucas et al. (2008), Hoover and Morrison (2005), Smallwood and Thelander (2004)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Moderate, although removal of some of the turbines thought to be in more risky areas should help to minimize risk.
Wind Speed	Mixed findings, probably locality dependent.	Barrios and Rodriguez (2004), Hoover and Morrison (2005), Smallwood et al. (2009)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Moderate, although removal of some of the turbines thought to be in more risky areas should help to minimize risk.

5.2 Fatality Predictions

Data collected during the eagle and other raptor surveys at the Project have been used to provide golden eagle and bald eagle fatality predictions under the current USFWS Bayesian fatality prediction model (USFWS 2013). The USFWS Bayesian fatality prediction model estimates the number of annual eagle fatalities that are expected at a proposed wind-energy facility based upon eagle use minutes recorded during on-site eagle use surveys. Assuming that eagle mortality is proportional to pre-construction eagle activity, a prior distribution for the probability of collision has been established by the USFWS based on pre- and post-construction golden eagle surveys conducted at four wind energy facilities as reported in Whitfield 2009. The Bayesian model also includes a prior distribution for eagle exposure based on 12 different locations representing a range of habitats and efforts (USFWS 2013). Bayesian analyses include a prior distribution about eagle exposure and collision probability along with site specific data in calculating an estimate of annual eagle mortality from a posterior distribution of eagle exposure and collision probability. In order to obtain an estimate of eagle fatalities at the Project using the USFWS methodology, the following information was used: 1) the number of subject eagle and unidentified eagle flight paths within 800 m of observers and below 200 m AGL; 2) an estimate of average annual operating time in future years given wind speed data at the Project; 3) the quantity of turbines and rotor radius of the original turbines proposed at Project; and 4) the prior distributions for exposure and collision probability in the USFWS Bayesian model (USFWS 2013).

For this Project, eagle fatality predictions are based on eagle observations and associated mapped eagle flight paths collected within 800 m of the eagle and other raptor survey locations over the two years of baseline studies conducted at the Project. A total of 1,787 hours of eagle and other raptor surveys were completed at the Project. There were a total of 722 golden eagle or unidentified eagle sightings during the studies, and flight paths were mapped for 690 golden eagle or unidentified eagle sightings. Of the 690 mapped golden eagle or unidentified eagle flight paths, 66 were within 800 m of observers and below 200 m in height. To account for the 32 golden or unidentified eagle sightings without flight paths, the percentage of the 690 mapped flight paths within 800 m of observers and below 200 m in height was calculated (10% of mapped flight paths were within 800 m and below 200 m) and this percentage was applied to the 32 sightings without flight paths (3 individual eagle observations), resulting in an estimate of 69 golden eagle or unidentified eagle sightings within 800 m of observers below 200 m in height.

There were a total of 71 bald eagle or unidentified eagle sightings during the studies, and flight paths were mapped for 69 bald eagle or unidentified eagle sightings. Note that since the unidentified eagles could be bald or golden eagles, they have been included in the totals for both species. Of the 69 mapped bald eagle or unidentified eagle flight paths, 10 were within 800 m of observers and below 200 m in height. The two bald eagle sightings without flight paths were assumed to be within 800 m of observers and below 200 m in height, resulting in an estimate of 12 individual bald eagle or unidentified eagle observations within 800 m of observers below 200 m in height.

Exposure rate (λ), as defined by the USFWS (2013), is the expected number of exposure events (eagle-minutes) per daylight hour per square kilometer (hr*km^2). Eagle and other raptor surveys at the Project were conducted prior to release of the ECPG and, as a result, eagle observations were not conducted on a per-minute basis and the total minutes eagles were observed in flight were not recorded. To account for this in the modeling approach, we assumed two minutes of eagle flight time per eagle observation, based on a flight path analysis that USFWS conducted on the data from the Project, which indicated that on average eagles were flying within 800 m for greater than one minute, but less than two minutes per observation. A total of 138 golden or unidentified eagle flight minutes and 24 bald or unidentified eagle flight minutes were recorded within fixed-point plots that covered the sampled portion of the Project during 1,787 survey hours (Table 7). A $Gamma(\alpha = 0.97, \beta = 2.70)$ prior distribution with mean (0.35)

and standard deviation (0.357) has been recommended by the USFWS for the exposure prior. Posterior exposure distributions of eagle use at the Project were estimated as $Gamma$ distributions with the α parameters equal to the sum of the prior α and total flight minutes below 200 m, and the β parameters equal to the sum of the prior β and effort (hours of surveys x km^2 of area surveyed). This resulted in a posterior distribution for the golden eagle exposure rate at the Project of *Gamma* (138.97, 3,595.74) with mean 0.039 golden eagle flight minutes observed per hour per km^2 (Table 5). The posterior distribution for the bald eagle exposure rate at the Project was *Gamma* (24.97, 3,595.74) with mean 0.007 bald eagle flight minutes observed per hour per km^2 (Table 5).

Table 7. Estimated Exposure Rate (λ) for golden and bald eagles from eagle observations made during Raptor Point Count surveys at the Pioneer Wind Park Project, Converse County, Wyoming.

Variable	Golden Eagle	Bald Eagle
1) Number of Surveys	166	166
2) Average Length of Surveys (hours)	10.8	10.8
3) Survey Hours	1,787	1,787
4) Survey Radius (meters)	800	800
5) Recorded Flight Minutes below 200 m at points	138	24
6) Eagle Flight Minutes (α : Line 5 + 0.97)	138.97	24.97
7) Effort (β ; survey hours x sq km of area surveyed+2.76)	3,595.74	3,595.74
8) Mean Exposure Rate (Line 6 / Line 7)	0.039	0.007

A facility-specific expansion factor is included, to account for the hazardous area within the Project and this expansion factor is multiplied by the eagle exposure rate $\left(\frac{\text{eagle flight minutes}}{\text{hour} \cdot \text{km}^2}\right)$ to estimate the potential annual eagle-wind turbine interactions (minutes of flight within the turbine hazardous area). The expansion factor also scales the exposure rate to daylight and/or operational daylight hours (τ) within a year across the total hazardous areas (δ_i) surrounding all proposed turbines (n_t; USFWS 2012). For this Project, an estimate of operational daylight hours (i.e. the wind speed is greater than 3.5 m/s) was determined, based on wind speed data from the Project area and the estimated operational daylight hours were included in the expansion factor.

$$\varepsilon = \tau \sum_{i=1}^{n_t} \delta_i$$

The USFWS has defined the turbine hazardous area (δ_i) as the rotor-swept area around each turbine or proposed turbine location below 200 m in height above ground level (km^2; USFWS 2012). Expansion factors (ε) were calculated using the estimated annual operating time and the originally proposed turbine scenarios (Table 8). The same expansion factor applies to both the golden eagle and bald eagle modeling efforts (i.e. the expansion factor for the Project is identical for the two separate modeling efforts).

Table 8. Expansion Factors (ε) for the originally proposed turbine layout at the Pioneer Wind Park Project, Converse County, Wyoming. Turbine Hazardous Area = pi * turbine radius expressed in km2. Expansion factor = Line 9 x Line 11 x Line 12.

Variable	GE 1.85
9) Estimated Annual Operating Time	4,018
10) Rotor Radius (meters)	43.5
11) Turbine Hazardous Area	0.006
12) Number of Turbines	62
13) Overall Expansion Factor	1,481.001

Collision probability (C) is defined as the probability of an eagle colliding with a turbine given each minute of eagle flight in the turbine hazardous area. The prior distribution for collision probability was developed by the USFWS using the four previous golden eagle fatality studies (Foote Creek Rim, WY; San Gorgonio, CA; Tehachapi, CA; and Altamont, CA) reported in Whitfield (2009). Averaging avoidance from these studies yields a mean and standard deviation for the prior collision probability distribution of *Beta* (2.31, 396.69) with mean and standard deviation of 0.006 and 0.004 eagle fatalities per minute of flight in the turbine hazardous area, respectively (Table 9). The model does not incorporate site specific information potentially influencing collision probability. As post-construction monitoring is completed at the Project, a posterior, site specific estimate of collision probability can be determined. At this time, the same collision correction factor is applied to modeling efforts for both species (i.e. the information in Table 9. was applied to both the golden and bald eagle models for the Project).

Table 9. Collision Probability (C) calculated as Line 14/(Line 14 + Line 15)).

Variable	Value
14) Prior Fatalities	2.310
15) Prior exposure events not resulting in fatality	396.69
16) Prior mean collision probability	0.006

The USFWS Bayesian fatality prediction model assumes that higher site-specific eagle flight activity will correspond to higher annual eagle mortality, once the wind energy facility is operational. Under this assumption, predictions of annual eagle mortality (F) were modeled as the pre-construction measure of eagle exposure (λ) within areas of potential eagle-wind turbine interactions (ε) multiplied by the probability of collision (C):

$$F = \varepsilon\lambda C$$

Credible intervals (i.e., Bayesian confidence intervals) were calculated using a simulation of 10,000 Monte Carlo draws from the posterior distribution of eagle exposure (λ) and the collision probability distribution $(C;$ Manly 1991). The product of each of these draws, with the exposure area corresponding to turbine type, was used to estimate the distribution of possible fatality at the Project. Based on USFWS recommendations, the 50th, 80th, 90th, 95th, and 99th credible intervals have been calculated and are presented in Table 10 below.

Predicted eagle fatalities per year using the USFWS Bayesian fatality prediction model with the originally proposed turbine layout range from 0.33 to 1.05 golden eagles and 0.06 to 0.20 bald eagles per year (Table 10).

Table 10. Eagle fatalities per year (F) given the originally proposed 62 turbine layout.

Variable	Golden Eagles	Bald Eagles
Estimated average (mean) annual eagle fatalities	0.3314	0.0595
50th Credible Interval	0.3337	0.0593
Upper 80th Credible Interval	0.4871	0.0878
Upper 90th Credible Interval	0.6232	0.1145
Upper 95th Credible Interval	0.7552	0.1398
Upper 99th Credible Interval	1.0462	0.1997

5.2.1 Re-evaluation of Risk Considering Reduction in Turbines

The USFWS Bayesian fatality prediction model was reapplied for the Project, to predict eagle fatalities given the final layout scenario: containing 46 1.85 MW turbines with a 43.5 meter rotor radius (Table 11). With the exception of the number of turbines, all inputs into the model were consistent with the analysis presented in Section 5.2 above. As such the mean exposure rate and the probability of collision did not change from the original modeling efforts. However, the expansion factors have been reduced given the reduction in the number of turbines in the final layout (Table 11).

Table 11. Updated expansion Factors (ε) for the final 46 turbine layout with a 43.5 meter rotor radius at the Pioneer Wind Park Project, Converse County, Wyoming. Turbine Hazardous Area = pi * turbine radius expressed in km2. Expansion factor = Line 9 x Line 11 x Line 12.

Variable	Value
9) Estimated Annual Operating Time	4,018
10) Rotor Radius (meters)	43.5
11) Turbine Hazardous Area	0.0059
12) Number of Turbines	46
13) Overall Expansion Factor	1,098.807

Based on USFWS recommendations, the 50th, 80th, 90th, 95th, and 99th credible intervals have been calculated and are presented in Table 12 below. Predicted eagle fatalities per year using the USFWS Bayesian fatality prediction model with the final 46 turbine layout and 43.5 meter rotor radius range from 0.25 to 0.77 golden eagles and 0.04 to 0.15 bald eagles per year (Table 12). The predictions suggest up to 3.86 golden eagles and 0.74 bald eagles in five years.

Table 12. Updated eagle fatalities per year (F) given the final 46 turbine layout with a 43.5 meter rotor radius for the Pioneer Wind Park Project, Converse County, Wyoming.

Variable	Golden Eagles	Bald Eagles
Estimated average (mean) annual eagle fatalities	0.2459	0.0442
50th Credible Interval	0.2462	0.0442
Upper 80th Credible Interval	0.3623	0.0653
Upper 90th Credible Interval	0.4640	0.0847
Upper 95th Credible Interval	0.5609	0.1039
Upper 99th Credible Interval	0.7716	0.1471

Taking into account the reduction in the number of turbines in the final turbine layout, the estimated annual eagle fatality predictions (at the 99th credible interval) were reduced by approximately 0.27 golden eagles and 0.05 bald eagles per year or 1.37 golden eagles and 0.26 bald eagles over a five-year period; a roughly 25 percent reduction overall. The Project appears to meet a Category 2 designation since the fatality prediction is neither less than 0.03 eagles per year, the maximum amount for a Category 3 designation, nor more than 5% of the local area population, the threshold for a Category 1 designation (see Section 6.4.1 below). However, PWPI believes the level of risk to eagles at the Project can be reduced to an acceptable level through a combination of conservation measures and compensatory mitigation as outlined in this ECP.

5.3 Categorizing Site according to Risk

The USFWS ECP Guidance (2013) identifies three categories for wind energy projects based on mortality risk to eagles. Based on a "weight of evidence" approach using the USFWS ECP guidance, the site-specific data collected to date, and the risk assessments, the Project appears to meet a Category 2 designation. Category 2 projects pose a high or moderate risk to eagles. However, there are opportunities to mitigate impacts. A project is in Category 2 if 1) the project has an important-eagle use area or migration concentration site within the project area but not in the project footprint; or 2) has a species-specific uncertainty-adjusted fatality estimate between 0.03 eagles per year and 5% of the estimated local-area population size; or 3) causes cumulative annual take of the species-specific local-area population of less than 5% of the estimated species-specific local-area population size. The site specific data don't appear to suggest that an important eagle use area exists within the Project footprint, but an important eagle use area may exist within the Project area (e.g. nest site or foraging area). However, the 99th credible interval (instead of the 80th credible interval recommended by the USFWS ECP Guidance) is presented for each of the species specific eagle fatality predictions to account for any uncertainties in the risk to eagles given the limitations of the baseline studies (that were conducted prior to the release of the USFWS ECPG). Section 6.4.1 below provides a preliminary discussion of the local-area population however; the USFWS will complete the final local-area population analyses for their Environmental Assessment of the eagle take permit application. Given that the estimated eagle fatalities for the Project are greater than 0.03 eagles per year but anticipated to be less than 5% of the estimated local area population based on the preliminary analysis in Section 6.4.1, PWPI preliminarily appears to meet the criteria for a Category 2 project. PWPI is proposing avoidance and minimization measures as outlined in the following section with the intent of reducing risk to eagles at the Project.

6.0 ADDITIONAL AVOIDANCE AND MINIMIZATION OF RISKS, ACP'S, AND COMPENSATORY MITIGATION

6.1 During Construction

The following BMPs and Conservation Measures will be implemented at the Project during construction to provide additional avoidance and minimization of risks to eagles:

- Prior to the start of construction and ongoing during operations, all employees, contractors and subcontractors will undergo an employee orientation program that will enhance wildlife awareness, minimize impacts to natural resources, and facilitate employee understanding of their respective roles in ensuring compliance with the Project permit conditions and commitments. Any known occurrence or habitat of federal listed species or other species of concern identified within construction areas will be included in the training.

- The area and intensity of disturbance will be minimized to the extent possible during construction, and construction activities will be conducted in a way that prevents any unnecessary damage to, or destruction of, natural habitats.

- A transportation plan will be developed and implemented to minimize impacts to wildlife during all phases (construction, operations and decommissioning). Speed limits for construction and operations personnel along the access and service roads will be restricted to 25 miles per hour (mph) to reduce the risk of wildlife or livestock collisions and to minimize sound emissions. Vehicle movement associated with the Project will be restricted to designated access and service roads and temporary construction areas. This measure will help to minimize carrion availability for golden and bald eagles.

- An Emergency Response Plan (that includes fire suppression) will be developed and implemented.

- A Spill Prevention, Control, and Countermeasure Plan (SPCC) will be developed and implemented.

- A stormwater pollution prevention plan (SWPP) will be developed and implemented in accordance with WDEQ regulations.

- A dust control plan will be implemented.

- An erosion control plan will be implemented.

- A weed control plan will be implemented.

- Activities which may attract raptors or their prey near turbine locations will be minimized to the extent possible. This includes:

    - Adherence to speed limits included in the Transportation Plan (25 mph) to reduce the likelihood of wildlife collisions;

  - Project personnel and all contractors will be instructed to remove garbage promptly to avoid creating attractive scavenging opportunities for birds.
  - Avoidance of seeding of areas with forbs, which may attract mammalian or bird prey;
  - Removal of rock piles resulting from construction activities, which may attract or provide cover for mammalian prey, and;
  - Avoidance of storage of parts or equipment near turbines and creation of large rock piles that attract small mammals and their predators will be prohibited;

- The Avian Power Line Interaction Committee (APLIC) guidance on power line construction (APLIC 2006 and 2012) will be followed.
- A minimum of a 1.9 mile spatial and seasonal separation will be implemented, between turbines and all currently known eagle nest sites.
- To the extent possible, facility construction will minimize cutting into hill slopes, with an objective of achieving smooth, rounded terrain, rather than sudden berms or cuts. This measure is intended to reduce attraction of fossorial or burrowing mammals and to reduce prey abundance.
- Gravel will be placed at least 15 ft. (4.6 m) around each turbine foundation, to discourage small mammals and reptiles from burrowing under or near turbine bases.
- Sensitive resources (e.g., nests) identified during pre-construction surveys will be flagged and all site personnel will be notified of their presence and necessary setbacks.
- Wyoming Department of Environmental Quality (WDEQ) Land Quality Division practices for topsoil handling and re-vegetation will be employed during construction.
- Appropriate native seed mixtures or seed mixtures requested by landowners will be utilized for re-vegetation as soon as practical following construction.
- Wildlife Conservation Plan will be implemented.

6.2 During Operation

The following BMPs and conservation measures will be implemented during operation of the Project to provide additional avoidance and minimization of risks to eagles:

- Management activities such as seeding forbs or maintaining rock piles, which attract potential prey, will not be implemented.
- Parts and equipment which may be used as cover by prey will not be stored in the vicinity of wind turbines.
- The Project has committed to, and Project permits require, the use of an aircraft detection sight solution system. Under this system, the only time the FAA lights on top of turbines will appear is when an airplane is flying overhead. Laufer Wind is the manufacturer of this system, and they are

working to add bird detection to their radar system. The hardware required to do this is quite similar to their aviation-related offering. The task is to add the software which interprets the radar returns and identifies them as birds. PWPI will consider installing this bird detection system at the Project, if it proves effective.

- Any carcasses that could be foraging sources for eagles or other raptors (with the exception of carcasses being used for post-construction bias trials) found within the Project will be removed immediately, assuming the appropriate permits/authorizations have been granted to PWPI. PWPI is currently working to acquire necessary permits/authorizations for this measure.

- Low level speed limits (< 25 mph) will be maintained on all roads within the Project.

- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions. All new employees will undergo an employee orientation program that will enhance wildlife awareness, minimize impacts to natural resources, and facilitate employee understanding of their respective roles in ensuring compliance with the Project permit conditions and commitments. Any known occurrence or habitat of federal listed species or other species of concern identified within construction areas will be included in the training.

- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress. Fire hazards from vehicles and human activities will be reduced (e.g., use spark arrestors on power equipment; avoid driving vehicles off roads; and allow smoking in designated areas only).

- Federal and state measures for handling toxic substances will be followed.

- A Spill Prevention, Control, and Countermeasure Plan (SPCC) will be developed and implemented.

- A stormwater pollution prevention plan (SWPP) will be developed and implemented in accordance with WDEQ regulations.

- Effects to wetlands and water resources will be minimized by following provisions of the Clean Water Act (1972).

- Project personnel and all contractors will be instructed to remove garbage promptly at the end of each day, to avoid creating attractive scavenging opportunities for birds.

- PWPI will develop and implement a Wildlife Incident Reporting System (WIRS) at the start of operations (see Section 7.5 below). The WIRS will be implemented for the life of operations for the Project.

- Any temporary guyed met towers will be removed within one year of operations.

- All met towers and wind turbines that are no longer operational will be removed.

- If snow removal is needed, roads will be plowed so as not to impede ungulate movement. Snow banks can cause ungulates to run along roads, resulting in their colliding with vehicles. Roadside carcasses attract raptors, subjecting them to collision as well.

- Weed control plan will be developed and implemented.
- Wildlife Conservation Plan will be implemented.

6.3 Upfront Compensatory Mitigation

Compensatory mitigation occurs in the eagle permitting process if the conservation measures and ACP's do not remove the potential for take, and the projected take exceeds calculated thresholds for the species-specific eagle management unit in which the project is located. For new wind development projects, if compensatory mitigation is necessary, the compensatory mitigation action (or a verifiable, legal commitment to such mitigation) will be required up front before project operations commence because projects must meet the statutory and regulatory eagle preservation standard before the USFWS may issue a permit (USFWS 2013).

PWPI will develop a compensatory mitigation plan in communication with the USFWS to offset predicted eagle take as determined through eagle fatality modeling for the Project. The final compensatory mitigation requirements for the Project will be determined by the USFWS. However, following the resource equivalency analysis (REA) example in the USFWS ECP Guidance (2013), PWPI has calculated the preliminary number of power-pole retrofits that may be needed to offset the anticipated level of golden eagle take at the Project given the results of the modeling efforts. The following assumptions were included in the preliminary analyses: 1) the power pole retrofits would occur prior to taking golden eagles; 2) Project life is 30 years; and 3) life of the retrofits is 30 years and/or the retrofits will be maintained for 30 years. Under these assumptions, the preliminary REA analysis indicates that 13 poles/golden eagle or 65 poles may need to be retrofitted upfront to offset one eagle per year for the first five years of operations. The compensatory mitigation implemented for golden eagles should also benefit bald eagles and reduce their risk of take for the Project area. Therefore, the preliminary analyses indicate that upfront compensatory mitigation might be completed for the first 5-year period by retrofitting 65 power poles at a cost of $4,500 per pole (based on the western market cost estimate to retrofit poles) for a total cost of $292,500, unless the actual cost to retro-fits poles is determined to be less than $4,500 per pole, or unless the cost of the retro-fits is determined to be higher than this amount. This would be completed by either 1) working directly with local utilities to compensate them for retrofitting poles, or 2) based on the western market cost estimate of $4,500 per pole retrofit, the proponent may choose to place the entire $292,500, or a higher or lesser amount depending on the true cost to retro-fit power poles, into a third-party mitigation account.

If the observed/estimated take is less than mitigated take at the end of the 5-year permit period, the excess take will be credited to the Project, if PWPI applies for and receives a programmatic ETP for future operation years of the Project. If estimated take is higher, increased mitigation will be required. In either case, compensatory mitigation for any potential subsequent permit renewal period would be re-evaluated based on actual take levels observed/estimated at the Project as compared with permitted levels of take.

Based upon communication with the USFWS, PWPI will also consider other options for compensatory mitigation to offset eagle take, as appropriate. Other options for compensatory mitigation might include: a lead abatement program, a carcass removal program along highways, or funding mitigation banking efforts. However, a resource equivalency analysis would first need to be developed for any alternative compensatory mitigation options, to demonstrate that the amount of anticipated eagle take from the Project would be fully offset by the alternative mitigation measures. USFWS would not accept any alternative compensatory mitigation options until a credible analysis was completed and accepted.

6.4 Cumulative Impacts

6.4.1 Population Status and Local Area Population Thresholds

This section provides preliminary estimates of the Project's local area bald and golden eagle populations and take thresholds based on eagle density estimates from the USFWS ECPG (USFWS 2013) and the USFWS western wide golden eagle surveys (Nielson et al. 2012). The approach used to calculate the preliminary estimates follows the example provided in the USFWS ECPG (USFWS 2013). However, it should be noted that these estimates are preliminary and subject to change and the USFWS will complete the final local-area population analyses in their Environmental Assessment of the eagle take permit application.

The project lies primarily within the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR); however, the northern portion of the project boundary lies within the Badlands and Prairies BCR. Golden eagle density estimates within the Southern Rockies/Colorado Plateau and the Badlands and Prairies BCRs are available from the USFWS western wide golden eagle surveys (Nielson et al. 2012). These estimates are based on surveys conducted from August 15 to September 15, timed when all juvenile eagles are expected to have fledged and the majority of golden eagles are unlikely to have initiated fall migrations. Density estimates in 2012 for the Southern Rockies/Colorado Plateau BCR were estimated to be 0.0084 km^2 (90% C.I. 0.0054, 0.0130), and density estimates for the Badlands and Prairies were 0.0142 km^2 (90% C.I. 0.0099, 0.0199; Nielson et al. 2012). The estimated number of golden eagles in the Southern Rockies/Colorado Plateau BCR in 2012 was 3,981 golden eagles (90% C.I. 2,547, 6,087), and within the Badlands and Prairies was 4,993 (90% C.I. 3,472, 6,944) with an estimate of 148 juvenile golden eagles (90% C.I. 1, 454) in the Southern Rockies/Colorado Plateau and 341 juvenile golden eagles (90% C.I. 87, 692) in the Badlands and Prairies (Nielson et al. 2012).

For bald eagles, eagle management units closely resemble USFWS Regions and a map of specific bald eagle management units is provided in the USFWS ECPG (2013). The Project occurs within the Northern Rocky Mountain Bald Eagle Management Unit. According to the USFWS ECP Guidance (2013), the density estimates for bald eagles in Region 6 are 0.0027 bald eagles/km^2. The estimated number of bald eagles within Region 6 is 5,385 bald eagles (USFWS 2013).

The USFWS has previously identified annual take levels of 5% of annual production to be sustainable for a range of healthy raptor populations, and annual take levels of 1% of annual production as a relatively benign harvest rate over at least short intervals, when population status was uncertain (Millsap and Allen 2006; USFWS 2013). This was the approach used to establish take thresholds at the eagle management unit scale (BCR level for golden eagles and Bald Eagle Management Units for bald eagles; USFWS 2009). However, in 2009 and 2016, the USFWS determined that golden eagle populations might not be able to sustain any additional unmitigated mortality, and as a result, set the thresholds for golden eagles to zero at the eagle management unit scale, and determined that any new authorized take of eagles must be at least equally offset by compensatory mitigation (USFWS 2009; USFWS 2016).

The USFWS has identified take rates of between 1% and 5% of the estimated total eagle population size at the local-area population scale (140-mile buffer surrounding the Project for golden eagles and 43 miles for bald eagles) as benchmarks; with 5% being at the upper end of what might be appropriate under the BGEPA preservation standard, whether offset by compensatory mitigation or not (USFWS 2013). The 2013 USFWS ECP Guidance (USFWS 2013) recommends calculating the local-area 5% benchmark as follows:

$$(\text{Local-area} * \text{Regional Eagle Density}) * 0.05.$$

A 140-mile buffer surrounding the Project encompasses the following areas within five BCR's: Northern Rockies (64,332.62 km^2), Southern Rockies/Colorado Plateau (17,244.05 km^2), Badlands and Prairies (64,656.26 km^2), Shortgrass Prairie (23,997.59 km^2) and Central Mixed Grass Prairie (36.01 km^2). The latest regional density estimates for resident golden eagles are available in Nielson et al. (2012) for the Northern Rockies (0.0129 eagles/km^2), Southern Rockies/Colorado Plateau (0.0084 eagles/km^2), and Badlands and Prairies (0.0142 eagles km^2). The Shortgrass Prairie BCR is not included in the western-wide golden eagles surveys, but the USFWS ECP Guidance provides a regional density estimate for the Shortgrass Prairie BCR (0.0028 eagles/km^2; USFWS 2013). Density estimates for the Central Mixed Grass Prairie are not available, and as a result this analysis assumes that the Central Mixed Grass Prairie will contribute zero golden eagles to the Project local area population. Using the equation above, an estimated local area population size for the project is approximately 1,960 golden eagles. Based on this analysis, the local-area 5% benchmark would be 98 golden eagles annually. Assuming a mortality rate of less than one golden eagle per year, this amount of mortality comprises less than 0.05% of the total estimated local area population and less than 1.0% (less than 1/100th) of the local-area 5% benchmark for golden eagle mortality.

A 43-mile buffer surrounding the Project (18,444.67 km^2) is wholly contained within the Northern Rocky Mountain bald eagle management unit. Applying the equation above using the local area (18,444.67 km^2) and the regional bald eagle density estimate (0.0027 bald eagles/km^2), the estimated local area bald eagle population is approximately 50 bald eagles. The local-area 5% benchmark would be 2.5 bald eagles annually. Assuming a mortality rate of 0.15 bald eagles per year, this amount of mortality comprises 0.3% of the total estimated local area population and 6% (approximately 1/16th) of the local-area 5% benchmark for bald eagle mortality.

As part of the assessment of cumulative impacts to both golden and bald eagles at the local area population scale USFWS Region 6 will review all available internal records on known eagle mortalities within the 140 mile and 43 mile species-specific buffers. This review will consider eagle mortality records from other existing wind energy facilities as well as all other sources of known mortality such as electrocution, collisions, shootings, poisonings, etc. This information, and the accompanying analysis, will be fully presented in the Environmental Assessment that USFWS will complete for the Project. Also this information about known eagle mortality will be used by USFWS Region 6 in the decision making process about whether or not to issue an programmatic eagle take permit for the Project and the level of take for golden and bald eagles that could potentially be authorized.

7.0 POST-CONSTRUCTION MONITORING (STAGE 5)

A post-construction monitoring program will be implemented at the Project. Plans for post-construction monitoring are described in a Conservation Plan that has been developed for the Project (SWCA 2014). The observations made during post-construction monitoring will be reported to the appropriate agencies, which will make management recommendations to the Project owner who will determine the appropriate management actions to implement based on agency recommendations and the results of the monitoring program.

Since post-construction monitoring methods are constantly improving, recommendations to adopt new survey techniques and protocols will be considered as they become available as researchers develop new and more accurate methods of survey.

7.1 Fatality Monitoring

The Project will be subject to a minimum of two years of post-construction monitoring, using a statistically rigorous sampling design, for eagles will be a condition of the permit and is consistent with USFWS recommendations provided in the USFWS ECPG (USFWS 2013). PWPI and the USFWS will review and agree on a final monitoring protocol for these purposes. The protocol for conducting eagle mortality monitoring will be developed separately and will become an Appendix to the ECP. After two years of eagle mortality monitoring, PWPI and USFWS will review the results and determine what additional monitoring would be needed for the permit. At a minimum, it is likely USFWS will require simple surveillance-type monitoring/spot-checking of turbines after the first two years of monitoring are completed but, depending on the results of the first two years of monitoring additional mortality monitoring that is more intensive could be necessary. Post-construction monitoring shall begin within two weeks after the initiation of commercial operation of the Project.

Assuming that the necessary permits have been obtained (e.g. a Special Purpose Utility Permit (SPUT) from the Migratory Bird Program), PWPI or its consultants will remove all carcasses identified during post-construction monitoring (with the exception of carcasses being used for post-construction bias trials). These surveys will be completed regularly to document the number eagles attributable to the Project. The methods for estimating mortality at the Project will conform to peer-reviewed standards in the U.S. As part of these mortality surveys, the searcher efficiency rate (i.e., the ability of a surveyor to locate a mortality) and carcass removal rate (i.e., the average time that a carcass persists before a scavenger removes it) will be determined and used to adjust mortality estimates, as appropriate, for eagles. Additional details associated with conducting experimental bias trials will be developed by PWPI and USFWS and will be included in the more detailed post-construction mortality monitoring protocol. The study design will be informed based on the results of the experimental bias trials and may be modified depending on the results of searcher efficiency and carcass removal to meet the objectives of the monitoring program. Based on communication with USFWS, PWPI will monitor 100% of the turbines every other week throughout the year. Square search plots (160m X 160m) centered on each turbine will be established at each turbine and transects will be spaced approximately 10-20m apart within the plot. PWPI would like to use large raptors and other migratory bird carcasses for observer bias and scavenger removal trials if made available by the agencies. In the event that large raptors are not available or are not available in sufficient numbers to have an adequate sample size, hen mallards or the best available surrogates will be used for trials.

7.2 Avian Use Surveys

Monitoring for all winter bird use (observations of all avian species will be recorded), spring migratory and breeding season songbird and raptor use as well as greater sage-grouse lek attendance will be conducted by qualified biologists with appropriate experience as described in the Project's Conservation Plan (SWCA 2014).

7.3 Golden and Bald Eagle Nest Surveys

Golden eagle nest surveys will be conducted by qualified biologists with appropriate experience during at least the first two years of operations. Eagle nest monitoring will follow recommendations that have been provided by the USFWS Region 6, MBM Office for the Project. PWPI will work with the agencies to determine the appropriate survey area for eagle nest surveys. Eagle Nests 3 and 4 will be of primary interest during monitoring, given that they are closest known eagle nest locations to the Project. Nest locations found during surveys will be documented by noting the species, dates of activity, Universal Transverse Mercator (UTM) NAD 83 coordinates, nest contents (when possible), and behavior. The data

will be presented to the appropriate agencies to determine whether mitigation should be recommended to reduce impacts to nesting activities. Assuming access is available, active eagle nests will be monitored from the ground (with a sufficient number of monitoring visits to allow for occupancy, productivity, and nest success to be determined for all active eagle nests) to track the breeding success of resident eagles and to evaluate the effectiveness of the conservation measures that have been applied.

7.4 Reporting

Annual monitoring reports will be prepared within three months of completing each year of standardized post-construction monitoring, with each report including cumulative results of post-construction monitoring performed to date.

All monitoring reports, including all raw monitoring data upon which the reports are based, shall be made available to the appropriate agencies**.** All monitoring reports shall report annual fatalities for eagles on a per-turbine, per-megawatt, and per-megawatt hour basis. The monitoring reports shall also summarize the results of the eagle nesting studies, as applicable. As part of the reporting process, all eagle mortalities will be reported to USFWS and field forms and photographs of all eagle fatalities will be reported to USFWS (Office of Law Enforcement, Wyoming Ecological Services Field Office, and Region 6 Migratory Bird Management Office) for their direction on collection and/or sending carcasses to the national eagle repository.

7.5 Wildlife Incident Report and Handling System

In addition to the post-construction fatality monitoring study described above, PWPI will develop and implement a Wildlife Incident Reporting System (WIRS) at the start of operations, and it will remain active for the life of the Project. The purpose of the WIRS is to standardize the actions taken by site personnel in response to wildlife incidents encountered at the Project and to fulfill the obligations for reporting wildlife incidents. The WIRS will be utilized by site operations and maintenance personnel who encounter dead or injured birds or bats incidentally while conducting general wind facility or transmission line maintenance activities. The WIRS is designed to provide a means of recording and collecting (but only if the appropriate permits have been previously obtained) fatalities at the Project to increase the understanding of wind turbine and wildlife interactions. During the standardized post construction monitoring studies, any carcass found incidentally by site operations and maintenance personnel will be reported to the contractor conducting the post construction monitoring studies so that the contractor can process the carcass. Any carcasses found incidentally within the standardized search plots will be included in fatality estimates. Additionally, assuming the appropriate permits/authorizations are in place, any native bird or bat found injured within the Project will be taken to the nearest appropriate wildlife rehabilitation facility as directed in the WIRS. Any incident (i.e. mortality or injury) involving a federally listed threatened or endangered species or a bald or golden eagle must be reported to the USFWS within 24 hours of identification. PWPI maintains an ongoing commitment to investigate wildlife incidents involving company facilities and to work cooperatively with federal and state agencies in an effort to prevent and mitigate future bird and wildlife fatalities. It is the responsibility of PWPI employees and subcontractors to report all avian incidents to their immediate supervisor.

8.0 ADAPTIVE MANAGEMENT PROCESS

8.1 Adaptive Management Process

In communication with the appropriate agencies, PWPI will discuss the need for and implement mitigation or experimental conservation measures if it is determined that eagle take is higher than anticipated based on eagle model predictions. A stepwise process will be used to guide the implementation of additional conservation measures as needed (Table 13).

Table 13. Summary of Potential Conservation Measures to be implemented if a Threshold is reached using a Step-wise Approach.

Step	Conservation Measures	Threshold or Trigger
Step I	Assess eagle fatalities to determine if cause or contributing risk factors can be determined (e.g., nest proximity, weather, presence of prey/carrion) and if management response is warranted and feasible. Consult with USFWS about findings from assessment. Of primary concern is whether common elements between eagle fatalities exist that indicate a more concentrated assessment of the cause of mortality should be performed.	Any eagle is taken
Step II	Perform additional observational/behavioral studies to further evaluate risk and inform potential conservation measures. Consult with USFWS about findings from evaluation.	Two eagles taken in one year or an average of greater than one eagle per year after the first two years

Table 13. Summary of Potential Conservation Measures to be implemented if a Threshold is reached using a Step-wise Approach.

Step	Conservation Measures	Threshold or Trigger
Step III	If threshold is exceeded, PWPI will consult with the USFWS regarding information gained with respect to eagle take experienced to date, in an attempt to identify causal factors which might be exploited, to avoid further take. Total costs associated with examination and/or implementation of conservation measures and experimental advanced conservation practices will be limited to $75,000 per year or a maximum of $300,000 (the "Capped Amount")[1]. The Capped Amount is defined as the total of (a) direct out-of-pocket costs incurred in the implementation of such measures and practices, (b) revenues from sales of power or environmental attributes forgone through any program of operational curtailment, and (c) wind energy production tax credit proceeds associated with forgone power generation, expressed in a pre-tax fashion (PTCs divided by 1 minus the applicable corporate tax rate). PWPI's overall mitigation program for the subsequent 5-year permit period would be re-evaluated, based on actual results as compared with permitted levels of take, and this stepwise approach will start over with Step I. • Employ onsite biological monitor(s) during daylight hours at locations and/or times of suspected risk, to further refine the understanding of risk factors. • Implement a limited curtailment program specific to the area(s) and/or period(s) of highest collision risk. • Develop and evaluate an automated detection and deterrent system for eagles approaching area(s) of risk. • Other agreed upon measures	If before or by the end of the 4th year the Project has taken one bald eagle and/or 4 golden eagles.

Table 13. Summary of Potential Conservation Measures to be implemented if a Threshold is reached using a Step-wise Approach.

Step	Conservation Measures	Threshold or Trigger

[1] Establishing a "cost cap" for the implementation of experimental advanced conservation practices is in accordance with the final rule for 50 CFR Parts 13 and 22, Eagle Permits; Changes in the Regulations Governing Eagle Permitting published in the Federal Register in December of 2013 which states "We [Service] and the permittee will agree on the upper limit of the costs to implement and on trigger points tied to post construction monitoring that, if reached, would result in implementation of the experimental ACPs."

8.2 Agency Interaction

The development of the Project ECP has been the result of considerable interaction and coordination between PWPI and USFWS. Similarly, ongoing implementation of the Project ECP will continue to depend on frequent communication between agency biologists and PWPI. Many of the avoidance, minimization, and mitigation measures that will or may be implemented at the Project are experimental and will need to be reviewed and evaluated for effectiveness. It is anticipated that our understanding of the status of eagle populations and eagle/wind turbine interactions will evolve over time, both locally and nationally, and over the life of the Project Hence, adjustments to the eagle permit program and to the eagle conservation measures associated with the Project will be made over time. As suggested in the USFWS ECP Guidance, PWPI plans to allow USFWS personnel access to the site to assist in monitoring the effects and effectiveness of the avoidance, minimization, and mitigation measures that have been implemented.

9.0 CONCLUSION

This document was written to provide guidance for all eagle avoidance, minimization, mitigation and monitoring efforts prior to, during, and after construction of the Project. The measures described in this document are intended to help protect and reduce potential impacts to eagles, as well as to monitor potential impacts to eagles following implementation of the Project. It is anticipated that this eagle conservation plan will adaptively manage potential eagle impacts from the Project based on findings following construction.

10.0 LITERATURE CITED

Anderson, R., N. Neuman, J. Tom, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2004. Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area, California. Period of Performance: October 2, 1996 - May 27, 1998. NREL/SR-500-36416. National Renewable Energy Laboratory, Golden, Colorado. September 2004. http://www.nrel.gov/docs/fy04osti/36416.pdf

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code § 668-668d. June 8, 1940.

Barclay, R.M.R., E.F. Baerwald, and J.C. Gruver. 2007. Variation in Bat and Bird Fatalities at Wind Energy Facilities: Assessing the Effects of Rotor Size and Tower Height. Canadian Journal of Zoology 85: 381-387. http://www.bio.ucalgary.ca/contact/faculty/pdf/Barclay07Tur.pdf

Barrios, L. and A. Rodriguez. 2004. Behavior and Environmental Correlates of Soaring-Bird Mortality at on-Shore Wind Turbines. Journal of Applied Ecology 41: 72-81.

Chamberlain, D.E., M.R. Rehfisch, A.D. Fox, M. Desholm, and S.J. Anthony. 2006. The Effect of Avoidance Rates on Bird Mortality Predictions Made by Wind Turbine Collision Risk Models. Ibis 148(S1): 198-202.

Clean Water Act (CWA). 1972. Clean Water Act. October 18, 1972. 33 United States Code § 1251-1387, 1251 et seq., 2000.

De Lucas, M., G.F.E. Janss, and M. Ferrer, eds. 2007. Birds and Wind Farms: Risk Assessment and Mitigation. Quercus. 275 pp.

De Lucas, M., G. F. E. Janss, D. P. Whitfield and M. Ferrer. 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. Journal of Applied Ecology 45:1695–1703.

ESRI. 2012. Geographic Information Services (GIS). Producers of ArcGIS software. ESRI, Redlands, California.

Federal Register. 1974. 50 Code of Federal Regulations (CFR) Part 13. Title 50 - Wildlife and Fisheries, Chapter I - United States Fish and Wildlife Service, Department of the Interior, Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants, Part 13 - General Permit Procedures.

Federal Register. 1974. 50 Code of Federal Regulations (CFR) Part 22. Title 50 - Wildlife and Fisheries, Chapter I - United States Fish and Wildlife Service, Department of the Interior, Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants, Part 22 - Eagle Permits. January 4, 1974, as amended.

Ferrer, M. de Lucas, G. F. E. Janss, E. Casado, A. R. Munõz, M. J. Bechard, and C. P. Calabuig. 2011. Weak relationship between risk assessment studies and recorded mortality in wind farms. Journal of Applied Ecology doi: 10.1111/j.1365-2664.2011.02054.x.

Gritski, B., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

Hoover, S.L. and M.L. Morrison. 2005. Behavior of Red-Tailed Hawks in a Wind Turbine Development. Journal of Wildlife Management 69(1): 150-159.

Hunt, W.G. 2002. Golden Eagles in a Perilous Landscape: Predicting the Effects of Mitigation for Wind Turbine Bladestrike Mortality. California Energy Commission (CEC) Consultant Report P500-02-043F, CEC Sacramento, California. July 2002. Prepared for CEC, Public Interest Energy Research (PIER), Sacramento, California, by University of California, Santa Cruz, California. http://www.energy.ca.gov/reports/2002-11-04_500-02-043F.PDF

ICF Jones & Stokes. 2008. Altamont Pass Wind Resource Area Bird Fatality Study. Prepared for Alameda County Community Development Agency, Hayward, California. July 2008.

Jeffrey, J.D., W.P. Erickson, K. Bay, M. Sonnenberg, J. Baker, J.R. Boehrs, and A. Palochak. 2009. Horizon Wind Energy, Elkhorn Valley Wind Project, Union County, Oregon, Post-Construction Avian and Bat Monitoring, First Annual Report, January-December 2008. May 4, 2009. Prepared for Telocaset Wind Power Partners, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Walla Walla, Washington.

Manly, B.F.J. 1991. Randomization and Monte Carlo Methods in Biology. Chapman and Hall, London, United Kingdom.

Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code § 703-712. July 13, 1918.

Millsap, B.A. and G.T. Allen. 2006. Effects of Falconry Harvest on Wild Raptor Populations in the United States: Theoretical Considerations and Management Recommendations. Wildlife Society Bulletin 34: 1392-1400.

Nielson, R.M., L. McManus, T. Rintz, and L.L. McDonald. 2012. A Survey of Golden Eagles (*Aquila chrysaetos*) in the Western US, 2006 - 2012. Prepared for the US Fish and Wildlife Service (USFWS), Migratory Birds, Albuquerque, New Mexico. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 14, 2012.

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Nygård, T., Bevanger, K., Dahl, E.L., Flagsted, Ø., Follestad, A., Hoel, P.H., May, R. & Reitan, O. 2010. A study of White-tailed Eagle movements and mortality at a wind farm in Norway. British Ornithologist's Union (BOU) Proceedings, Climate Change and Birds. Peterborough, United Kingdom. http://www.bou.org.uk/bouproc-net/ccb/nygard-etal.pdf

Smallwood, K.S., L. Rugge, and M.L. Morrison. 2009. Influence of Behavior on Bird Mortality in Wind Energy Developments. Journal of Wildlife Management 73(7): 1082–1098.

Smallwood, K. S. 2007. Estimating Wind Turbine-Caused Bird Mortality. Journal of Wildlife Management 71: 2781-2791.

Smallwood, K.S. and C.G. Thelander. 2004. Developing Methods to Reduce Bird Fatalities in the Altamont Wind Resource Area. Final report prepared by BioResource Consultants for the California Energy Commission, Public Interest Energy Research-Environmental Area, under Contract No. 500-01-019 (L. Spiegel, Project Manager).

SWCA. 2012. Final Biological Pre-Construction Survey Report for the Pioneer Wind Park Wildlife Study Area. Prepared for Pioneer Wind Park, LLC. Prepared by SWCA Environmental Consultants. June 2012.

SWCA. 2014. Conservtion Plan for Pioneer Wind Parks I and II, Converse County, Wyoming. Prepared for Pioneer Wind Park I, LLC and Pioneer Wind Park II, LLC. Prepared by SWCA Environmental Consultants. March 2014.

US Fish and Wildlife Service (USFWS). 2009. United States Fish and Wildlife Service, Department of the Interior. 50 CFR 13 and 22. Eagle Permits; Take Necessary to Protect Interests in Particular Localities. 74 FR 46836. September 11, 2009.

US Fish and Wildlife Service (USFWS). 2011. Draft Eagle Conservation Plan Guidance. January 2011. Available online at: http://www.fws.gov/windenergy/docs/ECP_draft_guidance_2_10_final_clean_omb.pdf

US Fish and Wildlife Service (USFWS). 2012. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy Technical Appendices. Division of Migratory Bird Management, USFWS. August 2012.

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy. Version 2. Division of Migratory Bird Management, USFWS. April 2013. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

US Fish and Wildlife Service (USFWS). 2016. Bald and Golden Eagles: Population demographics and estimation of sustainable take in the United States, 2016 update. Division of Migratory Bird Management, Washington D.C., USA.

US Geological Survey (USGS). 2006. National Land Cover Database (NLCD) Land Use/Land Cover, NLCD 2001. USGS Headquarters, USGS National Center. Reston, Virginia.

US Geological Survey (USGS). 2013. The National Map/US Topo. Last updated June 18, 2013. Homepage available at: http://nationalmap.gov/ustopo/index.html

Whitfield, D. P. 2009. Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report from Natural Research to Scottish Natural Heritage, Banchory, United Kingdom.

Wyoming Game and Fish Department (WGFD). 2013. Big Game GIS Data. Wyoming Game and Fish Department Headquarters, Cheyenne, Wyoming. http://wgfd.wyo.gov/web2011/wildlife-1000819.aspx

Appendix A: Bird and Bat Conservation Strategy for the Pioneer Wind Park Wind Energy Facility.

BIRD AND BAT CONSERVATION STRATEGY FOR THE PIONEER WIND PARK WIND ENERGY FACILITY

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October 19, 2016

CONTENTS

1.0 STATEMENT OF PURPOSE 1

2.0 REGULATORY FRAMEWORK 1
2.1 USFWS Laws, Regulations, and Policies 1
2.1.1 Migratory Bird Treaty Act (MBTA) 1
2.1.2 Bald and Golden Eagle Protection Act (Eagle Act) 1
2.1.3 Endangered Species Act (ESA) 2
2.1.4 State and Federal Permit Requirements 2

3.0 PROJECT DESCRIPTION 4

4.0 PROJECT HISTORY OF BIRD AND BAT PRESENCE, AND RISK ASSESSMENTS 12
4.1 Preliminary Site Evaluation (WEG Tier 1) and Site-specific Characterization and Decisions (WEG Tier 2) 12
4.1.1 Site Description 12
4.1.2 Decision to Abandon Site(s) or Advance to Site-Specific Baseline Bird and Bat Studies 15
4.2 Field Studies to Document Birds, Bats and Their Habitat, and Predict Potential Project Impacts (WEG Tier 3) 15
4.2.1 Raptor Nest Surveys 16
4.2.2 Eagle and other Raptor Surveys: Long-watch Surveys 19
4.2.3 Other Avian Use Surveys: 20 Minute Point Counts 23
4.2.4 February 2010 Winter Bird Survey 28
4.2.5 Eagle Roost Site Surveys 29
4.2.6 Burrowing Owl Surveys 32
4.2.7 Greater Sage-Grouse Lek Surveys 32
4.2.8 Raptor Prey Base 34
4.2.9 Passive Acoustic Bat Activity Monitoring at MET Towers 37
4.2.10 Mobile Passive Surveys 40
4.2.11 Active Acoustic Surveys 42
4.2.12 Bird and Bat Status Assessments 42
4.2.13 Bird and Bat Habitats 44
4.2.14 Bird and Bat Risk Assessment and Decisions Based on Assessments 51
4.2.15 Risk Assessment Decisions 58

5.0 CONSERVATION MEASURES TO AVOID AND MINIMIZE ADVERSE IMPACTS 58
5.1 Pre-Construction 58
5.1.1 Siting the Project Layout 58
5.1.2 Additional Pre-construction BMP's and Conservation Measures 62
5.2 During Construction 63
5.3 During Operation 64
5.4 Measures to Minimize Habitat Loss/Degradation/Fragmentation 65

6.0 POST-CONSTRUCTION STUDIES TO ESTIMATE IMPACTS (WEG TIERS 4 AND 5) 67
6.1 Mortality Monitoring 67
6.2 Post-construction Continuation of Before/After-Control Impact Surveys 68
6.3 Habitat Surveys 68

7.0 ADAPTIVE MANAGEMENT 68

8.0 PROJECT PERMITS ADDRESSING BIRDS AND BATS 69
8.1 Bird and Bat Permits 69
8.2 Agency and Process for Permit Issuance 69

9.0 REPORTING FORMATS AND SCHEDULE 70
A. Preconstruction Survey Data 70
B. Operation/Post-construction Monitoring 70

10.0PERSONNEL TRAINING 70
10.1 Wildlife Incident Report and Handling System 71

11.0CONTACTS/KEY RESOURCES 71
11.1 List of Contacts and Key Resources 71

12.0REFERENCES 72

TABLES

Table 1. List of Potential Federal, State, and Local Permit Requirements. 3

Table 2. Estimated Temporary and Permanent Acres of Impact Associated with Pioneer Wind Park Project Features, Converse County, Wyoming. 5

Table 3a. Land Use/Habitat types present within the Pioneer Wind Park Project Area, Converse County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006). 8

Table 3b. Estimated Temporary and Permanent Acres of Impact by Major Land-Use/Habitat Types Associated with Pioneer Wind Park Project Features, Converse, County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006). 9

Table 4. Wyoming Game and Fish Department Special Status Species according to the Wyoming State Wildlife Action Plan and USFWS special status species based on a recent search of the USFWS online IPAC tool for Converse County, Wyoming. 13

Table 5. Mean use (# raptors/station/hour) for each raptor species observed during the eagle and other raptor long-watch surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, from April 2010 – November 2011. Year 1 was from April 16, 2010 to March 2, 2011, and year 2 was from March 16 to November 11, 2011. 22

Table 6. Sample size and mean bird use (number of birds/survey) observed during avian use surveys, by season and overall, at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (May 13, 2010 – March 2, 2011) and Year 2 (April 5, 2011 – March 1, 2012). 26

Table 7. Species with a minimum mean use of 1.0 birds/survey recorded during avian use surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (May 13, 2010 - March 2, 2011) and Year 2 (April 5, 2011 - March 1, 2012). 26

Table 8. Mean use (# birds/survey) at each point surveyed during avian use surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (March 13, 2010 – March 2, 2011) and Year 2 (April 5, 2010 – March 1, 2012). 27

Table 9. Number of bat passes by frequency classification: low frequency (LF), mid-frequency (MF), and high frequency (HF). 37

Table 10. Wyoming bat species categorized by call frequency (low, mid, and high frequency) based on characteristic call frequency (Hester and Grenier 2005). 43

Table 11. Estimated annual avian mortality from anthropogenic causes in the United States. 52

FIGURES

Figure 1. General location of the Pioneer Wind Park Project Area, Converse County, Wyoming. 6

Figure 2. Proposed Pioneer Wind Park Project, Converse County, Wyoming. 7

Figure 3. Digital elevation map of the Pioneer Wind Park Project Area, Converse County, Wyoming. 10

Figure 4. Landuse/landcover within the Pioneer Wind Park Project Area, Converse County, Wyoming. 11

Figure 5. Aerial survey pathway (May 13, 2011), ground-based call playback survey points, and raptor nests observed in 2010 and 2011 at the Pioneer Wind Park I Project, Converse County, Wyoming. 18

Figure 6. Location of Eagle and other Raptor Survey (Long Watch Survey) Stations and associated 800-m radius plots within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. Please note that observations were not restricted to 800 m. 21

Figure 7. Total number of survey hours for each Eagle and other Raptor Survey (Long Watch Survey) Station (per season and overall) conducted during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011. 23

Figure 8. Location of other Avian Use Survey Stations within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. 25

Figure 9. Comparison of mean annual bird use among avian use survey points at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (March 13, 2010 – March 2, 2011) and Year 2 (April 5, 2010 – March 1, 2012). 28

Figure 10. Location of aerial eagle roost survey route conducted on March 3, 2011 within the vicinity of the Pioneer Wind Park Project Area, Converse County, Wyoming. 32

Figure 11. Location of fixed-wing transects flown to search for greater sage-grouse leks in the vicinity of the Pioneer Wind Park Project Area, Converse, County, Wyoming 33

Figure 12. Prairie dog colonies, greater sage grouse leks, and mule deer crucial winter in the vicinity of the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. 36

Figure 13. MET tower locations and potential bat use areas based on LANDFIRE spatial vegetation and National Wetland Inventory data. 38

Figure 14. Mean weekly number of bat passes at the MET B and MET C Anabat stations at the Pioneer Wind Park I Project Area, Converse County, Wyoming, between April 15 and October 15 in 2010 and 2011. 39

Figure 15. Location of mobile passive bat survey sites monitored from April 16 –October 15, 2010 and April 15 – October 15, 2011, at the Pioneer Wind Park I Project Area, Converse County, Wyoming. 41

Figure 16. Predicted greater sage-grouse breeding habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County Wyoming. 46

Figure 17. Predicted greater sage-grouse summer/early fall habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County Wyoming. 47

Figure 18. Predicted greater sage-grouse fall/winter habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County, Wyoming. 48

Figure 19. Grid-based analysis of all raptor flight paths recorded during pre-construction surveys of the Pioneer Wind Park I Project. Converse County, Wyoming, from April 16, 2010 – March 1, 2012. 50

Figure 20. Annual per megawatt bird fatality rates reported at wind energy facilities in western North America. 53

Figure 21. Annual per megawatt raptor fatality rates reported at wind energy facilities in western North America. 54

Figure 22. Annual per megawatt bat fatality rates reported at wind energy facilities in western North America. 55

Figure 23. Illustration of the progression in turbine layouts, showing efforts to avoid locating turbines in areas of highest eagle and raptor use areas based on pre-construction survey data, resulting in the final proposed layout with 46 turbines for the Pioneer Wind Park Project, Converse County, Wyoming. 61

APPENDICES

Appendix A: Baseline Survey Reports

1.0 Statement of Purpose

Pioneer Wind Park I, LLC (PWPI) has proposed a wind-energy facility in Converse County, Wyoming near the town of Glenrock (Figure 1). The proposed wind-energy facility is known as the Pioneer Wind Park Project (the "Project"). The following Bird and Bat Conservation Strategy (BBCS) has been developed to identify and describe the decision-making process employed during Project development to ensure conservation of bird and bat wildlife resources and their habitats. The PWPI BBCS is a package that includes: 1) a summary of the bird and bat studies that have been conducted to date and how the results of those studies have been used to inform potential risk along with actions intended to minimize potential risk; 2) conservation measures that have been or will be implemented during planning, construction, operation, and decommissioning of the Project with the intent of avoiding and minimizing impacts to birds and bats; and 3) a framework for adaptive management with the implementation of additional conservation measures depending on the results of post-construction monitoring efforts.

2.0 Regulatory Framework

2.1 USFWS Laws, Regulations, and Policies

2.1.1 Migratory Bird Treaty Act (MBTA)

The MBTA is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not a prerequisite of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation. The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird …" 16 U.S.C. 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" 50 CFR 10.12. The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

2.1.2 Bald and Golden Eagle Protection Act (Eagle Act)

Under authority of the Eagle Act, 16 U.S.C. 668–668d, bald eagles and golden eagles are afforded additional legal protection. The Eagle Act prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof, 16 U.S.C. 668. The Eagle Act also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," 16 U.S.C. 668c, and includes criminal and civil penalties for violating the statute. See 16

U.S.C. 668. The term “disturb” is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior, 50 CFR 22.3.

2.1.3 Endangered Species Act (ESA)

The ESA directs the USFWS to identify and protect endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. Among its other provisions, the ESA requires the USFWS to assess civil and criminal penalties for violations of the Act or its regulations. Section 9 of the ESA prohibits take of federally-listed species. Take is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct” 16 U.S.C. 1532. The term “harm” includes significant habitat alteration which kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering, 50 CFR 17.3. Projects involving Federal lands, funding or authorizations will require consultation between the Federal agency and the USFWS, pursuant to section 7 of the ESA. Projects without a Federal nexus should work directly with USFWS to avoid adversely impacting listed species and their critical habitats.

2.1.4 State and Federal Permit Requirements

In the State of Wyoming, an “Industrial Facility” is required to obtain an industrial siting permit pursuant to Wyo. Stat. Ann. § 35-12-109 prior to constructing and operating the facility. The proposed Project meets the definition of an “Industrial Facility” in that the Project has an estimated construction cost of at least $178,300,000.00 and consists of 30 or more wind turbines. PWPI submitted an application for an industrial siting permit for the Project in February of 2011 and the permit was granted in July of 2011. As part of the application process, PWPI committed to obtaining all permits required for construction of the Project (Table 1).

Table 1. List of Potential Federal, State, and Local Permit Requirements.

Jurisdiction	Permit/Decision	Status/Agent
Federal		
Federal Aviation Administration	Notice of Proposed Construction or Alteration	Completed
U.S. Army Corps of Engineers	Clean Water Act (CWA) Section 404 - Individual or Nationwide Permit	Completed
U.S. Environmental Protection Agency (EPA)	Spill Prevention Control and Countermeasures (SPCC) Plan – Construction	Completed
	SPCC Plan –Operation	Pending final design/EPC will file prior to operation
Federal Communications Commission	Private Operational Fixed Microwave License	Completed
State		
Wyoming State of Engineer's Office	Permits to appropriate groundwater (use, storage, dewatering) or water stored in impoundments or reservoirs, Wyoming statutes (W.S.) 41-3-901 through 41-3-398, as amended (Form U.W. 5)	Pending final design/PWPI will file prior to use of groundwater, if and as necessary
Wyoming Department of Environmental Quality	Wyoming Industrial Development and Siting Act / Industrial Siting Council Order	Completed
	Wyoming Pollutant Discharge Elimination System (WyPDES) – Large Construction General Permit (WYR10-0000)	Completed
	General Permit for Temporary Discharge	Pending final design/EPC will file before construction begins, if and as necessary
	Permit to Construct Small Wastewater Facilities (Septic Tanks and Leach fields)	Pending final design, depending on size of septic tank needed for O&M Building/EPC will file prior to building construction
	Section 401 Water Quality Certification	Completed
	Air Quality Division - Temporary / Portable Source Air Permit	Completed
	Water Quality Division - Temporary Increase in Turbidity Permit	Pending final design/PWPI will file prior to construction, if and as necessary
Wyoming Department of Transportation	Port of Entry Permit for Oversized/Overweight Loads	Completed
	Road Use Agreement	Completed
Local		
Converse County	Right-of-Way Encroachment for collector line crossing of Mormon Canyon Road	Completed
	Road Use Agreement	Completed
	Wind Energy Conversion System (WECS) Use Permit	Completed

3.0 Project Description

In July of 2011, the Project was permitted through the Wyoming Industrial Siting Council (ISC; refer to Section 2.0 Regulatory Framework for a discussion of the ISC permit and other necessary permits for the Project). The Project as originally proposed and permitted by the ISC included the Pioneer Wind Park I (PWP I) Project consisting of 31 General Electric (GE) 1.6-megawatt (MW) wind turbine generators (WTGs) for a total nameplate capacity of 49.6 MW and the Pioneer Wind Park II (PWP II) Project consisting of 31 GE 1.6 MW WTGs for a total nameplate capacity of 49.6 MW. Combined, there were 62 proposed WTG locations with a total nameplate capacity of approximately 99 MW that were permitted for development. On June 24, 2013, the ISC approved a reduction in the number of turbines to 46 1.85 MW WTG's with a total net output of 80 MW (Figure 2). In addition to the WTGs, other proposed Project facilities would include access roads to each WTG location, underground power collection and communication lines linking the WTGs to a Project substation, the Project substation, approximately 5 miles of 230-kilovolt (kV) transmission line connecting the Project to the regional electrical grid, operation and maintenance facilities, and up to two permanent meteorological towers. Proposed new Project access roads include approximately 10.5 miles. The Project will result in both permanent and temporary loss of habitats. This BBCS defines permanent habitat loss as acres of lost habitat that will be removed for the operating life of the Project and temporary habitat loss as acres of lost habitat that will be removed during construction but, will be reclaimed and/or allowed to rejuvenate through succession following the construction period. Rough estimates of permanent and temporary acres of habitat loss for major project components are provided in Table 2. The Project area (area contained within the red polygon in Figures 1 and 2) encompasses approximately 25,268 acres and is located entirely on private land and Wyoming State School Trust Lands (approx. 3,107 acres of state lands are located within the Project area). The total area estimated for temporary and permanent habitat loss by the Project is approximately 283.6 acres (10.58 acres of state lands), a majority of which is temporary, or approximately 1% of the total Project area. However, actual loss of habitat is not the only type of potential impact associated with the Project. Other types of potential impacts include habitat fragmentation, displacement, avoidance, and collision with infrastructure. Construction of the Project substations commenced in February 2016. Construction of turbines, roads, and collection systems is anticipated to occur throughout 2016, with an estimated in-service date of mid to late October 2016.

Table 2. Estimated Temporary and Permanent Acres of Impact Associated with Pioneer Wind Park Project Features, Converse County, Wyoming.

Project Feature	Temporary Habitat Acres Lost	Permanent Habitat Acres Lost
Wind Turbine Generators	0	46
Access Roads	51.0	29.8
Crane Pads and Paths	103.6	0
Laydown Area	16.6	0
230 kv Transmission Line	15.7	<0.1
Collector System	10.9	0
O&M Building	0	1.0
Parking Lot	0	1.0
Substations	2.5	3.5
Permanent MET, Radar, Communication Towers	1.0	1.0
TOTAL	**201.3**	**82.3**

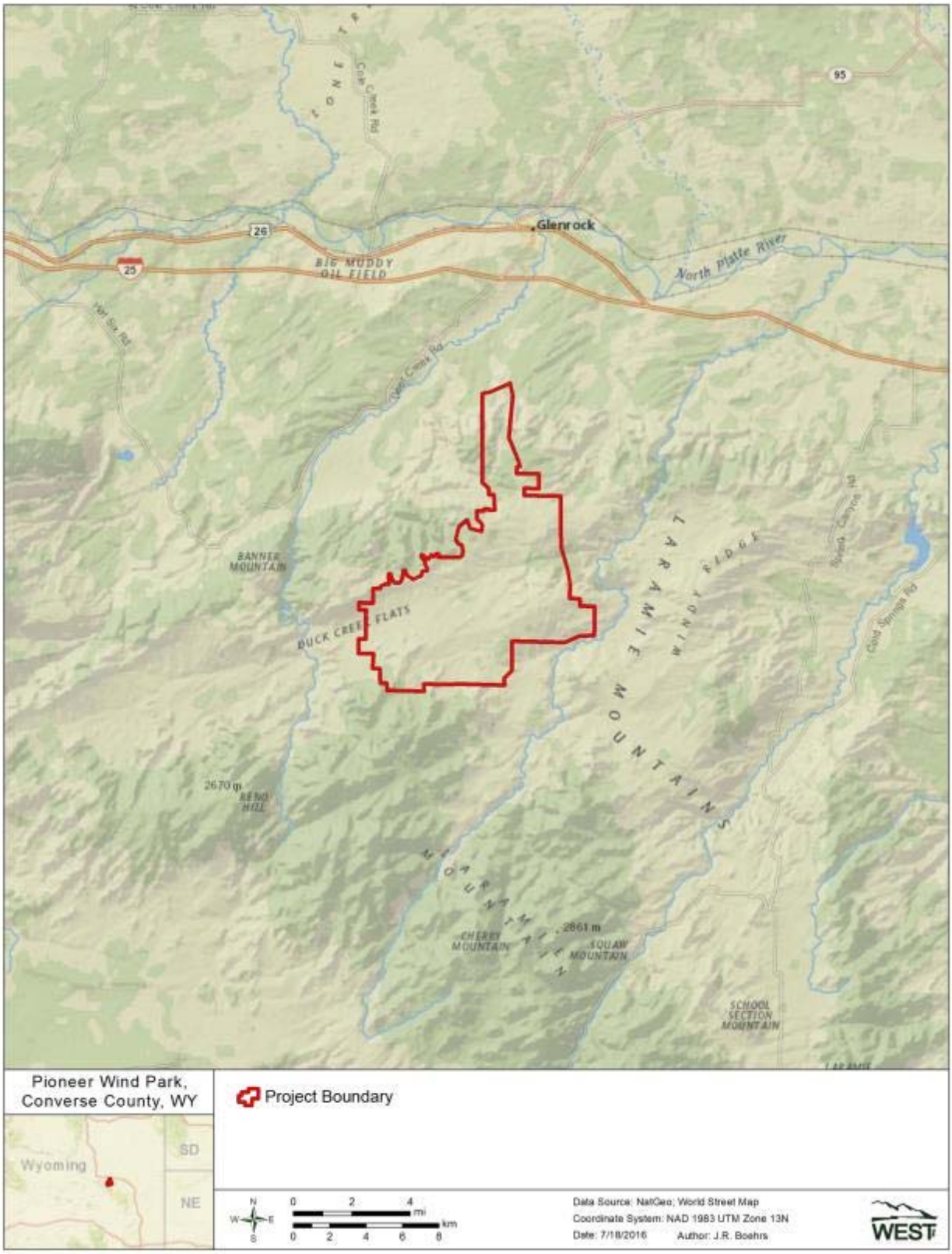


Figure 1. General location of the Pioneer Wind Park Project Area, Converse County, Wyoming.

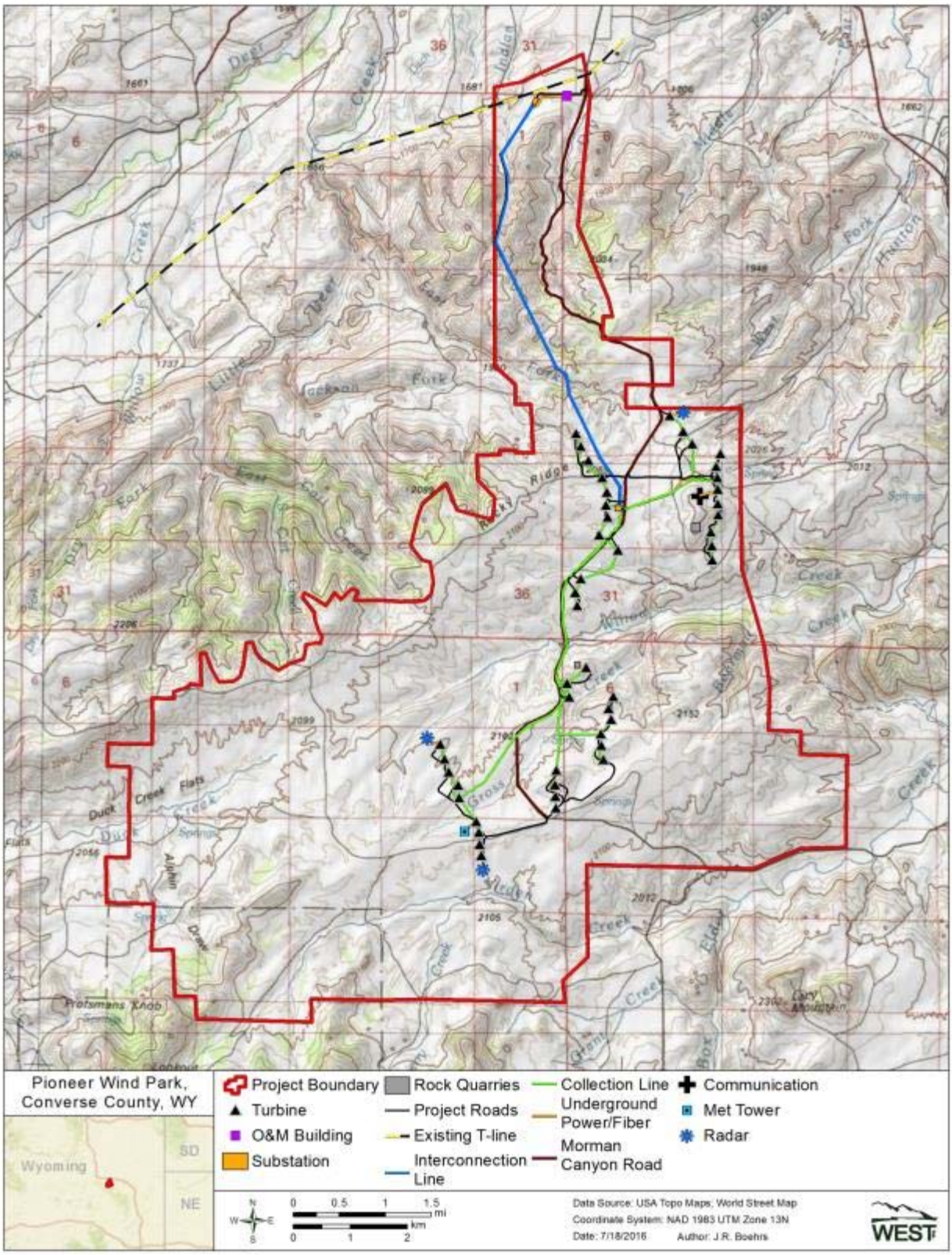


Figure 2. Proposed Pioneer Wind Park Project, Converse County, Wyoming.

The Project is located in the foothills of the Laramie Mountains, with elevations ranging from approximately 5,500 to 7,600 feet (Figures 3 and 4). The topography ranges from gently rolling slopes to abrupt canyons and ridges. Combined, the Project consists of approximately 25,268 acres (approx. 40 square miles [mi^2]) and is located entirely on private lands and Wyoming State School Trust Lands. There are no federally owned or managed lands located within the Project footprint (in this BBCS, the Project footprint refers to the actual location of Project features and infrastructure). The dominant land use is livestock grazing, although there are two open-pit rock quarries located within the Project area. Livestock grazing within the Project area is primarily domestic cattle grazing (aside from cattle, a small number of domestic horses may also be grazed in the area) with the majority of cattle grazing occurring in late spring through the fall season. Very little (if any) calving occurs in areas proposed for turbine locations. The northern existing rock quarry (see northern quarry location on Figure 2 above) receives very little seasonal activity (June through October), primarily by landowners hauling gravel to roads. There are no permanent lights at the quarry location. A second quarry site has also been permitted and began activity in 2016 (see southern quarry location in Figure 2 above).

The Project area contains a number of drainage features including: Dry Creek, East Fork of Little Deer Creek, Willow Creek, Hunton Creek, Gross Creek, Virden Creek, and Duck Creek (Figure 2). According to the National Land Cover Dataset (USGS NLCD 2006; Table 3a; Figure 4), the Project area is dominated by shrub/sage-steppe (approx. 18,177 acres; 72%). Evergreen forest (approx. 2,978 acres) and grassland (approx. 2,915 acres) each compose approximately 12% of the Project area. All other land cover types compose less than five percent of the total Project area (Table 3a; Figure 4). Based on the USGS NLCD 2006 there is very little (0.85 acres; <0.01%) developed; open space within the Project area and the density of human habitation in the vicinity of the Project is very low, consisting primarily of a few homesteads or buildings for ranching operations (in addition to the existing rock quarries discussed above).

Table 3a. Land Use/Habitat types present within the Pioneer Wind Park Project Area, Converse County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006).

Cover Type	Acreage	% Composition
Developed; Open Space	0.85	<0.01%
Barren	3.28	0.01%
Deciduous Forest	234.31	0.93%
Evergreen Forest	2,978.20	11.79%
Shrub/Sage-steppe	18,177.35	71.94%
Grassland	2,915.44	11.54%
Pasture/Hay	38.93	0.15%
Woody Wetlands	419.62	1.66%
Emergent Wetlands	500.41	1.98%
Total	**25,268.39**	**100.00%**

Descriptions of the various land cover types contained within the 2006 NLCD have been modified from the Anderson Land Cover Classification System and are available at: http://www.mrlc.gov/nlcd06_leg.php.

Table 3a above illustrates the major land use/habitat types present within the Project area. However, as illustrated above in Table 2, the Project footprint is only estimated to permanently impact 82.3 acres and temporarily impact 201.3 acres. Based on the USGS National Land Cover Data Set (2006), an estimate of the major land-use/habitat types that will actually be impacted by the Project footprint is provided in Table 3b. The rough estimates are provided, to give a general idea of the type of habitats that may be impacted (i.e. primarily shrub/sage-steppe and grassland) as the dataset is for use at the landscape scale.

Table 3b. Estimated Temporary and Permanent Acres of Impact by Major Land-Use/Habitat Types Associated with Pioneer Wind Park Project Features, Converse, County, Wyoming. Data were obtained the US Geological Survey National Land Cover Data Set (2006).

Project Feature	Shrub/sage-steppe		Grassland		Forest		Wetlands	
	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost	Temporary Acres Lost	Permanent Acres Lost
Wind Turbines	-	36.1	-	9.9	-	-	-	-
Access Roads	39.9	22.0	10.6	5.3	-	2.5	0.5	<0.1
Crane Pads/Paths	78.4	-	24.8	-	<0.1	-	0.4	-
Laydown Area	15.7	-	0.9	-	-	-	-	-
230 kV Trans. Line	8.8	<0.1	1.6	<0.1	5.3	<0.1	-	-
Collector System	7.4	-	3.4	-	<0.1	-	0.1	-
O&M Building	-	1.0	-	-	-	-	-	-
Parking Lot	-	0.8	-	0.2	-	-	-	-
Substations	2.5	3.5	-	-	-	-	-	-
Permanent MET, Radar, Comm. towers	0.8	0.8	0.2	0.2	-	-	-	-
Total	**153.5**	**64.2**	**41.5**	**15.6**	**5.3**	**2.5**	**1.0**	**<0.1**

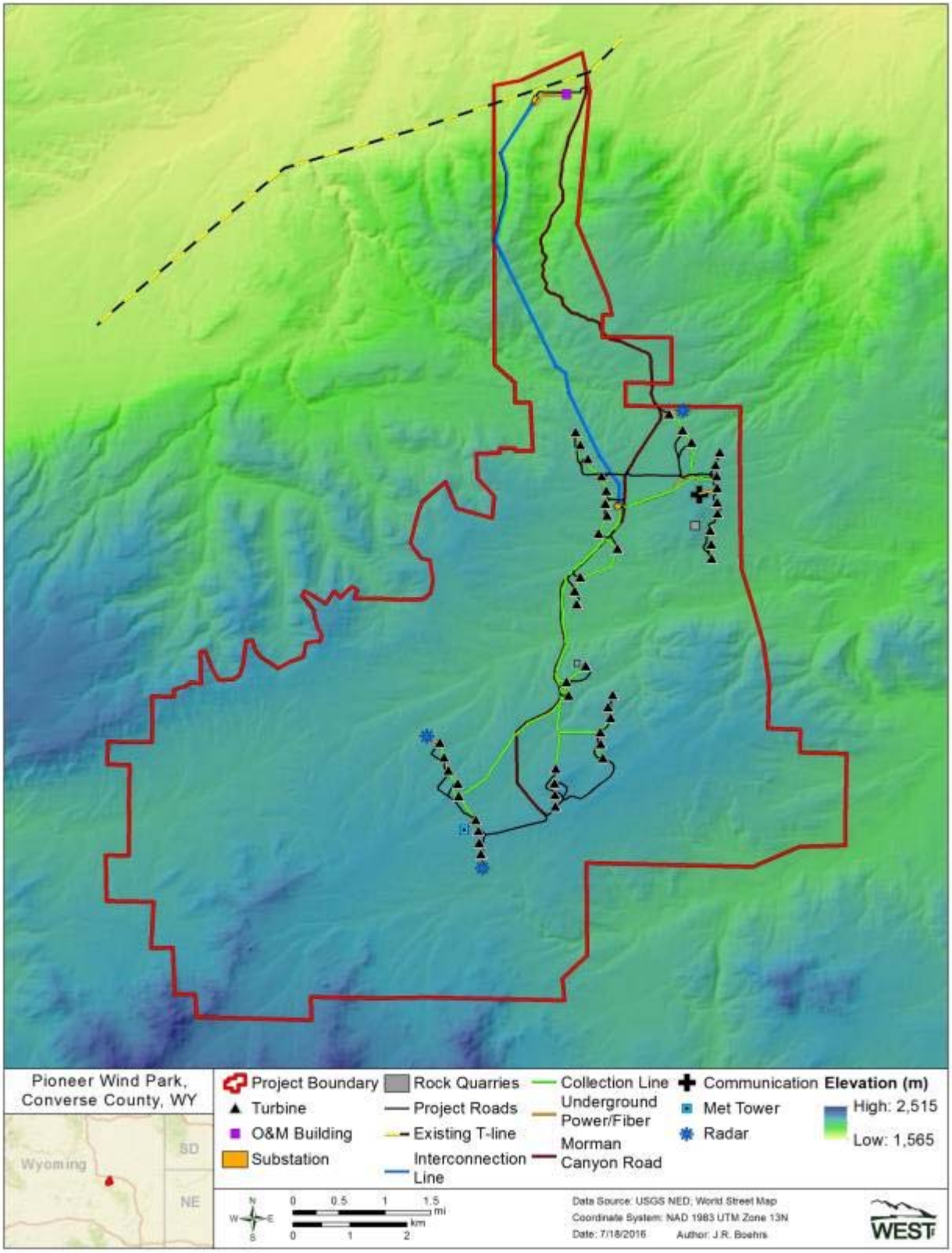


Figure 3. Digital elevation map of the Pioneer Wind Park Project Area, Converse County, Wyoming.

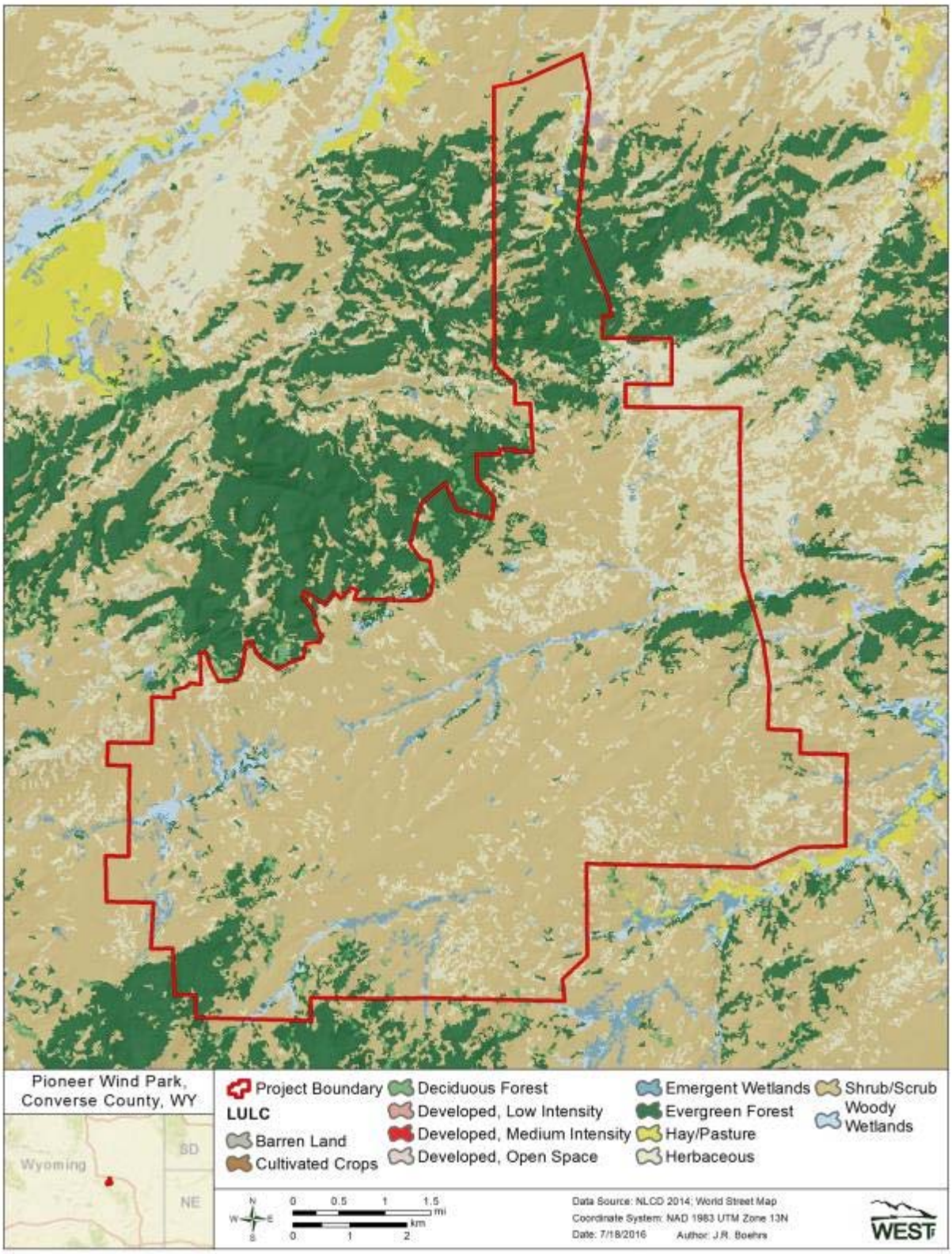


Figure 4. Landuse/landcover within the Pioneer Wind Park Project Area, Converse County, Wyoming.

4.0 Project History of Bird and Bat Presence, and Risk Assessments

4.1 Preliminary Site Evaluation (WEG Tier 1) and Site-specific Characterization and Decisions (WEG Tier 2)

A Critical Issues Analysis (CIA) was conducted by SWCA Environmental Consultants (SWCA) for the Project. The analysis included a desktop review of existing data with respect to the Project area, and was presented to the Wyoming Game and Fish Department (WGFD) and the Wyoming ISC in March of 2010. A number of biological data sources were utilized including: 1) USGS LANDFIRE Existing Vegetation Type GIS data; 2) National Wetlands Inventory; 3) Wyoming Natural Diversity Database; and 4) WGFD (online data and conversations with Casper and Lander Field Office Staff). In addition to the desktop review, a site visit was conducted by SWCA biologists on January 28, 2010.

4.1.1 Site Description

The analysis indicated that the Project was dominated by shrublands and grasslands, with other vegetative cover types including coniferous forest, riparian areas, hardwood, and agricultural areas. The following species or habitats of potential concern were identified during the preliminary site evaluations: 1) NWI data indicated that some wetlands were present within the various drainage features within the Project area, but that those areas could likely be avoided during Project siting; 2) crucial winter range for mule deer was identified in the northern portion of the Project area; 3) two historic WGFD greater sage-grouse (*Centrocercus urophasianus*) leks were identified with the Project area; 4) in a search for any historical records of raptor species of special concern, three historical records of bald eagle (*Haliaeetus leucocephalus*) were identified from 1990 to 1993 within the general vicinity of the Project; 5) bird species of special concern with known occurrence in the vicinity of the Project included: ferruginous hawk (*Buteo regalis*), greater sage-grouse, golden eagle (*Aquila chrysaetos*), bald eagle, Lewis' woodpecker (*Melanerpes lewis*), long-billed curlew (*Numenius americanus*), and American white pelican (*Pelecanus erythrorhynchos*); however, no threatened or endangered bird or bat species were identified as potentially occurring with the Project area. Table 4 provides a list of sensitive species in Wyoming according to the Wyoming State Wildlife Action Plan as well as USFWS species (based on a recent search of the USFWS online IPAC tool) for Converse County.

Table 4. Wyoming Game and Fish Department Special Status Species according to the Wyoming State Wildlife Action Plan and USFWS special status species based on a recent search of the USFWS online IPAC tool for Converse County, Wyoming.

Common Name	Scientific Name	Federal Status	State Status
BIRDS			
Golden eagle		BGEPA	
Common loon	*Gavia immer*		NSS1
Bald eagle	*Haliaeetus leucocephalus*	BGEPA	NSS2
Greater sage-grouse	Centrocercus urophasianus		NSS2
Burrowing owl	*Athene cunicularia*		NSSU
Ferruginous hawk	*Buteo regalis*		NSSU
Great gray owl	*Strix nebulosa*		NSSU
Mountain plover	*Charadrius montanus*		NSSU
Northern goshawk	*Accipiter gentilis*		NSSU
Trumpeter swan	*Cygnus buccinator*		NSS2
American bittern	*Botaurus lentiginosus*		NSS3
Ash-throated flycatcher	*Myiarchus cinerascens*		NSS3
Barrow's Goldeneye	*Bucephala islandica*		NSS3
Black tern	*Chlidonias niger*		NSS3
Black-crowned night-heron	*Nycticorax nycticorax*		NSS3
Boreal owl	*Aegolius funereus*		NSS3
Bushtit	*Psaltriparus minimus*		NSS3
Canvasback	*Aythya valisineria*		NSS3
Caspian tern	*Hydroprogne caspia*		NSS3
Forster's tern	*Sterna forsteri*		NSS3
Franklin's gull	*Larus pipixcan*		NSS3
Harlequin duck	*Histrionicus histrionicus*		NSS3
Juniper titmouse	*Baeolophus ridgwayi*		NSS3
Lesser scaup	*Aythya affinis*		NSS3
Long-billed curlew	*Numenius americanus*		NSS3
Northern pintail	*Anas acuta*		NSS3
Peregrine falcon	*Falco peregrinus*		NSS3
Redhead	*Aythya americana*		NSS3
Snowy egret	*Egretta thula*		NSS3

Table 4. Wyoming Game and Fish Department Special Status Species according to the Wyoming State Wildlife Action Plan and USFWS special status species based on a recent search of the USFWS online IPAC tool for Converse County, Wyoming.

Common Name	Scientific Name	Federal Status	State Status
Virginia rail	*Rallus limicola*		NSS3
Western scrub-jay	*Aphelocoma californica*		NSS3
White-faced ibis	*Plegadis chihi*		NSS3
Bobolink	*Dolichonyx oryzivorus*		NSS4
Brewer's sparrow	*Spizella breweri*		NSS4
Chestnut-collared longspur	*Calcarius ornatus*		NSS4
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*		NSS4
Dickcissel	*Spiza americana*		NSS4
Grasshopper sparrow	*Ammodramus savannarum*		NSS4
Lark bunting	*Calamospiza melanocorys*		NSS4
McCown's longspur	*Calcarius mccownii*		NSS4
Sage sparrow	*Amphispiza belli*		NSS4
Sage thrasher	*Oreoscoptes montanus*		NSS4
Short-eared owl	*Asio flammeus*		NSS4
American Three-toed Woodpecker	*Picoides dorsalis*		NSSU
Black Rosy-Finch	*Leucosticte atrata*		NSSU
Black-backed Woodpecker	*Picoides arcticus*		NSSU
Brown-capped Rosy-Finch	*Leucosticte australis*		NSSU
Clark's Grebe	*Aechmophorus clarkii*		NSSU
Lewis's Woodpecker	*Melanerpes lewis*		NSSU
Northern Pygmy-Owl	*Glaucidium gnoma*		NSSU
Pygmy Nuthatch	*Sitta pygmaea*		NSSU
Swainson's Hawk	*Buteo swainsoni*		NSSU
Upland Sandpiper	*Bartramia longicauda*		NSSU
Greater Sandhill Crane	*Grus canadensis tabida*		NSS4
Willow Flycatcher	*Empidonax traillii*		NSS4
Merlin	*Falco columbarius*		NSSU
Yellow-billed Cuckoo	*Coccyzus americanus*		NSSU
BATS			

Table 4. Wyoming Game and Fish Department Special Status Species according to the Wyoming State Wildlife Action Plan and USFWS special status species based on a recent search of the USFWS online IPAC tool for Converse County, Wyoming.

Common Name	Scientific Name	Federal Status	State Status
Townsend's Big-eared Bat	*Corynorhinus townsendii*		NSS2
Fringed Myotis	*Myotis thysanodes*		NSS3
Long-eared Myotis	*Myotis evotis*		NSS3
Long-legged Myotis	*Myotis volans*		NSS3
Northern Myotis	*Myotis septentrionalis*		NSS3
Spotted Bat	*Euderma maculatum*		NSS3
Big Brown Bat	*Eptesicus fuscus*		NSS4
Little Brown Myotis	*Myotis lucifugus*		NSS4
Western Small-footed Myotis	*Myotis ciliolabrum*		NSS4
Eastern Red Bat	*Lasiurus borealis*		NSSU
Pallid Bat	*Antrozous pallidus*		NSS3

Source: WGFD State Wildlife Action Plan and USFWS online IPAC tool.

4.1.2 Decision to Abandon Site(s) or Advance to Site-Specific Baseline Bird and Bat Studies

The preliminary site evaluation and site-specific characterization determined that while some species or habitats of potential concern may be present in the vicinity of the Project, the available information did not suggest that the Project should be abandoned at this tier due to a high probability of significant adverse impacts that could not be avoided or minimized. As such, PWPI decided to pursue additional site-specific baseline bird and bat studies within the proposed Project area to further inform potential risk to bird and bat species within the Project area.

4.1.2.1 Determine Need for Other Bird or Bat Conservation Plans

At the time of preliminary site evaluation and site-specific characterization (2010), the USFWS eagle conservation plan guidance (ECPG) did not exist. However, since then, in communication with the USFWS, PWPI has determined that an eagle conservation plan (ECP) should be developed for the Project and PWPI has developed an ECP in consultation with USFWS and is pursuing an eagle take permit for the Project.

4.2 Field Studies to Document Birds, Bats and Their Habitat, and Predict Potential Project Impacts (WEG Tier 3)

PWPI contracted SWCA to conduct baseline wildlife studies within the Project area. Representatives for PWPI and SWCA met with the Wyoming Game and Fish Department

(WGFD) in Cheyenne, Wyoming, in February 2010 to provide an overview of the project and again in March 2010 to discuss preliminary biological survey protocols developed by SWCA using WGFD's then-recommended guidelines for wind development. Two additional iterations of the WGFD's recommendations were provided to PWPI and SWCA, following which study protocol was modified to adhere to the revised recommendations. Final survey protocols were agreed upon with a signed WGFD letter on 8 June 2010 that was also sent to USFWS. Two years of baseline wildlife studies were conducted with surveys initiated in April of 2010 and completed in March of 2012. This section provides a brief summary of the baseline wildlife studies, and SWCA's complete final baseline wildlife report has been included in Appendix A.

4.2.1 Raptor Nest Surveys

4.2.1.1 Methods

Raptor nest survey methods were coordinated with the agencies (WGFD and USFWS). Both ground-based and aerial raptor nest surveys were conducted within the Project area (Appendix A). On April 27 and May 9, 2010 as well as on April 1, 2011, SWCA opportunistically scanned for raptor nest structures while conducting greater sage-grouse lek surveys from a fixed-wing aircraft (see Section 4.2.7, Figure 11 for an illustration of the survey coverage provided by the fixed-wing transects). The aerial lek surveys allowed coverage of at least a 3-mile buffer of final proposed turbine locations and up to six miles in some cases (Figure 11). While the main focus of the fixed-wing surveys was to search for greater sage-grouse leks and this likely influenced the ability to detect raptor nests, the lek surveys did provide extensive coverage over the Project area, and surrounding buffer and additional ground and aerial surveys provide further data on raptor nests in the vicinity of the Project. On June 21, 22, 23, and 30, 2010, mid-day nest searches were also conducted from the ground by personnel hiking meandering transects focused on patches of woodland that appeared suitable for raptor nests.

One formal aerial helicopter survey for raptor nests occurred on May 13, 2011 (Figure 5). During this survey, the Project area and an associated 1-mile buffer were surveyed for all raptor species, and the Project area and an associated 3-mile buffer were surveyed for golden eagle nests. The one aerial helicopter raptor nest search allowed for the determination of nest locations and active nests identified at the time of the survey, but was limited in its ability to determine occupancy status (given that only one survey was conducted). However, additional observational work in the vicinity of the Project area provides data on the likelihood of nest occupancy during the baseline studies. As described in the final baseline report, nests observed incidentally over the course of the baseline studies were also recorded (Appendix A).

4.2.1.2 Results and Discussion

Surveys along the 2010 transmission line corridor resulted in multiple responses and/or observations of northern harrier (Circus cyaneus), red-tailed hawk, American kestrel (Falco sparverius), short-eared owl (Asio flammeus), and great horned owl (Bubo virginianus). American kestrel breeding activity was noted near a potential nest site (i.e., snag with cavities). A large stick nest structure was located in an area of red-tailed hawk activity. A second large stick nest structure was located, but no raptor activity was observed near the nest. The broadcast call

surveys in 2011 resulted in no raptor responses or location of nests, which was likely due to minimal suitable habitat along the revised transmission corridor compared to the 2010 corridor which included portions of Mormon Canyon Road.

Four black-billed magpie (*Pica hudsonia*) nests and one medium-sized stick nest were found in June 2010. Black-billed magpie nests are notable because some diurnal raptor species (e.g., Cooper's hawk [*Accipiter cooperii*], merlin [*Falco columbarius*]) will occasionally use old black-billed magpie nest structures for their own nesting attempts. Two potential nest cavities were also located in an area of American kestrel territorial activity. No activity was observed at any of these nests, and no other potential raptor nest structures were located during area search surveys in 2010.

No nest structures were observed opportunistically during the lek surveys. Eight nest structures were located during the formal aerial raptor nest survey (Figure 5). Only one of the eight structures was determined to be active: a red-tailed hawk (*Buteo jamaicensis*) nest with an attending adult. Three of the nests were attributed to golden eagles (*Aquila chrysaetos*) and one bald eagle nest was identified. The bald eagle nest was observed outside of the aerial nest survey area with two adults siting on the nest during the eagle roost surveys conducted in March of 2011 and was considered active in 2011. Since the bald eagle nest was outside of the raptor nest survey area (located 5.98 miles from the nearest proposed turbine location), follow-up visits to document success/productivity of the bald eagle nest were not conducted. No golden eagles were observed in proximity to the nests during the aerial helicopter survey on May 13, 2011 and all three golden eagle nests (located from 1.97 to 3.42 miles from the nearest proposed turbine location) were considered inactive (Appendix A). Follow-up visits to these nests were not conducted as the nests were located on private land where access was not available.

In August 2011, a pair of adult Swainson's hawks (*Buteo swainsoni*) and one fully fledged hatch-year juvenile were observed incidentally in a portion of the Project area where a stick nest was observed during aerial surveys in 2010, but not located from the ground in either 2010 or 2011. An adult Swainson's hawk had also been observed in this area in June and July of 2011. Three American kestrel nests, all in snags, and a possible northern harrier nest, were discovered in 2011. Of the nest structures found in 2010 only the red-tailed hawk nest noted above was determined active in 2011.

4.2.1.3 Conclusions

There is evidence of raptors breeding in the vicinity of the Project area, and two active red-tailed hawk nests and one active American kestrel nest were observed in the Project area. In addition, there were several observations indicative of raptors nesting in the larger survey area.

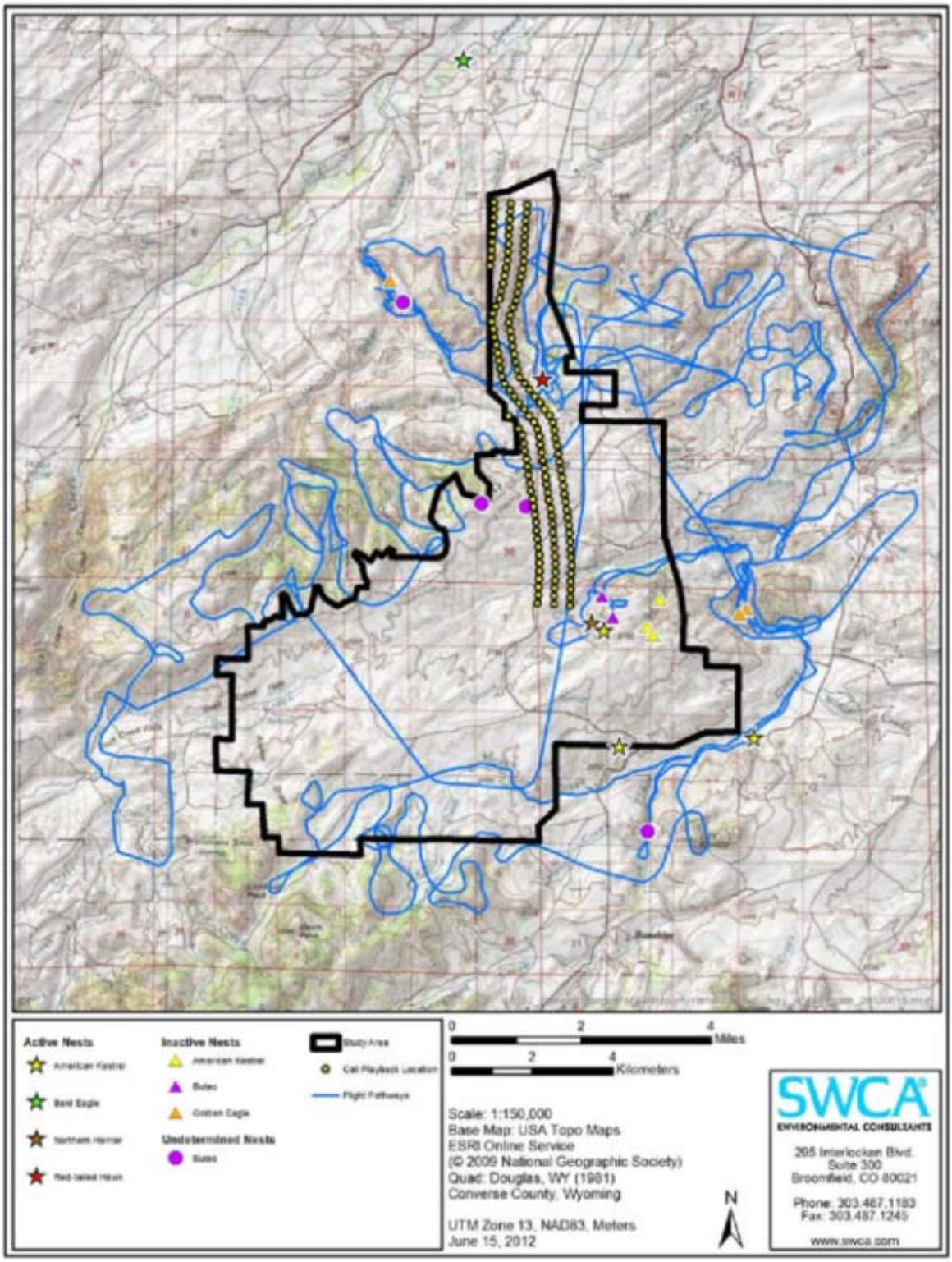


Figure 5. Aerial survey pathway (May 13, 2011), ground-based call playback survey points, and raptor nests observed in 2010 and 2011 at the Pioneer Wind Park I Project, Converse County, Wyoming.

4.2.2 Eagle and other Raptor Surveys: Long-watch Surveys

4.2.2.1 Methods

The primary purpose of the eagle and other raptor (long-watch surveys) was to assess the species composition and magnitude of early, mid-, and late season migrants passing through the Project area. Protocols for the baseline studies were developed prior to release of the USFWS Land-Based Wind Energy Guidelines (USFWS 2012); however, they were developed in communication with USFWS and WGFD. Surveys were conducted from April 16, 2010 – November 11, 2011, and 166 surveys were conducted at four stations (51 surveys at station RRM, 51 surveys at station P2RM, 49 surveys at station P1RM1, and 15 surveys at station P1RM2; Figure 6). The four stations were selected to maximize viewsheds and visibility over the Project area as well as a reference area. Station P1RM2 was only surveyed from August 2010 through January 2011. Surveys were generally conducted once a week and the duration of surveys was up to 12 daylight hours. Surveyors recorded all raptor species observed during surveys (regardless of distance) as well as the number of individuals, age, sex, initial, maximum, and minimum flight heights, flight direction, flight behavior, and time of observation (Appendix A). Flight paths were mapped on topographic maps and then digitized into a GIS format. Observers used landscape features, topography, meteorological (MET) towers, and roads to aid in estimating distances and for mapping of observations recorded during the eagle and other raptor surveys (long watch surveys). Western Ecosystems Technology, Inc (WEST) calculated mean use as the number of raptors per station per hour to standardize observations for survey effort.

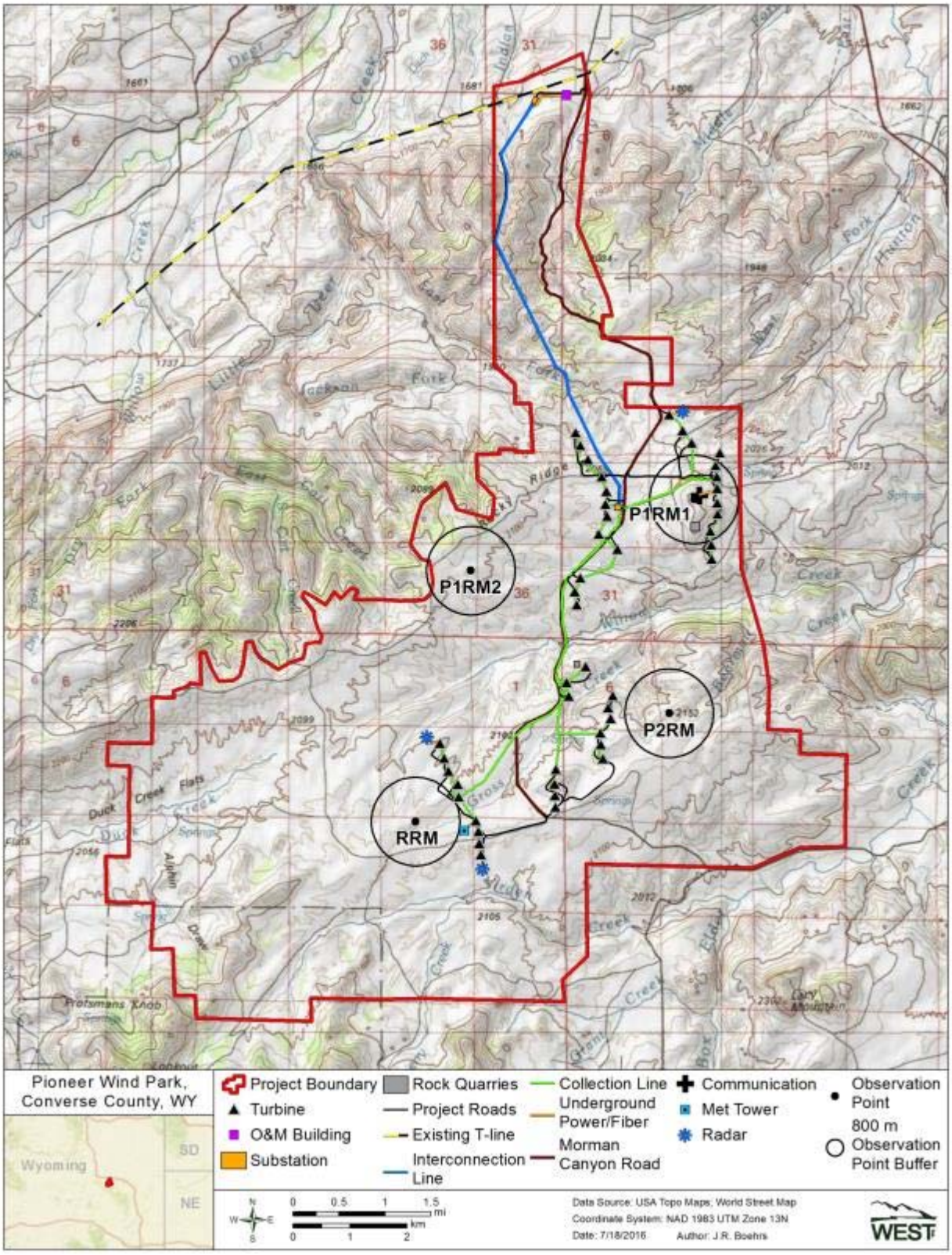

P1RM1
P1RM2
P2RM
RRM
Pioneer Wind Park, Converse County, WY
Project Boundary
Turbine
O&M Building
Substation
Rock Quarries
Project Roads
Existing T-line
Interconnection Line
Collection Line
Underground Power/Fiber
Morman Canyon Road
Communication
Met Tower
Radar
Observation Point
800 m Observation Point Buffer
Wyoming
SD
NE
Data Source: USA Topo Maps; World Street Map
Coordinate System: NAD 1983 UTM Zone 13N
Date: 7/18/2016
Author: J.R. Boehrs
WEST

Figure 6. Location of Eagle and other Raptor Survey (Long Watch Survey) Stations and associated 800-m radius plots within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming. Please note that observations were not restricted to 800 m.

4.2.2.2 Results and Discussion

During the two years of baseline surveys, a total of 1,786 observation hours (967.26 hours in fall; 379.36 in spring; 350.59 in summer; and 89.13 in winter) were conducted across all eagle and other raptor survey stations (average of 10.8 hours per survey; Figure 7). Golden eagle was the most commonly recorded species over the two years of baseline surveys (623 observations with 713 sightings of individuals (some of which are likely repeat observations of the same individuals); 26% of all raptors detected). American kestrel and red-tailed hawk were also common relative to other raptor species (377 and 361 sightings of individuals, respectively).

Diurnal raptor use was lower in the spring of year 1 compared to year 2 (0.756 and 1.334 birds/station/hour, respectively; Table 5). Golden eagles and some buteos (i.e., Swainson's hawk, ferruginous hawk, and unidentified buteo) had lower use in Year 1 than in Year 2. Similarly, summer raptor use was lower in year 1 than in year 2 (0.682 and 1.914 birds/station/hour, respectively). Similar to spring, the species with lower use in the summer of Year 1 were golden eagles and buteos. Several common raptor species, such as northern harrier, American kestrel, and red-tailed hawk had less variation in spring and summer use between years 1 and 2. Diurnal raptor use in fall was similar between years 1 and 2 (1.987 and 1.809 birds/station/hour, respectively), and species composition in fall was also similar between years. Golden eagles, red-tailed hawks, and American kestrels had the highest use in either year. Diurnal raptor use was lower in winter (0.219 birds/stations/hour), and only four identifiable species were observed: bald eagle, golden eagle, prairie falcon (*Falco mexicanus*), and rough-legged hawk (*Buteo lagopus*). Golden eagles and rough-legged hawks had the highest raptor use in the winter season.

A total of 6,495 non-raptors in 674 groups representing 32 species and 585 unidentified sightings of individuals (some of which are likely repeat observations of the same individuals) were also observed during raptor point surveys. Turkey vulture (*Cathartes aura*) was observed most frequently during pre-construction raptor point counts (417 observations totaling 688 sightings of individuals), while common nighthawk (*Chordeiles minor*) had the highest number of individuals recorded (875 sightings of individuals in 34 groups). More unique non-raptor species were observed in fall than in other seasons. Several large mixed flocks were also recorded, which included species such as McCown's longspur (*Rhynchophanes mccownii*), chestnut-collared longspur (*Calcarius ornatus*), horned lark (*Eremophila alpestris*), American pipit (*Anthus rubescens*), and unknown sparrow species.

4.2.2.3 Conclusions

American kestrel and golden eagle had the highest raptor use during both years. Overall raptor use was determined to be 0.88 raptors/station/hour during the year 1 study and 1.68 raptors/station/year in year 2. Raptor use at the project varied in spring and summer between the two years, with Swainson's hawk, golden eagle, and ferruginous hawk contributing to the lower overall raptor use in the spring and summer of year 1. Red-tailed hawk and American kestrel experienced less fluctuation in use levels between years.

Table 5. Mean use (# raptors/station/hour) for each raptor species observed during the eagle and other raptor long-watch surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, from April 2010 – November 2011. Year 1 was from April 16, 2010 to March 2, 2011, and year 2 was from March 16 to November 11, 2011.

	Spring		Summer		Fall		Winter	Overall	
Species	**Year 1**	**Year 2**	**Year 1**	**Year 2**	**Year 1**	**Year 2**	**Year 1**	**Year 1**	**Year 2***
American kestrel	0.158	0.226	0.228	0.274	0.222	0.195	0	0.141	0.230
bald eagle	0.007	0.011	0.017	0.005	0.044	0.079	0.009	0.019	0.033
broad-winged hawk	0	0	0	0.014	0.005	0	0	0.001	0.004
Cooper's hawk	0.024	0.021	0	0	0.018	0.009	0	0.010	0.010
ferruginous hawk	0.048	0.079	0.028	0.329	0.107	0.142	0	0.044	0.177
golden eagle	0.107	0.395	0.050	0.509	0.441	0.637	0.082	0.169	0.514
merlin	0	0.027	0	0	0.033	0.014	0	0.008	0.014
northern goshawk	0	0	0	0	0.002	0.010	0	<0.001	0.003
northern harrier	0.186	0.108	0.137	0.140	0.173	0.108	0	0.117	0.118
osprey	0	0	0	0	0.002	0	0	<0.001	0
peregrine falcon	0	0.003	0	0.019	0.012	0.020	0	0.003	0.014
prairie falcon	0.043	0.059	0.031	0.051	0.073	0.081	0.009	0.038	0.064
red-tailed hawk	0.151	0.105	0.097	0.106	0.362	0.169	0	0.146	0.128
rough-legged hawk	0	0.003	0	0	0.133	0.063	0.066	0.052	0.023
sharp-shinned hawk	0	0	0	0.009	0.007	0.003	0	0.002	0.004
Swainson's hawk	0.024	0.105	0.084	0.310	0.095	0.146	0	0.047	0.182
unidentified accipiter	0	0.020	0	0	0.005	0.002	0	0.001	0.008
unidentified buteo	0	0.145	0.006	0.112	0.153	0.106	0	0.039	0.121
unidentified eagle	0	0.014	0	0	0.005	0.003	0.009	0.004	0.006
unidentified falcon	0	0	0	0	0.006	0.006	0	0.001	0.002
unidentified raptor	0.007	0.010	0.006	0.037	0.091	0.017	0.043	0.038	0.021
Diurnal Raptors	**0.756**	**1.334**	**0.682**	**1.914**	**1.987**	**1.809**	**0.219**	**0.880**	**1.676**

* The year 2 average use does not include winter data and is, therefore, likely an overestimate of annual use.

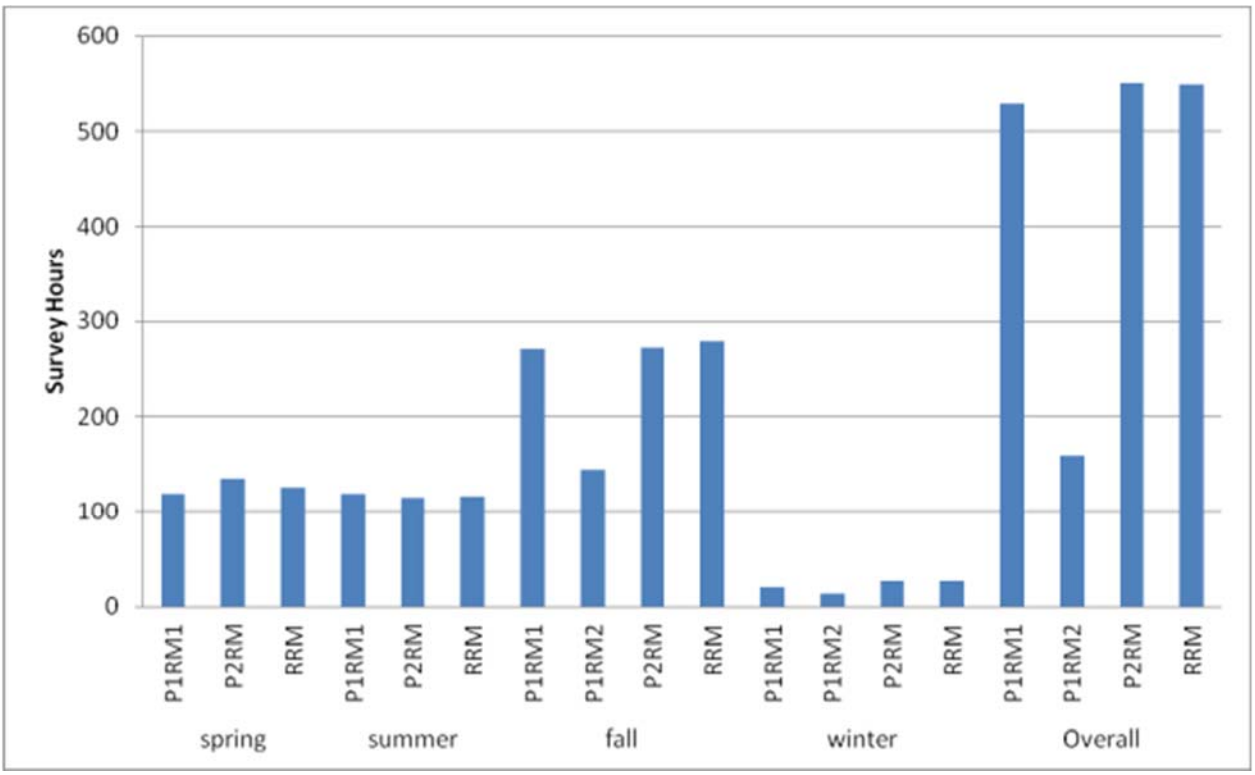


Figure 7. Total number of survey hours for each Eagle and other Raptor Survey (Long Watch Survey) Station (per season and overall) conducted during baseline studies within the Pioneer Wind Park Project Area, Converse County, Wyoming from April 2010 to November 2011.

4.2.3 Other Avian Use Surveys: 20 Minute Point Counts

4.2.3.1 Methods

A total of 22 fixed-point avian use survey stations were established and 945 avian use surveys were conducted resulting in a total of 281.67 hours of survey effort during baseline wildlife studies (Figure 8). The major purpose of these surveys was to record other avian use (i.e. non-eagle and non-raptor use) for the Project area, but some eagle and other raptor observations were recorded during these avian use surveys as well. During the first year of studies, plots were surveyed weekly from May 13 to June 30, 2010 and August 18 to 13 November, 2010. Plots were surveyed twice in the winter (January 12 to 14, 2011 and February 28 to March 2, 2011). During the second year of studies, plots were surveyed weekly from April 5 to June 30, 2011 and August 17 to November 12, 2011. Two winter surveys were conducted on February 14 to 15 and February 28 to March 1, 2012 (Appendix A).

Surveys were conducted from sunrise to no later than four to five hours after sunrise. With the exception of the spring 2011 surveys, survey duration was 20-minutes at each station and all birds detected within 200 m of the point location were recorded. During the spring of 2011, surveys were conducted using 10-minute count durations instead of the 20-minute duration used during other seasons. Data collected included: species, number of individuals, age, sex, distance from

observer (a rangefinder was used to help in estimating distance during avian use surveys), activity, flight height, flight direction, time, and whether the bird/flock was inside the survey plot at initiation of the point count or moved into the plot during the survey.

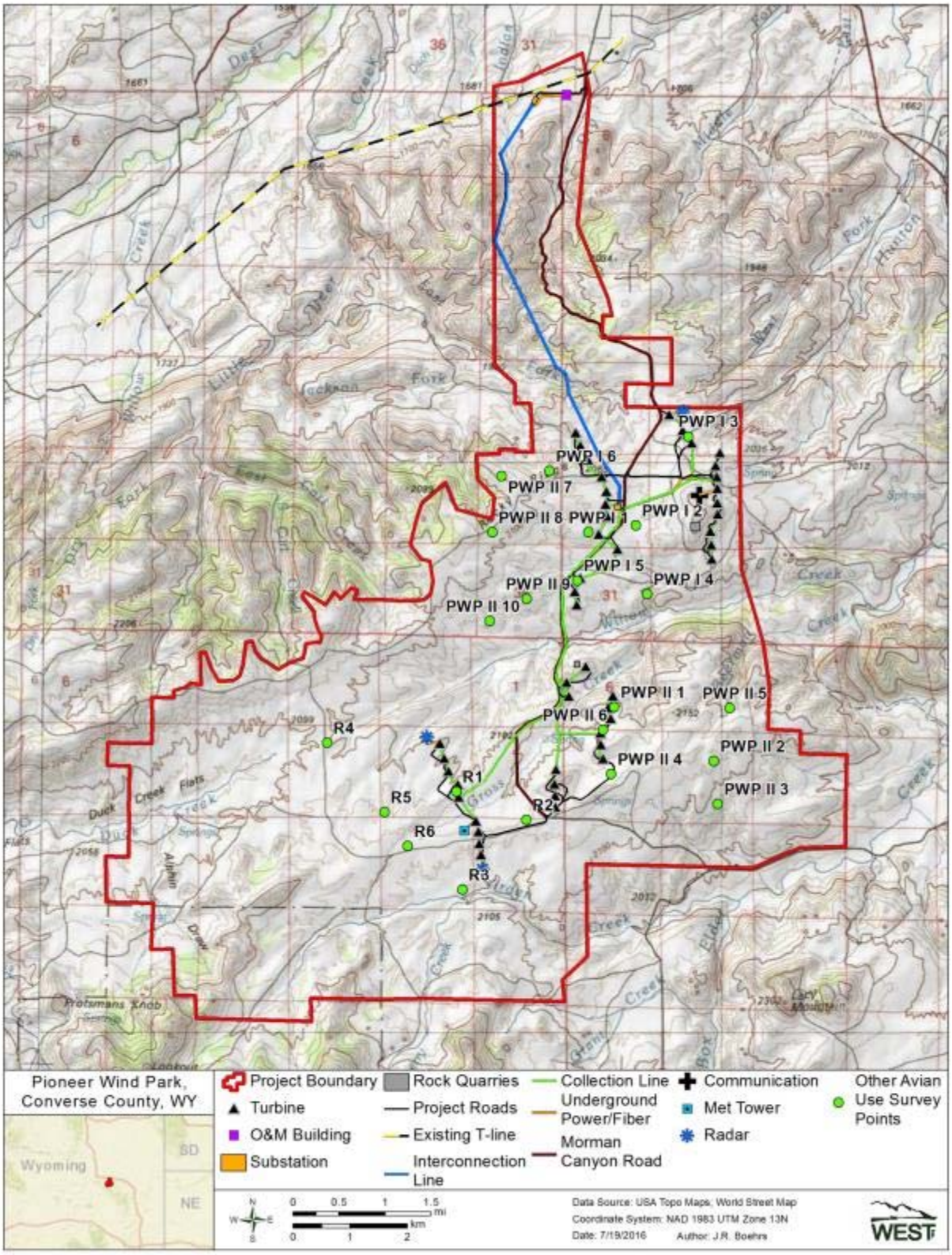


Figure 8. Location of other Avian Use Survey Stations within the proposed Pioneer Wind Park Project Area, Converse County, Wyoming.

4.2.3.2 Results

A total of 945 avian use surveys were conducted between May 13, 2010 and March 1, 2012. During Year 1, a total of 5,910 sightings of individuals (some of which are likely repeat observations of the same individuals) were observed in 2,347 groups representing 90 species. In year 2, 88 species were seen totaling 6,136 individuals in 2,765 groups. Mean use was similar between Year 1 and Year 2 (13.2 and 12.3 birds/survey, respectively; Table 6). Some inter-annual seasonal variation was observed; however, some of the variation may be attributable to differences in survey timing between years (Table 6).

Table 6. Sample size and mean bird use (number of birds/survey) observed during avian use surveys, by season and overall, at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (May 13, 2010 – March 2, 2011) and Year 2 (April 5, 2011 – March 1, 2012).

	Date Range		sample size		mean bird use	
Season	**Year 1 (2010-2011)**	**Year 2 (2011-2012)**	**Year 1**	**Year 2**	**Year 1**	**Year 2**
spring	May 13-26	Apr 5 - May 31	48	144	10.7	15.9
summer	Jun 3-30	June 2-30	90	90	13.5	13.2
fall	Aug 18 - Nov 13	Aug 17 - Nov 12	270	227	15.4	11.6
winter	Jan 12 - Mar 2	Feb 14 - Mar 1	39	37	0.6	0.9
Total	**May 13 - Mar 2**	**Apr 5 - Mar 1**	**447**	**498**	**13.2**	**12.3**

Four species comprised the majority of all birds observed during avian use surveys: horned lark, vesper sparrow (*Pooecetes gramineus*), Brewer's blackbird (*Euphagus cyanocephalus*), and western meadowlark (*Sturnella neglecta*; Table 7). Horned lark, vesper sparrow, Brewer's blackbird, and western meadowlark consistently had the highest use in spring and summer, and horned lark had the highest use in fall and winter.

Table 7. Species with a minimum mean use of 1.0 birds/survey recorded during avian use surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (May 13, 2010 - March 2, 2011) and Year 2 (April 5, 2011 - March 1, 2012).

	# of Flocks		# of Individuals[1]		Mean Use	
Species	**Year 1**	**Year 2**	**Year 1**	**Year 2**	**Year 1**	**Year 2**
Horned Lark	314	367	1,056	989	2.4	2.0
Unknown Sparrow	65	124	820	539	1.8	1.1
Vesper Sparrow	489	374	783	570	1.8	1.1
Brewer's Blackbird	221	156	612	900	1.4	1.8
Western Meadowlark	489	736	587	811	1.3	1.6
Mixed Flock	23	--	546	--	1.2	--
Total (abundant species)	**1,601**	**1,757**	**4,404**	**3,809**	**9.9**	**7.6**
Portion of All Species	**68%**	**64%**	**75%**	**62%**	**75%**	**62%**
Total (all species)	**2,347**	**2,765**	**5,910**	**6,136**	**13.2**	**12.3**

[1] Some are likely repeat observations of the same individuals.

Use by point is provided in Table 8 below. In general, mean use was similar across the Project area. However, during Year 1 surveys, use was highest at points R5, R2, PWPII 5, and PWP II 6. During Year 2, use by point was highest at points R3, PWPI 7, PWPII 5, and R6 (Table 8; Figure 9). Surveys at PWP I 4, 9, and 10 were discontinued in January of 2011 as the remaining avian use survey stations provided sufficient coverage of the area surrounding the proposed turbine layout and infrastructure.

Table 8. Mean use (# birds/survey) at each point surveyed during avian use surveys at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (March 13, 2010 – March 2, 2011) and Year 2 (April 5, 2010 – March 1, 2012).

	Mean Use		# of Surveys	
Survey Point	**Year 1**	**Year 2**	**Year 1**	**Year 2**
PWP I 1	5.7	8.7	22	26
PWP I 2	12.0	14.4	22	26
PWP I 3	8.7	12.3	22	26
PWP I 4	13.6	--	21	--
PWP I 5	5.4	10.3	22	26
PWP I 6	5.8	7.3	22	25
PWP I 7	14.5	17.4	14	26
PWP I 8	12.0	15.5	14	26
PWP I 9	8.3	--	13	--
PWP I 10	11.7	--	13	--
PWP II 1	13.7	10.5	22	25
PWP II 2	11.3	9.2	21	26
PWP II 3	12.7	10.0	22	26
PWP II 4	10.1	7.8	21	26
PWP II 5	21.4	16.7	22	26
PWP II 6	20.1	7.7	22	26
R1	10.7	11.1	22	27
R2	21.5	13.7	22	27
R3	17.2	23.3	22	27
R4	10.9	11.1	22	27
R5	23.6	10.0	22	27
R6	17.4	16.2	22	27

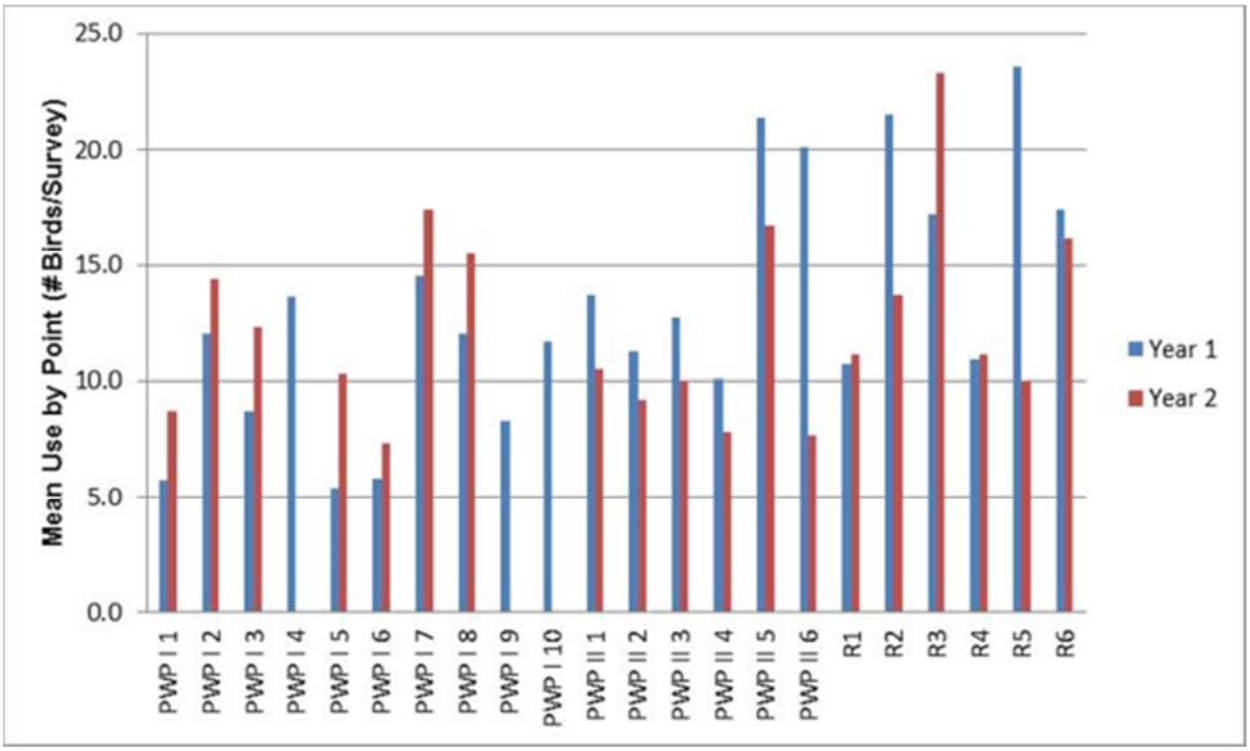


Figure 9. Comparison of mean annual bird use among avian use survey points at the Pioneer Wind Park I Project Area, Converse County, Wyoming, during Year 1 (March 13, 2010 – March 2, 2011) and Year 2 (April 5, 2010 – March 1, 2012).

4.2.3.3 Conclusions

Generally consistent levels of bird use were recorded within the Project area during spring, summer, and fall, and bird use in winter was considerably lower. Most birds observed at the Project are relatively common passerine species in eastern Wyoming's sage-steppe and grassland habitat (e.g. horned lark, western meadowlark, vesper sparrow, and Brewer's blackbird). In general, bird use was also evenly distributed among points in the Project area with the highest use recorded at some of the stations in the southern portion of the Project area.

4.2.4 February 2010 Winter Bird Survey

4.2.4.1 Methods

In addition to the eagle and other raptor surveys conducted in the winter of 2010 – 2011, SWCA visited the Project area on February 24, 2010 to assess winter bird species composition and relative abundance (Appendix A). One 4.5-hour survey was conducted by driving on county maintained roads (Boxelder Creek and Mormon Canyon) and snowshoeing in the northern portion of the study area. All bird observations were identified as to species and observers recorded the number of individuals and location. Access into some portions of the Project was limited due to snow cover and only the portions along Mormon Canyon and Boxelder Creek Roads were surveyed.

4.2.4.2 Results and Discussion

Seven passerine species and one raptor were observed during the 2010 Winter Survey, for a total of 26 individuals. Red crossbills (*Loxia curvirostra*) accounted for about a third of the observations (eight individuals). No birds were seen in open grassland or sage-steppe habitats. Most species were seen in aspen woodland-mixed conifer forest habitat: Clark's nutcracker (*Nucifraga columbiana*), black-capped chickadee (*Poecile atricapillus*), mountain chickadee (*P. gambeli*), red-breasted nuthatch (*Sitta canadensis*), American robin (*Turdus migratorius*), and red crossbill. Black-billed magpies (*Pica hudsonia*) were observed in riparian and floodplain habitats, and golden eagles were observed on the ridgelines along Mormon Canyon.

4.2.4.3 Conclusions

No birds were seen in the open habitats typically associated with wind energy development. Aspen woodland and mixed conifer forests had the most species diversity. However, these results are representative of only one day of surveys. The distribution of birds among habitat types may vary throughout the winter based on resource availability and environmental conditions (e.g., weather variables). As such, generalizations based on this survey effort should be made with caution.

4.2.5 Eagle Roost Site Surveys

4.2.5.1 Methods

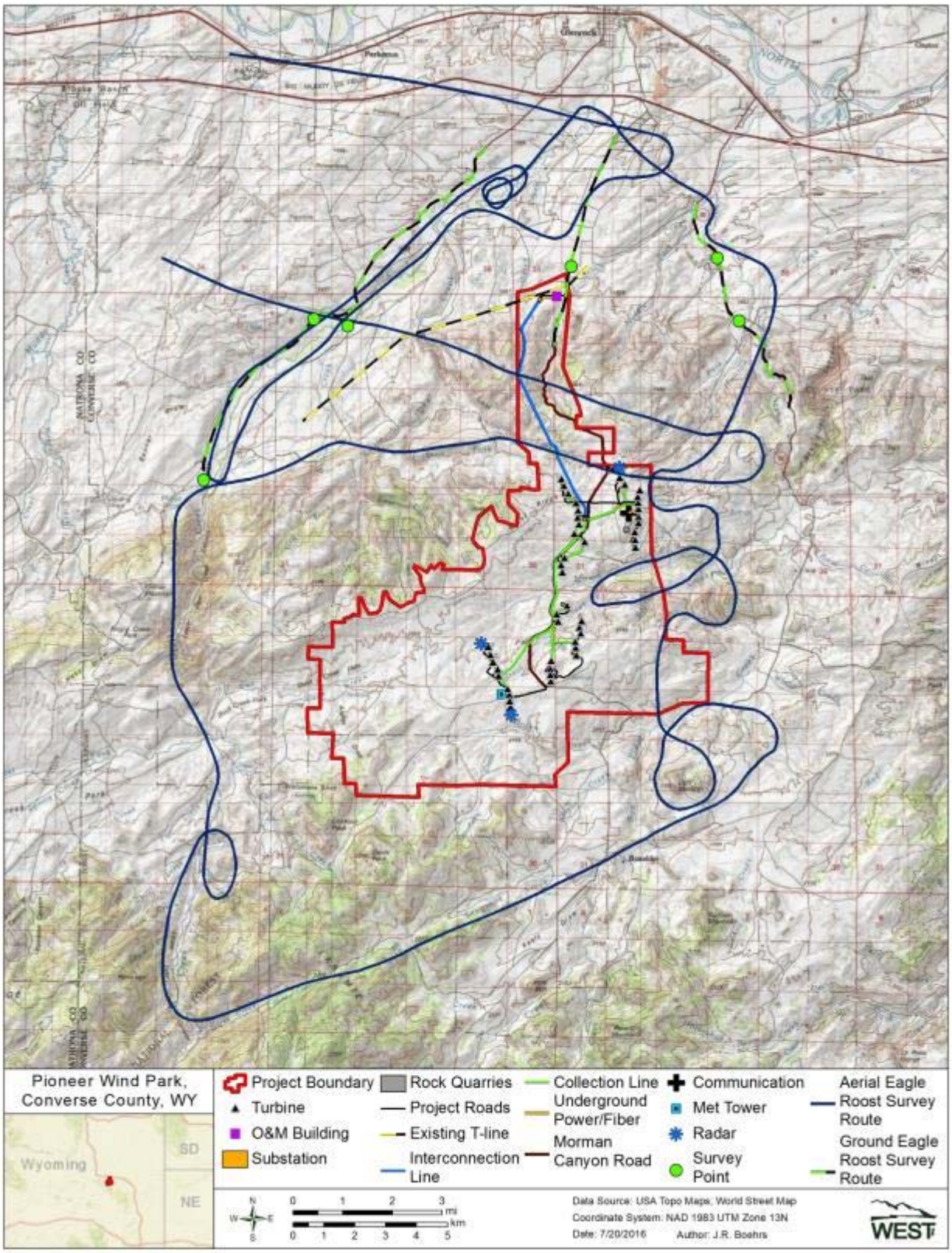
SWCA conducted one aerial fixed-wing survey to search for undocumented eagle roosts in all areas identified as potential roost habitat within the Project area and an associated 3-mile buffer extending outward from the edge of the Project boundary on March 3, 2011 (Figure 10; Appendix A). Two biologists were used to conduct the survey. The aerial roost survey was conducted along suitable habitat (primarily along riparian corridors, canyons, and other topographic depressions protected from wind and adverse weather conditions, with stands of mature trees suitable for roosting eagles (Appendix A). Roost surveys were also conducted from the ground along selected riparian corridors and canyons (areas were selected for ground surveys based on the suitability of habitat for eagle roosting as well as public driving access) in the search area on February 28, and March 1, 2, and 4, 2011 (Figure 10). Areas surveyed included the Deer Creek basin, the mouth of Mormon Canyon, Boxelder Creek basin, and the mouth of Boxelder Canyon. The entire segment of Deer Creek west of the study area was surveyed, despite being outside of the 3-mile buffer, due to the presence of potential roosting habitat. The ground-based surveys were conducted from public roadways and were conducted for approximately 1.5 hours per survey either right after sunrise or right before sunset.

4.2.5.2 Results and Discussion

No eagle roosts were identified during the eagle roost surveys conducted by SWCA (Appendix A). One juvenile golden eagle was observed soaring along Deer Creek outside of the 3-mile survey buffer; however, the golden eagle was not observed within the search area and was not observed perched (Appendix A).

4.2.5.3 Conclusions

No concentrated winter eagle roost sites were identified for bald or golden eagles during the surveys and there is no communal winter roost habitat in the Project footprint. However, given the level of survey effort, the time of day of the aerial survey, and the time of year of the surveys, and that eagles use the site throughout the year, it is possible that a small number of eagles may occasionally roost within the vicinity of the Project area given that eagles do occur in the area throughout the year as determined during the baseline studies.


Pioneer Wind Park,
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Turbine
O&M Building
Substation
Rock Quarries
Project Roads
Existing T-line
Interconnection Line
Collection Line
Underground Power/Fiber
Morman Canyon Road
Communication
Met Tower
Radar
Survey Point
Aerial Eagle Roost Survey Route
Ground Eagle Roost Survey Route
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0 1 2 3 4 5 km
Data Source: USA Topo Maps, World Street Map
Coordinate System: NAD 1983 UTM Zone 13N
Date: 7/20/2016
Author: J.R. Boehrs
WEST

Figure 10. Location of aerial eagle roost survey route conducted on March 3, 2011 within the vicinity of the Pioneer Wind Park Project Area, Converse County, Wyoming.

4.2.6 Burrowing Owl Surveys

4.2.6.1 Methods

Burrowing owls surveys were conducted at two black-tailed prairie dog (*Cynomys ludovicianus*) colonies in 2010 and at five colonies in 2011 (Figure 11). Surveys used Colorado Division of Wildlife protocols (2007) adopted from Conway and Simon (2003). In 2010, prairie dog colonies were surveyed three times between July and August, and in 2011, surveys were conducted between July and September.

4.2.6.2 Results and Discussion

In 2010, two previously identified prairie dog colonies were surveyed for burrowing owls. Three additional colonies were identified following burrowing owl surveys in 2010 and as such, five prairie dog colonies were surveyed for burrowing owls in 2011. No burrowing owls or evidence of burrowing owls were detected during any surveys.

4.2.6.3 Conclusions

There was no evidence of resident burrowing owls during the 2010 and 2011 surveys. One burrowing owl that had been killed by a vehicle collision was found on September 19, 2011, near the prairie-dog town associated with the Virden Creek sage-grouse lek in the south-central PWPI. This individual was likely a migrant, as there had been no evidence of activity in the prairie-dog colonies earlier in the year and the late-September date of the carcass find.

4.2.7 Greater Sage-Grouse Lek Surveys

4.2.7.1 Methods

SWCA conducted three aerial (fixed-wing) surveys within the Project area and the area within 2 miles of the Project area boundary, to search for greater sage-grouse leks, on April 27 and May 9, 2010, and again on April 1, 2011 (Appendix A). Surveys were conducted by two observers under acceptable time and weather parameters for lek surveys established by WGFD. Surveys were conducted by flying north-south-oriented transects separated by 0.6 miles at an average altitude of 200 feet above ground level (AGL; Figure 11).

In addition to the aerial searches, a minimum of three ground-based counts were conducted at two historic lek locations and one new lek location in the study area between April 16 and May 15, 2010 and between April 12 and May 18, 2011, following WGFD protocols (Appendix A).

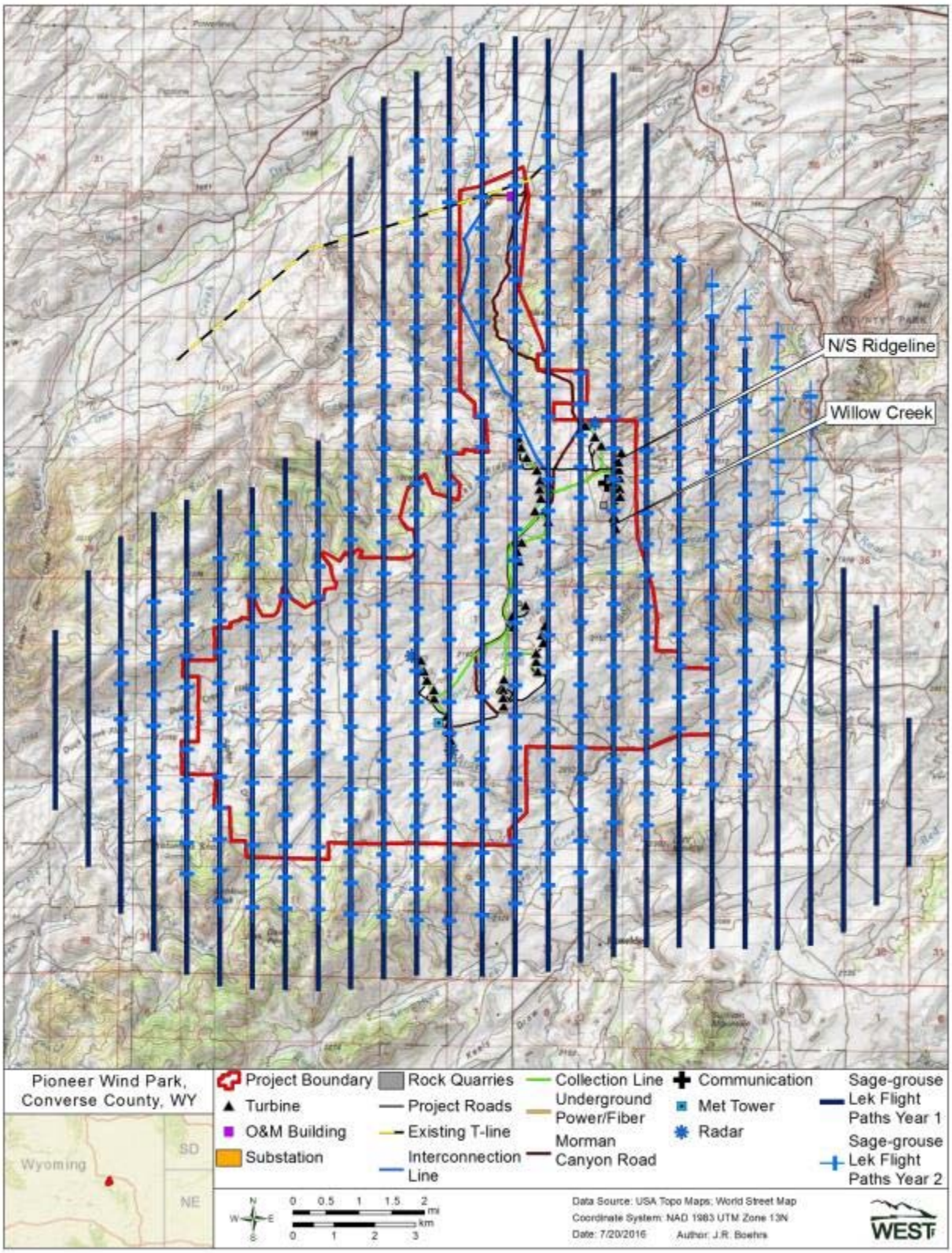

Figure 11. Location of fixed-wing transects flown to search for greater sage-grouse leks in the vicinity of the Pioneer Wind Park Project Area, Converse, County, Wyoming

4.2.7.2 Results

Two historically active leks, Morman Canyon and Virden Creek leks, are located in the Project area, and no new lek locations were identified during any of the aerial searches within the study area. However, a new location with strutting grouse was identified incidentally while conducting avian use surveys, and was confirmed by a follow-up ground visit (refer to Figure 12 in Section 4.2.8 for the location of greater sage-grouse leks). Seven displaying adult males and two females were observed at this location. Over the two years of ground counts conducted at leks in the vicinity of the Project area, the maximum male counts from the ground ranged from seven males to 35 males (Appendix A).

4.2.7.3 Conclusions

Methods for conducting greater sage-grouse lek surveys (both ground counts and aerial searches) were coordinated with the agencies (WGFD and USFWS) and the methods are in accordance with the WGFD's Wildlife Protection Recommendations for Wind Energy Development in Wyoming. The Project is located outside of the core sage-grouse habitat mapped by the WGFD. However, two historic WGFD greater sage-grouse leks and one new location with strutting grouse are located in the Project area. The closest core sage-grouse habitat is located approximately 4.5-miles west of the Project area. Greater sage-grouse were also identified within the site during other survey efforts.

4.2.8 Raptor Prey Base

All incidental wildlife observations that occurred while in the Project area conducting standardized surveys were recorded. This includes a variety of prey species for eagles and other raptors such as greater sage-grouse (see Section 4.2.7 above), prairie dogs (five prairie dog colonies were identified and mapped during baseline studies), lagomorph species (recorded incidentally), big game species including elk, mule deer, and antelope (recorded incidentally) and ground squirrels (recorded incidentally). SWCA mapped prairie dog colonies within the Project by walking the perimeter of identified colonies and collecting UTM locations at outlying burrow locations. A 100 m buffer was applied to these UTM locations and turbines were sited outside of these areas (Figure 12). Crucial mule deer winter range exists within the northern portion of the Project and mule deer were observed within the Project area and in the vicinity of the crucial winter range during the baseline studies; however, raptor count surveys were conducted for 75 hours in December 2010, January 2011, and February 2011 and only 5 individual golden eagle observations and one individual bald eagle observation were recorded in the winter (only one of the golden eagle and the one bald eagle were recorded at a survey station [P1RM1] in crucial winter range and the remaining four golden eagle observations were located at station [P2RM] which is to the south and outside of the crucial winter range), suggesting that mule deer carcasses were not attracting a large number of eagles (or other raptors) into the Project area during baseline studies. WGFD indicated that they foresee no issue with mule deer because the Project elements in crucial winter habitat consist primarily of a transmission line corridor (WGFD letter dated April 27, 2010). WGFD did recommend that winter big game stipulations be applied during construction (no construction activities within big game winter range from November 15 through April 30). Livestock grazing within the Project is primarily domestic cattle grazing (although domestic horses may also occur in the area), with the majority of cattle grazing occurring in late spring through the

fall season. Very little, if any, calving occurs in areas proposed for turbine locations. A figure depicting areas identified as having potential for concentrated prey is provided below (Figure 12). Raptor habitat is present throughout the Project area including shrub/steppe, grasslands, rock outcroppings, cliffs, and trees. Refer to Section 5.0 below for a description of how the baseline data including information on prey base were used to inform Project siting.

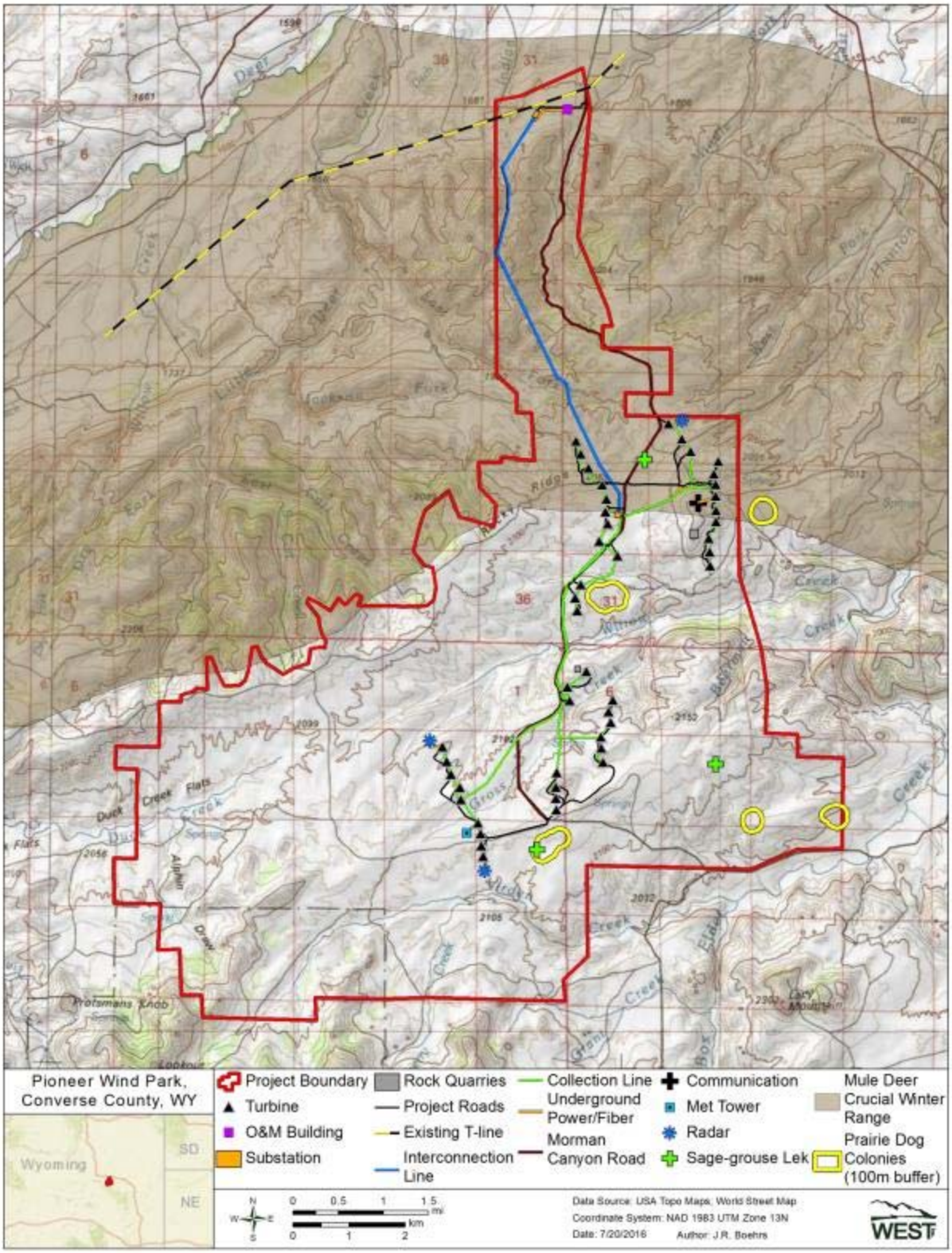

Figure 12. Prairie dog colonies, greater sage grouse leks, and mule deer crucial winter in the vicinity of the proposed Pioneer Wind Park Project Area, Converse County, Wyoming.

4.2.9 Passive Acoustic Bat Activity Monitoring at MET Towers

4.2.9.1 Methods

In the fall of 2009, four Anabat SD1 bat detectors were placed at meteorological (MET) towers B and C (Figure 13). Two detectors were placed at each MET tower: one at 5 m and one at 50 m above ground level. Data were collected from April 15 to October 15 in 2010 and 2011. Storage cards were replaced every two weeks, and the detectors were programmed to collect data from 30 minutes before sunset to 30 minutes after sunrise each day.

4.2.9.2 Results

In 2010, both detectors at MET C and the 5 m detector at MET B were operational for 168 nights, and due to an equipment malfunction, the 50 m detector at MET B was operational for 154 nights. In 2011, there were no equipment failures, and the detectors collectively monitored for 751 survey nights. The detector at the 5-m MET C station recorded about half of all passes in both years, and thus MET C stations recorded more passes than MET B stations in either year (Table 9). The 50-m detector at MET B consistently recorded the lowest number of bat passes. The majority of bat passes were by low-frequency species at the 50-m detectors at either MET tower, while the distribution between low- and mid-frequency species was much more even at the 5-m detector at MET B and more mid-frequency bats were recorded than low frequency bats at the 5-m detector at MET C. High-frequency calls were rarely recorded during baseline studies (Table 9).

Table 9. Number of bat passes by frequency classification: low frequency (LF), mid-frequency (MF), and high frequency (HF).

	LF		MF		HF		Unidentified		All Passes	
Location	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
MET B (50 m)	149	146	6	7	0	0	14	16	**169**	**169**
MET B (5 m)	180	196	145	170	0	1	39	67	**364**	**434**
MET C (50 m)	212	294	40	37	0	0	37	11	**289**	**342**
MET C (5 m)	231	313	410	632	2	2	185	27	**828**	**974**
Total Passes	**772**	**949**	**601**	**846**	**2**	**3**	**275**	**121**	**1,650**	**1,919**

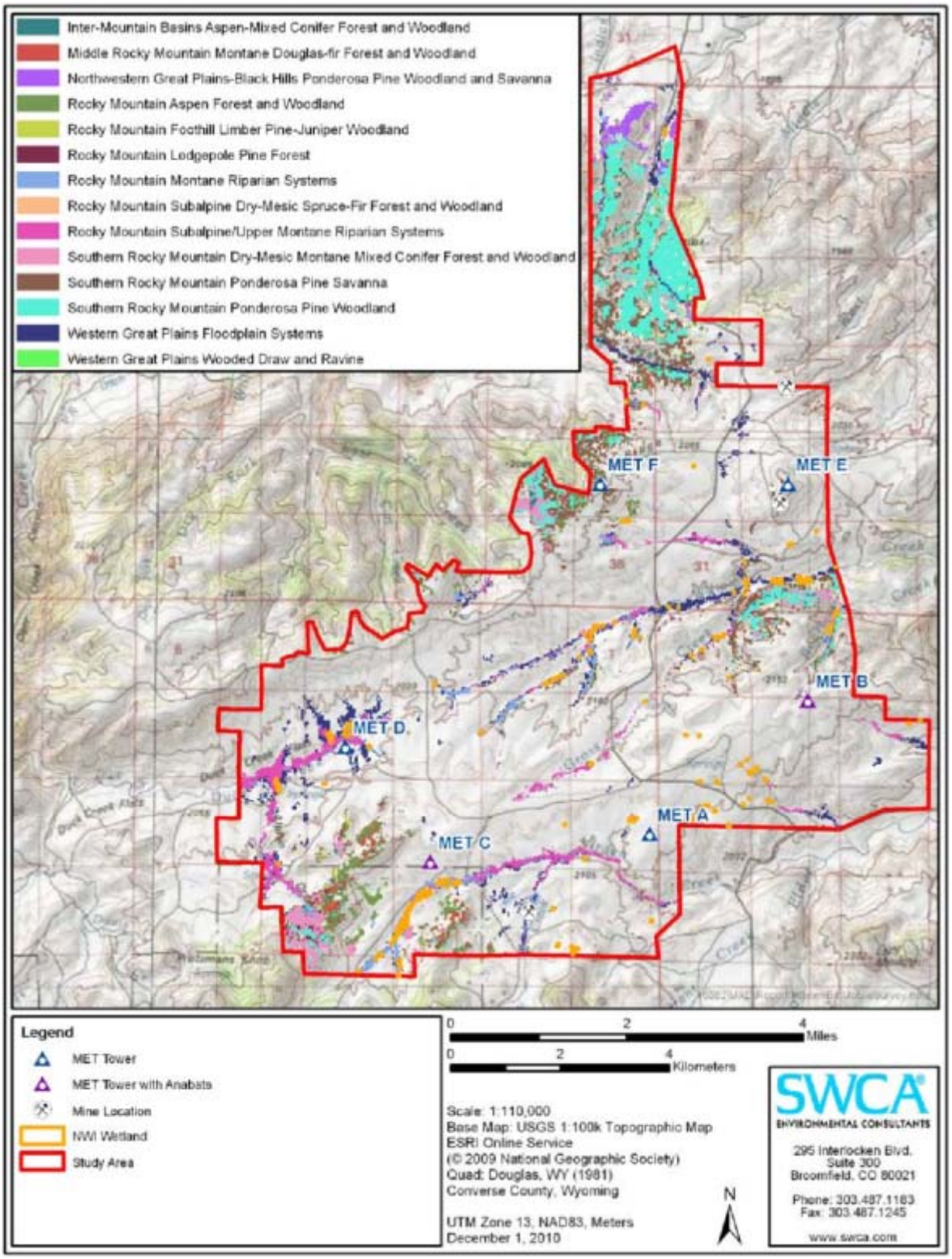

Figure 13. MET tower locations and potential bat use areas based on LANDFIRE spatial vegetation and National Wetland Inventory data.

The pattern of bat activity during each study year was similar, with low activity early in the study period (i.e., April and May) and increasing activity through early summer that peaked between late July and early September (Figure 14). The peaks in bat activity recorded in mid-September may be indicative of migrating bats passing through the Project area (Figure 14).

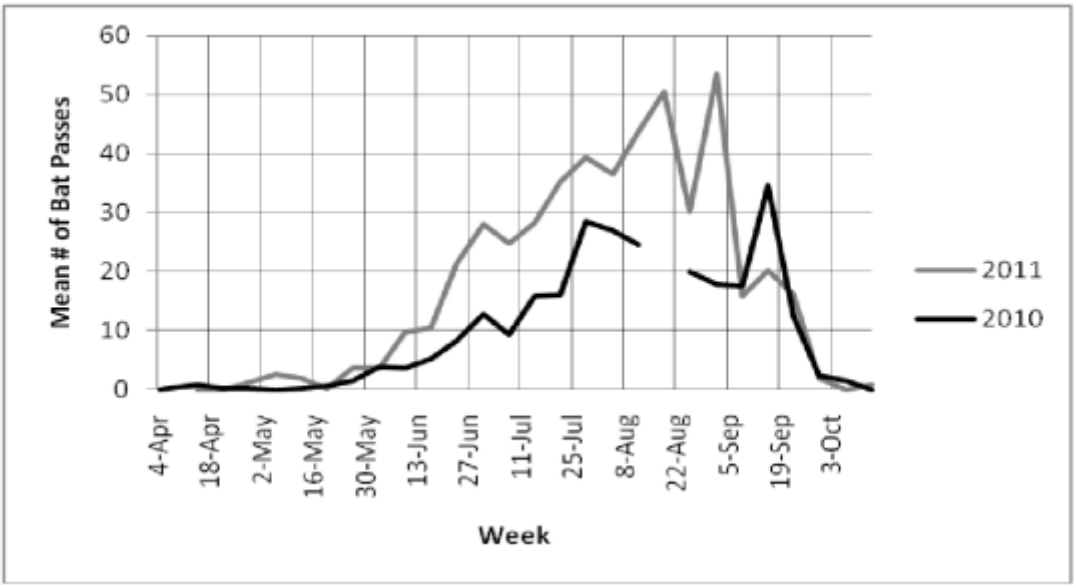

Figure 14. Mean weekly number of bat passes at the MET B and MET C Anabat stations at the Pioneer Wind Park I Project Area, Converse County, Wyoming, between April 15 and October 15 in 2010 and 2011.

4.2.9.3 Conclusions

The low levels of activity through early April and May coincides with the lack of suitable roost habitat for maternity colonies in the Project area. The higher activity in late July, August and September are likely attributable to bats foraging in the area, and the spatial distribution of bat activity in the Project area also suggests that bats primarily use the Project area for foraging after the dissolution of maternity colonies. The detectors at MET C stations, which are located close to the Virden Creek corridor, recorded approximately twice as many bat calls as the MET B stations in either year. The area surrounding Virden Creek was identified as a potential bat use area in the habitat evaluation, whereas MET B is located further from potential bat use areas (Figure 13; *see* Bird and Bat Habitat *section below*). The riparian corridor associated with Virden Creek does not contain suitable roosting habitat; however, the slow-moving creek likely provides reliable foraging habitat for insectivorous bats. It is possible that small groups of bats may roost in portions of the Project area, but the data collected to date suggest that there are no large maternity colonies present in the Project area.

4.2.10 Mobile Passive Surveys

4.2.10.1 Methods

Mobile Anabat units were moved between 10 sites in 2010 and 14 sites in 2011 (Figure 15). Mobile survey sites were broadly selected based on the habitat evaluation and were micro-sited based on several logistical concerns (e.g., exposure to roads, suitable substrates for Anabat placement, etc.). Anabat microphones were attached to 10-foot (3-m) poles that were secured to suitable substrates at each survey site. Anabats were moved every two weeks between April 16 and October 15, 2010, and between April 15 and October 15 in 2011.

4.2.10.2 Results

The detectors used early in the study period (i.e., between April 16 and June 14) recorded low levels of bat activity similar to the fixed stations at MET B and MET C. Similarly, those bat detectors operating in late September and early October 2010 recorded few bat passes. In 2011, one mobile unit operating primarily at the northern stations did not record any bat passes. It is unknown whether this was due to an undetected malfunction with the unit or microphone or if there were in fact no bats using the area in 2011.

4.2.10.3 Conclusions

The low levels of bat activity recorded in spring further support the hypothesis that the Project area is primarily used by foraging bats in July, August, and early September. In addition, the results suggest that there are not major maternity roosts located in the Project.

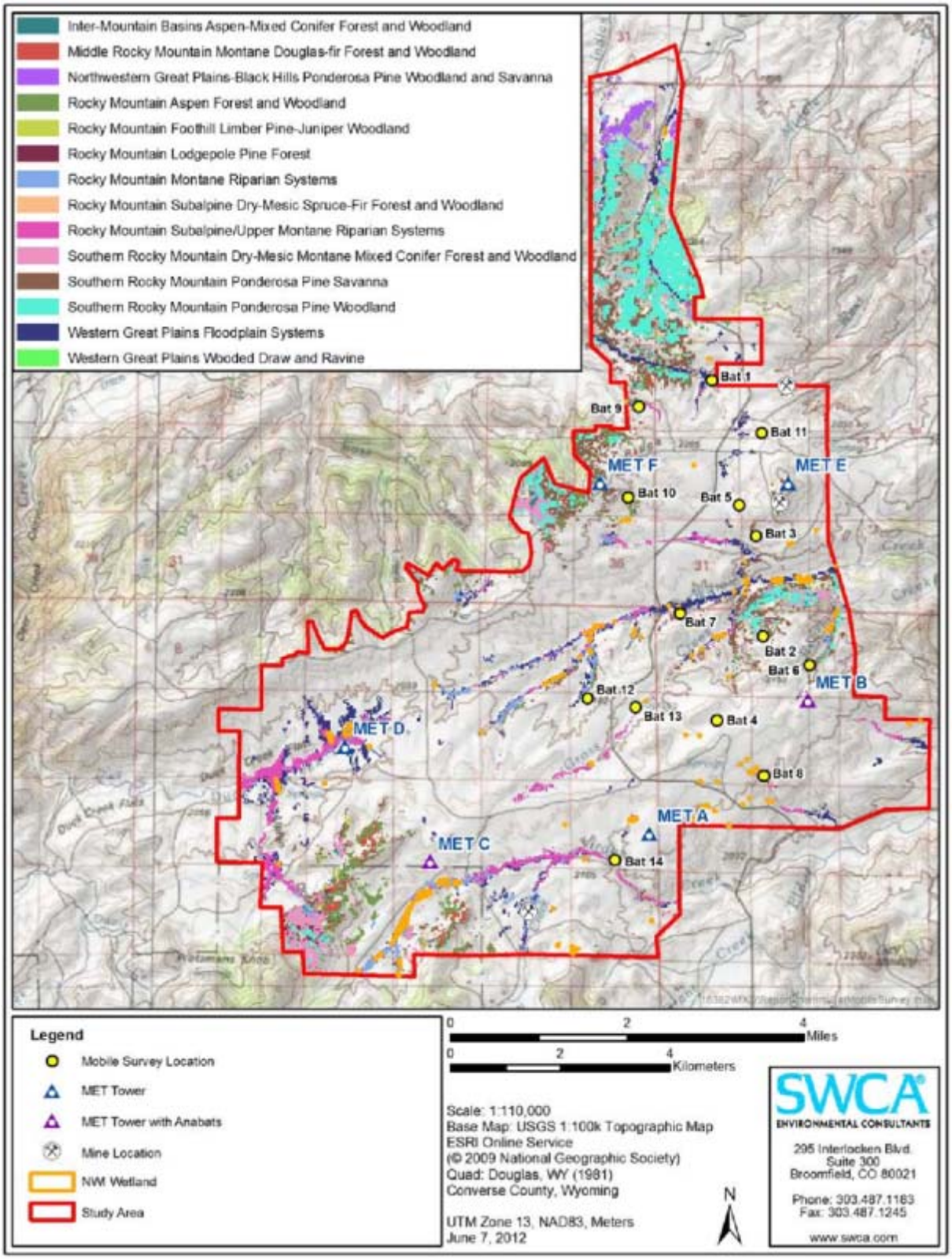

Figure 15. Location of mobile passive bat survey sites monitored from April 16 –October 15, 2010 and April 15 – October 15, 2011, at the Pioneer Wind Park I Project Area, Converse County, Wyoming.

4.2.11 Active Acoustic Surveys

4.2.11.1 Methods

Active acoustic surveys were conducted in the Project area from May 23 – October 6, 2010, and from June 6 – August 30, 2011, to capture high-quality, extended call sequences for species identification. Active surveys were conducted from 30 min prior to sunset to 2.5 hours after sunset, and surveys were conducted both on foot and by vehicle. Once a bat was detected, observers attempted to visually detect the bat using a spotlight. When possible, individual bats were followed. Effort varied among surveys based on location and number of bat encounters; therefore, data collected during active acoustic surveys were used only for species identification.

4.2.11.2 Results and Discussion

Five bat species were identified in the Project area based on high-quality bat calls: pallid bat (*Antrozous pallidus*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), little brown myotis (*Myotis lucifugus*), and big brown bat (*Eptesicus fuscus*). Additionally, long-eared bat (*Plecotus auritus*) and fringed bat (*Myotis thysanodes*) may have been recorded in both years; however, it is difficult to distinguish between these two Myotis species' calls.

4.2.12 Bird and Bat Status Assessments

Pre-construction baseline bird and bat studies were developed in communication with the WGFD and the USFWS and the results of these studies have been used to evaluate potential risk to bird and bat species, as well as to inform the conservation measures that have been or will be implemented during planning, construction, operation and decommissioning of the Project.

4.2.12.1 Bird and Bat Species Presence

During raptor point surveys, golden eagle was the most commonly observed species and was observed year round. At least one bald eagle and prairie falcon were observed during all seasons as well. American kestrel and red-tailed hawks were only observed during spring, summer, and fall, but were the most common raptor species after golden eagles. More raptor species were present during the fall (16), compared to spring (12), summer (10), and winter (4). The most abundant raptor species in summer were American kestrel, northern harrier, red-tailed hawk, golden eagle, and Swainson's hawk. Raptors confirmed to nest in the vicinity of the Project area include red-tailed hawk, American kestrel, Swainson's hawk, golden eagle and bald eagle.

Horned lark, vesper sparrow, Brewer's blackbird, and western meadowlark made up the majority of bird observations recorded during migratory bird surveys. Horned lark, vesper sparrow, Brewer's blackbird, and western meadowlark consistently had the highest use in spring in summer, and horned lark had the highest use in fall and winter.

Bat activity in the Project area peaked from July through September, and bats likely migrate to hibernacula outside of the Project area during the winter months. Eighteen bat species have the potential to occur in Wyoming (Hester and Grenier 2005). Six bat species have call frequencies lower than 30 kilohertz (kHz), and are therefore classified as low-frequency bats (Table 10). Ten

bat species' call frequencies are between 30 and 50 kHz and are categorized as mid-frequency bats, and two *Myotis* bat species have calls with frequencies greater than 50 kHz and are referred to as high-frequency bats (Table 10). Among low-frequency bats, Brazilian free-tailed bats (*Tadarida brasiliensis*) and big free-tailed bats (*Nyctinomops macrotis*) are considered peripheral and accidental, respectively (Hester and Grenier 2005). The eastern red bat (*Lasiurus borealis*) is considered peripheral in Wyoming, and the tri-colored bat (*Perimyotis subflavus*) is considered accidental. Both high-frequency bats (California and Yuma myotis [*M. californicus and M. yumanensis*]) are considered peripheral in Wyoming (Hestern and Grenier 2005).

Five species of bat were identified during active acoustic monitoring surveys: pallid bat, hoary bat, silver-haired bat, little brown myotis, and big brown bat. Two additional species may have been identified, but were not positively identified due to difficulty distinguished between these species' calls: long-eared bat and fringed bat.

Table 10. Wyoming bat species categorized by call frequency (low, mid, and high frequency) based on characteristic call frequency (Hester and Grenier 2005).

Call Frequency	Common Name	Scientific Name
Low (<30 kHz)	Hoary Bat	*Lasiurus cinereus*
	Silver-haired Bat	*Lasionycteris noctivagans*
	Big brown Bat	*Eptesicus fuscus*
	Spotted Bat	*Euderma maculatum*
	Brazilian Free-tailed Bat	*Tadarida brasiliensis*
	Big Free-tailed Bat	*Nyctinomops macrotis*
Mid (30–50 kHz)	Western Small-footed Myotis	*Myotis ciliolabrum*
	Long-eared Myotis	*Myotis evotis*
	Northern Myotis	*Myotis septentrionalis*
	Little Brown Myotis	*Myotis lucifugus*
	Fringed Myotis	*Myotis thysanodes*
	Long-legged Myotis	*Myotis volans*
	Townsend's Big-eared Bat	*Corynorhinus townsendii*
	Pallid Bat	*Antrozous pallidus*
	Eastern Red Bat	*Lasiurus borealis*
	Tri-colored Bat	*Perimyotis subflavus*
High (>50 kHz)	California Myotis	*Myotis californicus*
	Yuma Myotis	*Myotis yumanensis*

Species of Concern

No federally-listed threatened or endangered species were observed within the Project area. Twenty-one bird species listed as either WGFD species of greatest conservation need (SGCN) or listed as species of concern (SOC) by the Wyoming USFWS Ecological Service (ES) were observed at the project; collectively, they are referred to as species of concern (SOC). Four species of concern were documented year-round: golden eagle, bald eagle, prairie falcon, and greater sage-grouse. Most bald eagle and prairie falcon observations occurred in fall, and use was relatively low. Four additional species were observed during the summer: Brewer's sparrow, ferruginous hawk, peregrine falcon, and Swainson's hawks. The ferruginous hawk and peregrine falcon were relatively uncommon in the summer and are not believed to breed in the vicinity of

the Project, but data collected during surveys suggest that both Brewer's sparrow and Swainson's hawk potentially breed in or near the Project. Breeding season activity was observed for Brewer's sparrow during both years. Evidence of breeding Swainson's hawk was only documented during the Year 2 studies, and the relatively low numbers of Swainson's hawk observations during Year 1 suggests that this species may not breed in the vicinity of the Project every year. Single observations of upland sandpiper (*Bartramia longicauda*) and sage thrasher (*Oreoscoptes montanus*) were recorded in late June (with all of the remaining observations of these species recorded in August); however, the few observations recorded and lack of breeding behavior suggest these species occur in the Project infrequently and do not typically breed in the area.

Eleven additional species of concern were only observed in the spring and/or fall and are suspected to migrate through the Project. Of these species, seven were rarely detected: burrowing owl (found dead as roadkill), short-eared owl, Franklin's gull (*Leucophaeus pipixcan*), sandhill crane (*Grus canadensis*), loggerhead shrike (*Lanius ludovicianus*), northern goshawk (*Accipiter gentilis*), and pygmy nuthatch (*Sitta pygmaea*). The four remaining migrant species of concern were most commonly observed in fall: chestnut-collared longspur, lark bunting (*Calamospiza melanocorys*), McCown's longspur, and merlin.

Species of Habitat Fragmentation Concern

The greater sage-grouse is considered sensitive to habitat fragmentation and is present in the Project year round. However, the Project is sited outside of designated Wyoming greater sage-grouse Core Areas. For Projects outside of core habitat, the WGFD recommends that a minimum of a ¼ mile No Surface Occupancy (NSO) be adhered to and that a two mile seasonal construction buffer be applied to occupied leks.

4.2.13 Bird and Bat Habitats

As discussed in Section 3.0 above, the Project area is dominated by shrub/sage-steppe, followed by evergreen forest and grassland. Sagebrush steppe is plentiful throughout the Project area, and sage-steppe habitat in the Project area is suitable for a variety of the bird species observed during the baseline studies, such as golden eagle, American kestrel, horned lark, vesper sparrow, and Brewer's sparrow. Forest interior species are unlikely to utilize the edge habitat and small stands located in the Project area. However, generalist species that may utilize edge habitat or roost in trees and forage in open areas are likely to find suitable foraging opportunities in the Project area. Marginal habitat is present for species that prefer riparian corridors and these habitats have largely been avoided during project siting (see Section 5.0 below). Foraging habitat for raptor species, such as red-tailed hawk and golden eagle, is present in the Project area (e.g. prairie-dog colonies, greater sage-grouse, lagomorphs and other small mammals). Some nesting habitat for raptors is also present in the Project area.

Greater sage-grouse habitat was mapped within a 2-mile buffer of the Project by SWCA (Figures 16 – 18; Appendix A). Based on the GIS mapping effort, greater sage-grouse habitat is typically more plentiful within the 2-mile buffer than in the Project boundary. Suitable sage-grouse habitat occurs primarily along the edges of the Project, and especially along the transmission corridor in

the northern portion of the Project as well as along Willow Creek Canyon. Breeding and wintering habitat is generally much more abundant in the study area compared to summer/early fall habitat.

For the purposes of the habitat evaluation, bat habitat was defined as areas with characteristics that may concentrate bat activity for foraging or roosting (i.e., hibernacula and maternal colonies; Figure 13). Specifically, areas that contained a combination of woodlands, rock outcroppings, or cliffs, with slow-moving or still surface water were considered habitat suitable for concentrated bat activity. However, because bats are highly mobile, bat activity is possible throughout the Project area as they may fly through habitat typically categorized as unsuitable. The bat habitat evaluation was a GIS-based exercise with spatial data from LANDFIRE (USGS 2006) and the National Wetland Inventory (NWI; USFWS 2010) overlaid on a map of the Project area. The LANDFIRE dataset does not specifically identify rock outcroppings or cliffs, and all mines within the Project area were determined to be unsuitable bat roosts/hibernacula. Willow creek provides suitable foraging and drinking habitat; however, it is bordered by willows, which are typically unsuitable roosting habitat. Other ephemeral waterbodies scattered throughout the area provide foraging and drinking opportunities, but roosting habitat is generally lacking in the Project area. As well, the preferred combination of roosting and foraging habitat is not present at the Project area. Bats are likely to utilize the Project primarily for foraging; although, suitable habitat for tree-roosting species is present in the periphery of the project area.

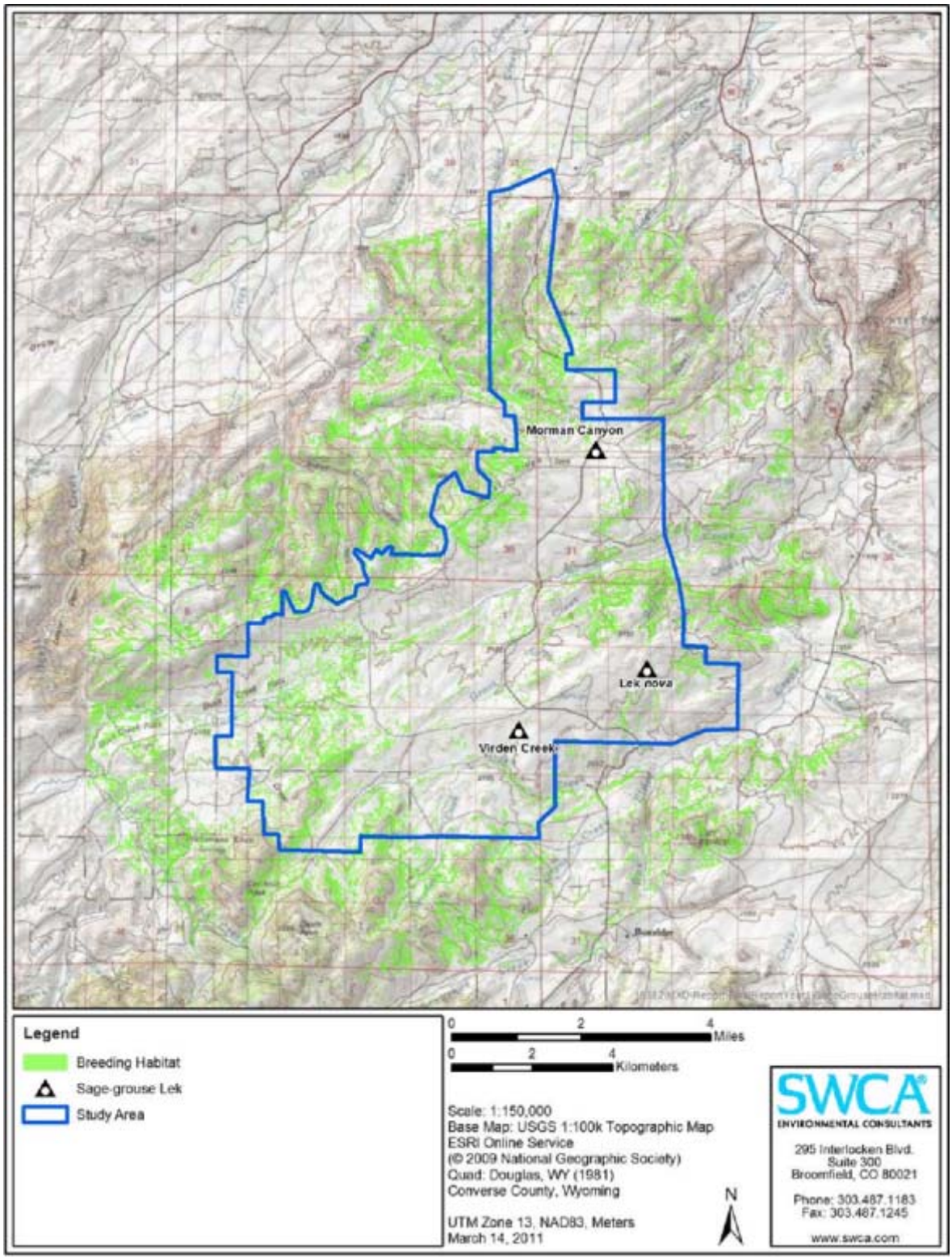

Figure 16. Predicted greater sage-grouse breeding habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County Wyoming.

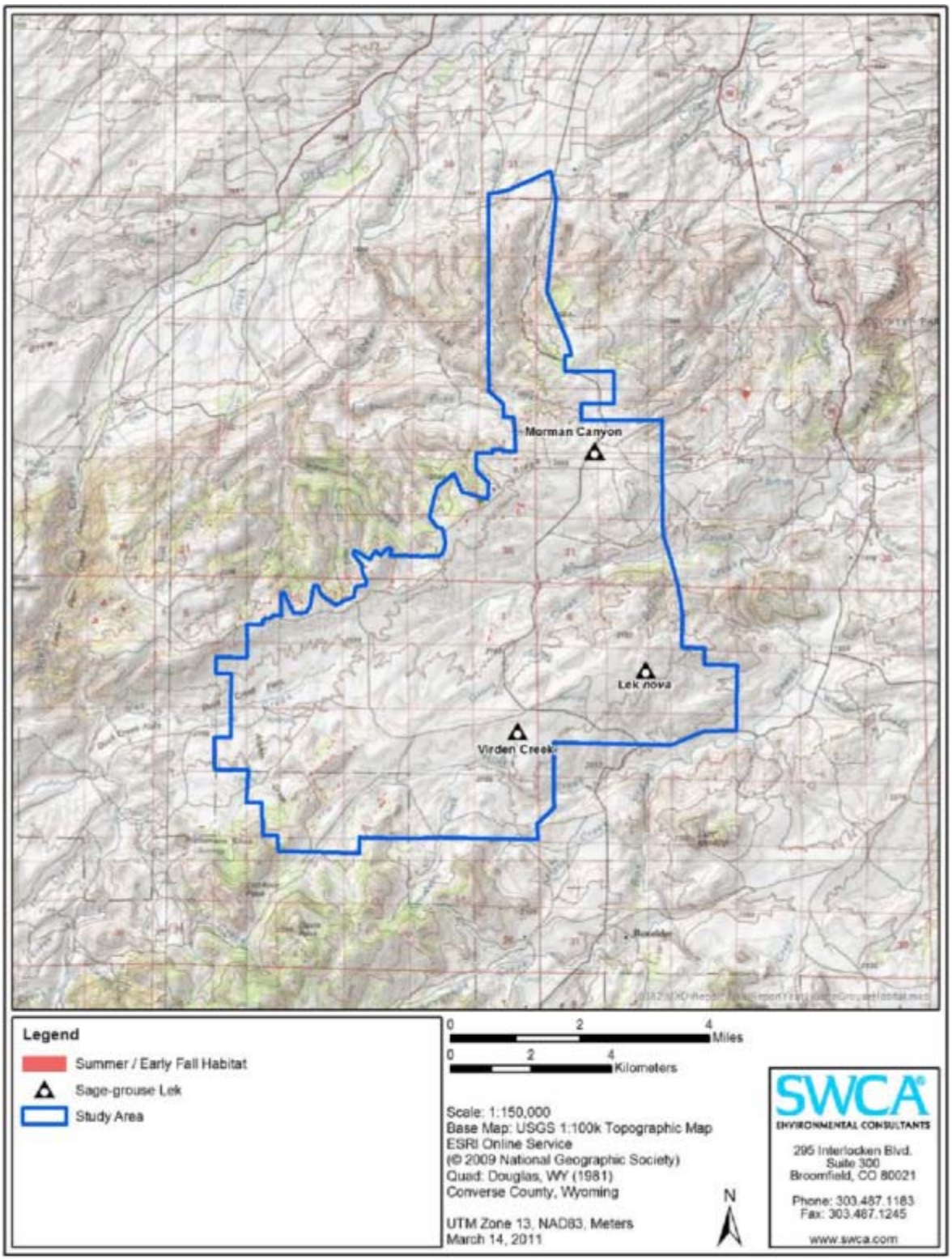

Figure 17. Predicted greater sage-grouse summer/early fall habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County Wyoming.

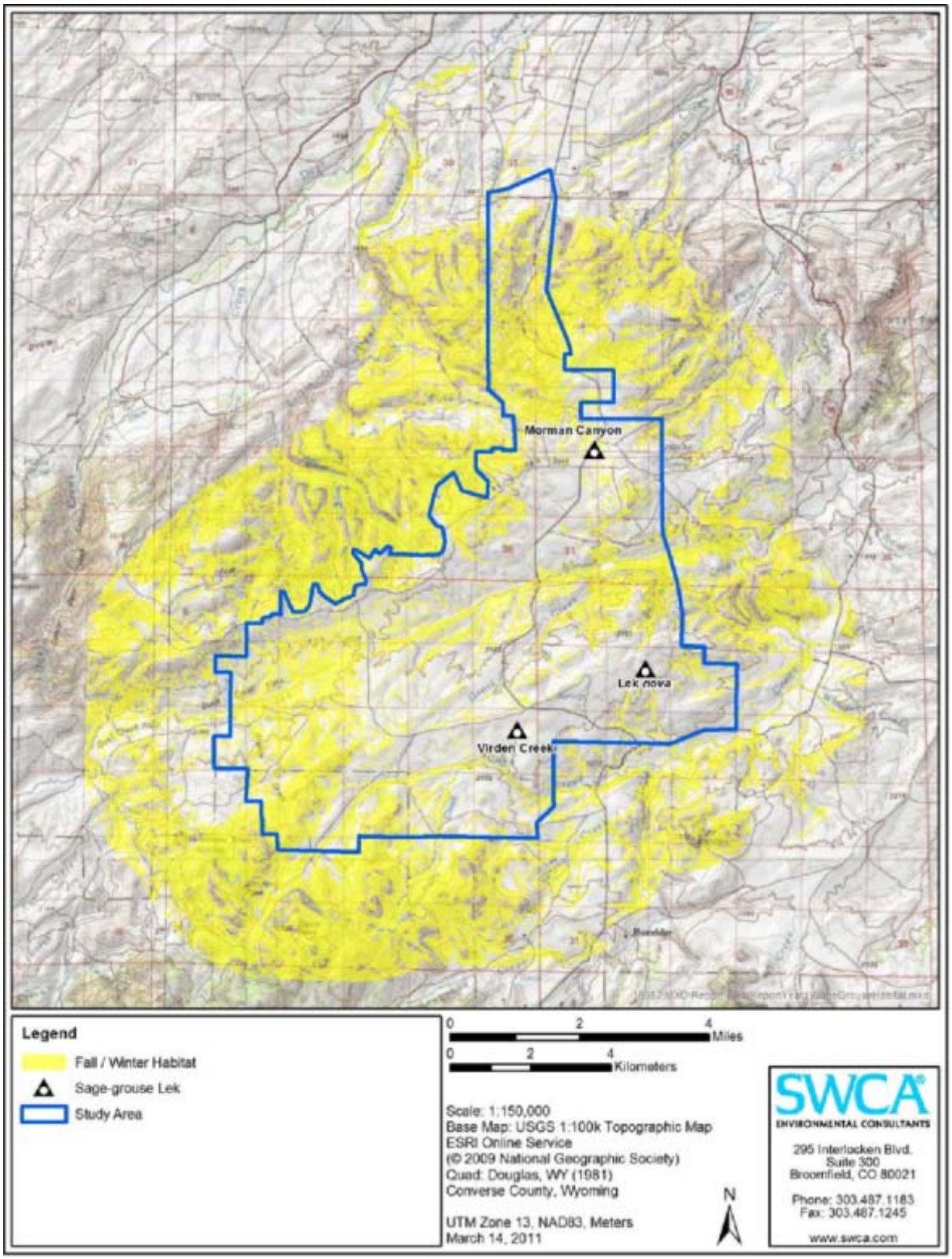

Figure 18. Predicted greater sage-grouse fall/winter habitat within the Pioneer Wind Park I Project Area and a two-mile buffer, Converse County, Wyoming.

4.2.13.1 Bird and Bat Use Patterns

An analysis of spatial raptor use was conducted using mapped raptor flight paths recorded during eagle and other raptor surveys. Mapped raptor flight paths were overlaid on a 100 X100 m grid cell. Each cell within the grid was assigned a numeric value when a unique flight path intersected the cell. Each flight path was counted only one time per cell (i.e. a single mapped flight path was not counted more than once per cell regardless of the number of times it intersected the cell). Based on the analysis, raptor use appears to be concentrated along the eastern portion of the Project area north and south of Willow Creek Canyon (Figure 19). The analysis suggested that raptor use was not necessarily associated with the location of mapped prairie-dog colonies. The southwestern part of the study area, which has relatively less topographic relief, had the least amount of raptor use. More golden eagle flight paths occurred in the area along the Willow Creek canyon and the associated ridgelines. Mapped flight paths for ferruginous hawk suggested that this species may have slightly higher use along and near the western ridgeline associated with MET tower E, north of Willow Canyon. Few bald eagle flight paths were mapped, and no obvious areas of concentration were noted.

During avian use surveys, which were focused on small bird species, bird use was relatively evenly distributed among points in the Project area with the highest use recorded at some of the stations in the southern portion of the Project area. During Year 1 surveys, use was highest at points R5, R2, PWPII 5, and PWP II 6 and during Year 2, use by point was highest at points R3, PWPI 7, PWPII 5, and R6 (refer to Table 8; Figure 9 in Section 4.2.3 above).

Low levels of bat activity were recorded throughout the pre-construction baseline studies. Relatively higher activity rates in late July, August and September are likely attributable to bats foraging in the area, and the spatial distribution of bat activity in the Project area also suggests that bats primarily use the Project area for foraging after the dissolution of maternity colonies. The detectors at MET C stations, which are located close to the Virden Creek corridor, recorded approximately twice as many bat calls as the MET B stations in either year. The area surrounding Virden Creek was identified as a potential bat use area in the habitat evaluation; whereas MET B is located further from potential bat use areas (refer to Figure 13 in Section 4.2.9 above). The riparian corridor associated with Virden Creek does not contain suitable roosting habitat; however, the slow-moving creek likely provides reliable foraging habitat for insectivorous bats.

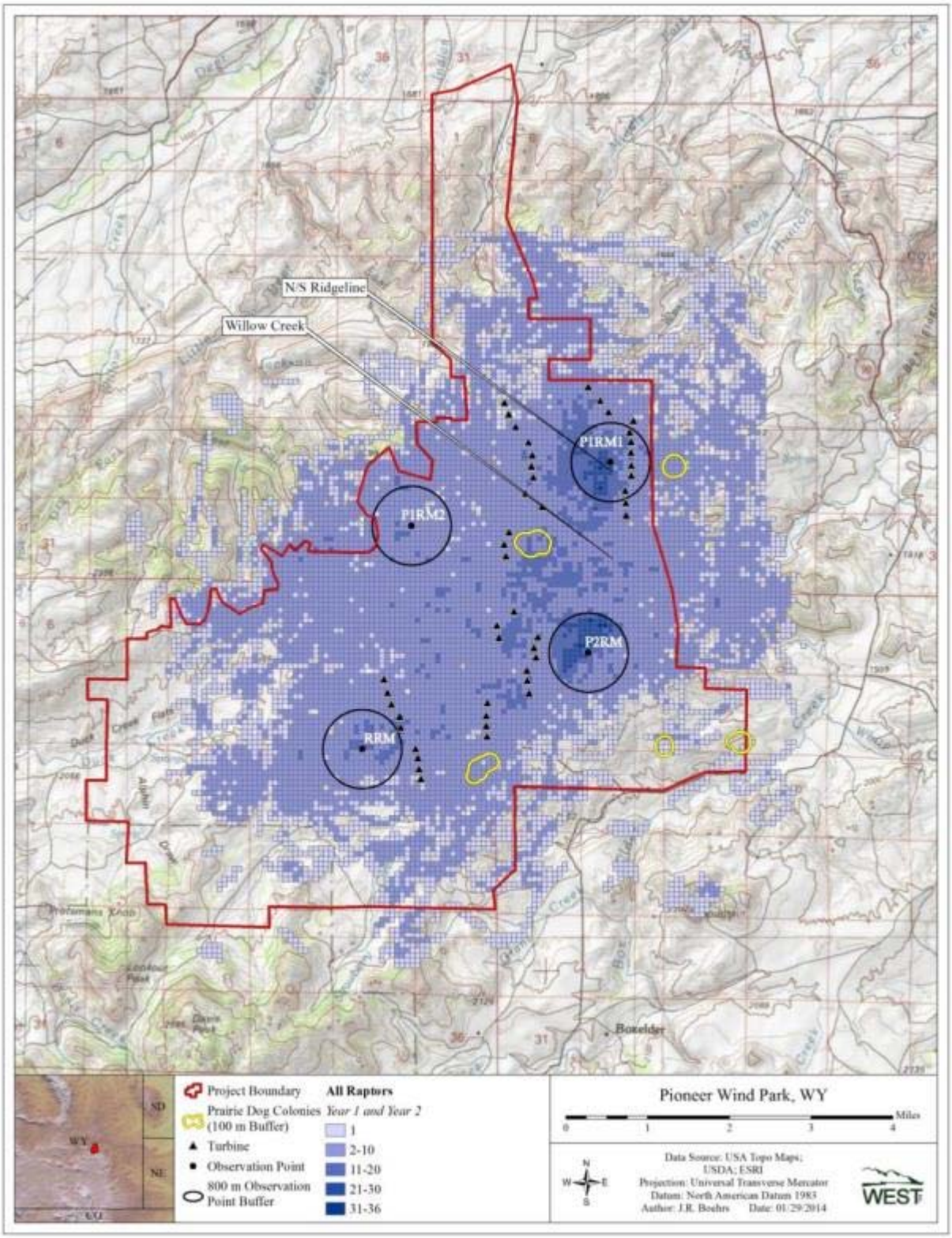

Figure 19. Grid-based analysis of all raptor flight paths recorded during pre-construction surveys of the Pioneer Wind Park I Project. Converse County, Wyoming, from April 16, 2010 – March 1, 2012.

4.2.13.2 Baseline (Pre-construction) Habitat Management

Baseline land management and usage of the Project include grazing, hunting, agriculture, mining, and roads. Grazing is the primary land use, and cattle are currently grazed on a rotational system and have open access to the streams within the Project. Agricultural fields, containing row crops, also occur in the Project area, though relatively little land is used for row crops. Ranch buildings and access roads occur near Dry Creek, Box Elder Creek, and Virden Creek. Two active rock quarries are located within the Project area. Several small abandoned gravel pits also occur within the Project area. Mormon Canyon Road is the primary road which occurs within the Project area and parallels Dry Creek.

4.2.14 Bird and Bat Risk Assessment and Decisions Based on Assessments

4.2.14.1 Facility-related Fatality Risk Assessment

Potential risk to bird and bat species is assessed through a comparison of use recorded during the pre-construction baseline studies conducted within the Project and use information from other facilities that have also reported fatality rates based on post-construction monitoring studies. To the extent possible, publicly available studies in Wyoming are used to inform the risk assessment. Bird and bat risk associated with other sources of mortality (e.g., powerline electrocutions/collisions, vehicle collisions) was also assessed by reviewing literature on other sources of bird and bat mortality.

Collision with various man-made structures can be a significant source of bird mortality (Table 11). Nationwide, wind turbines are estimated to be responsible for a small fraction of all avian mortalities due to human structures (Table 11). The Best Management Practices (BMPs) employed at the Project (e.g., low speed limits, tubular towers, or towers without guy wires, red flashing aviation warning lights, and burying collection lines whenever possible) help to reduce the risk of collision mortality associated with the Project. Collision risk is also associated with meteorological (MET) towers, and although data on MET tower impacts to birds indicate that, overall, the average number of discovered bird mortalities per year is similar for MET towers as for turbines, one site in Wyoming reported average avian mortality was three times greater at guyed MET towers than at the turbines (Young et al. 2003). To minimize collision risk associated with MET towers, the permanent MET towers used at the Project will be un-guyed, lattice structures with concrete foundations.

Table 11. Estimated annual avian mortality from anthropogenic causes in the United States.

Mortality Source	Estimated Annual Mortality	Reference
Collisions with buildings	98-980 million	Klem 1990
Collisions with power lines	Tens of thousands to 174 million	USFWS 2002; APLIC 2006
Depredation by domestic cats	1.4 – 3.7 billion	Loss et al. 2013
Automobiles	60 - 80 million	Erickson et al. 2005
Pesticides	67 million	Pimentel et al. 1991
Communication towers	6.8 million	Longcore et al. 2012
Aircraft	4,722	Dolbeer et al. 2009
Oil pits	500,000 - 1 million	USFWS 2009a
Wind turbines	213,760 – 573,000	Erickson et al. 2014; Smallwood 2013

Project construction and decommissioning could result in the destruction of nests, eggs, or young, as well as collisions with vehicles and construction equipment. To avoid and minimize mortality associated with vehicle collisions or other construction-related activities, project personnel will be advised regarding speed limits and travel will be restricted to designated roads and work areas. In addition, all supervisory construction personnel will be instructed on the protection of wildlife resources. All workers will be aware of the correct procedures and responsibility to report wildlife incidences.

The most recent estimates of annual bird mortality from wind facilities in the United States are 213,760 to 573,000 (Erickson et al. 2014; Smallwood 2013). Studies have shown avian mortality rates to be consistent across wind energy facilities, both nationally and by region. The number of avian mortalities at wind energy facilities is generally low when compared to the total number of birds observed at these sites (Erickson et al. 2002). Although avian collision mortality can occur during both the breeding and migration seasons, patterns in avian mortality at man-made structures suggest that most fatalities occur during the spring and fall migration periods (NRC 2007).

Based on the pre-construction avian surveys, avian use within the Project area was similar to other comparable studies at wind resource areas evaluated throughout the US. Therefore, mortality of non-raptor avian species is anticipated to be similar to other wind resource areas in western North America, which range from 0.16 to 8.45 bird mortalities/megawatt (MW)/year (URS Corporation 2010, Enz et al. 2011; Figure 20). There is one publicly available post-construction monitoring study from a wind facility in Wyoming (Foote Creek Rim), and mortality rates at this facility ranged from 1.93 birds/MW/year in 2001-2002 to 3.4 in 1999 (Young et al. 2003). Given the proximity of the Project to the Foote Creek Rim facility, generally similar habitats and land use, and similar bird species composition, mortality rates at the Project may be similar to those reported at the Foote Creek Rim facility.

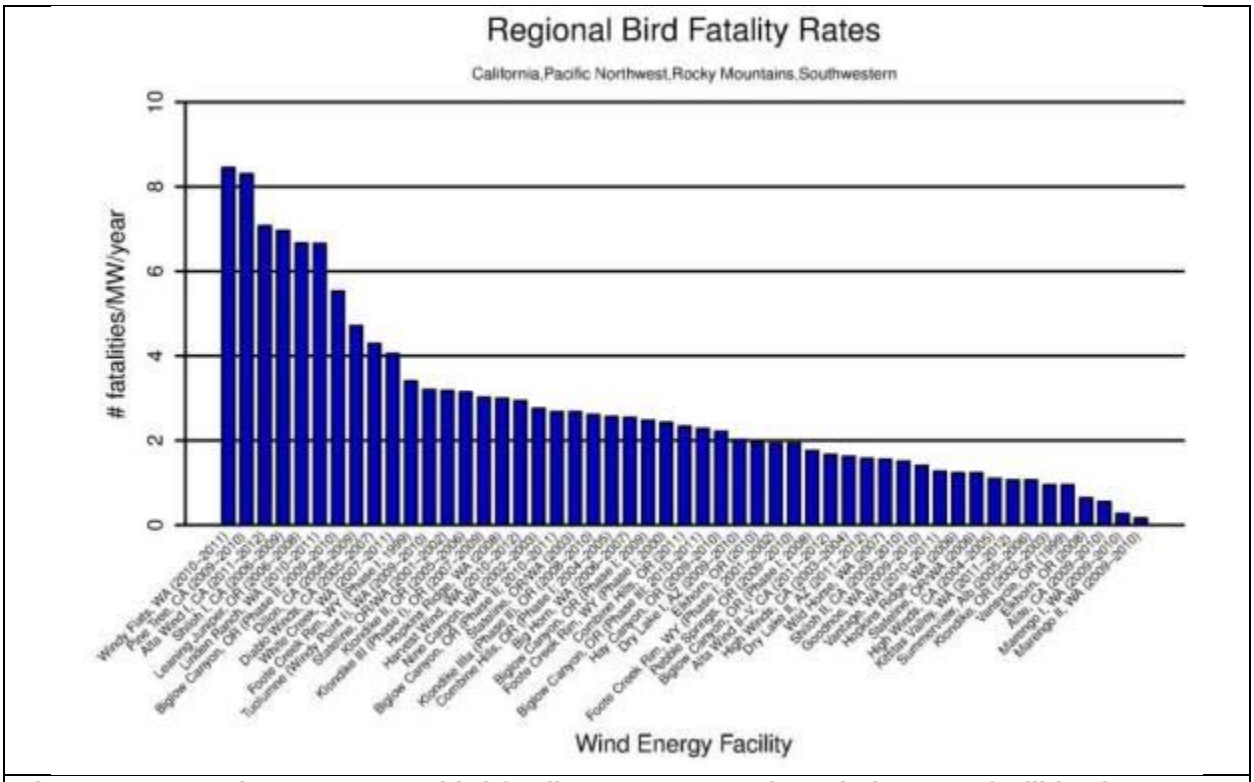

Figure 20. Annual per megawatt bird fatality rates reported at wind energy facilities in western North America.

Mean raptor use at the Project was estimated to be 0.756 and 1.334 birds/hour or 0.25 and 0.44 birds/20-min irrespective of distance from observer. Mean raptor use at other wind energy facilities in western North America that implemented similar protocols to the baseline study ranged from 0.04 to 2.337 raptors/plot/20-min survey (Erickson et al. 2009 and Kerlinger et al. 2005, respectively). Mean raptor use at the Foote Creek Rim Facility in Wyoming was 0.554 raptors/800-m plot/20-minute survey, and similar to the Project, golden eagles were the most commonly observed raptor species (Johnson et al. 2000). Raptor mortality rates reported at other wind energy facilities in western North America ranged from zero to 0.5 raptor mortalities/MW/year (Figure 21). At the Foote Creek Rim facility, the only facility that has reported post-construction monitoring results in Wyoming, annual raptor mortality ranged from 0.08 raptor mortalities/MW/year in 1999 to zero raptors found in 2001-2002 (Young et al. 2003).

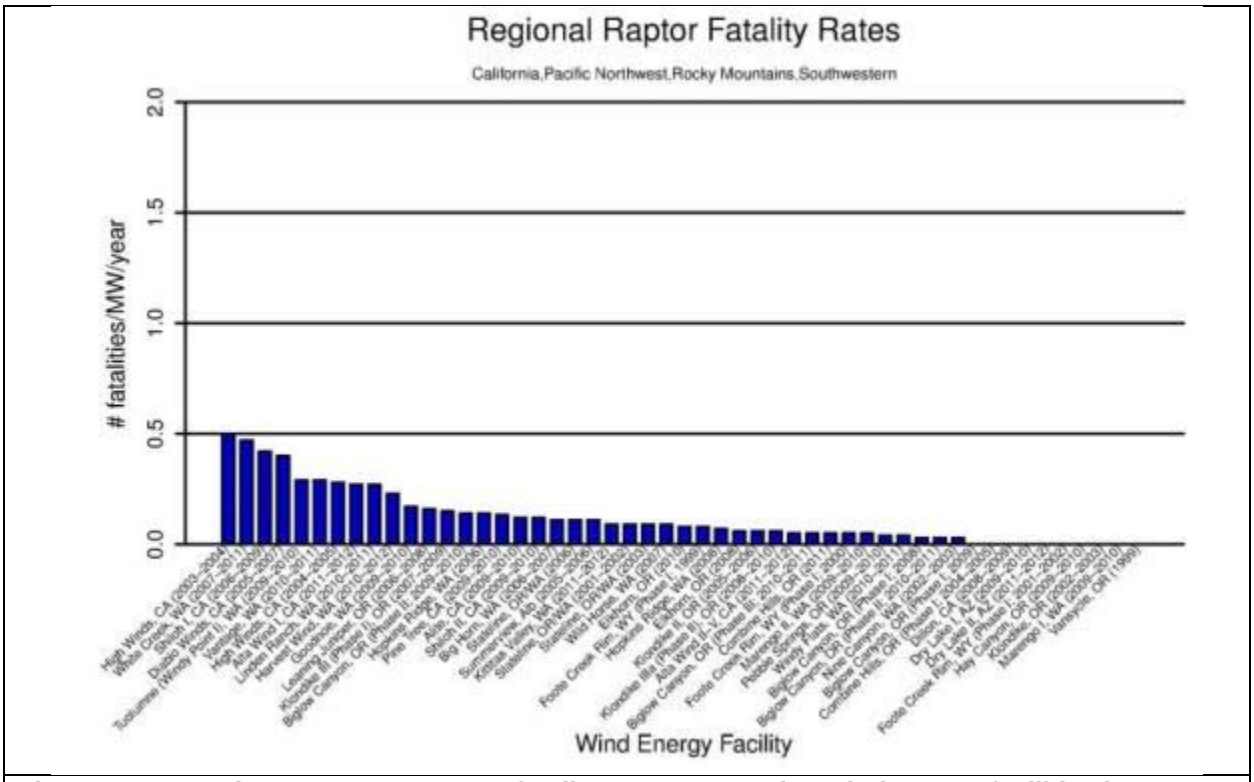

Figure 21. Annual per megawatt raptor fatality rates reported at wind energy facilities in western North America.

Bat mortalities have been discovered at most wind energy facilities monitored in North America, ranging from 0.10 (Tierney 2007) to 39.70 bat mortalities/MW/year (Fiedler et al. 2007). In 2012, an estimated 600,000 bats died as a result of interactions with wind turbines in the US (Hayes 2013). In western North America, bat mortalities have generally been lower, ranging from 0.08 (Chatfield et al. 2012) to 11.42 bat mortalities/MW/year (Baerwald 2008; Figure 22). At the Foot Creek Rim facility, bat mortality rates have generally been low, ranging from 1.05 to 3.97 bat mortalities/MW/year (Young et al. 2013) Bat mortalities are largely due to collisions with moving turbine blades (Grodsky et al. 2011; Rollins et al. 2012), but the underlying reasons for why bats come near turbines are still largely unknown (Cryan and Barclay 2009). It is generally expected that pre-construction bat activity is positively related to post-construction bat mortalities (Kunz et al. 2007b). However, to date, few studies of wind energy facilities have recorded both bat passes per detector-night and bat mortality rates. The few studies that have estimated pre-construction activity and post-construction mortalities suggest a general association between activity and mortality rates, with higher or lower activity rates coinciding with higher or lower mortality rates in several cases. However, this general association is more consistent for sites with very low activity; the relationship is not as consistent for sites with moderate or higher activity (Hein et al. 2013). Bat activity rates at the Project were relatively low; therefore, it is anticipated that bat fatality rates will also be low.

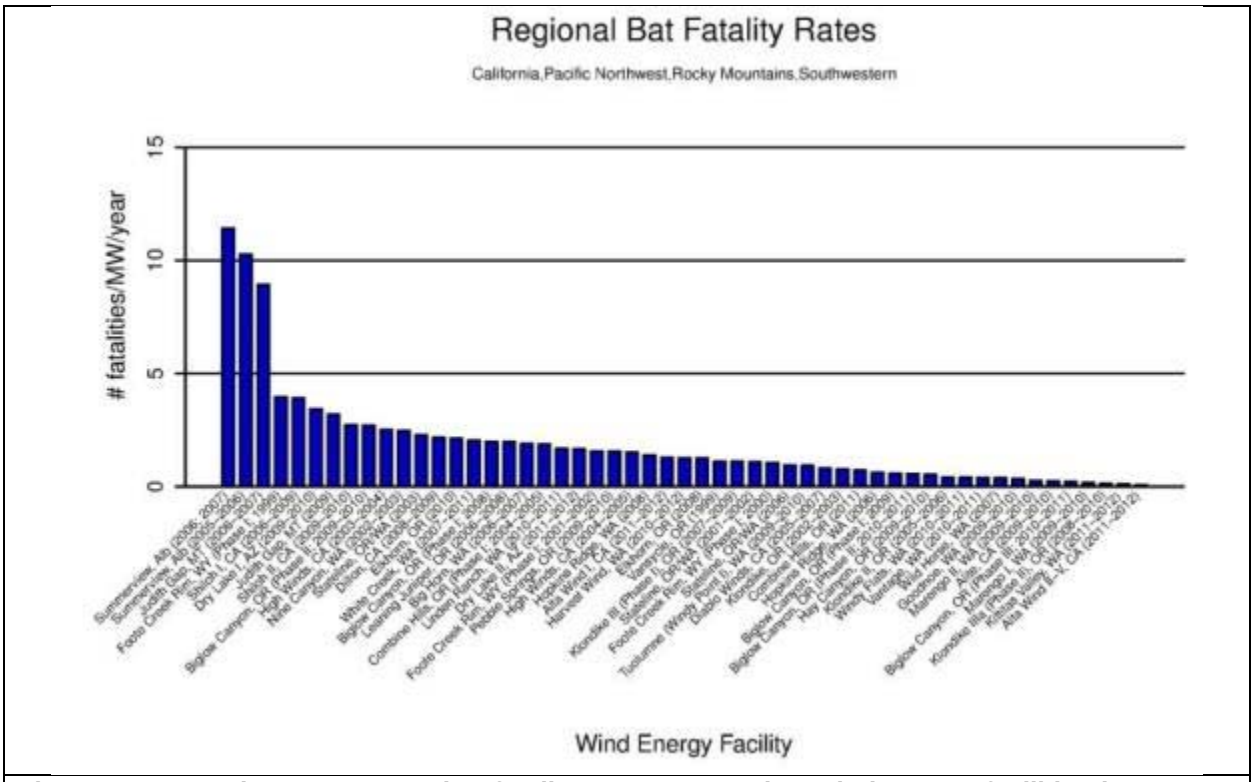

Figure 22. Annual per megawatt bat fatality rates reported at wind energy facilities in western North America.

4.2.14.2 Habitat Loss

As discussed in Section 3.0 above, temporary and permanent disturbance acres have been calculated for the Project based on the USGS landuse/landcover dataset. However, the impacts of habitat loss can be minimized through proper Project planning and siting (*see* Section 5.0 below). Construction of the 46-turbine Project will result in the removal of approximately 72.4 acres of habitat. The primary habitat lost will be sagebrush steppe and mixed grasslands. Temporary land disturbances resulting from the construction of the turbines and associated infrastructure will be reclaimed and re-vegetated so that natural succession can occur. Permanent habitat impacts will be restored upon decommissioning of the Project; however, it will be removed for the life of the project and is considered a long-term loss of habitat. Post-construction landcover evaluation, sage-grouse habitat evaluation, and bat habitat evaluations will enable an assessment of the level of impact associated with habitat loss.

4.2.14.3 Indirect Impacts

In addition to removing habitat, project wind turbines may displace wildlife from an area due to creation of edge habitat, the introduction of vertical structures, and disturbances directly associated with turbine operation (e.g., noise and shadow flicker) (USFWS 2012, NRC 2007). These impacts are typically concentrated near turbine locations and along access roads, available data indicate that avoidance of wind turbines by birds generally extends 245 to 2,625 ft from a turbine, depending on the environment and the bird species affected (Strickland 2004). The Project will result in a relatively small amount of habitat loss and disruption relative to the

surrounding landscape; therefore it is unlikely that there will be significant adverse impacts. Impacts are expected to consist primarily of shifts in species distribution within the Project area similar to shifts in distribution resulting from other anthropogenic effects (USFWS 2012).

Displacement associated with noise is unlikely to cause significant displacement of birds, based on a review of Dooling (2002). Dooling's research suggests that birds cannot hear the noise from wind turbine blades as well as humans can. In practical terms, a human with normal hearing can probably hear a wind turbine blade twice as far away as can the average bird. Although Dooling's study was intended to explore potential avoidance measures for birds (i.e., collision mortality), he found that birds habituate to acoustic disturbances and that blade noise becomes inaudible to some bird species at 82 ft from the turbine, suggesting that impacts from noise may be minimal at these distances.

Construction and operation of the wind energy facility may displace some groups of birds, while the Project was sited in undisturbed native habitats; these habitats are abundant in the region. As a result, any potential displacement of birds is unlikely to result in adverse population-level impacts.

Most bird and bat species occurring in the Project are volant, therefore, populations are unlikely to become isolated, which could result in a reduction of population vigor; however, several studies have shown that some grouse, such as greater sage-grouse, may experience adverse indirect impacts (Robel et al. 2004, Holloran 2005, Pruett et al. 2009). The only known study of the short-term effect of wind energy development on greater sage grouse was conducted at wind energy facility and a reference site in Carbon County, Wyoming (LeBeau 2012). Leks within both the impact and reference study areas experienced significant declines from one year pre development to four years post development; however, declines were not attributed to the presence of the wind energy facility. Radio-collared hen sage-grouse monitored during the first two years post-construction did not avoid wind turbines during the nesting and brood-rearing periods. High site fidelity inherent in greater sage-grouse may explain continued use of habitats near turbines for both nesting and brooding hens and lekking males. Nest and brood survival was significantly lower in habitats within five km (3.1 miles) of the wind energy facility potentially due to increased predation and edge effects associated with the presence of the wind energy facility. Based on the apparent significant impact on nest and brood success for those females using areas closest to the wind facility, it was recommended that wind energy facilities not be constructed within five km (3.1 miles) of known sage-grouse nesting and brood-rearing habitats (LeBeau 2012). Two historic WGFD leks and one new strutting grouse location are located within the Project area; however, the majority of greater sage-grouse habitat is located outside of the Project and turbines are generally not sited in habitat within the Project boundary (*see* Section 4.2.13 above). Potential impacts to greater sage-grouse will be reduced by implementing WGFD recommendations (*see* Section 5.0 below). The Project has been sited outside of a core area for greater sage-grouse, and the potential impacts of the Project are unlikely to cause reductions in greater sage-grouse population viability and vigor.

4.2.14.4 Cumulative Impacts

Proposed facilities to be considered in this cumulative impact assessment include those for which public information is available and/or are actively engaged in the Wyoming ISC permit process. No known industrial facilities are planned to be under construction in the area of site influence at the same time as the Project. There are three other wind energy facilities in the area of site influence that will continue to be in operation when the proposed Project is scheduled to become operational: Glenrock-Rolling Hills (GRH) Wind Energy Projects, Campbell Hill Windpower (CHW) Project, and the Top of the World (TOTW) Windpower Project. The GRH projects consist of 158 WTGs with a combined nameplate capacity of 237 MW. The CHW consists of 66 WTGs with a combined nameplate capacity of 99 MW. The TOTW project consists of 110 WTGs with a combined nameplate capacity of just over 200 MW. When combined with the Project, there will be 380 WTGs with a total nameplate capacity of 616 MW operating within the area of site influence.

Permanent habitat disturbance resulting from implementation of the proposed Project would affect a very small percent of the Project area, and the overall disturbance footprint on all currently operating wind energy projects in Converse County is assumed to be comparably low; however, there may be cumulative impacts to the function of these habitats when viewed at the landscape scale. GRH, CHW and TOTW have resulted in localized habitat loss, fragmentation, and disturbance and an increase of human presence and activity in rural areas that have considerable value to wildlife. The construction of the proposed Project may cause temporary displacement of individuals that might avoid the project site in response to construction activity. Although Project infrastructure has been sited to avoid impacts to raptor concentration areas and riparian corridors, some level of unavoidable impacts to birds and bats is anticipated. Combined with mortalities caused by other wind energy facilities in Converse and Natrona Counties, there could be cumulative impacts to wildlife, particularly raptors; therefore, a detailed post-construction monitoring protocol has been developed for the Project.

Detailed scientific study results will lead to better understanding of direct, indirect, and cumulative wildlife impacts, to better develop and implement mitigation strategies and adaptive management measures, if warranted, to further reduce wind energy cumulative wildlife impacts. All of these measures are being undertaken at the Project, as well as at other projects operating in Converse County. Avian species composition in the immediate vicinity of operating WTGs may change from baseline conditions. Species that use sparsely vegetated or unvegetated habitats and human disturbance areas are likely to become more common relative to those requiring vegetative cover and those intolerant of human disturbance. These small-scale changes may eventually result in long-term changes to avian use patterns, displacing some species away from wind energy facilities. However, high quality native habitats are abundant in the region surrounding the Project and the other operational wind energy facilities; therefore, it is unlikely that displacement will result in any discernible population impacts at a landscape level.

A minimum of two years of post-construction wildlife monitoring will be initiated by PWPI at the Project. Bird and bat surveys conducted prior to construction will be continued in the Project area to determine if project operations are influencing the types of species in the area, the number of

individuals, or their behavior. Post-construction monitoring will include a statistically rigorous mortality study that will include assessments of searcher efficiency and carcass removal rates to calibrate estimates of actual avian and bat mortality resulting from turbine operations. Mortality data will be compared with baseline avian use data, and mortality rates will be compared with the results of mortality studies at other wind power facilities (where available) to assess whether operational impacts to birds and bats is comparable to other operating wind farms in the region and to attempt to quantify cumulative impacts. This level of study should enable PWPI to identify adverse site-specific and potentially cumulative impacts and to develop adaptive management strategies to ensure the Project impact does not become significant.

4.2.15 Risk Assessment Decisions

4.2.15.1 Decision Criteria to either Abandon Site or Advance Project

The potential for significant adverse impact to bird and bat populations are generally low, as supported by the data and analyses enumerated above. The data collected to date suggest that risk associated with the Project can be minimized through the use of conservation measures. The risk to greater sage-grouse in the vicinity of the Project is moderate, but given that the Project is largely sited outside of suitable greater sage-grouse habitat and is well outside designated core areas for greater sage-grouse, the Project is unlikely to cause significant adverse impacts to greater sage-grouse populations.

4.2.15.2 Decision of Need for Other Bird and Bat Conservation Plans

In communication with the USFWS, PWPI has developed an ECP to avoid, minimize, and mitigate any potential impacts to eagles from the Project. The ECP will be used to support an eagle take permit for the Project.

5.0 Conservation Measures to Avoid and Minimize Adverse Impacts

PWPI has already and plans to implement a variety of Best Management Practice's (BMP's) and Conservation Measures to reduce the risks the Project poses to birds and bats. The following BMP's and conservation measures have been implemented or are planned for the Project during the pre-construction, construction, and operation phases of the Project to reduce the potential risk to birds and bats.

5.1 Pre-Construction

5.1.1 Siting the Project Layout

In 2008, PWPI was exploring the opportunity of developing wind projects in Wyoming. PWPI first went to the State of Wyoming who was managing a met tower loan program. This program was designed to loan met towers to ranchers/landowners to either collect data to build their own turbine for on-site use or to attract large scale wind developers to develop their land to increase the value of their land—to improve the economics of ranching. In the case of the Project, PWPI thought the data that was collected by one of the landowners indicated that there was enough wind for a

commercial scale wind farm. PWPI then began leasing land rights conducting a critical issues analysis and commencing wildlife studies. Through that process, PWPI came up with an original turbine layout with the help of wind meteorologists. The original layout included turbines within approximately 1 mile of nests and nearby historic properties (Figure 23). PWPI submitted an application for a permit to the ISC, which included this original turbine layout, on February 2, 2011. After revisiting the layout and realizing the turbines' proximity to raptor nests and cultural resources, PWPI updated its application to the ISC on April 1, 2011 and requested that the hearing address the newly developed layout (see alternative turbine layout in Figure 23). This new layout moved the whole southern string approximately 1.5 miles to the west so that the closest turbine is now greater than 1.97 miles from nearest golden eagle nest. Additionally, the flight paths from the eagle use surveys indicate that eagle use is heavier in other parts of the Project area compared to the area with turbines closest to the nest sites, and these turbines do not bisect direct flight paths from the nest site to areas of known concentrated prey (e.g prairie dog towns and sage grouse leks) within approximately 3 miles of the nests.

In addition to moving turbines further to the west, the site-specific raptor use information was utilized to help identify and remove turbines from areas believed to pose a higher risk to raptors relative to other proposed turbine locations. A use-intensity grid was developed by overlaying mapped raptor flight paths on 100-m square grid cells within the Project area (similar to the flight occurrence analysis conducted by SWCA [see Appendix A]). The number of unique flight paths that intersected each pixel yields an index of the frequency of flight activity observed during surveys (see Figure 19 in Section 4.2.13). The grid was then used to identify relatively higher risk areas for all raptors, including eagles, within the Project.

PWPI had initially proposed in its Wyoming Industrial Siting Permit process a project comprised of 62 wind turbines, subsequent commercially-related factors as well as identified resources concerns (including eagles) required a reduction of the project size by 16 turbines. Based on the available information and recommendations from USFWS, PWPI removed the nine highest-priority turbine locations (those locations considered to pose the highest potential risk to eagles) from the layout (Figure 23). USFWS considered the following factors when evaluating relative risk of proposed turbine locations: 1) eagle/raptor use surveys that indicated preferred use areas; 2) location of nest sites; 3) prey base features; 4) topographic uplift features; and 5) point counts with relatively more diverse and numerous migratory bird use. In identifying areas of greater risk, USFWS recommendations were to avoid placing turbines in areas of higher avian use in the Project area, which are also generally in areas of relatively more topographic relief. USFWS provided a list of 17 turbines that were of highest priority for removal and PWPI removed the top nine locations from the layout (Figure 23). Of the nine higher risk turbine locations, eight were located west of a prominent north/south ridgeline within the Project area that received higher levels of mapped raptor flight paths, and that included north-south movements as well as spiraling flights of eagles and other raptors. The spiraling movements documented by SWCA indicate eagles and other raptors may utilize this area to gain altitude by exploiting apparent uplifts along the north/south ridgeline. This is further supported through an assessment of slope and aspect within the Project relative to the prominent WSW wind direction (see PWPI ECP). The ninth turbine removed at the recommendation of USFWS was located just east of a mapped prairie dog

colony, which would have resulted in turbines “boxing in” the mapped town. The turbine was also located between the mapped town and known nest locations, was near an avian use station where a high diversity of bird species use was recorded, and was somewhat off by itself relative to other turbine locations (Figure 19). In addition to the nine turbines that were removed based on USFWS recommendations, an additional seven turbines were removed from the layout resulting in a final layout (June 2013) of 46 turbines (Figure 23). The remaining final 46 turbine layout is considered to pose a low risk to eagles based upon the USFWS Bayesian fatality prediction model which estimates the Project will take less than one eagle per year.

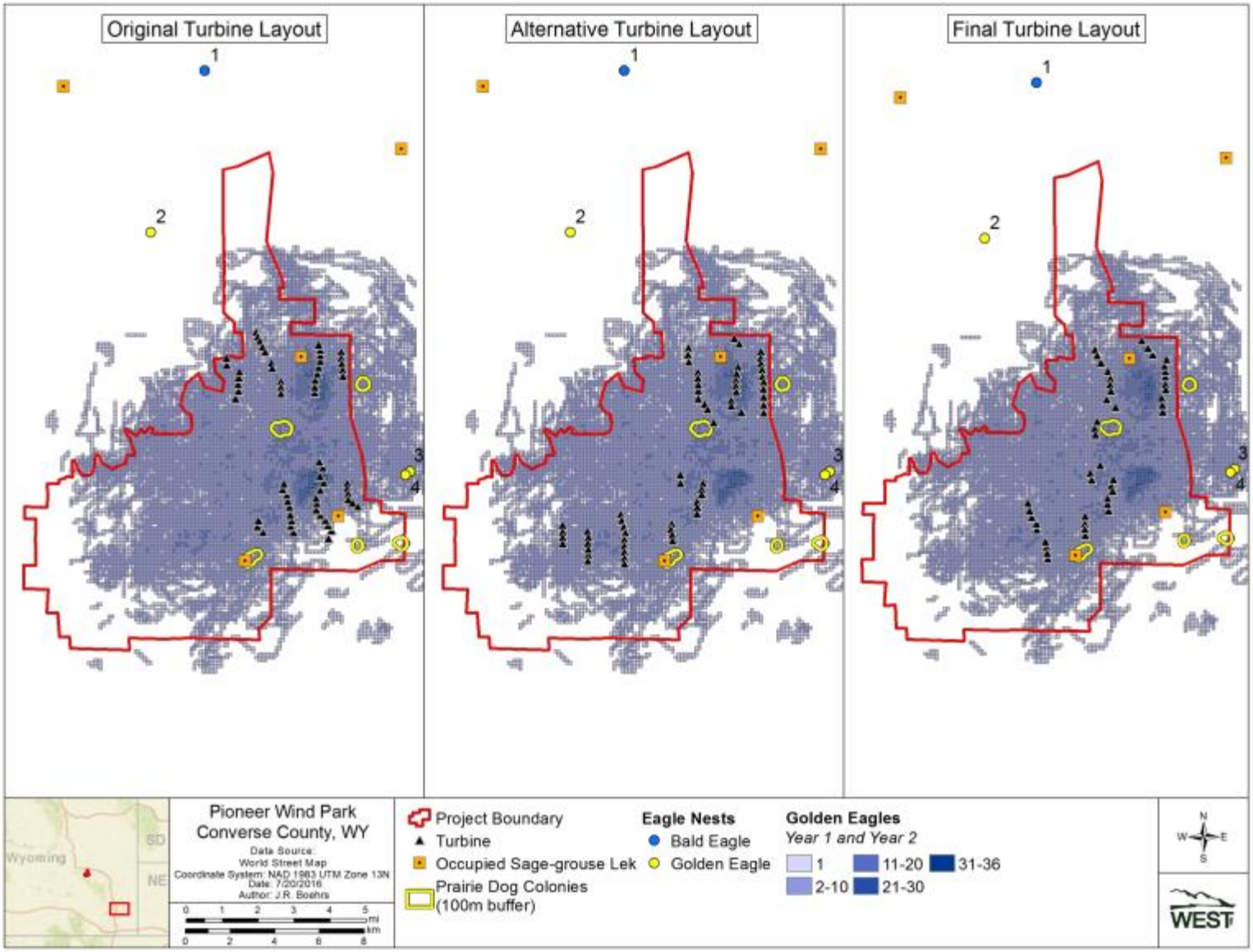

Figure 23. Illustration of the progression in turbine layouts, showing efforts to avoid locating turbines in areas of highest eagle and raptor use areas based on pre-construction survey data, resulting in the final proposed layout with 46 turbines for the Pioneer Wind Park Project, Converse County, Wyoming.

5.1.2 Additional Pre-construction BMP's and Conservation Measures

Other BMP's and Conservation Measures that were implemented during the pre-construction phase of the Project include:

- The area and intensity of disturbances (e.g. utilizing existing roads while traveling on site) was minimized during pre-construction monitoring and testing activities.
- Existing roads and transmission corridors have been incorporated into the site plans to the extent possible.
- Site plans minimized the extent of the road network needed for the Project.
- A dust control plan will be developed prior to construction.
- An erosion control plan will be developed prior to construction.
- A storm water pollution prevention plan will be developed prior to construction.
- To the extent possible, electrical collection lines will be buried underground. The exception is an above ground line that connects the southern portion of the Project with the northern portion of the Project.
- With the exception of one or two permanent MET and radar towers, no other lattice towers or structures that are attractive to birds for perching are included in plans for the facilities.
- Wind Turbine Generators (WTGs) will feature tubular supports, rather than lattice supports, to minimize bird perching and nesting opportunities. External ladders and platforms will not be used on WTGs, to minimize perching and nesting opportunities for birds.
- No guy wires will be included on permanent MET towers.
- Lighting plans for the facility will be the minimum, according to FAA recommendations PWPI intends to have red flashing lights turned off except when a plane flies over head. All security lighting will be motion- or heat-activated, instead of being left on throughout the night.
- All security lighting will be down-shielded and related to infrastructure lights.
- The facility was not sited in any areas containing high concentrations of ponds, streams, or wetlands.
- Parking areas and laydown areas will not be located within 500 feet of perennial streams.
- A fire safety plan will be developed and implemented during all phases (construction, operations and decommissioning). Measures to reduce risk of fire hazards from vehicles and Project and contractor personnel will be implemented. An Emergency Response Plan will be developed and implemented during Project and/or transmission tie-line construction and operation. The plan will contain emergency fire precautions, notification procedures, and emergency response sequences. These measures will help reduce or avoid impacts to wildlife.
- A weed control plan that is designed to prevent the spread of non-native and invasive species has been developed.

- The Project was sited outside of core greater-sage grouse areas and no turbines are located within ¼ mile of the three known greater-sage grouse leks (discussed in further detail Section 2.6 above).
- Turbines were not sited within at least 100 m any mapped prairie dog colonies.
- PWPI worked with the Wyoming Game and Fish Department (WGFD) and landowners to develop a wildlife conservation plan for the Project which may be updated over time.

5.2 During Construction

The following BMP's and Conservation Measures will be implemented at the Project during construction:

- Prior to the start of construction and ongoing during operations, all employees, contractors and subcontractors will undergo an employee orientation program that will enhance wildlife awareness, minimize impacts to natural resources, and facilitate employee understanding of their respective roles in ensuring compliance with the Project permit conditions and commitments. Any known occurrence or habitat of federal listed species or other species of concern identified within construction areas will be included in the training.
- The area and intensity of disturbance will be minimized to the extent possible during construction and construction activities will be conducted in a way that prevents any unnecessary damage to, or destruction of, natural habitats.
- A transportation plan will be developed to minimize impacts to wildlife during all phases (construction, operations and decommissioning). Speed limits for construction and operations personnel along the access and service roads will be restricted to 25 miles per hour (mph) to reduce the risk of wildlife or livestock collisions and to minimize sound emissions. Vehicle movement associated with the Project will be restricted to designated access and service roads and temporary construction areas. This will help to minimize carrion availability for golden eagles and other raptors.
- A dust control plan will be implemented.
- An erosion control plan will be implemented.
- A storm water pollution prevention plan will be implemented.
- A weed control plan will be implemented.
- Activities which may attract raptors or their prey near WTG locations will be minimized to the extent possible. This includes:
    - Adherence to speed limits included in the Transportation Plan (25 mph) to reduce the likelihood of wildlife collisions;
    - Project personnel and all contractors will be instructed to remove garbage promptly to avoid creating attractive scavenging opportunities for birds.
    - Avoidance of seeding of areas with forbs, which may attract mammalian or bird prey;

  - removal of rock piles resulting from construction activities, which may attract or provide cover for mammalian prey, and;
  - Avoidance of storage of parts or equipment near WTGs and creation of large rock piles that attract small mammals and their predators will be prohibited;
- The Avian Power Line Interaction Committee (APLIC) guidance on power line construction (Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006; APLIC 2006) and Reducing Avian Collisions with Power Lines: The State of the Art in 2012; APLIC 2012) will be followed.
- A minimum of a 1.9-mile spatial and seasonal separation will be implemented, between turbines and all currently known eagle nest sites.
- To the extent possible and practicable, facility construction will minimize cutting into hill slopes, with an objective of achieving smooth, rounded terrain, rather than sudden berms or cuts. This measure is intended to reduce attraction of fossorial or burrowing mammals and to reduce prey abundance.
- Gravel will be placed at least 15 ft. (4.6 m) around each turbine foundation, to discourage small mammals and reptiles from burrowing under or near turbine bases.
- Sensitive resources (e.g., nests) identified during per-construction surveys will be flagged and all site personnel will be notified of their presence and necessary setbacks.
- Wyoming Department of Environmental Quality (WDEQ) Land Quality Division practices for topsoil handling and re-vegetation will be employed during construction.
- Appropriate native seed mixtures or seed mixtures requested by landowners will be utilized for re-vegetation as soon as practical following construction.
- The Project Wildlife Conservation Plan that was developed by PWPI, the WGFD, and the landowners will be implemented.

5.3 During Operation

The following BMP's and conservation measures will be implemented during operation of the Project to provide additional avoidance and minimization of risks:

- Management activities such as seeding forbs or maintaining rock piles, which attract potential prey, will not be implemented.
- Parts and equipment which may be used as cover by prey will not be stored in the vicinity of wind turbines.
- Any carcasses that could be foraging sources for eagles or other raptors (with the exception of carcasses being used for post-construction bias trials) found within the Project will be removed immediately, assuming the appropriate permits/authorizations have been granted to PWPI. PWPI is currently working to acquire necessary permits/authorizations for this measure.
- Low level speed limits (< 25 mph) will be maintained on all roads within the Project.

- The Project has committed to, and Project permits require, the use of an aircraft detection sight solution system. Under this system, the only time the FAA lights will appear is when an airplane is flying overhead. Laufer Wind is the manufacturer of this system, and they are working to add bird detection to their radar system. The hardware required to do this is quite similar to their aviation-related offering. The task is to add the software which interprets the radar returns and identifies them as birds. PWPI will consider installing this bird detection system at the Project, if it proves effective.
- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions. All new employees will undergo an employee orientation program that will enhance wildlife awareness, minimize impacts to natural resources, and facilitate employee understanding of their respective roles in ensuring compliance with the Project permit conditions and commitments. Any known occurrence or habitat of federal listed species or other species of concern identified within construction areas will be included in the training.
- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress.
- Fire hazards from vehicles and human activities will be reduced (e.g., use spark arrestors on power equipment; avoid driving vehicles off roads; and allow smoking in designated areas only).
- Federal and state measures for handling toxic substances will be followed.
- Effects to wetlands and water resources will be minimized by following provisions of the Clean Water Act (1972).
- Project personnel and all contractors will be instructed to remove garbage promptly at the end of each day, to avoid creating attractive scavenging opportunities for birds.
- PWPI will implement a Wildlife Incident Reporting System (WIRS) at the start of operations (see Section 5.6 below). The WIRS will be implemented for the life of operations for the Project.
- All permanent met towers will be un-guyed.
- All met towers and wind turbines that are no longer operational will be removed.
- If snow removal is needed, roads will be plowed so as not to impede ungulate movement. Snow banks can cause ungulates to run along roads, resulting in their colliding with vehicles. Roadside carcasses attract raptors, subjecting them to collision as well.
- Weed control plan will be implemented.
- Wildlife Conservation Plan will be implemented.

5.4 Measures to Minimize Habitat Loss/Degradation/Fragmentation

- Changes in land cover, and specifically in greater sage-grouse and bat habitat, after construction, will be compared with pre-construction habitat assessments.
- Areas temporarily disturbed during construction will be reclaimed according to the reclamation plan that was developed for the Project.

  - Topsoil will be stockpiled in discrete rows or piles along the edge of the disturbed area.
  - Topsoil will be segregated from subsoil excavated from trenches or cleared areas.
  - Stockpiled topsoil will be redistributed and re-graded across the temporary use site upon completion of construction activities.
  - Work area soils will be amended to a condition where surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural re-vegetation, provide for proper drainage, and prevent erosion.
  - Disturbed areas will be revegetated (in coordination with landowners and pending land owner approval) to establish self-perpetuating native plant communities (or pasture grasses at landowner's request) capable of supporting existing and future land uses.
  - Post-seeding erosion control measures and monitoring will be implemented until soils are stabilized by vegetation growth from planting and/or reseeding.
  - Noxious weeds will be controlled.
- Areas where long-term infrastructure was sited will be reclaimed upon project decommissioning according to a predetermined reclamation plan (Stantec Consulting Services Inc. 2015).
  - Compacted soils will be amended; regrading to natural or near-natural topographic contours (where appropriate) will occur; and other soil conservation, surface manipulation, and water management techniques will be implemented to landowner satisfaction to establish stable slopes, watercourses, and drainage features to minimize erosion and sedimentation (also protecting surface water and groundwater resources). This includes tilling compacted soils in areas subjected to compaction in a manner adequate to restore the topsoil and subgrade material to the density consistent with the surrounding area.
  - Disturbed areas will be revegetated (in coordination with landowners and pending land owner approval) with habitat-appropriate seed mixtures (or seed mixtures desired by the landowners) to establish self-perpetuating native plant communities (or pasture grasses at landowner's request) capable of supporting existing and future land uses.
  - Noxious weeds will be controlled
- The reclamation plan will include a pre-disturbance assessment, management of soil for restoration, erosion control, re-vegetation, accelerating reclamation, stewardship and reclamation success.
  - Reclamation will be implemented, managed, and routinely monitored by PWPI with oversight/approval from WGFD and the Technical Advisory Committee (TAC; see below for additional discussions regarding the TAC); additional input to these success standards will be provided by representatives of project area landowners.
- Noxious weed monitoring and management
  - Access roads, turbine pads, staging areas, and other project-related soil disturbances will be inspected regularly to ensure that noxious/invasive weeds do not become established on newly disturbed sites.

  - If use of herbicides is deemed necessary, they will be used only in the season or growth stage during which they are most effective and with mutual consent of the landowner. Herbicides will be applied only by certified personnel using approved precautions and application procedures in compliance with all applicable federal, state, and local regulations.
  - Pesticide Use Reports and Pesticide Application Records will be submitted in an annual report, in addition to a weed management plan.
  - Water-safe herbicides used within 100 feet of open water will be applied by backpack sprayers or other appropriate gear; application during extremely windy conditions will be avoided.
  - Certified weed-free seed mixtures and mulches will be used, thereby minimizing the potential for noxious weed introduction.
  - Weed control methods shall be in accordance with guidelines, rules, laws, and regulations established by the Environmental Protection Agency, and state and local authorities and agencies.
- PWPI and its contractor(s) will conduct a pre-construction site visit and yearly site visits with the WGFD, WDEQ–Water Quality Division, and landowners. The pre-construction site visit will identify BMPs, road infrastructure improvements, and associated monitoring to reduce impacts to stream channels and aquatic species (WGFD 2010).

6.0 Post-construction Studies to Estimate Impacts (WEG Tiers 4 and 5)

6.1 Mortality Monitoring

The Project will be subject to a minimum of two years of post-construction monitoring for birds and bats, unless additional monitoring is indicated as appropriate and agreed upon by PWPI. Post-construction monitoring shall begin within two weeks after the initiation of commercial operation of the Project.

Consistent with necessary permits (e.g. a Special Purpose Utility Permit (SPUT) from the Migratory Bird Program), PWPI or its consultants will remove all carcasses identified during post-construction monitoring (with the exception of carcasses being used for post-construction bias trials). These surveys will be completed regularly to document the number and species of bird and bat fatalities attributable to the Project. The methods for estimating mortality at the Project will conform to peer-reviewed standards in the U.S. As part of these mortality surveys, the searcher efficiency rate (i.e., the ability of a surveyor to locate a mortality) and carcass removal rate (i.e., the average time that a carcass persists before a scavenger removes it) will be determined and used to adjust mortality estimates, as appropriate, for bats and small and large bird size classes. The frequency of monitoring will be informed based on the results of the carcass removal studies and will be designed to meet the objectives of the monitoring program. Based on communication with USFWS regarding a recommended study design for large birds (particularly eagles), PWPI intends to monitor 100% of the turbines every other week throughout the year. Square search plots (160m X 160m) will be established at each turbine and transects will be

spaced approximately 10-20m apart within the plot. PWPI would like to use large raptors for observer bias and scavenger removal trials if made available by the agencies. In the event that large raptors are not available, then mallards or the best available surrogates will be used for trials.

6.2 Post-construction Continuation of Before/After-Control Impact Surveys

Surveys conducted during the pre-construction field study that will be repeated for two years after Project construction include point counts, long-distance raptor point counts, raptor nest searches, golden eagle winter roost survey, winter raptor surveys, passive acoustic monitoring for bats, greater sage-grouse lek counts, as well as habitat evaluations (see below). The methods of the post-construction surveys will mirror those employed during the pre-construction baseline study.

Point counts and long-distance raptor surveys will be conducted at each fixed-point count location weekly form April 1 – June 30 and from August 15 – November 15. Winter raptor surveys will be long-distance surveys, occurring approximately every three weeks, from early December through late March. Raptor nest searches will be conducted in the time frame identified in WGFD's Recommendations (2010). Both MET and mobile passive acoustic surveys for bats will be repeated post-construction between April 15 and October 15. Greater sage-grouse lek counts will occur at all three leks in the Project area in late March or April and will follow WGFD protocols.

6.3 Habitat Surveys

Post-construction habitat surveys will be conducted to quantify changes in land cover. Post-construction habitat analysis will be conducted using a similar manner as pre-construction surveys to quantify changes to vegetation. Post-construction habitat changes will be reported in both acreages and percentages using the vegetation classes used during pre-construction surveys, and locations where reclamation efforts could be focused will be identified.

A post-construction greater sage-grouse habitat assessment will be conducted following a similar approach as the pre-construction habitat assessment. The analysis will quantify changes to and the loss of potential sage-grouse nesting and brood rearing habitat in the Project area. The total area and percentage of habitat within and adjacent to the Project before and after construction will be analyzed.

The bat habitat evaluation will be repeated after construction of the Project to quantify the loss of bat habitat. The total area and percentage of foraging and roosting habitat before and after Project construction will be reported.

7.0 Adaptive Management

In communication with the appropriate agencies, PWPI will discuss the need for mitigation or experimental conservation measures if post-construction monitoring efforts indicate that impacts to birds and bats are higher than anticipated. Eagle specific adaptive management measures are included in the Project's ECP. A framework for the adaptive management process has been adopted from the recommendations in the USFWS Region 6 Outline for a Bird and Bat

Conservation Strategy: Wind Energy Projects. The following framework will be used to direct the adaptive management process for the Project:

A. Evaluate need for action (1) based on assessing effectiveness of conservation measures through post-construction monitoring of impacts, or (2) as determined by unforeseen impacts or circumstances.
B. Identify potential technical/operational option(s) to avoid and minimize impacts (e.g., via scientific literature or industry innovation).
C. Present technical/operational option(s) to TAC for review to determine if it merits field testing or application. If, after review, field testing or application is not merited, go to step B. If field testing or application is merited, go to step D.
D. Field test or apply technical/operational option(s), with agency/authority concurrence of methods, in settings which will not increase adverse impacts to birds and bats nor will result in impacts exceeding those allowable in permits or other project-related plans.
E. Evaluate and report effectiveness of technical/operational option(s) with review by agency/authority. If ineffective, go to step B. If effective go to step F.
F. Apply effective avoidance and minimization measures.
G. Monitor effectiveness (update post-construction monitoring in BBCS, if necessary, with agency/authority review).
H. Update BBCS Section on Conservation Measures, return to step A to evaluate need for further action.

8.0 Project Permits Addressing Birds and Bats

8.1 Bird and Bat Permits

As indicated above in 6.1, a USFWS Special Purpose Utility Permit (SPUT) from the Migratory Bird Program, will be required before any migratory bird carcass can be collected at the Project. In addition, PWPI is currently pursuing an Incidental Take Permit for eagles from the USFWS Migratory Bird Program as well. At the state level, two WGFD permits will be required to address potential and likely issues that arise during post-construction monitoring: a Chapter 10 Permit and a Chapter 33 Permit. A Chapter 10 Permit is required to “import, possess, confine, transport, sell, and/or dispose of live wildlife”. This permit should be obtained in the event that a bird is injured by Project operations and requires minor on-site rehabilitation or transport from the Project to a permitted Wyoming rehabilitator. A Chapter 33 Permit is similar to a federal Salvage permit and pertains to both birds and small mammals. This permit allows the permit holder to salvage and transport birds and small mammals. Dead birds are to be disposed of as directed by the WGFD Glenrock Game Warden, and small mammals (i.e., bats) are to be disposed of as directed by the WGFD nongame biologists.

8.2 Agency and Process for Permit Issuance

The USFWS Migratory Bird Permit Office (MBPO) is the responsive agency for obtaining project salvage permits and incidental take permits for eagles. Each bird collected must be tagged with the following information: date and location of specimen salvaged, and the name of the person

who salvaged the specimen. The permit number under which the specimen was salvaged must be recorded in the permanent accession record. All birds must be deposited with the repository designated on your permit (or as directed on the permit) within 6 months and/or by December 31 of that calendar year. An annual report must be submitted to the issuing MBPO by January 31. Salvage permits can be renewed by sending a completed renewal application to the Regional MBPO at least 30 days prior to the expiration of the current permit. The Region 6 MBPO is located in Denver, Colorado. The Salvage permit application and Region 6 MBPO contact information is available online at http://www.fws.gov/forms/3-200-10a.pdf.

The Wyoming Game and Fish Commissions issues Chapter 10 and Chapter 33 Permits through the WGFD. The WGFD applications to obtain either a Chapter 10 Permit or a Chapter 33 Permit are self-explanatory and are available on the department's website. Each permit requires its own application. The Permit applications must be submitted to the local game warden for initial approval. The applications must be received by the WGFD at least 20 working days prior to the issuance of the permit. Copies of any required federal permits for the take or possession of wildlife must accompany the permit applications. Permit applications must be submitted to the WGFD permitting officer at the Casper Region field office.

9.0 Reporting Formats and Schedule

A. Preconstruction Survey Data

Pre-construction baseline bird and bat study results have been provided to the WGFD and the USFWS.

B. Operation/Post-construction Monitoring

Within 30 days of the end of each survey year a Post-Construction Wildlife Monitoring Report will be provided by PWPI to the WGFD (Habitat Protection Office and appropriate Regional Office) for distribution to the TAC (including USFWS). This report will include all research and monitoring methods and results, including: 1) results, analysis, and discussion of avian, bat, and greater sage-grouse use surveys, including comparison to pre-construction survey results; 2) results, analysis, and discussion of fatality-monitoring searches, including results of carcass removal and searcher efficiency trials; and 3) analysis and discussion of annual fatality rates per MW or per turbine. The report will be submitted each year within the first two years following construction. Additional reporting requirements beyond the two-year post-construction period will be determined by the TAC.

10.0 Personnel Training

Prior to the start of construction, all employees, contractors and subcontractors will undergo an employee orientation program that will enhance wildlife awareness, minimize impacts to natural resources, and facilitate employee understanding of their respective roles in ensuring compliance with the Project permit conditions and commitments. Any known occurrence or habitat of federal

listed species or other species of concern identified within construction areas will be included in the training.

10.1 Wildlife Incident Report and Handling System

In addition to the post-construction fatality monitoring study described above, PWPI will implement a Wildlife Incident Reporting System (WIRS) at the start of operations, and it will remain active for the life of the Project. The purpose of the WIRS is to standardize the actions taken by site personnel in response to wildlife incidents encountered at the Project and to fulfill the obligations for reporting wildlife incidents. The WIRS will be utilized by site operations and maintenance personnel who encounter dead or injured birds or bats incidentally while conducting general wind facility or transmission line maintenance activities. The WIRS is designed to provide a means of recording and collecting (but only if the appropriate permits have been previously obtained) fatalities at the Project to increase the understanding of wind turbine and wildlife interactions. During standardized post construction monitoring studies, any carcass found incidentally by site operations and maintenance personnel will be reported to the contractor conducting the post construction monitoring studies so that the contractor can process the carcass. Any carcasses found incidentally within the standardized search plots will be included in fatality estimates. Additionally, consistent with the appropriate permits/authorizations, any native bird or bat found injured within the Project will be taken to the nearest appropriate wildlife rehabilitation facility as directed in the WIRS. Any incident (i.e. mortality or injury) involving a federally listed threatened or endangered species or a bald or golden eagle will be reported to the USFWS within 24 hours of identification. PWPI maintains an ongoing commitment to investigate wildlife incidents involving company facilities and to work cooperatively with federal and state agencies in an effort to prevent and mitigate future bird and wildlife fatalities. It is the responsibility of PWPI employees and subcontractors to report all avian incidents to their immediate supervisor.

11.0 Contacts/Key Resources

11.1 List of Contacts and Key Resources

Primary contacts for agency personnel include:

Patricia Sweanor Wildlife Biologist Energy Program Coordinator USFWS Wyoming Field Office 5353 Yellowstone Road, Suite 308A Cheyenne, WY 82009 (307) 772-2374	Kevin Kritz Wildlife Biologist Mountain Prairie Region U.S. Fish and Wildlife Service 303-236-4416
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12.0 References

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Public Interest Energy Research Program (PIER) Final Project Report CEC-500-2006-022. Edison Electric Institute, APLIC, and the California Energy Commission. Washington D.C. and Sacramento, California.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC, Washington D.C.

Baerwald, E. F. 2008. Variation in the Activity and Fatality of Migratory Bats at Wind Energy Facilities in Southern Alberta: Causes and Consequences. Thesis. University of Calgary, Calgary, Alberta, Canada.

BioResource Consultants, Inc. (BRC). 2012. Avian Mortality Monitoring Report, Pine Tree Wind Farm, Kern County, California. Prepared for the City of Los Angeles Department of Water and Power. Report prepared by BioResource Consultants, Inc., Ojai, California. March 26, 2012.

Brown, W. K. and B. L. Hamilton. 2006. Monitoring of Bird and Bat Collisions with Wind Turbines at the Summerview Wind Power Project, Alberta: 2005-2006. Prepared for Vision Quest Windelectric, Calgary, Alberta by TAEM Ltd., Calgary, Alberta, and BLH Environmental Services, Pincher Creek, Alberta. September 2006. http://www.batsandwind.org/pdf/Brown2006.pdf

Chatfield, A., W. Erickson, and K. Bay. 2009. Avian and Bat Fatality Study, Dillon Wind-Energy Facility, Riverside County, California. Final Report: March 26, 2008 - March 26, 2009. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 3, 2009.

Chatfield, A., M. Sonnenberg, and K. Bay. 2012. Avian and Bat Mortality Monitoring at the Alta-Oak Creek Mojave Project, Kern County, California. Final Report for the First Year of Operation March 22, 2011 – June 15, 2012. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 12, 2012.

Chatfield, A., D. Riser-Espinoza, and K. Bay. 2014. Bird and Bat Mortality Monitoring at the Alta Wind Energy Center, Phases I - V, Kern County, California. Final Report for the Second Year of Operation: March 4, 2013 - March 6, 2014. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 22, 2014.

Colorado Division of Wildlife. 2007. Recommended Survey Protocol and Actions to Protect Nesting Burrowing Owls When Conducting Prairie Dog Control. Colorado Division of Wildlife, Denver.

Conway, C.J., and J.C. Simon. 2003. Comparison of detection probablity associated with Burrowing Owl survey methods. Journal of Wildlife Management 67:501-511.

Cryan, P.M. and R.M.R. Barclay. 2009. Causes of bat fatalities at wind turbines: Hypotheses and predictions. Journal of Mammalogy. 90(6): 1330-1340.

Dolbeer, R. A., S. E. Wright, M. J. Begier, and J. Weller. 2009. Wildlife Strikes to Civil Aircraft in the United States 1990-2008. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 15. Report of the Associate Administrator of Airports Office of Airport Safety and Standards & Certification, Washington, DC.

Dooling, R. 2002. Avian Hearing and the Avoidance of Wind Turbines. NREL/TP-500-30844. National Renewable Energy Laboratory. Golden, Colorado.

Downes, S. and R. Gritski. 2012a. Harvest Wind Project Wildlife Monitoring Report: January 2010 – January 2012. Prepared for Harvest Wind Project, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Downes, S. and R. Gritski. 2012b. White Creek Wind I Wildlife Monitoring Report: November 2007 - November 2011. Prepared for White Creek Wind I, LLC, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Enk, T., K. Bay, M. Sonnenberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2010. Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring Second Annual Report, Sherman County, Oregon. January 26, 2009 - December 11, 2009. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc.(WEST) Cheyenne, Wyoming, and Walla Walla, Washington. April 2010.

Enk, T., K. Bay, M. Sonnenberg, J. Flaig, J. R. Boehrs, and A. Palochak. 2011. Year 1 Post-Construction Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase II, Sherman County, Oregon. September 10, 2009 - September 12, 2010. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. January 7, 2011.

Enz, T., K. Bay, S. Nomani, and M. Kesterke. 2011. Bird and Bat Fatality Monitoring Study, Windy Flats and Windy Point II Wind Energy Projects, Klickitat County, Washington. Final Report: February 1, 2010 - January 14, 2011. Prepared for Windy Flats Partners, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 19, 2011.

Enz, T. and K. Bay. 2010. Post-Construction Avian and Bat Fatality Monitoring Study, Tuolumne Wind Project, Klickitat County, Washington. Final Report: April 20, 2009 - April 7, 2010. Prepared for Turlock Irrigation District, Turlock, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 6, 2010.

Erickson, W. P., R. Good, G. Johnson, E. Lack, and J. Jeffrey. 2003. Analysis of Potential Wildlife and Habitat Impacts from the Windtricity Wind Projects, Klickitat County, Washington. Final Report prepared for Windtricity Ventures, LLC., and Northwest Regional Power, LLC., Goldendale, Washington, by WEST, Inc., Cheyenne, Wyoming & Walla Walla, Washington. June 2003.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 2004.

Erickson, W. P., J. Jeffrey, and V. K. Poulton. 2008. Avian and Bat Monitoring: Year 1 Report. Puget Sound Energy Wild Horse Wind Project, Kittitas County, Washington. Prepared for Puget Sound Energy, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 2008.

Erickson, W. P., G. D. Johnson, M. D. Strickland, and K. Kronner. 2000. Avian and Bat Mortality Associated with the Vansycle Wind Project, Umatilla County, Oregon: 1999 Study Year. Final report prepared for Umatilla County Department of Resource Services and Development, Pendleton, Oregon. February 7, 2000.

Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, and R. E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Bird Collision Mortality in the United States. National Wind Coordinating Collaborative (NWCC) Publication and Resource Document. Prepared for the NWCC by WEST, Inc., Cheyenne, Wyoming. August 2001. Available online at: http://www.nationalwind.org/assets/archive/Avian_Collisions_with_Wind_Turbines_-_A_Summary_of_Existing_Studies_and_Comparisons_to_Other_Sources_of_Avian_Collision_Mortality_in_the_United_States__2001_.pdf

Erickson, W. P., G. D. Johnson, and D. P. Young, Jr. 2005a. Summary and Causes of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions. USDA Forest Service Technical Report PSW-GTR-191.

Erickson, W. P., G. D. Johnson, D. P. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared for Bonneville Power Administration, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. December 2002. http://www.bpa.gov/Power/pgc/wind/Avian_and_Bat_Study_12-2002.pdf

Erickson, W. P., K. Kronner, and K. J. Bay. 2007. Stateline 2 Wind Project Wildlife Monitoring Report, January - December 2006. Technical report submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Erickson, W. P., K. Kronner, and R. Gritski. 2003b. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P., K. Kronner, and R. Gritski. 2005b. Nine Canyon Phase II Wind Power Project, Fall 2004 Avian and Bat Monitoring Report: July 2004 – October 2004. Prepared for the Nine Canyon Technical Advisory Committee, Energy Northwest, by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. March 2005.

Erickson, W. P., M. M. Wolfe, K. J. Bay, D. H. Johnson, and J. L. Gehring. 2014. A Comprehensive Analysis of Small Passerine Fatalities from Collisions with Turbines at Wind Energy Facilities. PLoS ONE 9(9): e107491. doi: 10.1371/journal.pone.0107491.

Fiedler, J. K., T. H. Henry, R. D. Tankersley, and C. P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority. June 28, 2007.

Gritski, R., S. Downes, and K. Kronner. 2009a. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring Year One Summary, October 2007-October 2008. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 3, 2009. Available online at: http://www.oregon.gov/energy/Siting/docs/KWP/KWPWildlifeReport040309.pdf

Gritski, R., S. Downes, and K. Kronner. 2009b. Klondike IIIa (Phase 2) Wind Power Project, Wildlife Monitoring Year One Summary, August 2008 - August 2009. Prepared for Iberdrola Renewables, Klondike Wind Power III LLC, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. November 13, 2009. Available online at: http://www.oregon.gov/energy/Siting/docs/KWP/KWPWildlifeReport111309.pdf

Gritski, R., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring: October 2007-October 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21, 2010 (Updated September 2010). Available online at: http://www.oregon.gov/energy/Siting/docs/KWP/KWPWildlifeReport091210.pdf

Gritski, R. and K. Kronner. 2010a. Hay Canyon Wind Power Project Wildlife Monitoring Study: May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Hay Canyon Wind Power Project LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. September 20, 2010.

Gritski, R. and K. Kronner. 2010b. Pebble Springs Wind Power Project Wildlife Monitoring Study: January 2009 - January 2010. Prepared for Iberdrola Renewables, Inc. (IRI), and the Pebble Springs Advisory Committee. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 20, 2010.

Gritski, R., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

Hayes, M.A. 2013. Bats killed in large numbers at United States Wind Energy Facilities. BioScience 63(12): 975-979.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013b. Effectiveness of an Operational Mitigation Experiment to Reduce Bat Fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Hester, S.G., and M.B. Grenier. 2005. A conservation plan for bats in Wyoming. Wyoming Game and Fish Department, Nongame Program, Lander, WY.

Holloran, M.J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to energy development in Wyoming. Journal of Wildlife Management. 74:65-72.

Jeffrey, J. D., V. K. Poulton, K. J. Bay, K. F. Flaig, C. C. Roderick, W. P. Erickson, and J. E. Baker. 2007. Wildlife and Habitat Baseline Study for the Vantage Wind Power Project, Kittitas County, Washington. Final Report. Prepared for Invenergy. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. August 2007. Available online at: https://www.co.kittitas.wa.us/uploads/cds/land-use/Wind%20Farm/WSA-07-01%20Vantage%20Wind%20%20Power%20Project%20Application/VANTAGE_WILDLIFE_BASELINE%20REPORT_8.27.07.pdf

Jeffrey, J.D., W.P. Erickson, K. Bay, M. Sonnenberg, J. Baker, J.R. Boehrs, and A. Palochak. 2009. Horizon Wind Energy, Elkhorn Valley Wind Project, Union County, Oregon, Post-Construction Avian and Bat Monitoring, First Annual Report, January-December 2008. May 4, 2009. Prepared for Telocaset Wind Power Partners, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Walla Walla, Washington.

Jeffrey, J. D., K. Bay, W. P. Erickson, M. Sonneberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2009a. Portland General Electric Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring First Annual Report, Sherman County, Oregon. January 2008 - December 2008. Technical report prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology (WEST) Inc., Cheyenne, Wyoming, and Walla Walla, Washington. April 29, 2009.

Jeffrey, J. D., Young, D.P. Jr., W. P. Erickson, J. Baker, K. Bay, and M. Sonnenberg. 2009b. Puget Sound Energy Hopkins Ridge Wind Project Phase 1, Columbia County, Washington: Post-Construction Avian and Bat Monitoring. Second Annual Report: January - December, 2008. Draft report prepared for Puget Sound Energy, Dayton, Washington, and the Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 20, 2009.

Johnson, G. D., D. P. Young, W. P. Erickson, C. E. Derby, M. D. Strickland, R. E. Good, and J. W. Kern. 2000. Wildlife Monitoring Studies, Seawest Windpower Plant, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 9, 2000.

Johnson, G. D. and W. P. Erickson. 2006. Analysis of Potential Wildlife Impacts from the Proposed Hoctor Ridge and Imrie Ranch South Wind Energy Projects, Klickitat County, Washington. Prepared for Windtricity, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D. and W. P. Erickson. 2011. Avian, Bat and Habitat Cumulative Impacts Associated with Wind Energy Development in the Columbia Plateau Ecoregion of Eastern Washington and Oregon. Prepared for Klickitat County Planning Department, Goldendale Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. May 18, 2011. Available online at: http://www.klickitatcounty.org/planning/filesHtml/200408-EOZ-EIS/cummulative2.pdf

Johnson, G. D., W. P. Erickson, and J. White. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. Technical report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 2003. http://www.west-inc.com

Johnson, G.D., J. Jeffrey, V. Poulton, and K. Bay. 2008. Baseline Ecological Studies for the Goodnoe Hills Wind Energy Project, Klickitat County, Washington. Prepared for Northwest Wind Partners, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST).

Jones and Stokes Associates, Inc. 1995. Avian Use of Proposed Kenetech and Cares Wind Farm Sites in Klickitat County, Washington. Technical Report (JSA 93-303). Prepared for R. W. Beck, Seattle, Washington, by Jones and Stokes Associates, Inc., Bellevue, Washington. January 31.

Kerlinger, P., L. Culp, and R. Curry. 2005. Post-Construction Avian Monitoring Study for the High Winds Wind Power Project, Solano County, California. Year One Report. Prepared for High Winds, LLC and FPL Energy.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009. Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California. Final Report: October 2009. Third Year Report (Revised 2010). Prepared for Iberdrola Renewables, Inc. (IRI). Prepared by Curry and Kerlinger, LLC., McLean, Virginia.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010. Post-Construction Avian Monitoring Study for the Shiloh II Wind Power Project, Solano County, California. Year One Report. Prepared for enXco Development Inc. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. September 2010.

Klem, D. Jr. 1990. Collisions between Birds and Windows: Mortality and Prevention. Journal of Field Ornithology 61(1): 120-128.

Kronner, K., R. Gritski, and S. Downes. 2008. Big Horn Wind Power Project Wildlife Fatality Monitoring Study: 2006−2007. Final report prepared for PPM Energy and the Big Horn Wind Project Technical Advisory Committee by Northwest Wildlife Consultants, Inc. (NWC), Mid-Columbia Field Office, Goldendale, Washington. June 1, 2008.

Kunz, T.H., E.B. Arnett, W.P. Erickson, A.R. Hoar, G.D. Johnson, R.P. Larkin, M.D. Strickland, R.W. Thresher, and M.D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

LeBeau, C.W., Evaluation of Greater Sage-Grouse Reproductive Habitat and Response to Wind Energy Development in South-Central, Wyoming, MS, Department of Ecosystem Science and Management, August 2012.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D. G. Bert, L. M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M. L. Avery, R. L. Crawford, A.M. Manville, II, E. R. Travis, and D. Drake. 2012. An Estimate of Avian Mortality at Communication Towers in the United States and Canada. PLoS ONE 7(4): e34025; doi: 34010.31371/journal.pone.0034025.

Loss, S. R., T. Will, and P. P. Marra. 2013. The Impact of Free-Ranging Domestic Cats on Wildlife of the United States. Natural Communications 4: 1396; doi: 1310.1038/ncomms2380.

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C. www.nap.edu

Northwest Wildlife Consultants, Inc. (NWC) and Western EcoSystems Technology, Inc. (WEST). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.

Pimentel, D., L. McLaughlin, A. Zepp, B. Lakitan, T. Kraus, P. Kleinman, F. Vancini, W. J. Roach, E. Graap, W. S. Keeton, and G. Selig. 1991. Environmental and Economic Impacts of Reducing U.S. Agricultural Pesticide Use. Pp. 679-718. *In*: Handbook of Pest Management in Agriculture. Second Edition. D. Pimentel, ed. CRC Press, Boca Raton, Florida.

Robel, R.J. J.A. Harrington, C. A. Hagen, J.C. Pitman, and R.R. Recker. 2004. Effect of energy development and human activity on the use of sand sagebrush habitat by lesser prairie-chickens in southwestern Kansas. Trans. No. Amer. Resour.Conf. 69:251-266.

Pruett, C.L., M.A. Patten, and D.H. Wolfe. 2009. Avoidance behavior by prairie grouse: Implications for wind energy development. Conservation Biology 23:1253-1259.

Smallwood, K. S. 2013. Comparing Bird and Bat Fatality-Rate Estimates among North American Wind-Energy Projects. Wildlife Society Bulletin 37(1): 19-33; doi: 10.1002/wsb.1260.

Strickland, M. D. 2004. Non-Fatality and Habitat Impacts on Birds from Wind Energy Development. S. S. Schwartz, ed. *In*: Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts.Washington, DC. May 18-19, 2004. September 2004. Prepared by RESOLVE, Inc. Washington, D.C.

SWCA. 2012. Final Biological Pre-Construction Survey Report for the Pioneer Wind Park Wildlife Study Area. Prepared for Pioneer Wind Park, LLC. Prepared by SWCA Environmental Consultants. June 2012.

SWCA. 2014. Conservation Plan for Pioneer Wind Parks I and II, Converse County, Wyoming. Prepared for Pioneer Wind Park I, LLC and Pioneer Wind Park II, LLC. Prepared by SWCA Environmental Consultants. March 2014.

Thompson, J. and K. Bay. 2012. Post-Construction Fatality Surveys for the Dry Lake II Wind Project: February 2011 – February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 6, 2012.

Thompson, J., D. Solick, and K. Bay. 2011. Post-Construction Fatality Surveys for the Dry Lake Phase I Wind Project. Iberdrola Renewables: September 2009 - November 2010. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 10, 2011.

Tierney, R. 2007. Buffalo Gap I Wind Farm Avian Mortality Study: February 2006-January 2007. Final Survey Report. Prepared for AES SeaWest, Inc. TRC, Albuquerque, New Mexico. TRC Report No. 110766-C-01. May 2007.

URS Corporation. 2010a. Final Goodnoe Hills Wind Project Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 16, 2010.

URS Corporation. 2010b. Final Marengo I Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

URS Corporation. 2010c. Final Marengo II Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

URS Corporation (URS). 2009. Goodnoe Hills Avian/Bat Mortality Monitoring First Quarterly Findings. Technical memorandum to PacifiCorp Technical Advisory Committee. Prepared by Kidder, W., and D. Every, URS. CUP # 2003-10, 2003-12, and EOZ 2006-02. June 22, 2009.

US Fish and Wildlife Service (USFWS). 2002. Migratory Bird Mortality: Many Human-Caused Threats Afflict Our Bird Populations. USFWS Division of Migratory Bird Management, Arlington, Virginia. January 2002. Available online at: http://www.fws.gov/birds/mortality-fact-sheet.pdf

US Fish and Wildlife Service (USFWS). 2009a. Migratory Bird Mortality in Oilfield Wastewater Disposal Facilities Wyoming Ecological Services Field Office - Environmental Contaminants Program. Available online at: http://www.fws.gov/mountain-prairie/contaminants/documents/COWDFBirdMortality.pdf

US Fish and Wildlife Service (USFWS). 2009b. United States Fish and Wildlife Service, Department of the Interior. 50 CFR 13 and 22. Eagle Permits; Take Necessary to Protect Interests in Particular Localities. 74 Federal Register (FR) 46836-46879. September 11, 2009.

US Fish and Wildlife Service (USFWS). 2010. Wetlands Mapper. National Wetland Inventory, U.S. Fisha dn Wildlife Service, U.S. Department fo the Interior. Available online at http://www.fws.gov/wetlands/Data/Mapper.html. Accessed October 2010.

US Fish and Wildlife Service (USFWS). 2012. Final Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/windenergy/docs/WEG_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy. Version 2. Division of Migratory Bird Management, USFWS. April 2013. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

US Geological Survey (USGS). 2006. National Land Cover Database (NLCD) Land Use/Land Cover, NLCD 2001. USGS Headquarters, USGS National Center. Reston, Virginia.

Wasatch Wind Intermountain, LLC. 2011. Decommissioning plan: Pioneer Wind Park I, LLC/Pioneer Wind Park II, LLC, Converse County, Wyoming.

Western EcoSystems Technology, Inc. (WEST) and Northwest Wildlife Consultants, Inc. (NWC). 2003. Analysis of Potential Avian/Wind Plant Interactions in Klickitat County, Washington. Supplement to the Klickitat County Programmatic Environmental Impact Statement. Prepared for the Resource Development Department, Klickitat County, Goldendale, Washington, by WEST, Cheyenne, Wyoming, and NWC, Pendleton, Oregon. May 2003.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2008. Diablo Winds Wildlife Monitoring Progress Report: March 2005 – February 2007. Prepared by WEST, Cheyenne, Wyoming. August 2008.

Wyoming Game and Fish Department (WGFD). 2010. Widlife protection recommendations for wind energy development in Wyoming. Wyoming Game and Fish Commission approved version dated April 23, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

Young, D.P. Jr., W. P. Erickson, J. Jeffrey, and V. K. Poulton. 2007. Puget Sound Energy Hopkins Ridge Wind Project Phase 1 Post-Construction Avian and Bat Monitoring First Annual Report, January - December 2006. Technical report for Puget Sound Energy, Dayton, Washington and Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Walla Walla, Washington. 25 pp.

Young, D.P. Jr., J. Jeffrey, W. P. Erickson, K. Bay, V. K. Poulton, K. Kronner, R. Gritski, and J. Baker. 2006. Eurus Combine Hills Turbine Ranch. Phase 1 Post Construction Wildlife Monitoring First Annual Report: February 2004 - February 2005. Technical report prepared for Eurus Energy America Corporation, San Diego, California, and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla Washington, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. February 21, 2006.

Young, D.P. Jr., J. D. Jeffrey, K. Bay, and W. P. Erickson. 2009. Puget Sound Energy Hopkins Ridge Wind Project, Phase 1, Columbia County, Washington. Post-Construction Avian and Bat Monitoring, Second Annual Report: January - December, 2008. Prepared for Puget Sound Energy, Dayton, Washington, and the Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. May 20, 2009.

Young, D.P. Jr., G. D. Johnson, W. P. Erickson, M. D. Strickland, R. E. Good, and P. Becker. 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Wind Power Project, Carbon County, Wyoming: November 1998 - June 2002. Technical report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for Pacific Corp, Inc., SeaWest Windpower Inc., and Bureau of Land Management. January 10, 2003. 35 pp. http://www.west-inc.com

Appendix B: Chronology of Agency Communication.

Pioneer Wind Park I (PWPI) has communicated with U.S. Fish and Wildlife (USFWS) and Wyoming Game and Fish Department (WGFD) throughout the development process for the Pioneer Wind Park. Beginning in 2010, PWPI has regularly communicated with the USFWS and the WGFD in regards to the Project. Communication has included many phone calls, e-mails, and in-person meetings throughout the development of the Project. A number of meetings have been held to discuss the proposed Project including a site visit that was attended by USFWS and WGFD. Study designs for the two years of baseline data collection were developed with input from USFWS and WGFD, and the results of the studies have been provided to USFWS and WGFD. PWPI utilized recommendations from USFWS to aid in determining a final turbine layout, with the intent of avoiding and minimizing impacts to eagles and other raptor species (USFWS provided a list of highest priority turbines for removal based on site-specific data and topographic features and PWPI removed nine of USFWS's highest priority turbines from the layout; See Section 4.0 below). A number of in-person meetings have been held to discuss the development of the Project's ECP as well as the eagle permit process. PWPI intends to continue working with the USFWS to avoid and minimize impacts to migratory birds including eagles (PWPI is currently developing a BBCS in communication with USFWS). The following chronology provides a list dates for various meetings with USFWS and WGFD. While an attempt has been made to capture all meetings, additional meetings may have taken place beyond what is identified below.

June 9, 2010	Meeting with USFWS
June 30, 2010	Meeting with WGFD
September 17, 2010	Site visit with WGFD
October 5, 2010	Meeting with WGFD
December 12, 2010	Meeting with WGFD and landowners
February 24, 2011	Meeting with WGFD
March 31, 2011	Meeting with WGFD
September 9, 2011	Meeting with USFWS and WGFD
January 6, 2012	Meeting with USFWS and WGFD
March 7, 2012	Meeting with WGFD
October 17, 2012	Meeting with WGFD
November 16, 2012	Meeting with WGFD
February 7, 2013	Meeting with USFWS
April 26, 2013	Meeting with WGFD and USFWS
May 30, 2013	Meeting with USFWS
August 22, 2013	Meeting with USFWS
January 17, 2014	Meeting with USFWS
January 30, 2014	Conference call with USFWS
February 6, 2014	Meeting with WGFD
February 25, 2016	Conference call with USFWS
April 27, 2016	Meeting with USFWS
August 3, 2016	Conference call with USFWS

Appendix C: Baseline Wildlife Studies Conducted within the Pioneer Project.

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Final Biological Pre-Construction Survey Report for the Pioneer Wind Park Wildlife Study Area

Prepared for

Pioneer Wind Park, LLC

Prepared by

SWCA Environmental Consultants

June 2012

Final Biological Pre-Construction Survey Report for the Pioneer Wind Park Wildlife Study Area

Prepared for

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June 2012

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Physiographic Setting 1
1.3 Vegetation 1
1.4 Study Design 5
1.5 Study Site Description 5
2.0 RAPTORS AND LARGE FLOCKS 8
2.1 Raptor Point Surveys 8
2.1.1 Methodology 8
2.1.2 Results and Discussion for Raptor Species 8
2.1.3 Results and Discussion for Non-Raptor Flocks 12
2.2 Raptor Flight Occurrence Analysis 17
2.2.1 Methodology 17
2.2.2 Results and Discussion 18
2.2.3 Raptor Nest Surveys 26
3.0 OTHER RAPTOR SURVEYS 28
3.1 Golden Eagle Roost Site Surveys 28
3.2 Prey Base 29
3.3 Burrowing Owl Survey 29
4.0 MIGRATORY BIRDS 31
4.1 Methodology 31
4.2 Results and Discussion 31
4.2.1 Study Area 31
4.2.2 Spring 33
4.2.3 Summer 34
4.2.4 Fall 34
4.2.5 Winter 35
4.2.6 February 2010 Winter Survey 35
5.0 GREATER SAGE-GROUSE 36
5.1 Lek Sites 36
5.2 Lek Surveys 36
5.3 Lek Counts 37
6.0 BIG GAME 38
6.1 Spring Migration 38
6.2 Fall Migration 38
7.0 AMPHIBIANS 40
7.1 Northern Leopard Frog 40
8.0 REPTILES 40
9.0 AQUATICS 41
10.0 U.S. FISH AND WILDLIFE LISTED SPECIES 42
10.1.1 Sprague's Pipit 43
10.1.2 Ute Ladies'-tresses 44

TABLE OF CONTENTS (continued)

Page
11.0 BATS 45
11.1 Data Analysis 45
11.1.1 Low Frequency Bats 47
11.1.2 Mid-Frequency Bats 47
11.1.3 High Frequency Bats 47
11.2 Habitat Evaluation 47
11.3 MET-based Surveys 48
11.3.1 Results and Discussion 48
11.4 Mobile Passive Surveys 51
11.4.1 Results and Discussion 53
11.5 Active Acoustic Surveys 54
12.0 REFERENCES 55

LIST OF TABLES

Table **Page**
1 Land Cover within the Study Area 3
2 Raptors[1] Recorded on all Raptor Point Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March–11 November 2011 (Year 2). 9
3 Raptors[1] Recorded on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2). 10
4 Raptors[1] Recorded on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2). 11
5 Raptors[1] Recorded on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2). 11
6 Raptors Recorded on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011[1]. 12
7 Non-raptors Recorded on Raptor Point Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–2 March 2012 (Year 2). 13
8 Non-raptors Recorded on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2). 14
9 Non-raptors Recorded on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2). 15
10 Non-raptors Recorded on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2). 15
11 Non-raptors Recorded on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011 (Year 1 only)[1]. 16
12 Raptors Recorded in the RSZ (38–122 m HAGL) on Raptor Monitoring Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2). 18
13 Raptors Recorded in the RSZ (38–122 m HAGL) on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2). ... 24

TABLE OF CONTENTS (continued)

LIST OF TABLES (continued)

Table **Page**

14 Raptors Recorded in the RSZ (38–122 m HAGL) on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2). 24
15 Raptors Recorded in the RSZ (38–122 m HAGL) on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2). 25
16 Raptors Recorded in the RSZ (38–122 m HAGL) on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011 (Year 1 only) and as Incidental Sightings in February 2012 [1]. 25
17 Comparative Summary of the Number of Flocks, Individuals, Mean Use, and Number of Species for all Migratory Bird Survey Points in the Study Area, 13 May 2010–2 March 2011 (Year 1) and 5 April 2011–1 March 2012 (Year 2). 32
18 Species with Minimum 1.0 Bird/Survey Recorded on Migratory Bird Point Surveys in the Study Area, 13 May 2010–2 March 2011 (Year 1) and 5 April 2011–1 March 2012 (Year 2). 33
19 Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Spring Migratory Bird Point Surveys in the Study Area, 13–26 May 2010 (Year 1) and 5 April–31 May 2011 (Year 2). 34
20 Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Summer Migratory Bird Point Surveys in the Study Area, 3–30 June 2010 (Year 1) and 2–30 June 2011 (Year 2). 34
21 Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Fall Migratory Bird Point Surveys in the Study Area, 18 August–13 November 2010 (Year 1) and 17 August–12 November 2011 (Year 2). 35
22 Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Winter Migratory Bird Point Surveys in the Study Area, 12 January–2 March 2011 (Year 1) and 14 February–1 March 2012 (Year 2). 35
23 Number of Individuals and General Habitat for Bird Species Detected on a Late Winter Bird Area Search Survey in the Study Area, 24 February 2010. 36
24 Peak Male Counts for 2010 and 2011, 10-Year (2002–2011) Averages, and # of Years Surveyed in Last 10-Year Period for Leks within the Study Area and the East Casper Core Area. 37
25 Species Listed under the ESA by the USFWS for Converse County, Wyoming. 42
26 Bat Species Comprising Low, Mid-, and High Frequency Groups in Wyoming Based on Characteristic Call Frequency.[1] 46
27 Dates and Survey Effort for MET-based Bat Surveys, 15 April–15 October 2010 and 2011. 50
28 Total Bat Passes and Bat Passes by Frequency and Unidentified Groups for MET-based Bat Surveys, 15 April–15 October 2010 and 2011. 50
29 Dates and Survey Effort for Mobile Bat Surveys, 16 April–15 October 2010[1] and 15 April–15 October 2011. 53

TABLE OF CONTENTS (continued)

LIST OF FIGURES

Figure **Page**
1 Inclusive Study Area boundary for the Pioneer Wind Parks I and II. 2
2 Dominant vegetative groups identified through LANDFIRE land cover data within the Study Area. 4
3 Avian survey locations and proposed turbine layouts for Pioneer Wind Parks I and II within the Study Area. 7
4 Grid-based analysis of all raptor flight paths within the RSZ (minimum two observations), 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2). 20
5 Grid-based analysis of golden eagle flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2). 21
6 Grid-based analysis of ferruginous hawk flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2). 22
7 Grid-based analysis of bald eagle flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2). 23
8 Aerial survey pathway (13 May 2011), ground-based call playback survey points (25–27 May 2011), and observed raptor nests in 2010 and 2011. 27
9 Potential concentrated raptor prey sites involving greater sage-grouse leks, prairie dog colonies, National Wetland Inventory wetlands, and perennial streams. 30
10 Digitized migration pathways of pronghorn and elk herds observed in the Study Area and WGFD big game crucial ranges. 39
11 Potential bat use areas within the Study Area based on LANDFIRE spatial vegetation layers and National Wetland Inventory sites. 49
12 Mean weekly number of bat passes for the MET-based Anabats, 15 April–15 October 2010 and 2011. 51
13 Mobile passive bat survey locations and areas considered potential bat use sites based on LANDFIRE-based habitat evaluation. 52

LIST OF APPENDICES

Appendix
A Biological Survey Protocols for Pioneer Wind Park, Converse County, Wyoming
B Wildlife Species Observed within the Pioneer Wind Park Study Area
C Upland and Wetland Plants Observed within the Pioneer Wind Park Study Area

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Pioneer Wind Park, LLC (Pioneer) has proposed development of two separate 49.6-megawatt (MW) wind energy facilities south of Glenrock, Converse County, Wyoming (Figure 1). The Pioneer Wind Park Wildlife Study Area (Study Area) is the portion of Pioneer's leased lands that contains both proposed PWP I and PWP II project sites, a transmission line corridor, and surrounding non-developmental lands available for before-after, control-impact (BACI) studies.

1.2 PHYSIOGRAPHIC SETTING

The Study Area is located in the foothills of the Laramie Mountains, with elevations ranging from approximately 5,500 to 7,600 feet above mean sea level. The landscape is a series of unglaciated hills, ridges, and foot slopes interspersed with irregular plains and dissected by perennial and intermittent streams (Chapman et al. 2004). Slopes are gentle to very steep (0%–75%) and soils are predominantly loams to sandy loams. Soils are developed from Tertiary formations and Quaternary-aged alluvium and/or residuum derived from granitic parent material. The Study Area includes portions of the middle North Platte sub-basin and contains six sub-watersheds: Lower Deer Creek-North Platte River, North Platte River-Dry Creek, Little Deer Creek, Box Elder Creek-Hunton Creek, Box Elder Creek-Virden Creek, and Middle Deer Creek-North Platte River.

1.3 VEGETATION

Vegetation cover in the Study Area is typical of Foothill Shrublands and Powder River Basin ecoregions (Chapman et al. 2004), dominated by foothill shrubland, sagebrush steppe, and mixed-grass prairies. Foothill shrubland is characterized by montane shrubland consisting of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and mountain mahogany (*Cercocarpus* spp.), surrounded by groves of quaking aspen (*Populus tremuloides*), low-growing common juniper (*Juniperus communis*), and limber pine (*Pinus flexilis*). Deciduous shrubland communities are interrupted by ponderosa pine (*P. ponderosa*) woodlands and savannas that transition into sagebrush steppe and mixed-grass prairies.

Sagebrush steppe is dominated by various densities of Wyoming big sagebrush (*A. t.* ssp. *wyomingensis*) and mountain big sagebrush at higher elevations, with areas of silver sagebrush (*A. cana*) in the lowlands and black sagebrush (*A. nova*) and Wyoming threetip sagebrush (*A. tripartita* ssp. *rupicola*) on exposed, rocky soils. Sagebrush steppe communities are interspersed with bunchgrass/rhizomatous grass communities and allied shrubs, and generally have relatively low forb cover.

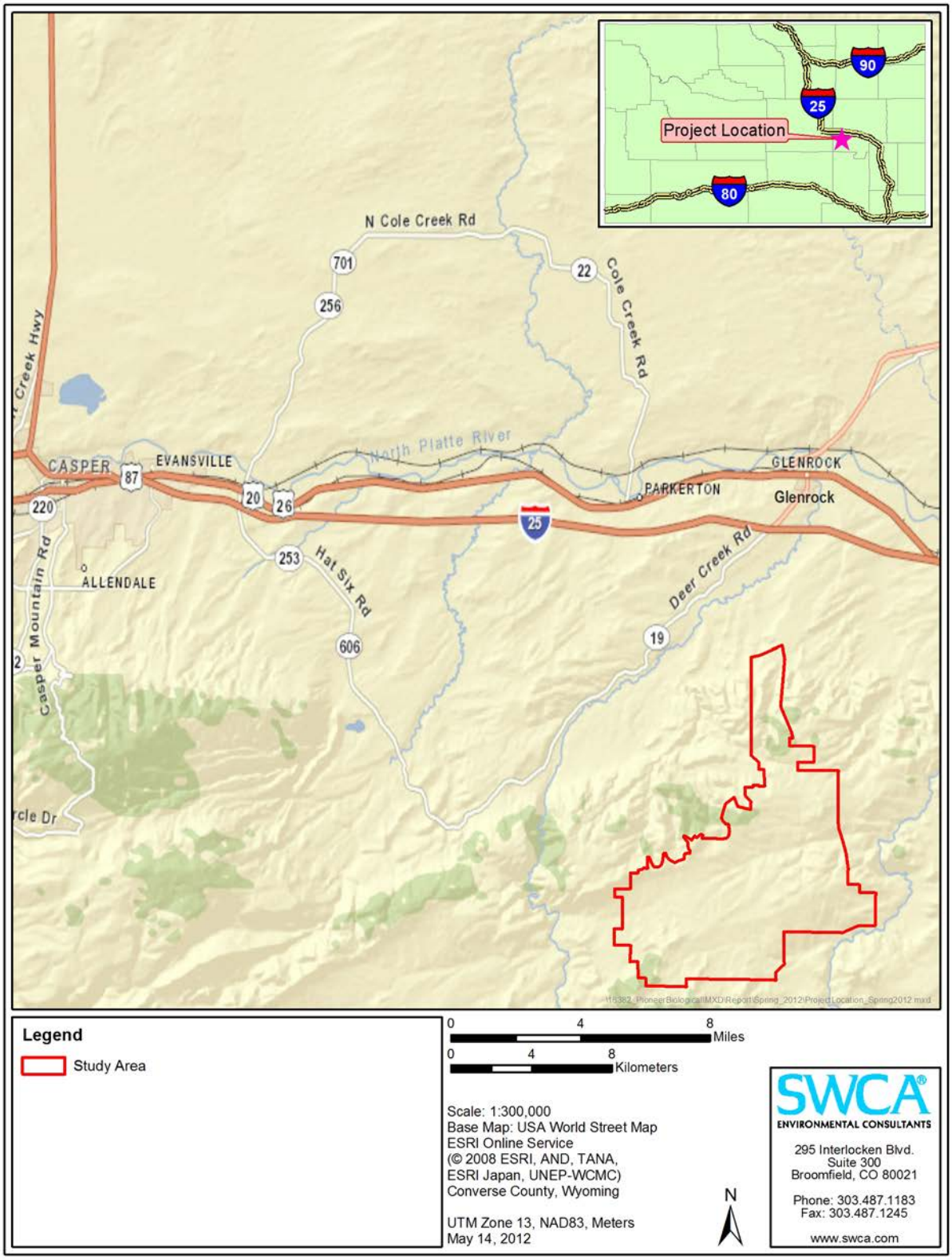

Figure 1. Inclusive Study Area boundary for the Pioneer Wind Parks I and II.

Mixedgrass prairies, including foothill-valley grasslands, are characterized by blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*), needle-and-thread grass (*Hesperostipa comata*), rabbitbrush (*Chyrsothamnus* spp. and *Ericameria* spp.), and fringed sage (*A. frigida*). Mountain mahogany and skunkbush sumac (*Rhus trilobata*) occur on bluffs within the Study Area. Perennial and intermittent streams channel through the Study Area, creating interspersed riparian and wetland areas. Common vegetation in these areas includes peachleaf willow (*Salix amygdaloides*), coyote willow (*S. exigua*), orchard grass (*Dactylis* spp.), foxtail (*Alopecurus* spp.), creeping bentgrass (*Agrostis stolonifera*), redtop (*A. gigantea*), Nebraska sedge (*Carex nebrascensis*), mountain rush (*Juncus arcticus*), bulrush (*Scirpus* spp.), and red clover (*Trifolium pratense*).

The two vegetation ecoregions in the Study Area as described by Chapman et al. (2004) are further divided into 10 vegetation classifications primarily defined by dominant vegetative functional groups and dominant species using LANDFIRE land cover data (U.S. Geological Survey [USGS] 2006). LANDFIRE provides greater resolution of dominant vegetation cover, while ecoregions were identified to provide general descriptions of associated vegetation communities. The LANDFIRE vegetation classifications are Aspen Woodland-Mixed Conifer Forest, Dwarf Sagebrush Steppe, Foothill-Valley Grassland, Mixedgrass Prairie, Montane Grassland and Mesic Meadow, Mountain Mahogany Woodland and Montane Shrubland, Ponderosa Pine Woodland and Savanna, Riparian and Floodplain Systems, Sagebrush Steppe, and Sparsely Vegetated (Figure 2). Additional land cover includes open water or areas that have been exceedingly modified by human development (i.e., developed-open space, introduced upland vegetation, and agriculture-pasture/hay). Approximately 77% of the Study Area (18,361 acres) is covered by either sagebrush steppe (including dwarf sagebrush steppe) or mixed-grass prairie (including foothill-valley grassland), while other less frequently occurring plant communities are more restricted by elevation, topography, soil, hydrology, and development (Table 1).

Table 1. Land Cover within the Study Area.

Vegetation Type	Acres	% Area
Agriculture-Pasture/Hay	23	<1
Aspen Woodland-Mixed Conifer Forest	810	3
Developed-Open Space	1	<1
Dwarf Sagebrush Steppe	5,075	21
Foothill-Valley Grassland	2,145	9
Introduced Upland Vegetation	62	<1
Mixedgrass Prairie	4,672	20
Montane Grassland and Mesic Meadow	19	<1
Mountain Mahogany Woodland and Montane Shrubland	1,495	6
Ponderosa Pine Woodland and Savanna	1,788	8
Riparian and Floodplain Systems	1,269	5
Sagebrush Steppe	6,469	27
Sparsely Vegetated	5	<1
Total	**23,833**	**100**

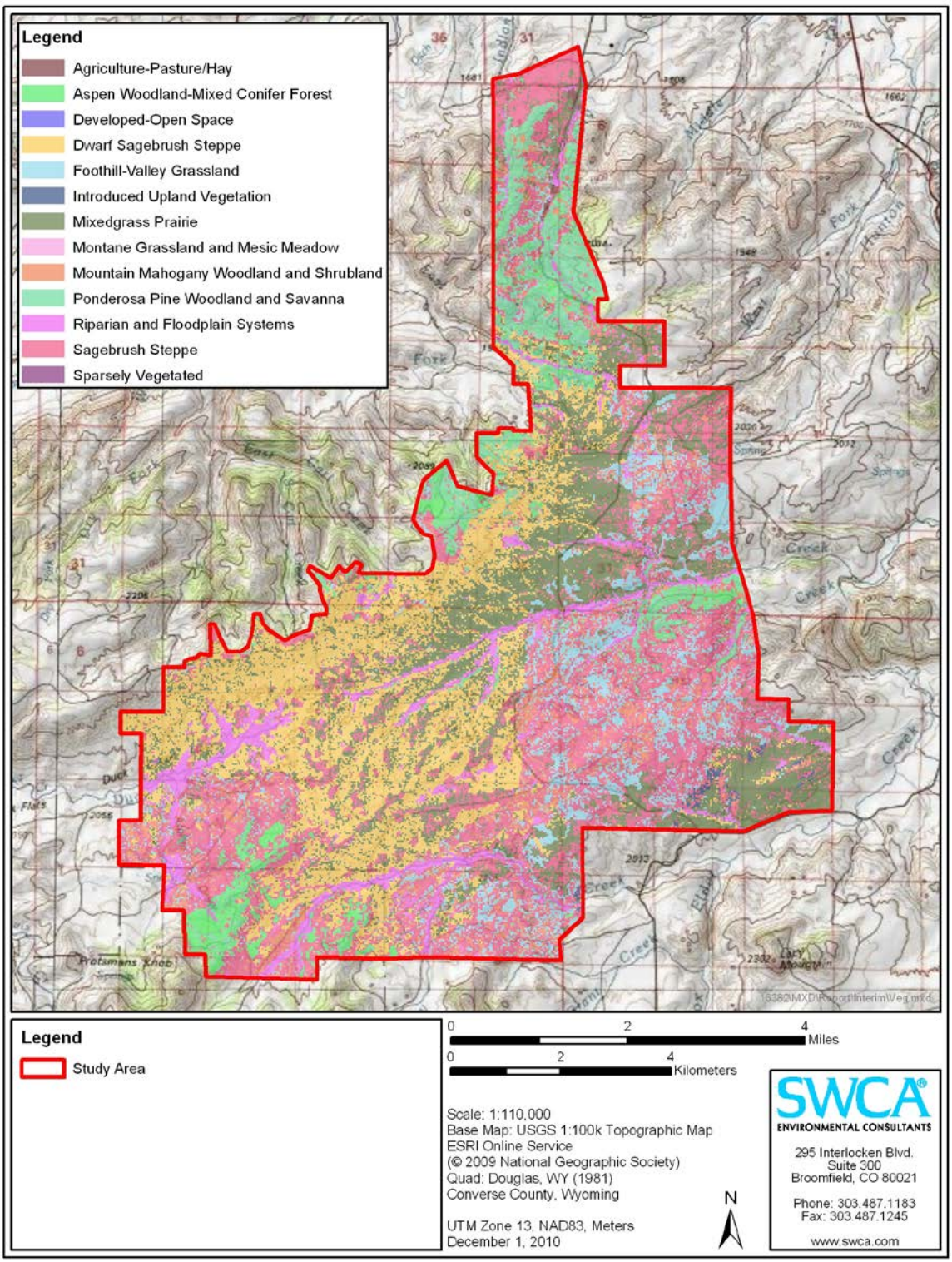

Figure 2. Dominant vegetative groups identified through LANDFIRE land cover data within the Study Area.

1.4 STUDY DESIGN

Representatives for Pioneer and SWCA Environmental Consultants (SWCA) met with the Wyoming Game and Fish Department (WGFD) in Cheyenne, Wyoming, on 11 February 2010 to provide an overview of the project. As a follow up, on 19 March 2010 representatives from the same entities met in Cheyenne to discuss preliminary biological survey protocols developed by SWCA using WGFD's then-recommended guidelines for wind development (dated 26 October 2009) (hereafter this and subsequent versions are referred to as *Recommendations*). At that meeting, WGFD provided copies of the same-day updated draft of the *Recommendations*.

Pioneer subsequently provided a letter to WGFD on 24 March 2010 summarizing the meeting discussions and providing species-specific protocols. A winter bird area search of the two project sites was completed in February 2010 and SWCA initiated regular, systematic migratory bird and raptor surveys on 16 April 2010 based on these meetings. However, response by WGFD on 27 April 2010 to this letter emphasized following another updated version of *Recommendations* from 5 April 2010 (WGFD 2010a); as such, the April guidance document was followed for monitoring efforts at the Pioneer Wind Park beginning in May 2010. Final survey protocols, as agreed upon with a signed WGFD letter on 8 June 2010, are provided in Appendix A.

1.5 STUDY SITE DESCRIPTION

Initially, three sites (PWP I, PWP II, and Reference) were established in the Study Area for BACI avian studies. The PWP I and PWP II study sites encompassed preliminary turbine layouts developed in winter 2009–2010. The third site (Reference Site) was established as a reference area for avian studies conducted within PWP I and PWP II. The Reference Site was selected because of its proximity and topographic, elevational, and vegetative habitat similarities to PWP I and PWP II. Originally, the Reference Site was not proposed for development. However, realignment of the PWP II turbine layout due to avoidance and minimization of impacts to raptors and visual impacts to nearby landowners has resulted in several rows of turbines now planned within the Reference Site. Therefore, to allow for additional flexibility in turbine siting for the PWP I and PWP II projects, the initial study sites have been dissolved and all surveys are now conducted and presented for the entire Study Area (e.g., not on a study site basis as presented in the Year 1 report [SWCA 2010a]). Point counts can be allocated post hoc as either impact (i.e., within the turbine layout footprint) or reference (i.e., outside the footprint) for BACI analyses.

SWCA determined that seven avian survey locations (six fixed-point counts and one raptor monitoring station) would be required to provide adequate coverage of each of the former three study sites (PWP I, PWP II, and the Reference Site). The fixed-point count survey locations were randomly selected and stratified by habitat in proportion to a habitat's percent coverage within the general area of each site. Additional migratory bird survey points and another raptor monitoring location were later incorporated into the survey design for PWP I, the proposed boundaries of which had expanded slightly westward as Pioneer continued discussions with landowners concerned with viewshed issues. These additional survey points were established in August 2010. In January 2011, based on the turbine layout and

infrastructure footprint outlined in Pioneer's Industrial Siting Commission application, two of the three new migratory bird survey points (MBs 9 and 10) and one original survey point (MB 4), as well as the additional raptor monitoring point RM 4 were discontinued from the ongoing study since the remaining survey points provided ample coverage within the proposed PWP I footprint and nearby areas as BACI reference survey points. Figure 3 illustrates the final arrangement of survey points, excluding MBs 4, 9, 10, and RM 4.

Raptor monitoring stations were initially identified using topographic maps to identify high ridgelines for maximum viewshed within the original PWP I, PWP II, and Reference study sites. Raptor monitoring stations were micro-sited in the field to allow for optimal views of the surrounding landscape. These locations remain unchanged during the turbine siting process since these locations provide broad coverage of the Study Area. The Year 1 survey report (SWCA 2010a) provides a viewshed analysis of these points showing portions of the Study Area covered by each survey location.

Multiple biological surveys were conducted as due diligence for the PWP I and PWP II wind parks. Results of these surveys are presented in this report for both Year 1 and Year 2 survey periods collectively for the entire Study Area. Scientific names for all animal and plant species observed within the Study Area are provided in Appendices B and C, respectively. Scientific names for all other species (i.e., those not observed in the Study Area but discussed herein) are provided only the first time the species is mentioned in this report.

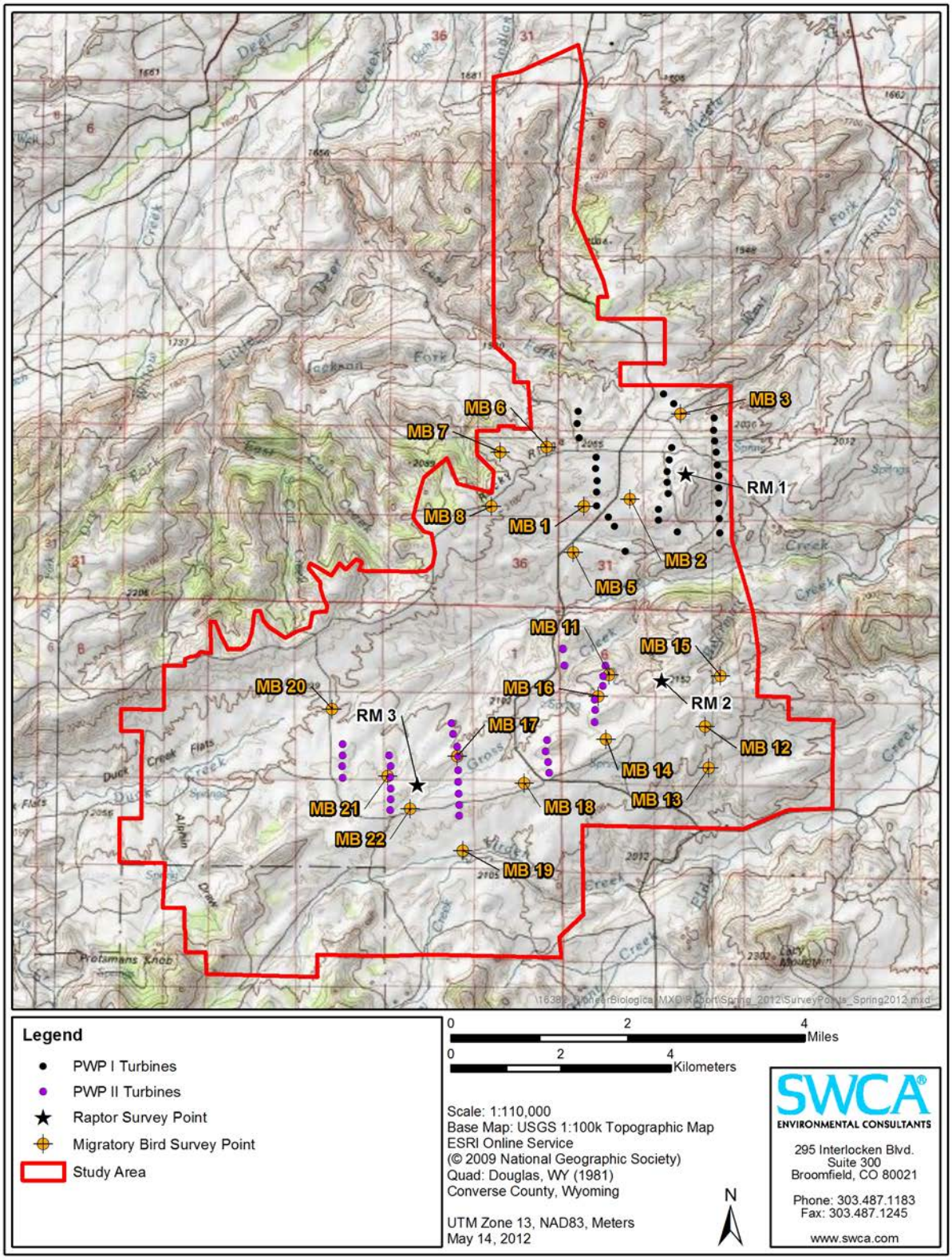

Figure 3. Avian survey locations and proposed turbine layouts for Pioneer Wind Parks I and II within the Study Area.

2.0 RAPTORS AND LARGE FLOCKS

2.1 RAPTOR POINT SURVEYS

2.1.1 Methodology

Raptor point survey locations were initially identified via geographical information system (GIS) vegetation and topographic maps. Survey points were then micro-sited in the field to take advantage of open viewsheds and maximize coverage around each point.

The WGFD *Recommendations* indicated two, 12-week periods for weekly surveys to assess species composition and magnitude of early, mid-, and late season migrants passing through the Study Area. These periods are 1 April–30 June and 15 August–30 November. For each weekly survey, a biologist recorded all raptors, large non-raptor species (e.g., great blue heron, turkey vulture), as well as flocks consisting of four or more individuals regardless of species body size (e.g., migrating longspurs, horned larks) over the course of one calendar day (up to 12 daylight hours). Information collected during surveys included species, number of individuals, age, sex, estimated initial height above ground level (HAGL), estimated maximum and minimum HAGL within the Study Area, flight direction, flight behavior (e.g., soaring, powered flight, hovering), and time of observation. Observers plotted on topographic field maps the flight pathways taken by individuals and flocks. These flight pathways were then digitized into a GIS format. Raptor and non-raptor data were analyzed separately.

2.1.2 Results and Discussion for Raptor Species

Raptor surveys were conducted from 16 April 2010 to 11 November 2011. Additionally, data and flight pathway information were also collected for raptor sightings during, and incidental to, migratory bird surveys in February-March 2012. During this survey period, 49 surveys were completed at RM 1 and 51 surveys at RM 2 and RM 3. Fifteen surveys were conducted at RM 4 from 19 August to 13 January 2011 (Year 1 only). For all sites combined, SWCA conducted 166 surveys for a total of 1,787 hours of survey time (average of 10.8 hours per survey). Table 2 provides a survey period breakdown by Year.

Surveyors recorded 2,733 raptors in 2,455 observations (some observations consisted of multiple individuals) represented by 16 species and 292 unidentified individuals (Table 2). For the entire pre-construction survey period (Year 1 and Year 2, combined) golden eagle was the most commonly recorded species (623 observations; 26% of all raptors detected), followed by American kestrel (317; 13%), red-tailed hawk (336; 13%), and northern harrier (232; 9%).

Table 2. Raptors[1] Recorded on all Raptor Point Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March–11 November 2011 (Year 2).

Species	# of Observations		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 92)	Year 2 (n = 74)
Golden Eagle	248	375	275	438	20	32	64	91
American Kestrel	161	156	192	185	14	14	58	73
Red-tailed Hawk	224	112	243	118	18	9	63	77
Northern Harrier	137	95	144	98	11	7	55	70
Ferruginous Hawk	72	107	74	108	5	8	35	49
Unknown Buteo	82	97	92	108	7	8	42	70
Swainson's Hawk	57	109	76	132	6	10	27	38
Prairie Falcon	53	54	55	55	4	4	39	47
Unknown Raptor	50	13	56	13	4	1	30	14
Rough-legged Hawk	70	22	73	23	5	2	24	14
Bald Eagle	26	29	30	32	2	2	21	20
Merlin	16	12	20	12	1	1	16	14
Cooper's Hawk	13	10	14	10	1	1	10	8
Peregrine Falcon	7	11	7	11	1	1	7	12
Sharp-shinned Hawk	4	3	4	3	<1	<1	4	4
Unknown Eagle	3	5	4	5	<1	<1	3	7
Unknown Large Falcon	3	1	3	1	<1	<1	3	1
Broad-winged Hawk	3	1	3	1	<1	<1	2	1
Unknown Small Falcon	--	1	--	1	--	<1	--	1
Unknown Accipiter	2	6	3	6	<1	<1	2	4
Northern Goshawk	1	3	1	3	<1	<1	1	4
Osprey	1	--	1	--	<1	--	1	--
Total	**1,233**	**1,222**	**1,370**	**1,363**	**100**	**100**	**92***	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

* Seven surveys resulted in no raptor detections; therefore, the percentage of surveys with at least one raptor detection is 92% (85 of 92 surveys). All surveys with no raptor detections occurred during the 2010–2011 winter survey period.

Review of data by season may be useful in detecting shifts in occupancy and/or abundance in the Study Area across a calendar year. Tables 3 through 6 summarize seasonal raptor count data for all survey points for Year 1 and Year 2 survey periods.

Since migratory periods vary between species, survey data beginning in mid-March 2011 are included in the Year 2 spring migration period to account for early migrating species, particularly bald and golden eagles. This early portion of the spring survey season is not included in Year 1 because raptor monitoring surveys did not start until mid-April in 2010.

Year-to-year comparisons are difficult to make for the spring and fall migratory periods due to differences in survey effort caused by increased duration of the spring survey period in 2011 to include March and the number of raptor survey locations (four in fall Year 1 vs. three in Year 2). No winter raptor monitoring surveys were conducted in Year 2, although incidental sightings and detections within 800 meters (m) during migratory bird point-count surveys were recorded. Species are listed by percent occurrence on surveys in Year 2.

Table 3. Raptors[1] Recorded on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2).

Species	# of Observations		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 12)	Year 2 (n = 24)
Golden Eagle	12	100	13	111	16	30	50	92
American Kestrel	15	54	15	63	19	17	75	79
Unknown Buteo	--	34	--	41	--	11	--	75
Northern Harrier	15	30	17	31	22	8	58	63
Red-tailed Hawk	14	29	17	30	22	8	50	63
Ferruginous Hawk	4	22	4	22	5	6	17	54
Prairie Falcon	6	16	6	17	8	5	42	50
Swainson's Hawk	2	19	2	29	3	8	17	25
Merlin	--	6	--	6	--	2	--	21
Unknown Accipiter	--	5	--	5	--	1	--	21
Cooper's Hawk	3	6	3	6	4	2	17	13
Bald Eagle	1	3	1	3	1	1	8	13
Unknown Raptor	1	3	1	3	1	1	8	13
Unknown Eagle	--	4	--	4	--	1	--	17
Rough-legged Hawk	--	1	--	1	--	<1	--	4
Peregrine Falcon	--	1	--	1	--	<1	--	4
Total	**73**	**333**	**79**	**373**	**100**	**100**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Raptor monitoring survey locations and effort were identical during the summer survey period (June only) in Year 1 and Year 2. General patterns of occurrence were similar between years. American kestrel, northern harrier, red-tailed hawk, and golden eagle were the most frequently detected species both years. Notably, the number of golden eagles recorded and frequency of occurrence on surveys was substantially higher in Year 2 than in Year 1.

Table 4. Raptors[1] Recorded on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2).

Species	# of Observations		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 15)	Year 2 (n = 15)
American Kestrel	39	38	40	41	34	18	93	100
Northern Harrier	24	23	24	24	20	11	73	87
Red-tailed Hawk	15	21	16	23	13	10	53	87
Golden Eagle	8	52	9	65	8	29	47	80
Unknown Buteo	1	22	1	24	1	11	7	80
Swainson's Hawk	13	26	15	28	13	13	40	53
Ferruginous Hawk	4	8	5	8	4	4	20	33
Prairie Falcon	5	5	5	5	4	2	33	27
Sharp-shinned Hawk	--	2	--	2	--	1	--	13
Unknown Raptor	1	2	1	2	1	1	7	13
Bald Eagle	3	1	3	1	3	<1	20	7
Peregrine Falcon	--	1	--	1	--	<1	--	7
Total	**113**	**201**	**119**	**224**	**100**	**100**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 5. Raptors[1] Recorded on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2).

Species	# of Observations		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 52)	Year 2 (n = 35)
Golden Eagle	221	223	246	262	21	34	83	94
Red-tailed Hawk	195	62	210	65	18	8	85	83
Northern Harrier	98	42	103	43	9	6	63	69
Unknown Buteo	81	41	91	43	8	6	73	63
American Kestrel	107	64	137	81	12	11	58	57
Prairie Falcon	41	33	43	33	4	4	48	54
Ferruginous Hawk	64	77	65	78	6	10	52	51
Swainson's Hawk	42	64	59	75	5	10	33	40
Bald Eagle	21	25	25	28	2	4	27	31
Rough-legged Hawk	64	21	67	22	6	3	35	26
Peregrine Falcon	7	9	7	9	1	1	12	20
Unknown Raptor	44	8	50	8	4	1	44	14
Merlin	16	6	20	6	2	1	29	14
Cooper's Hawk	10	4	11	4	1	1	13	9
Northern Goshawk	1	3	1	3	<1	<1	2	9
Sharp-shinned Hawk	4	1	4	1	<1	<1	8	3

Species	# of Observations		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 52)	Year 2 (n = 35)
Unknown Large Falcon	3	1	3	1	<1	<1	6	3
Unknown Small Falcon	--	1	--	1	--	<1	--	3
Broad-winged Hawk	3	1	3	1	<1	<1	4	3
Unknown Accipiter	2	1	3	1	<1	<1	4	3
Unknown Eagle	2	1	3	1	<1	<1	4	3
Osprey	1	--	1	--	<1	--	2	--
Total	**1,027**	**688**	**1,152**	**766**	**100**	**100**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

No raptor monitoring surveys were formally conducted during the winter of 2011–2012. Sightings incidental to, and during, migratory bird surveys were recorded and mapped using the raptor monitoring survey protocols. In total, 10 golden eagles and one rough-legged hawk were observed during migratory bird survey work on 14 and 15 February 2012 and one rough-legged hawk during survey work conducted from 28 February to 1 March 2012. The observed occurrences of golden eagle and rough-legged hawk generally follows results from Year 1 when both species were observed in higher numbers during standard raptor monitoring surveys (Table 6).

Table 6. Raptors Recorded on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011 [1].

Species	# of Observations[2]	# of Individuals	% of Total Individuals	% of Surveys Detected (n = 13)
Rough-legged Hawk	6	6	30	31
Golden Eagle	7	7	35	23
Unknown Raptor	4	4	20	23
Bald Eagle	1	1	5	8
Prairie Falcon	1	1	5	8
Unknown Eagle	1	1	5	8
Total	**20**	**20**	**100**	**46**

[1] No raptor point surveys were conducted during winter Year 2.

[2] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

2.1.3 Results and Discussion for Non-Raptor Flocks

Surveyors recorded 6,495 non-raptors in 674 observations represented by 32 species and 585 unidentified individuals (Table 7). For the entire pre-construction survey period (Year 1 and Year 2, combined) turkey vulture was the most frequently recorded species (417 observations totaling 688 individuals; 11% of all non-raptors detected). The highest number of individuals was recorded for common nighthawk (875 individuals in 34 observations; average of 25.7

individuals per observation). The mixed flock category included mixed-species flocks containing two or more of the following species: McCown's longspur, chestnut-collared longspur, horned lark, American pipit, and unknown sparrow species.

Table 7. Non-raptors Recorded on Raptor Point Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–2 March 2012 (Year 2).

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 92)	Year 2 (n = 74)
Turkey Vulture	168	249	322	366	8	15	34	64
Horned Lark	20	7	392	151	10	6	10	8
Common Nighthawk	19	15	525	350	13	14	6	7
Mixed Flock	10	1	227	12	6	<1	6	1
Unknown Passerine	9	2	233	220	6	9	7	3
Gray-crowned Rosy-Finch	8	--	605	--	15	--	4	--
Mountain Bluebird	8	5	208	112	5	5	5	5
Clark's Nutcracker	6	3	126	33	3	1	5	4
Common Raven	7	17	57	223	1	9	6	14
Lark Bunting	--	2	--	176	--	7	--	1
Canada Goose[2]	5	1	205	40	5	2	3	1
American Robin	5	--	76	--	2	--	4	--
Chipping Sparrow	5	4	103	78	3	3	4	4
Brewer's Blackbird	4	6	175	330	4	14	3	7
Violet-green Swallow	--	1	--	30	--	1	--	1
Unknown Finch	--	1	--	80	--	3	--	1
Unknown Sparrow	4	3	160	80	4	3	3	4
Unknown Non-raptor	36	3	183	4	4	<1	20	3
Chestnut-collard Longspur	--	1	--	20	--	1	--	1
McCown's Longspur	--	1	--	10	--	<1	--	1
American Crow	3	--	284	--	7	--	3	--
Greater Sage-Grouse	3	9	14	68	<1	3	3	8
Western Meadowlark	2	1	48	15	1	1	2	1
American White Pelican	2	--	32	--	1	--	2	--
Black-headed Grosbeak	1	--	14	--	<1	--	1	--
White-throated Swift	1	--	12	--	<1	--	1	--
Sandhill Crane	1	--	11	--	<1	--	1	--
Lapland Longspur	1	--	10	--	<1	--	1	--
Unknown Shorebird	1	1	9	24	<1	1	1	1
Cassin's Finch	--	1	--	7	--	<1	--	1
Northern Flicker	1	--	7	--	<1	--	1	--
Tree Swallow	1	--	6	--	<1	--	1	--
Long-eared Owl	1	--	1	--	<1	--	1	--
Great Horned Owl	1	1	1	1	<1	<1	1	1
N. Rough-winged Swallow	1	1	4	11	<1	<1	1	1

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 92)	Year 2 (n = 74)
Great Blue Heron	1	2	2	2	<1	<1	1	3
Tundra Swan[2]	1	--	?	--	<1	--	1	--
Total	**336**	**338**	**4,052**	**2,443**	**100**	**100**	**67**	**91**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

[2] One detection each for Canada goose and tundra swan during fall 2010 surveys (Year 1) did not include number of individuals due to flocks flying within a low-level cloud bank and not visible to the observer. Estimated numbers of individuals based on calls were 20–100 geese and 6–15 swans.

As with the raptor data presented above, Tables 8 through 11 summarize seasonal data for non-raptor flocks. Turkey vulture ranked as the most frequently recorded species for spring, summer, and fall surveys in both survey years. Expectedly, no turkey vultures were recorded in winter. The fall migration surveys recorded more observations and individuals in Year 1 and Year 2 than all other seasonal surveys combined for each respective year.

Table 8. Non-raptors Recorded on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 12)	Year 2 (n = 24)
Turkey Vulture	3	71	3	109	11	22	25	67
Common Raven	--	9	--	33	--	7	--	17
Brewer's Blackbird	--	2	--	250	--	50	--	8
Mountain Bluebird	--	1	--	30	--	6	--	4
Unknown Shorebird	--	1	--	24	--	5	--	4
Unknown Sparrow	--	1	--	20	--	4	--	4
Greater Sage-Grouse	--	2	--	10	--	2	--	4
Horned Lark	--	1	--	9	--	2	--	4
Clark's Nutcracker	--	1	--	7	--	1	--	4
Unknown Species	--	3	--	4	--	1	--	8
Am. White Pelican	1	--	24	--	89	--	8	--
Total	**4**	**92**	**27**	**496**	**100**	**100**	**33**	**88**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 9. Non-raptors Recorded on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 15)	Year 2 (n = 15)
Turkey Vulture	45	70	45	104	75	35	33	93
Great Blue Heron	1	2	2	2	3	1	7	13
Brewer's Blackbird	--	3	--	42	--	14	--	13
Common Raven	--	2	--	130	--	44	--	7
Greater Sage-Grouse	1	2	5	16	8	5	7	7
Am. White Pelican	1	--	8	--	13	--	7	--
Total	**34**	**79**	**60**	**294**	**100**	**100**	**47**	**93**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 10. Non-raptors Recorded on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 52)	Year 2 (n = 35)
Turkey Vulture	134	108	274	153	7	9	52	49
Horned Lark	20	6	392	142	10	9	19	14
Common Nighthawk	19	15	525	350	13	13	12	14
Common Raven	4	6	48	60	1	4	8	14
Greater Sage-Grouse	--	5	--	42	--	3	--	11
Mountain Bluebird	8	4	208	82	5	5	10	9
Chipping Sparrow	5	4	103	78	3	5	8	9
Unknown Passerine	9	2	233	220	6	13	13	6
Clark's Nutcracker	6	2	126	26	3	2	10	6
Unknown Sparrow	4	2	160	60	4	4	6	6
Mixed Flock	10	1	227	12	6	1	12	3
Brewer's Blackbird	4	1	175	38	4	2	6	3
Canada Goose[2]	3	1	195	40	5	2	4	3
Western Meadowlark	2	1	48	15	1	1	4	3
N. Rough-winged Swallow	1	1	4	11	<1	1	2	3
Cassin's Finch	--	1	--	7	--	<1	--	3
Chestnut-collared Longspur	--	1	--	20	--	1	--	3
Lark Bunting	--	2	--	176	--	11	--	3
McCown's Longspur	--	1	--	10	--	1	--	3
Unknown Finch	--	1	--	80	--	5	--	3

Species	# of Observations[1]		# of Individuals		% of Total Individuals		% of Surveys Detected	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 52)	Year 2 (n = 35)
Violet-green Swallow	--	1	--	30	--	2	--	3
American Robin	5	--	76	--	2	--	8	--
American Crow	3	--	284	--	7	--	6	--
Gray-crowned Rosy-Finch	7	--	598	--	15	--	6	--
Unknown Non-raptor	4	--	146	--	4	--	6	--
Black-headed Grosbeak	1	--	14	--	<1	--	2	--
Lapland Longspur	1	--	10	--	<1	--	2	--
Northern Flicker	1	--	7	--	<1	--	2	--
Sandhill Crane	1	--	11	--	<1	--	2	--
Tree Swallow	1	--	6	--	<1	--	2	--
Tundra Swan[2]	1	--	?	--	<1	--	2	--
Unknown Shorebird	1	--	9	--	<1	--	2	--
White-throated Swift	1	--	12	--	<1	--	2	--
Total[3] (24)	**255**	**166**	**3,891**	**1,652**	**100**	**100**	**88**	**91**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

[2] One detection for Canada goose and tundra swan (separate flocks) did not include number of individuals due to flocks flying within a low-level cloud bank and not visible to the observer. Estimated numbers of individuals based on calls were 20–100 geese and 6–15 swans.

[3] Species tally includes McCown's longspurs, chestnut-collared longspurs, horned larks, American pipits, and unknown sparrows that were noted in the mixed flock category.

Table 11. Non-raptors Recorded on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011 (Year 1 only)[1].

Species	# of Observations[2]	# of Individuals	% of Total Individuals	% of Surveys Detected (n = 13)
Greater Sage-Grouse	2	9	28	15
Canada Goose	1	10	31	8
Common Raven	1	6	19	8
Gray-crowned Rosy-Finch	1	7	22	8
Total	**5**	**32**	**100**	**38**

[1] No formal raptor monitoring surveys were conducted during winter 2011–2012.

[2] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

2.2 RAPTOR FLIGHT OCCURRENCE ANALYSIS

2.2.1 Methodology

The raptor flight occurrence analysis categorizes areas within the Study Area based on the perceived risk to raptors of colliding with an operational turbine blade. For this occurrence analysis, SWCA used data from raptor monitoring surveys conducted from 16 April 2010 through 11 November 2011 (166 surveys) and sightings associated with migratory bird surveys in February and March 2012.

To establish occurrence of raptors flying within the rotor-swept zone (RSZ), SWCA assumed a single type of turbine would be used throughout the entire Study Area. Turbine dimensions used in the flight analysis are for a GE 1.6-MW xle wind turbine generator (WTG). This WTG has a nacelle height of 80.0 m and rotor diameter of 82.5 m, giving a RSZ of 38.75 to 121.25 m HAGL. SWCA extended the RSZ to 38 to 122 m for analysis purposes.

The following assumptions apply to SWCA's occurrence analysis as currently analyzed and applied.

1) Raptor use is defined as occupancy and does not account for the number of individuals within a single observation (e.g., groups) or for multiple visits by the same individual raptor.
2) The amount of time spent within the RSZ is unknown and the entire pathway is considered within the RSZ regardless of variation in recorded flight height estimates.
3) Surveys adequately and equally cover the entire area of interest (e.g., PWP I) resulting in no detectability bias.

To assess occurrence within the Study Area, SWCA created a grid system originating from the center point of the Study Area. Each grid cell was 100 by 100 m in size. This grid size was chosen to provide sufficient detail to distinguish use of prominent topographic features (e.g., ridgelines) and other small-scale areas (e.g., black-tailed prairie dog towns) from the broader landscape.

SWCA reviewed raptor flight pathway height variables to select only those pathways that crossed through the RSZ (38–122 m HAGL). These RSZ raptor flight pathways were projected onto the Study Area grid. Each grid cell was given a numerical value representing the number of unique flight pathways that intersected with the cell. Each flight path was counted only once regardless of the number of times it passed through the same cell or the number of individual birds involved with each detection. Grid cells were then color coded using a quartile system to graphically illustrate relative risk (low to high). These numerical values are not static. Future analyses will adjust occurrence values resulting from the accumulation of data from additional surveys and mapped pathways.

Occurrence (and therefore perceived risk) associated with any individual cell grid is relative to other cells and is representative only of the data collected 16 April 2010 through 29 February 2012.

SWCA excluded turkey vulture from these analyses to more accurately portray diurnal raptor use of the Study Area. Turkey vulture has traditionally been treated as a raptor species; however, inclusion of this species can lead to misinterpretation of risk assessment. Turkey vultures are olfactory scavengers and do not rely on regular flight pathways (e.g., between roost or nest sites and foraging areas). Therefore, vulture use of any given area is unpredictable and incorporation of vulture flight paths clouds the ability to detect regular pathways used by true raptor species.

2.2.2 Results and Discussion

2.2.2.1 All Seasons

Refinement of the raptor survey point dataset to only those occurrences within the RSZ resulted in 1,391 individuals in 1,262 observations represented by 15 species and 153 unidentified individuals (Table 12). Golden eagle had the highest occurrence ranking in Year 1 and Year 2, followed by red-tailed hawk, and a group called unknown buteo.

Table 12. Raptors Recorded in the RSZ (38–122 m HAGL) on Raptor Monitoring Surveys in the Study Area, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2).

Species	# of Observations[1]		# of Individuals		% of All Raptors in RSZ	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Golden Eagle	194	127	212	141	27	24
American Kestrel	48	105	55	121	7	20
Northern Harrier	18	71	19	72	2	12
Red-tailed Hawk	144	60	161	62	20	10
Swainson's Hawk	43	35	61	41	8	7
Ferruginous Hawk	46	39	47	40	6	7
Prairie Falcon	20	31	20	31	3	5
Unknown Buteo	68	25	78	25	10	4
Rough-legged Hawk	56	16	59	17	7	3
Bald Eagle	17	13	20	15	3	3
Merlin	3	9	3	9	<1	2
Cooper's Hawk	8	6	9	6	1	1
Peregrine Falcon	3	4	3	4	<1	1
Unknown Raptor	34	2	40	2	5	<1
Northern Goshawk	1	2	1	2	<1	<1
Sharp-shinned Hawk	3	2	3	2	<1	<1
Unknown Small Falcon	--	1	--	1	--	<1
Broad-winged Hawk	2	--	2	--	<1	--
Unknown Accipiter	2	--	3	--	<1	--
Unknown Eagle	1	--	1	--	<1	--
Unknown Large Falcon	3	--	3	--	<1	--
Total	**714**	**548**	**800**	**591**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Figure 4 illustrates areas of use for all raptors considered within the RSZ. SWCA excluded grid cells with only one observation to highlight those areas of greater raptor use and potential risk. The highest use in the Study Area is concentrated in two separate areas north and south of Willow Creek canyon. A black-tailed prairie dog town (visible from RM 1 and RM 4) is located near the Willow Creek canyon headlands, but this occurrence analysis did not detect any increased activity associated directly with that site.

The southwestern portion of the Study Area had the least relative use; it has less topographic relief than areas to the north and east, indicating that raptor activity may be skewed towards ridgelines in the Study Area. Also, there was no obvious increased use around the prairie dog town near Virden Creek.

Figure 5 through Figure 7 illustrate area use by golden eagle, ferruginous hawk, and bald eagle, respectively, and include grid cells with only one observation. The occurrence analysis indicates that golden eagles are primarily using an approximately 5-square-mile area along the Willow Creek canyon and associated ridgelines, and to a much lesser degree the ridgelines on the western periphery of the Study Area (Figure 5).

Ferruginous hawk use of the Study Area appears relatively low and no grid cell had more than four flight pathways associated with it (Figure 6). The occurrence analysis indicated one general area where ferruginous hawks were detected within the RSZ at relatively greater frequency than other portions in the Study Area. This area is concentrated along and near the western ridgeline associated with meteorological tower (MET) E north of Willow Creek canyon.

Few bald eagle observations and no obvious use patterns have been detected (Figure 7). Observations occurred along Willow Creek and southern ridgelines, as well as closer to the western edge of the Study Area. No observations were directly associated with sage-grouse leks, prairie dog towns, or waterbodies.

Tables 13 through 16 provide seasonal summaries for spring through winter survey periods for Year 1 and Year 2 for raptors observed within the RSZ. Species are organized by percentage of occurrence in the RSZ relative to all raptors observed in the RSZ in Year 2.

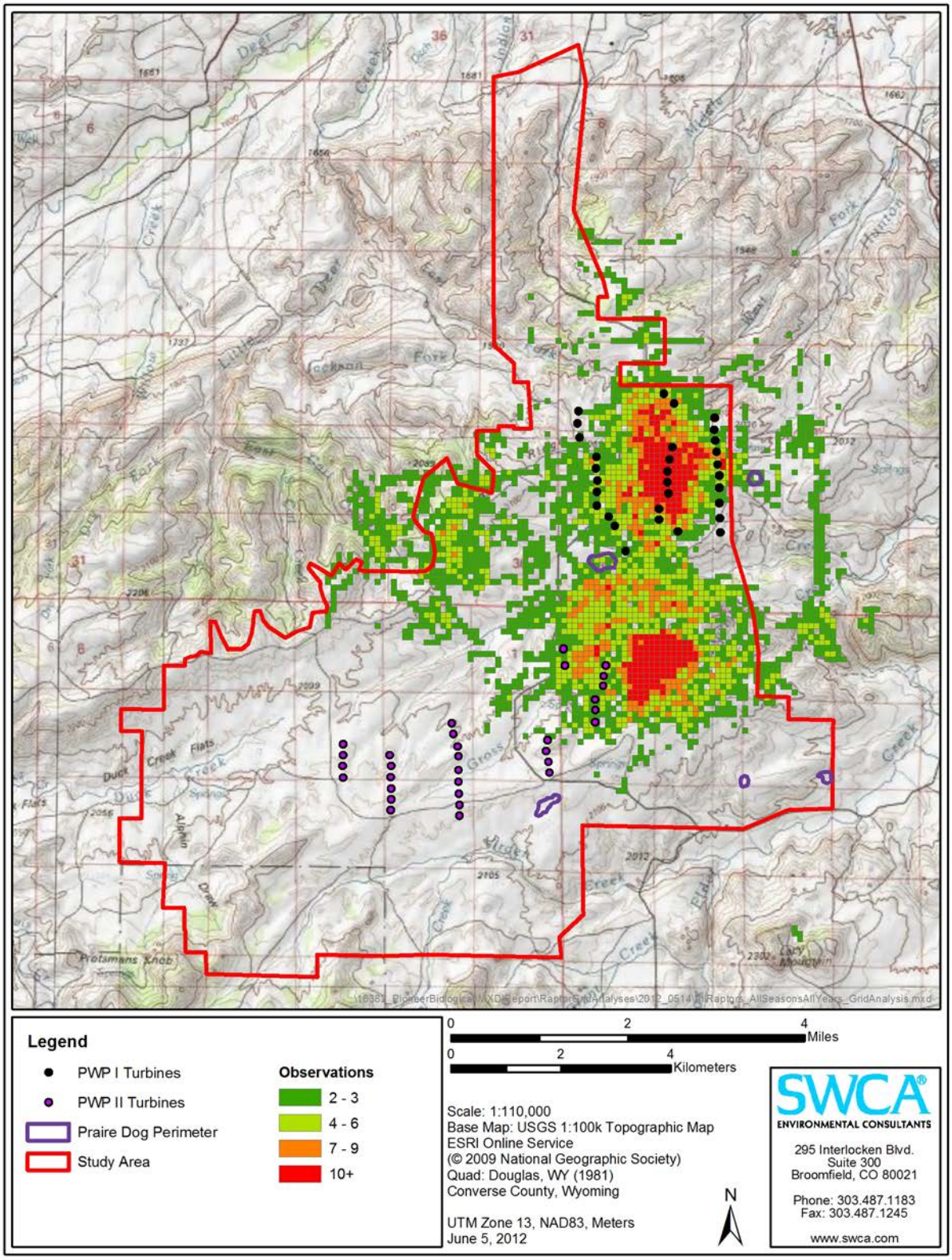

Figure 4. Grid-based analysis of all raptor flight paths within the RSZ (minimum two observations), 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2).

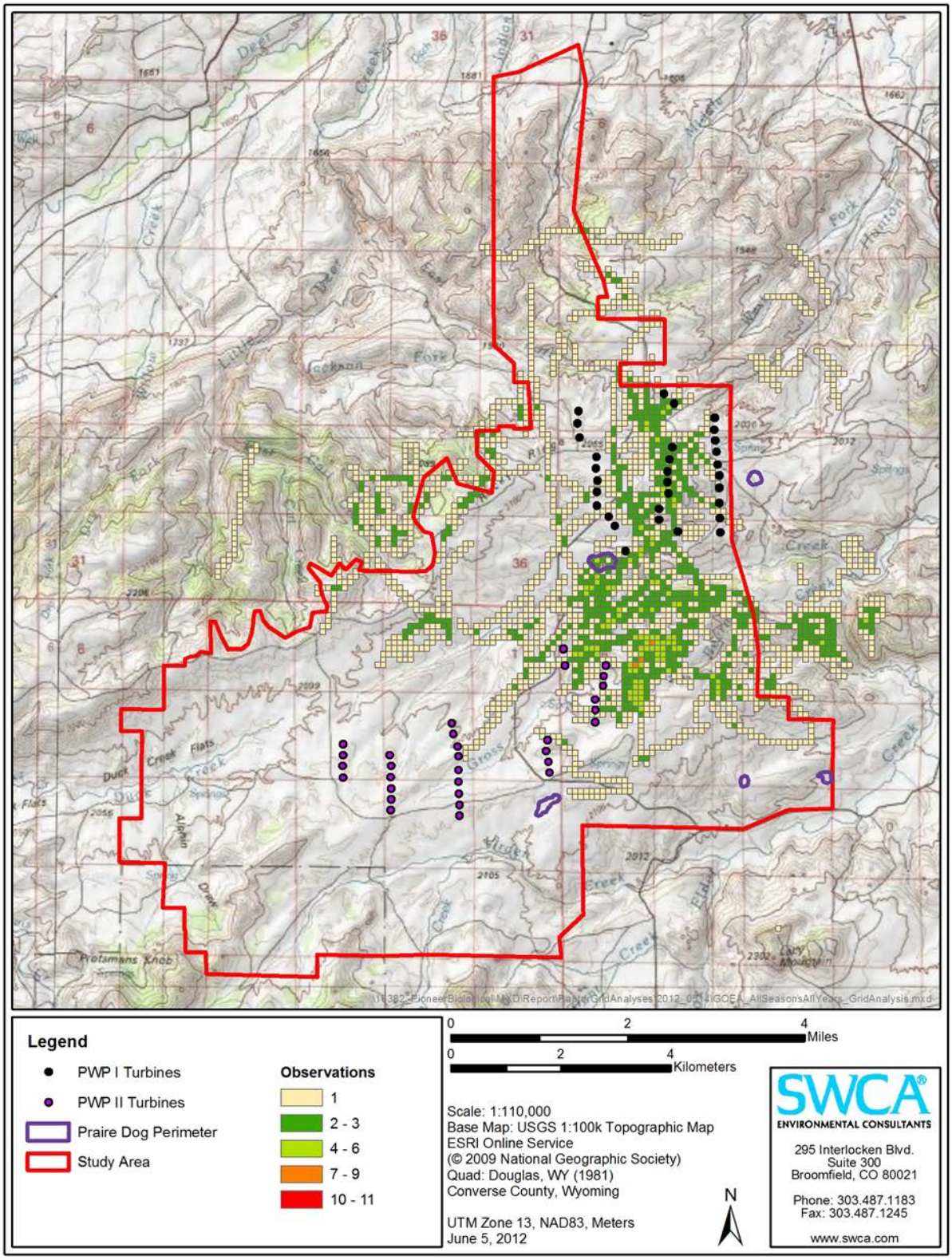

Figure 5. Grid-based analysis of golden eagle flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2).

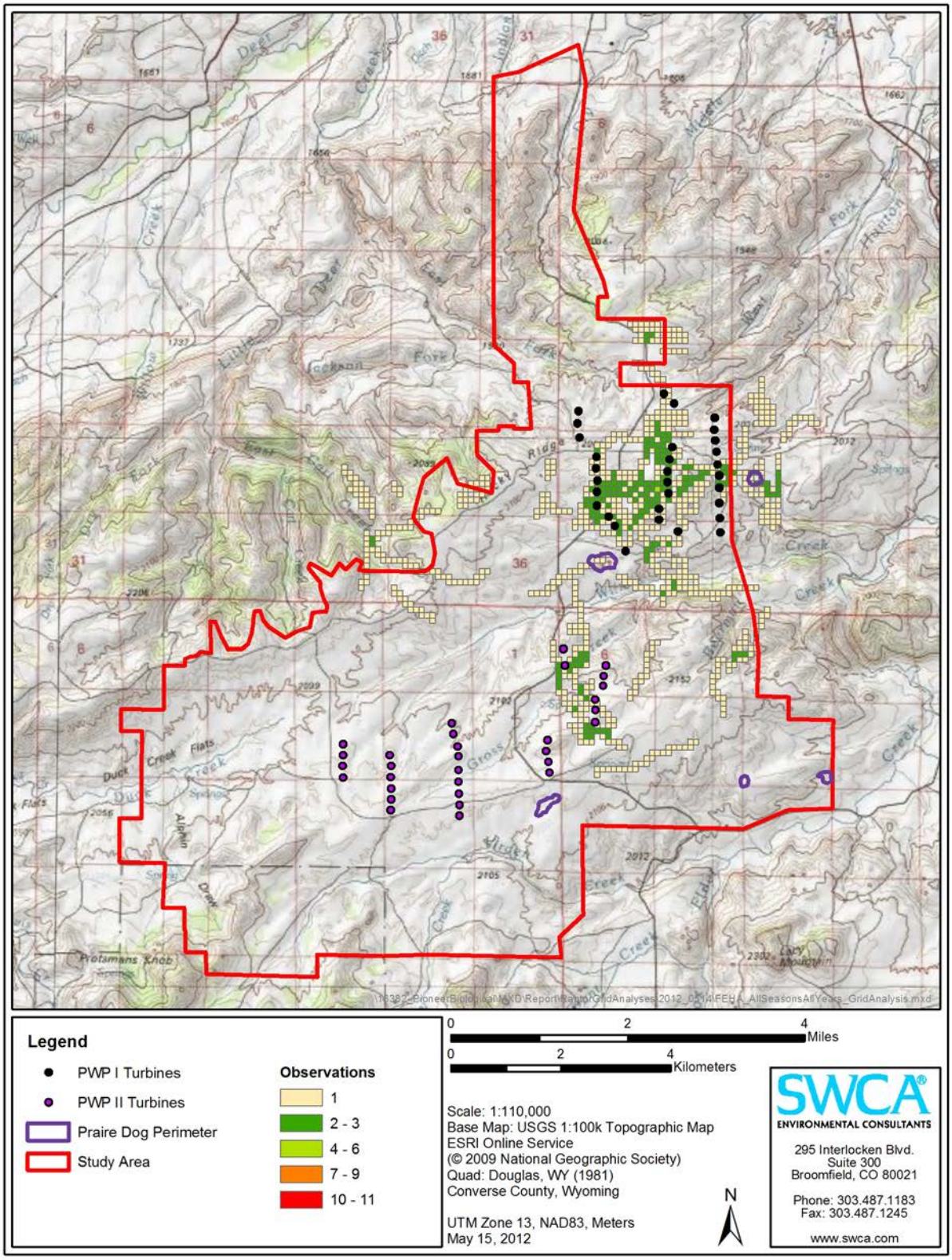

Figure 6. Grid-based analysis of ferruginous hawk flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2).

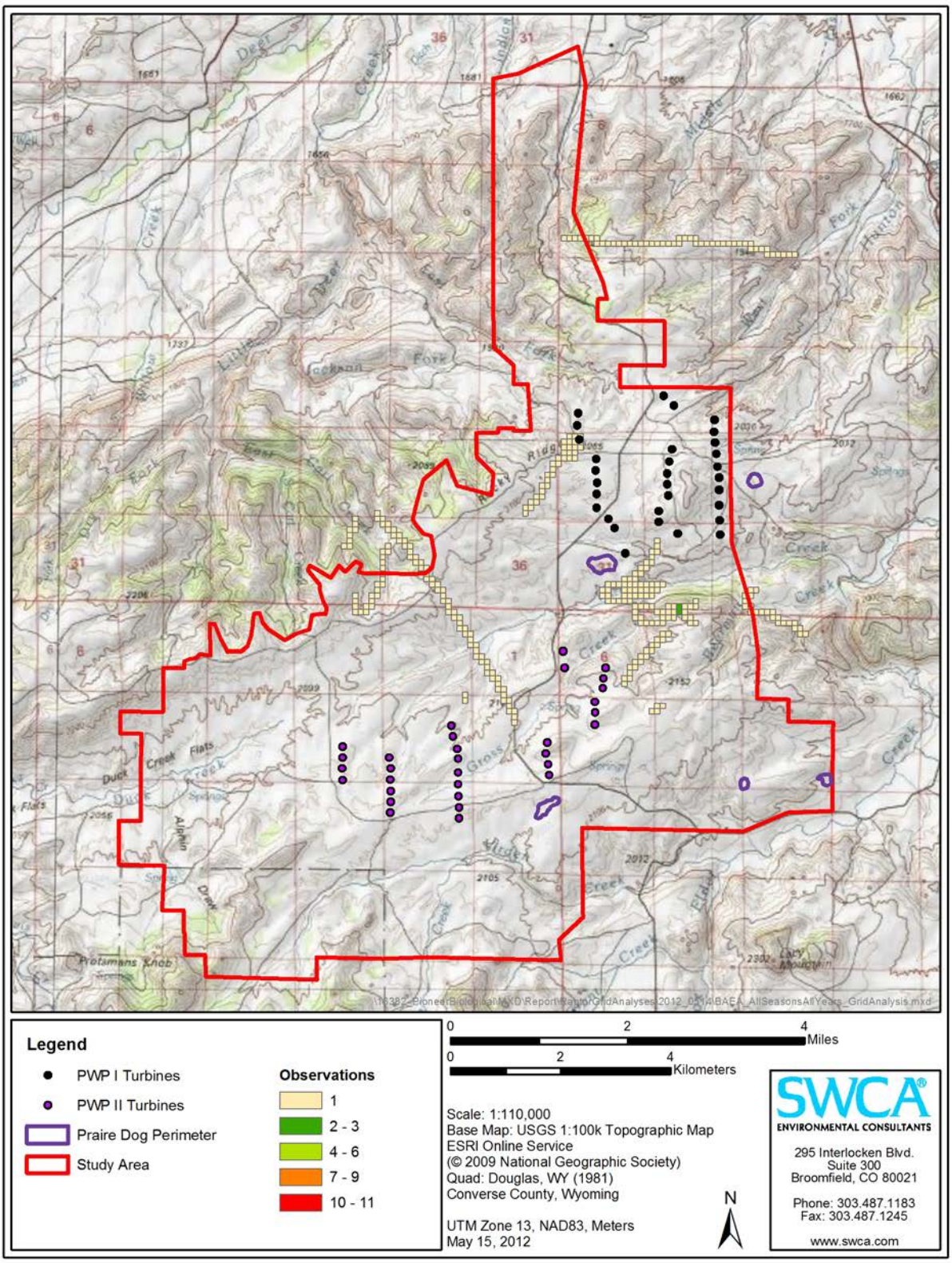

Figure 7. Grid-based analysis of bald eagle flight paths within the RSZ, 16 April 2010–2 March 2011 (Year 1) and 16 March 2011–1 March 2012 (Year 2).

Table 13. Raptors Recorded in the RSZ (38–122 m HAGL) on Spring Raptor Point Surveys in the Study Area, 16 April–25 May 2010 (Year 1) and 16 March–28 May 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of All Raptors in RSZ	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Golden Eagle	8	42	9	45	23	27
American Kestrel	2	34	2	36	5	22
Northern Harrier	4	23	4	23	10	14
Red-tailed Hawk	13	16	16	16	40	10
Ferruginous Hawk	4	15	4	15	10	9
Prairie Falcon	1	6	1	6	3	4
Swainson's Hawk	1	4	1	6	3	4
Unknown Buteo	--	7	--	7	--	4
Cooper's Hawk	2	3	2	3	5	2
Merlin	--	4	--	4	--	2
Bald Eagle	1	1	1	1	3	1
Unknown Raptor	--	2	--	2	--	1
Peregrine Falcon	--	1	--	1	--	1
Rough-legged Hawk	--	1	--	1	--	1
Total	**36**	**159**	**40**	**166**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 14. Raptors Recorded in the RSZ (38–122 m HAGL) on Summer Raptor Point Surveys in the Study Area, 1 June–1 July 2010 (Year 1) and 1–29 June 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of All Raptors in RSZ	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
American Kestrel	12	25	12	26	23	24
Golden Eagle	6	15	7	18	13	17
Northern Harrier	1	17	1	18	2	17
Red-tailed Hawk	9	13	10	15	19	14
Swainson's Hawk	10	13	12	14	23	13
Unknown Buteo	--	9	--	9	--	8
Prairie Falcon	3	3	3	3	6	3
Ferruginous Hawk	3	2	4	2	8	2
Bald Eagle	3	1	3	1	6	1
Sharp-shinned Hawk	--	1	--	1	--	1
Peregrine Falcon	--	1	--	1	--	1
Total	**47**	**100**	**52**	**108**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 15. Raptors Recorded in the RSZ (38–122 m HAGL) on Fall Raptor Point Surveys in the Study Area, 19 August–12 November 2010 (Year 1) and 16 August–11 November 2011 (Year 2).

Species	# of Observations[1]		# of Individuals		% of All Raptors in RSZ	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Golden Eagle	173	66	189	74	27	24
American Kestrel	34	46	41	59	6	19
Red-tailed Hawk	122	31	135	31	19	10
Northern Harrier	13	31	14	31	2	10
Ferruginous Hawk	39	22	39	23	6	7
Swainson's Hawk	32	18	48	21	7	7
Prairie Falcon	15	22	15	22	2	7
Rough-legged Hawk	53	13	56	14	8	5
Bald Eagle	12	11	15	13	2	4
Unknown Buteo	68	9	78	9	11	3
Merlin	3	5	3	5	<1	2
Cooper's Hawk	7	3	8	3	1	1
Peregrine Falcon	3	2	3	2	<1	1
Northern Goshawk	1	2	1	2	<1	1
Sharp-shinned Hawk	3	1	3	1	<1	<1
Unknown Small Falcon	--	1	--	1	--	<1
Unknown Raptor	31	--	37	--	5	--
Unknown Large Falcon	3	--	3	--	<1	--
Unknown Accipiter	2	--	3	--	<1	--
Broad-winged Hawk	2	--	2	--	<1	--
Total	**616**	**283**	**693**	**311**	**100**	**100**

[1] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

Table 16. Raptors Recorded in the RSZ (38–122 m HAGL) on Winter Raptor Point Surveys in the Study Area, 14 December 2010–2 March 2011 (Year 1 only) and as Incidental Sightings in February 2012[1].

Species	# of Observations[2]		# of Individuals		% of All Raptors in RSZ	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Golden Eagle	7	9	7	10	44	83
Rough-legged Hawk	3	2	3	2	19	17
Unknown Raptor	3	--	3	--	19	--
Bald Eagle	1	--	1	--	6	--
Prairie Falcon	1	--	1	--	6	--
Unknown Eagle	1	--	1	--	6	--
Total	**16**	**11**	**16**	**12**	**100**	**100**

[1] No formal raptor monitoring surveys were conducted during winter 2011–2012. Incidental sightings were recorded using raptor survey protocols during other field surveys in February 2012.

[2] Observations may involve the same individual recorded more than once during a single survey and/or across multiple surveys.

2.2.3 Raptor Nest Surveys

Raptor nest surveys were conducted with aerial surveys (fixed-wing and helicopter), as well as ground-based broadcast call and area search surveys.

2.2.3.1 Aerial Surveys

While performing fixed-wing (Cessna 172) aerial surveys for sage-grouse leks (see Section 5.2) in 2010 and 2011, SWCA opportunistically scanned for raptor nest structures. Sage-grouse lek aerial surveys were performed on 27 April and 9 May 2010, and on 21 April 2011. No nest structures were identified during those flights.

A formal aerial survey for raptor nests occurred on 13 May 2011 using a Bell 206B helicopter to facilitate access to canyons surrounding the Study Area. Two biologists surveyed from both sides of the helicopter for nest structures along cliff bands and in wooded areas of the Study Area. In accordance with recommendations from the Wyoming Field Office of the USFWS, a 1-mile buffer around the Study Area was used for all raptor species and a 4-mile buffer for golden eagle nests. This survey resulted in locating eight raptor nest structures (Figure 8). Three nests were attributed to golden eagles, but all three were considered inactive at time of the survey. No eagles were observed in proximity to these three structures. Furthermore, the biologists were able to view the nest bowls with binoculars to confirm that no eggs or hatchlings were present. Of the eight structures found, only one was determined to be active—a red-tailed hawk nest with attending adult.

2.2.3.2 Ground-based Surveys

Broadcast Call Surveys

SWCA conducted broadcast call surveys along the transmission line corridor in 2010 and 2011. The alignment used for the 2011 surveys is illustrated in Figure 8. The corridor more closely followed Mormon Canyon Road in 2010 and the corridor (not illustrated) was parallel to and slightly east of its current configuration. Broadcast call surveys were conducted on 17, 18, and 20 May 2010 and 25–27 May 2011 following protocols established by Mosher and Fuller (1996). Only points near and in areas of suitable raptor nesting habitat (e.g., wooded, other protected substrates) were surveyed. The remaining survey points were visually surveyed on foot for habitat suitability along the transect or by vehicle along Mormon Canyon Road, where appropriate, and determined to have no suitable raptor nesting substrates.

Surveys along the 2010 transmission line corridor resulted in multiple responses and/or observations of northern harrier, red-tailed hawk, American kestrel, short-eared owl, and great horned owl. One pair of American kestrels was noted copulating near a potential nest site (i.e., snag with cavities). A 25 May follow-up visit to previously identified sites of raptor activity revealed a large stick nest structure in an area of red-tailed hawk activity and a snag with cavities in an area of American kestrel activity. A second large stick nest structure was located on a follow-up visit to sites of raptor activity on 21 June, but no raptor activity was observed near the nest.

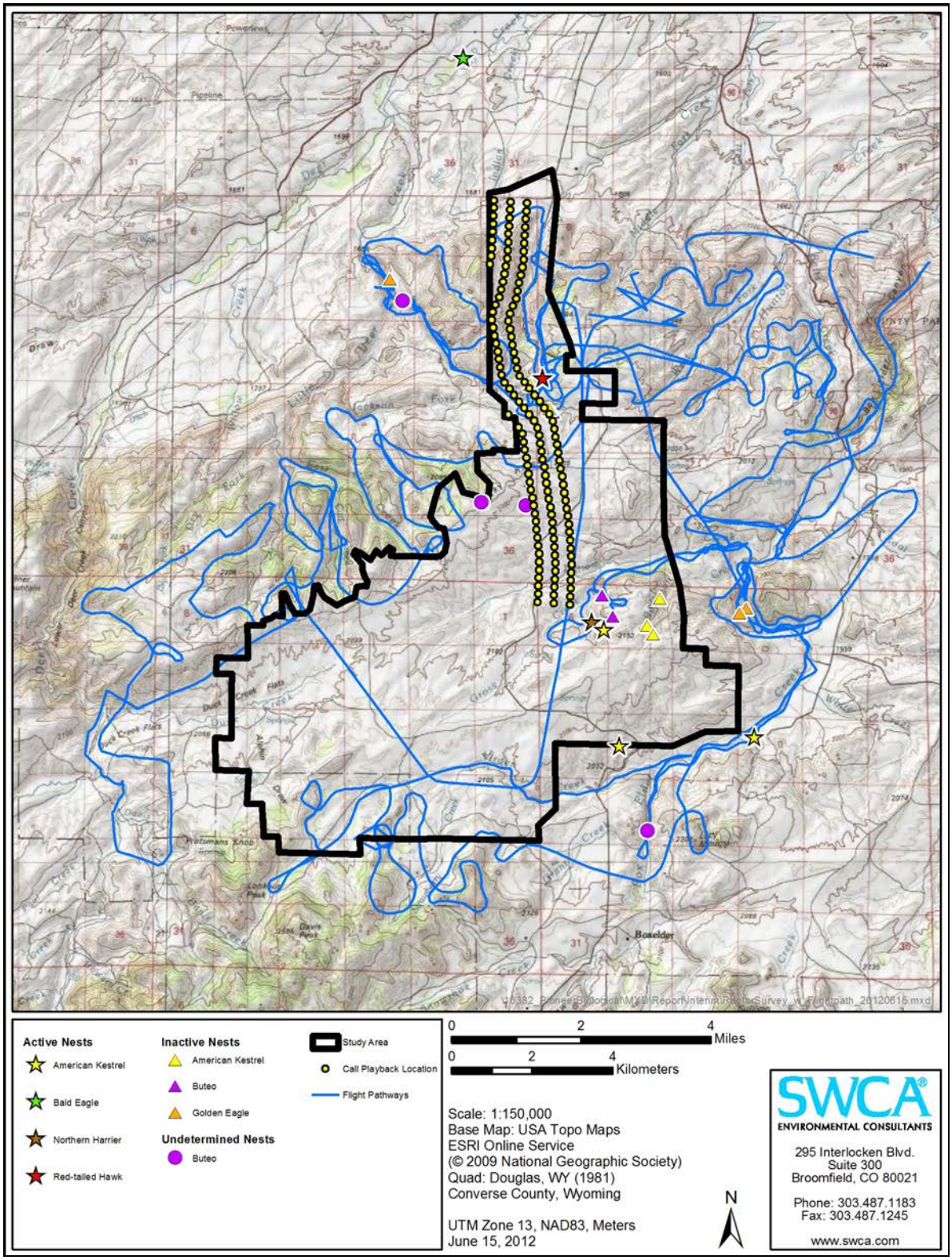

Figure 8. Aerial survey pathway (13 May 2011), ground-based call playback survey points (25–27 May 2011), and observed raptor nests in 2010 and 2011.

The broadcast call surveys in 2011 resulted in no raptor responses or location of nests. This result is likely due to minimal suitable habitat along the revised transmission corridor as compared to the 2010 corridor which included portions of Mormon Canyon Road.

Area Search Surveys
SWCA conducted area search surveys for nest sites in mixed conifer/deciduous woodland in the vicinity of the original PWP I and PWP II portions of the Study Area. The Reference Site portion was not actively surveyed for raptor nests due to a lack of wooded areas and other protected substrates. Area search surveys were conducted by hiking meandering transects through patches of woodland that appeared suitable for raptor nesting. Four black-billed magpie nests and one medium-sized stick nest were found in June 2010. Black-billed magpie nests are notable because some diurnal raptor species (e.g., Cooper's hawk, merlin) will occasionally use old black-billed magpie nest structures for their own nesting attempts. Two potential nest cavities were also located in an area of American kestrel territorial activity. No activity was observed at any of these nests, and no other potential raptor nest structures were located during area search surveys in 2010.

An incidental encounter on 27 August 2011 with a pair of adult Swainson's hawks and one fully fledged hatch-year bird occurred in a portion of the Study Area where a stick nest was observed during aerial surveys in 2010, but not located from the ground in either 2010 or 2011. An adult Swainson's hawk had also been observed in this area in June and July. Three American kestrel nests, all in snags, and a possible northern harrier nest were discovered in 2011. Of the nest structures found in 2010, only the red-tailed hawk nest noted above was determined active in 2011.

3.0 OTHER RAPTOR SURVEYS

3.1 GOLDEN EAGLE ROOST SITE SURVEYS

SWCA conducted one aerial survey within the Study Area and associated 3-mile buffer for undocumented eagle roosts on 3 March 2011. Two biologists conducted surveys from a fixed-wing Cessna 172 Skyhawk aircraft under acceptable time and weather parameters for eagle roost surveys adapted from USFWS (1983). Pathways were flown parallel to potential roost habitat at an average altitude of 400 feet above ground level, allowing both SWCA biologists to concentrate their survey effort on areas of interest. Surveys were implemented primarily along riparian corridors, canyons, and other topographic depressions protected from wind and adverse weather conditions with stands of mature trees suitable for roosting eagles. Most areas that fit these criteria were identified outside of the Study Area, but within the 3-mile buffer zone. The Study Area encompasses grasslands and sagebrush steppe with few sites suitable for roosting; whereas, the buffer zone includes several protected, forested canyons. No eagle roost sites were observed during the aerial survey.

SWCA conducted area search surveys for roost sites along select riparian corridors and canyons in the 3-mile buffer on 28 February and 1, 2, and 4 March 2011. Areas surveyed included the Deer Creek basin, the mouth of Mormon Canyon, Boxelder Creek basin, and the mouth of Boxelder Canyon. Although one section of Deer Creek fell outside of the 3-mile buffer, the entire segment of Deer Creek west of the Study Area was surveyed due to the

presence of potential roosting habitat. These areas were selected for survey based on the suitability of habitat for eagle roosting as well as public driving access. Two SWCA biologists conducted surveys from along public roadways in selected habitat areas under acceptable time and weather parameters for eagle roost surveys. Survey points were selected within corridors of potential eagle roost habitat, and the area surrounding the survey points was thoroughly scanned with binoculars. One juvenile golden eagle was observed soaring above Deer Creek on 28 February 2011; however, this observation was in an area of Deer Creek that fell outside of the 3-mile buffer. The eagle did not pass through the 3-mile buffer, nor did it perch within potential roosting areas while being observed. No other eagles were detected during the area surveys and no roost sites were observed.

3.2 PREY BASE

In the course of formal surveys, SWCA documented all incidental encounters with wildlife species across the Study Area. Many of these species constitute a prey base for the raptors present in the Study Area. Prey species observed during project-related activities include greater sage-grouse, black-tailed prairie dog, Wyoming ground squirrel, thirteen-lined ground squirrel, least chipmunk, red squirrel, white-tailed jackrabbit, cottontail, bullsnake, wandering garter snake, and prairie rattlesnake. This should not be considered an exhaustive list of prey species, only what was encountered by SWCA during the course of other surveys in the Study Area.

Figure 9 illustrates concentrations of prey species that could potentially attract raptors to certain locations, such as greater sage-grouse leks, black-tailed prairie dog colonies, and perennial water bodies that may support migratory and breeding waterbirds.

3.3 BURROWING OWL SURVEY

SWCA conducted surveys for burrowing owls at two black-tailed prairie dog colonies (sites 1 and 2) in the Study Area in 2010 and at five prairie dog colonies (sites 1–5) in 2011 (Figure 9). Passive burrowing owl surveys were conducted using Colorado Division of Wildlife (2007) protocols that were adopted from Conway and Simon (2003). Prairie dog colonies were surveyed three times in July through August (2010) and July through September (2011). No burrowing owls were detected during any survey at these prairie dog colonies.

In 2010, three black-tailed prairie dog colonies (sites 3–5) were discovered within the Study Area after the survey period (15 April–15 September) for burrowing owls had passed. Each of these colonies was surveyed for incidental signs of burrowing owl use, such as feathers, droppings, and pellets. No evidence of burrowing owl activity was detected at any of these prairie dog colonies in 2010.

The only burrowing owl occurrence known for the Study Area is of a road-killed owl discovered on 19 September 2011 on Duck Creek Road approximately 0.1 mile west of the Mormon Canyon Road junction. This site is close to the prairie dog town associated with the Virden Creek sage-grouse lek. The mid-September date and the absence of burrowing owls in the Study Area during the 2010 and 2011 breeding seasons suggests that this individual was a migrant.

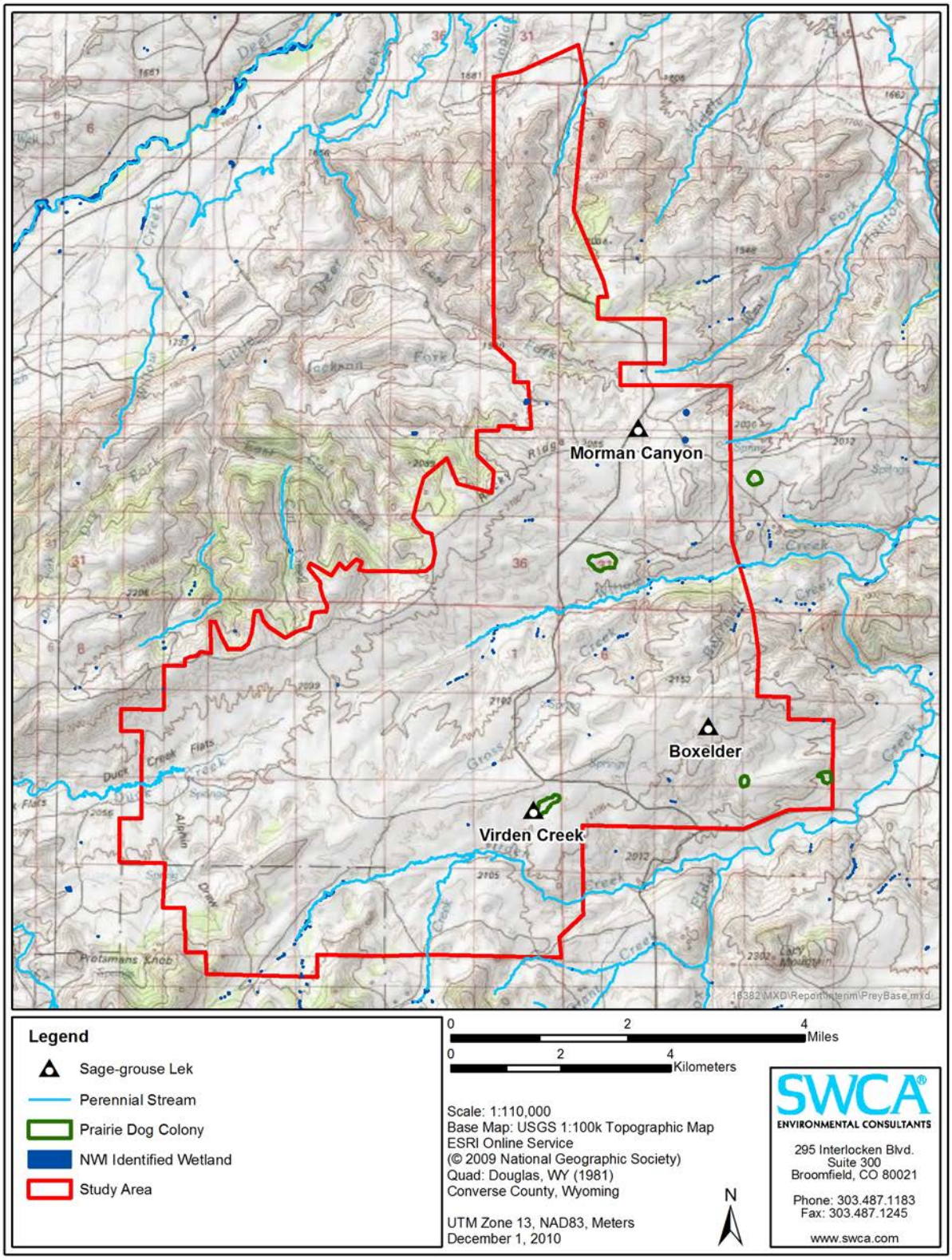

Figure 9. Potential concentrated raptor prey sites involving greater sage-grouse leks, prairie dog colonies, National Wetland Inventory wetlands, and perennial streams.

4.0 MIGRATORY BIRDS

4.1 METHODOLOGY

Six fixed-point count locations (also referred to as plots) were randomly selected and stratified by habitat in proportion to a habitat's percent coverage with each of the original PWP I, PWP II, and Reference Site areas. Four additional fixed-point count locations were selected in the same manner for PWP I in August 2010, but three were later discontinued (see Section 1.5). Some fixed-point count locations had to be shifted slightly in the field to allow for adequate viewshed coverage of the survey area (e.g., moved upslope from ravine bottom to ridgeline). Fixed-point count locations were selected to be a minimum of 400 m apart to avoid double sampling. Surveys at each fixed-point count location were performed weekly in Year 1 from 13 May–30 June 2011 and 18 August–13 November 2011. In addition, plots were surveyed twice in winter during 12–14 January 2011 and 28 February–2 March 2011. Year 2 surveys were performed from 5 April–30 June 2011 and 17 August–12 November 2011. Winter surveys were conducted on 14–15 February 2012 and 28 February–1 March 2012.

Fixed-point count surveys followed the circular-plot method described in Reynolds et al. (1980). Surveys were conducted from local sunrise to no later than four to five hours after sunrise. Individual fixed-point count duration was 20 minutes. All birds detected within 200 m of the fixed-point count were recorded. Data collected the first time a bird or flock was detected included species, number of individuals, age, sex, estimated or measured horizontal distance from point location, activity status, flight altitude, flight direction, time of observation, and whether the bird/flock was inside the survey circle at initiation of the point count or moved into the survey area during the survey session. Observers used a laser rangefinder to assist in more accurately measuring distance from the point center to the bird/flock. All species, not just birds, observed during the survey period, inside and outside the survey area, were included as incidental sightings in the notes section of the field form.

The spring 2011 data differ in that most surveys were conducted using a 10-minute count duration instead of the standard 20 minutes. SWCA conducted a simulation study to assess the impact of this shorter survey period on the ability to detect change in mean use (the metric used in the BACI study) using data from spring 2010 by truncating the full 20-minute survey period to 10 minutes. This simulation indicated that the number of surveys has a much greater effect on the ability to detect change in mean use than survey duration. Survey effort was greater in 2011 (144 surveys) than 2010 (48) due to longer survey period (see Section 4.2.2). Therefore, SWCA expects no adverse impact to the BACI study in assessing change in mean use.

4.2 RESULTS AND DISCUSSION

4.2.1 Study Area

In total, 945 migratory bird surveys were completed from 13 May 2010 through 1 March 2012. The number of surveys conducted at each point is presented in Table 17.

Observers recorded 2,347 flocks and 5,910 individuals representing 90 species on all surveys combined in Year 1 and 2,765 flocks, 6,136 individuals, and 88 species in Year 2 (Table 18). Mean bird use, as represented by the number of individuals per survey plot per survey (# birds/plot/survey), of the Study Area was calculated to be 13.2 and 12.3 birds in Year 1 and Year 2, respectively.

Four species occurred at a rate greater than one bird per survey in both Year 1 and Year 2 survey periods: horned lark, vesper sparrow, Brewer's blackbird, and western meadowlark. One group, unknown sparrow, also averaged greater than one bird per survey in both survey periods. The unknown sparrow group likely consisted mostly of mixed *Spizella* sparrow (chipping, Brewer's, and clay-colored) flocks, as their morphology, plumage coloration, and call notes are similar. Of the 189 unknown sparrow flocks, 176 (93%) were recorded during the fall migratory seasons of Year 1 and Year 2. Another unspecified species group, called mixed flock, averaged greater than one bird per survey in Year 1. Observer notes written for the mixed flock detections indicate that these flocks were consistently composed of horned larks and McCown's, chestnut-collared, and/or lapland longspurs. All 23 mixed flock groups (average of 23.4 birds per flock) were reported between 28 September and 4 November 2010. Collectively, these four species and two groups accounted for 8,213 individuals and 68% of all fixed-point count survey detections for Year 1 and Year 2 combined.

Table 17. Comparative Summary of the Number of Flocks, Individuals, Mean Use, and Number of Species for all Migratory Bird Survey Points in the Study Area, 13 May 2010–2 March 2011 (Year 1) and 5 April 2011–1 March 2012 (Year 2).

Site	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)		# of Surveys	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
MB 1	89	113	125	227	5.7	8.7	22	26
MB 2	134	134	264	375	12.0	14.4	22	26
MB 3	87	122	191	321	8.7	12.3	22	26
MB 4	157	--	285	--	13.6	--	21	--
MB 5	81	120	118	268	5.4	10.3	22	26
MB 6	90	106	127	182	5.8	7.3	22	25
MB 7	97	219	203	453	14.5	17.4	14	26
MB 8	64	210	168	402	12.0	15.5	14	26
MB 9	24	--	108	--	8.3	--	13	--
MB 10	63	--	152	--	11.7	--	13	--
MB 11	86	95	301	263	13.7	10.5	22	25
MB 12	87	139	237	240	11.3	9.2	21	26
MB 13	136	165	279	260	12.7	10.0	22	26
MB 14	113	96	213	204	10.1	7.8	21	26
MB 15	171	197	470	434	21.4	16.7	22	26
MB 16	97	108	443	200	20.1	7.7	22	26
MB 17	115	137	235	299	10.7	11.1	22	27
MB 18	129	146	473	371	21.5	13.7	22	27
MB 19	172	205	378	629	17.2	23.3	22	27
MB 20	108	146	239	300	10.9	11.1	22	27

Site	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)		# of Surveys	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
MB 21	112	139	519	270	23.6	10.0	22	27
MB 22	135	168	382	438	17.4	16.2	22	27
Total	**2,347**	**2,765**	**5,910**	**6,136**	**13.2**	**12.3**	**447**	**498**

Table 18. Species with Minimum 1.0 Bird/Survey Recorded on Migratory Bird Point Surveys in the Study Area, 13 May 2010–2 March 2011 (Year 1) and 5 April 2011–1 March 2012 (Year 2).

Species	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)	
	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 447)	Year 2 (n = 498)
Horned Lark	314	367	1,056	989	2.4	2.0
Unknown Sparrow	65	124	820	539	1.8	1.1
Vesper Sparrow	489	374	783	570	1.8	1.1
Brewer's Blackbird	221	156	612	900	1.4	1.8
Western Meadowlark	489	736	587	811	1.3	1.6
Mixed Flock	23	--	546	--	1.2	--
Total	**1,601**	**1,757**	**4,404**	**3,809**	**9.9**	**7.6**
Portion of Total (all species)	**68%**	**64%**	**75%**	**62%**	**75%**	**62%**
Total (all species)	**2,347**	**2,765**	**5,910**	**6,136**	**13.2**	**12.3**

Species with a mean use rate of at least one bird/plot/survey are presented for spring, summer, fall, and winter in Table 19 through Table 22, respectively. As noted in the Study Area synthesis provided above, there was a general trend of Brewer's blackbird, western meadowlark, horned lark, and/or vesper sparrow being substantial components of the avifauna during Year 1 and Year 2 surveys. The notable exceptions occurred in fall when Brewer's blackbird and western meadowlark averaged fewer than one bird per survey and the unknown sparrow group (relatively few flocks, but high number of birds per flock) ranked second highest in mean use both years. In winter, no species had a mean use of one bird per survey; however, species data are provided to show the relative low mean use of the Study Area in winter.

4.2.2 Spring

Brewer's blackbird, western meadowlark, horned lark, and vesper sparrow were the only species to have a mean use of one bird per survey on spring surveys. This result occurred for both survey years and neither year had other species with a mean use greater than one bird per survey (Table 19).

Table 19. Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Spring Migratory Bird Point Surveys in the Study Area, 13–26 May 2010 (Year 1) and 5 April–31 May 2011 (Year 2).

Species	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)	
	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 48)	Year 2 (n = 144)
Brewer's Blackbird	41	47	118	525	2.5	3.6
Western Meadowlark	116	398	130	410	2.7	2.8
Horned Lark	46	150	56	305	1.2	2.1
Vesper Sparrow	124	117	135	189	2.8	1.3
Total	**327**	**712**	**439**	**1,429**	**9.1**	**9.9**
Portion of Total (all species)	**84%**	**67%**	**86%**	**63%**	**85%**	**62%**
Total (all species)	**387**	**1,062**	**511**	**2,285**	**10.7**	**15.9**

4.2.3 Summer

Species composition and abundance were similar in summer as in spring, with Brewer's blackbird, western meadowlark, vesper sparrow, and horned lark being the only four species with a mean use of at least one bird per survey (Table 20). This result occurred in both years of surveys.

Table 20. Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Summer Migratory Bird Point Surveys in the Study Area, 3–30 June 2010 (Year 1) and 2–30 June 2011 (Year 2).

Species	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)	
	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 90)	Year 2 (n = 90)
Brewer's Blackbird	177	106	341	313	3.8	3.5
Western Meadowlark	286	252	295	257	3.3	2.9
Vesper Sparrow	226	182	233	207	2.6	2.3
Horned Lark	102	100	115	112	1.3	1.2
Total	**791**	**640**	**984**	**889**	**10.9**	**9.9**
Portion of Total (all species)	**80%**	**73%**	**81%**	**75%**	**81%**	**75%**
Total (all species)	**991**	**877**	**1,217**	**1,188**	**13.5**	**13.2**

4.2.4 Fall

Although horned larks and vesper sparrows were still abundant in the Study Area, the number of Brewer's blackbirds and western meadowlarks decreased during fall surveys to drop below a mean use rate of one bird per survey (Table 21). The unknown sparrow group and mixed flock categories (described above) were both present in Year 1 surveys, whereas only the unknown sparrow group had a mean use greater than one bird per survey in Year 2.

Table 21. Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Fall Migratory Bird Point Surveys in the Study Area, 18 August–13 November 2010 (Year 1) and 17 August–12 November 2011 (Year 2).

Species	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)	
	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 270)	Year 2 (n = 227)
Horned Lark	162	114	871	561	3.2	2.5
Unknown Sparrow	65	111	820	447	3.0	2.0
Mixed Flock	23	--	546	--	2.0	--
Vesper Sparrow	139	--	415	--	1.5	--
Total	**389**	**225**	**2,652**	**1,008**	**9.8**	**4.4**
Portion of Total (all species)	**41%**	**28%**	**64%**	**38%**	**64%**	**38%**
Total (all species)	**958**	**813**	**4,159**	**2,628**	**15.4**	**11.6**

4.2.5 Winter

No species were recorded in numbers sufficient to achieve a one bird per survey mean use (Table 22). Horned lark remained the only species in winter that also had a mean use of one bird per survey in spring, summer, and fall survey periods for both years. The paucity of species and low number of individuals suggests that winter conditions in the Study Area are relatively inhospitable to birds.

Table 22. Species with Minimum 1.0 Bird/Survey Mean Use Recorded on Winter Migratory Bird Point Surveys in the Study Area, 12 January–2 March 2011 (Year 1) and 14 February–1 March 2012 (Year 2).

Species	# of Flocks		# of Individuals		Mean Use (# Birds/Survey)	
	Year 1	Year 2	Year 1	Year 2	Year 1 (n = 39)	Year 2 (n = 37)
Horned Lark	4	3	14	11	0.4	0.3
Mountain Chickadee	3	1	4	1	0.1	<0.1
Common Raven	1	--	2	--	0.1	--
Rough-legged Hawk	1	--	2	--	0.1	--
Red Crossbill	--	6	--	17	--	0.5
Red-breasted Nuthatch	--	3	--	3	--	0.1
Gray Partridge	--	1	--	3	--	0.1
Dusky Grouse	1	--	1	--	<0.1	--
Total	**10**	**14**	**23**	**35**	**0.6**	**0.9**

4.2.6 February 2010 Winter Survey

On 24 February 2010, SWCA visited the original PWP I and PWP II portions of the Study Area to assess winter bird species composition and relative abundance. The 4.5-hour-long survey was conducted by vehicle on county-maintained roads (Boxelder Creek and Mormon

Canyon) and by snowshoe in the northern portion of the Study Area. All detected birds were identified to species, and the number of individuals per species and a global positioning system (GPS) location were recorded for each individual or group of birds observed. Access into the original PWP II site was very limited due to snow cover, and only the portions along Mormon Canyon and Boxelder Creek Roads were surveyed.

Twenty-six individuals representing eight species were detected during the survey within the forested portions along Mormon Canyon Road. Only one bird, a black-billed magpie, was detected in the original PWP II site along Boxelder Creek Road near a livestock ranching operation. No birds were detected in the open grassland/sage-steppe habitat of the Study Area. Species, total number of individuals per species, and primary associated habitat are summarized in Table 23.

Table 23. Number of Individuals and General Habitat for Bird Species Detected on a Late Winter Bird Area Search Survey in the Study Area, 24 February 2010.

Species	# of Individuals	Associated Habitat
Golden Eagle	3	Ridgelines along Mormon Canyon
Black-billed Magpie	4	Riparian and Floodplain Systems
Clark's Nutcracker	2	Aspen Woodland-Mixed Conifer Forest
Black-capped Chickadee	1	Aspen Woodland-Mixed Conifer Forest
Mountain Chickadee	2	Aspen Woodland-Mixed Conifer Forest
Red-breasted Nuthatch	4	Aspen Woodland-Mixed Conifer Forest
American Robin	2	Aspen Woodland-Mixed Conifer Forest
Red Crossbill	8	Aspen Woodland-Mixed Conifer Forest

5.0 GREATER SAGE-GROUSE

5.1 LEK SITES

Greater sage-grouse leks in the Study Area are not located within core sage-grouse habitat as mapped by the WGFD. The closest area of core sage-grouse habitat occurs approximately 4.5 miles west of the Study Area (WGFD 2010b) and contains three active leks (Altmann, Banner Draw 3, and Hat Six leks). Two historically active leks are located within the Study Area (Morman Canyon and Virden Creek leks), as well as one previously unknown lek documented by an SWCA biologist during surveys in 2010. Morman Canyon lek is located off of Mormon Canyon Road in the northeast of the Study Area. Virden Creek lek is located in the south portion of the Study Area. The previously undocumented lek (now named Boxelder) is located in the southeast portion of the Study Area (Figure 9).

5.2 LEK SURVEYS

SWCA conducted aerial surveys within the Study Area and a 2-mile buffer for undocumented greater sage-grouse leks on 27 April and 9 May 2010, and again on 1 April 2011. Two biologists conducted surveys in 2010 and 2011 from a fixed-wing Cessna 172 Skyhawk aircraft under acceptable time and weather parameters for lek surveys established by

Christiansen (2007). Surveys were implemented from east to west following predetermined flight transects uploaded to the aircraft's GPS unit. Each transect was separated by 0.6 mile and was flown at an average altitude of 200 feet above ground level. SWCA biologists observed from opposite sides of the aircraft to ensure complete coverage of the survey area. The same transects were used in both years. No new greater sage-grouse leks were observed during these surveys in 2010 or 2011.

While conducting migratory bird surveys, SWCA observed two displaying adult greater sage-grouse males in the company of two females on 13 May. Per Christiansen (2007), the site was revisited to determine lek status. On 14 May, an SWCA biologist observed seven displaying adult males and two females at the site under acceptable weather and time parameters, establishing it as an occupied lek for management purposes (Christiansen 2007). This previously undocumented lek site (Boxelder) is shown on Figure 9, and discussed below.

5.3 LEK COUNTS

Lek counts were conducted in the Study Area between 16 April and 15 May 2010 and 12 April and 18 May 2011 following protocols provided in WGFD (2009). A minimum of three official lek counts were conducted for the Morman Canyon, Virden Creek, and Boxelder lek sites. SWCA opportunistically counted these sites on other mornings and those data have been provided to WGFD. Summary data are presented in Table 24. On 14 May, an SWCA biologist observed two displaying males in a location of previously unknown lek activity. This initial encounter did not occur within lek survey protocols; however, the location was surveyed the following day within established protocols and seven male sage-grouse were observed displaying. This new lek (Boxelder) was only visited twice during 2010, but seven visits were made to the site in 2011. Only one displaying male, and no females, were observed at the Boxelder lek in 2011. Table 24 also summarizes data for three leks occurring in designated core habitat located approximately 4.5 miles west of the Study Area that may be used as reference sites when assessing impacts to sage-grouse during the post-construction phase of the Pioneer Wind Park projects. These three leks are Altmann and Hat Six (both located in the Hat Six lek complex), and Banner Draw 3 (located in the Banner Draw lek complex).

Table 24. Peak Male Counts for 2010 and 2011, 10-Year (2002–2011) Averages, and # of Years Surveyed in Last 10-Year Period for Leks within the Study Area and the East Casper Core Area.

Lek	2010 Peak Male Count	2011 Peak Male Count	10-Year Average (# Males)	# Years Surveyed in Last 10 Years
Morman Canyon	7	11	15.6	10
Virden Creek	35	25	25.8	4
Boxelder	7	1	4.0	2
Altmann	8	4	10.7	10
Banner Draw 3	13	8	8.6	8
Hat Six	13	14	28.0	10

6.0 BIG GAME

Big game species migrate between lower and higher elevations relative to the abundance of plant species suitable for grazing in different elevational zones. Typically, big game species in this region will move to higher elevations during the spring when the abundance of grazing plant species is highest. They use the higher elevations throughout the summer as parturition grounds for raising their young. During the fall as adverse weather conditions become more prevalent and the abundance of grazing plant species declines, most big game will begin to descend to lower elevations for the winter months. At lower elevations in the winter, snow cover does not persist for as long and interfere with grazing as it does at higher elevations.

In the course of initial consultations with WGFD, it was agreed upon that no specific big game monitoring would be required for the project. However, during a meeting on 30 June 2010, WGFD requested that SWCA document any large ungulate migration events detected during other surveys in the Study Area. Big game migration pathways were mapped on a topographic map using the same protocol for raptor flight pathways. Elk and pronghorn movements were recorded in spring and fall in 2010. Although both species were noted in 2011 in the Study Area, no migratory movements were observed in 2011. Similarly, mule deer were noted in the Study Area in 2010 and 2011, but no spring or fall migratory movement was observed.

6.1 SPRING MIGRATION

Although big game monitoring did not start before 30 June 2010, SWCA recorded migratory movements during a raptor migration survey at RM 1 on 16 April 2010. On that date, several herds of pronghorn and elk were observed moving through the northern portion of the Study Area (Figure 10). Separate groups of 90, 55, and 12 pronghorn were observed moving generally southwest across the Study Area. Groups of 23 and 10 elk were observed moving generally west and southwest, respectively (Figure 10).

6.2 FALL MIGRATION

SWCA recorded eight big game migratory events during fall 2010 raptor surveys (17 August–12 November). Four of these involved large movements of elk on 4 November 2010 from the forested ridgeline on the northwestern edge of the Study Area eastward towards Mormon Canyon Road (Figure 10). On that date, four groups of 17, 109, 130, and 150 elk were observed passing through the area. The only other recorded elk migration occurred on 7 October 2010 when 29 elk moved in a southwesterly direction along the ridgeline comprising the northwestern boundary of the Study Area. Three groups of 13, 20, and 21 pronghorn were noted moving through the area from 15–28 October (Figure 10) for the only recorded fall pronghorn migration. No mass migratory movements were recorded in 2011, although big game species were present.

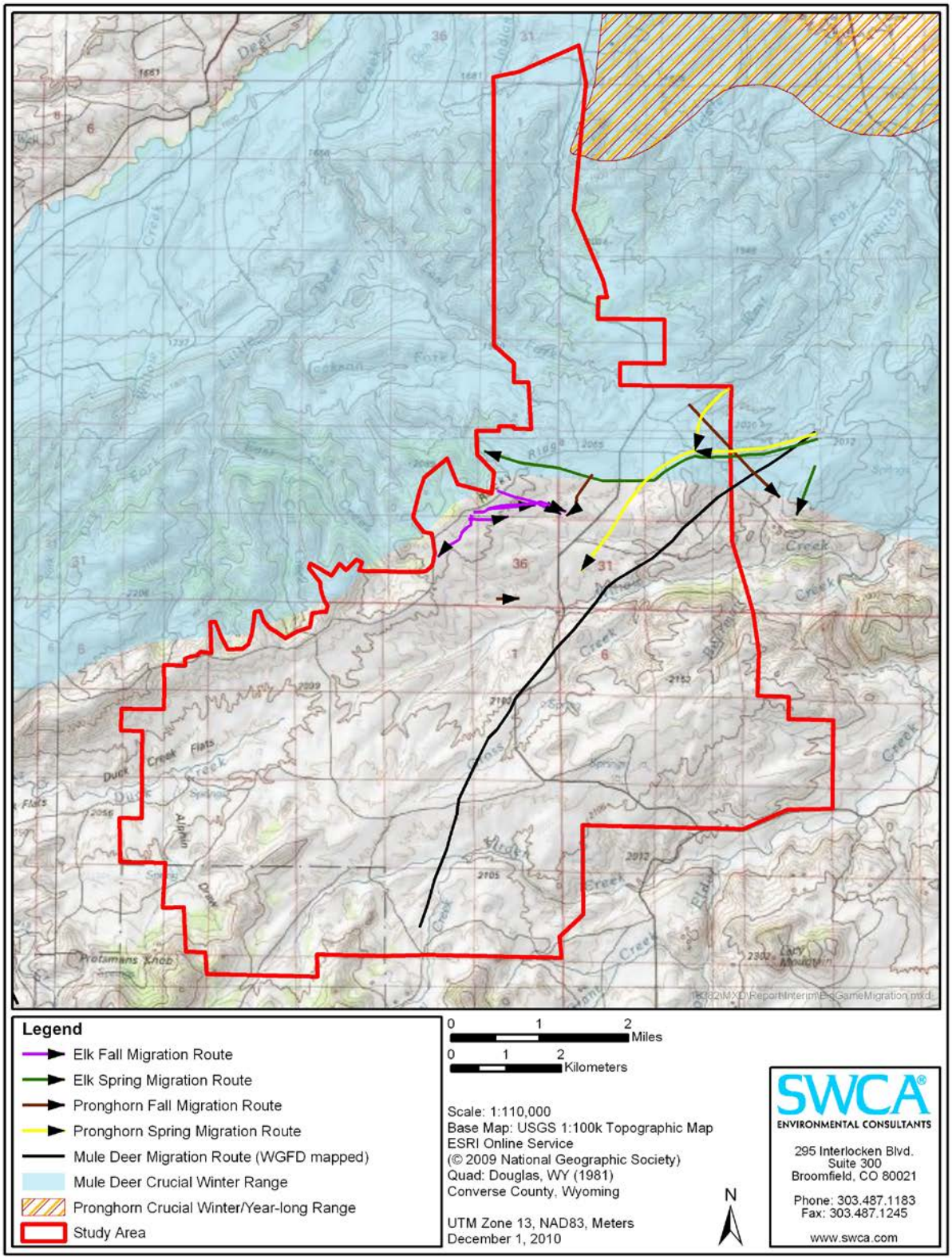

Figure 10. Digitized migration pathways of pronghorn and elk herds observed in the Study Area and WGFD big game crucial ranges.

7.0 AMPHIBIANS

The WGFD *Recommendations* document lists seven amphibian Species of Greatest Conservation Need (SGCN) for species-specific monitoring: boreal toad (*Bufo boreas boreas*), Wyoming toad (*Bufo baxteri*), wood frog (*Rana sylvatica*), Columbia spotted frog (*Rana luteiventris*), Great Basin spadefoot (*Spea intermontana*), plains spadefoot (*Spea bombifrons*), and northern leopard frog (*Rana pipiens*). During project-related consultation, WGFD also identified pale milksnake (*Lampropeltis triangulum multistrata*) as a species for which they request details of sightings incidental to other survey work. Review of range maps and distribution information in WGFD (2010c) indicates that only pale milksnake, plains spadefoot, and northern leopard frog may occur within the Study Area.

WGFD did not request formal surveys for any amphibian species. However, observations of amphibians incidental to other wildlife surveys and during additional project-related visits were recorded. Data collected for each observation included species, date, and UTM. Amphibian species observed in the Study Area in 2010 and 2011 were banded tiger salamander, boreal chorus frog, and northern leopard frog. Additional discussion on northern leopard frog observations is provided below.

7.1 NORTHERN LEOPARD FROG

No formal surveys were conducted for northern leopard frog during 2010 or 2011; however, all incidental encounters with northern leopard frog during other survey and project-related activities were noted. The species was observed in 2010 and 2011, and included tadpoles, subadults, and adults. Most observations in both years were associated with Willow Creek and its tributaries. A few observations were also made at ephemerally wet upland sites and drainages of Virden Creek.

8.0 REPTILES

Reptile species identified in WGFD *Recommendations* as SCGN are midget faded rattlesnake (*Crotalus oreganus concolor*), Great Basin gophersnake (*Pituophis melanoleucas deserticola*), and northern tree lizard (*Urosaurus ornata wrighti*). In Wyoming, all three species occur only in the southwestern corner of the state (WGFD 2010c) and are not expected in the Study Area.

Observations of reptiles incidental to other wildlife surveys and during additional project-related visits were recorded. Data collected for each observation included species, date, and UTM. Reptile species observed in the Study Area in 2010 and 2011 were bullsnake, wandering garter snake, and prairie rattlesnake.

9.0 AQUATICS

WGFD recommends that wind development proponents identify the potential for sediment impacts to aquatic habitats, address that potential during project development, and monitor for impacts in cases where aquatic resources may be in jeopardy. Geomorphological monitoring is required if wind development is proposed in areas that 1) are not heavily developed, 2) are not in a closed basin, or 3) do not have sediment catch basins. The purpose of geomorphological monitoring is to "determine the presence, absence and/or extent of cumulative impacts resulting from changes to upland surface hydrology, erosion and deposition and the potential for impacting habitats important to fish, macroinvertebrates, reptiles and amphibians" (WGFD 2010a:55). The recommended monitoring approach, as identified in the WGFD *Recommendations*, is the Watershed Assessment of River Stability and Sediment Supply (WARSSS) (Rosgen 2009; U.S. Environmental Protection Agency [EPA] 2008).

The WARSSS is a three-phase methodology that identifies the "hillslope, hydrologic and channel processes responsible for significant changes in erosion, sedimentation and related stream channel instability" (Rosgen 2009:1–2). The first two levels of WARSSS, the Reconnaissance Level Assessment (RLA) and the Rapid Resource Inventory for Sediment and Stability Consequence (RRISSC), are highlighted within the WGFD *Recommendations*. The RLA provides a broad overview of the landscape while focusing on processes that may affect sediment supply and channel stability. The RLA identifies sediment sources and existing channel stability problems and eliminates stable, low-risk slopes, sub-watersheds, and river reaches from further analysis. If results of the RLA indicate sub-watersheds are at risk, a more detailed assessment of the project's disturbance and potentially unstable stream reaches, sediment yield, and transport potential such as the RRISSC is recommended by the WGFD.

A RLA study was conducted during summer 2010 (SWCA 2010b) to identify sediment sources and existing channel stability problems based on a variety of existing and past land practices. Analysis was conducted on portions of the following sub-watersheds: Box Elder Creek-Hunton Creek, Box Elder Creek-Virden Creek, Little Deer Creek, Little Deer Creek-North Platte River, Middle Deer Creek-North Platte River, and North Platte River-Dry Creek. The identification of sediment sources within the Study Area consisted of multiple steps, which included 1) compiling existing data, 2) reviewing the landscape history, 3) summarizing activities that potentially affect sediment supply and channel stability, 4) assessing specific process relations affected by land use activities, 5) reviewing erosion risk, 6) reporting hill slope processes and erosional/depositional processes within the Study Area, and 7) field documenting erosional processes from current land uses.

Compiled data were analyzed to assess the potential influence of landscape history and current land management activities on stream channel stability and sediment supply and the potential erosional process impacts that could occur throughout the Study Area. The information from this process was subsequently used to document the guidance criteria and analysis for hillslope, hydrologic, and channel processes to determine which sub-watersheds may potentially require a more detailed assessment. The guidance criteria were used to determine if a particular sub-watershed should advance to level 2 of the WARSSS, the

RRISSC analysis. Results of the RLA based on current and past land management practices indicate that the North Platte River-Dry Creek, Box Elder Creek-Hunton Creek, Middle Deer Creek-North Platte River, and Box Elder Creek-Virden Creek sub-watersheds may require advancement to the RRISSC analysis. Little Deer Creek and Little Deer Creek-North Platte River sub-watersheds are in a lower risk category and should not advance to the RRISSC analysis (SWCA 2010b). However, avoidance measures (e.g., 0.25-mile buffer along the perennial portion of Willow Creek and smaller buffers along intermittent and ephemeral drainages) and other project refinements implemented for PWP I and PWP II would offset the need to conduct any RRISCC analyses (WGFD letter to T. Schroeder, Department of Environmental Quality/Industrial Siting Commission, dated 3 March 2011). Pioneer would still be required to monitor areas of disturbance adjacent to intermittent and ephemeral drainages during construction to ensure that impacts are avoided, minimized, or quickly mitigated if necessary.

10.0 U.S. FISH AND WILDLIFE LISTED SPECIES

SWCA evaluated the Study Area for potential habitat and occurrence of species listed under the Endangered Species Act (ESA) by the USFWS for Converse County (Table 25) (USFWS 2010a).

Table 25. Species Listed under the ESA by the USFWS for Converse County, Wyoming.

Species	Scientific Name	Status	Habitat
Preble's Meadow Jumping Mouse	*Zapus hudonius preblei*	Threatened	Well-developed riparian
Greater Sage-Grouse	*Centrocercus urophasianus*	Candidate	Sagebrush communities
Mountain Plover	*Charadrius montanus*	Proposed	Grasslands and prairie dog towns
Platte River species: Interior Least Tern Pallid Sturgeon Piping Plover Whooping Crane	 *Sternula antillarum* *Scaphirhychus albus* *Charadrius melodus* *Grus americana*	 Endangered Endangered Threatened Endangered	Downstream riverine habitat of the Platte River system
Blowout Penstemon	*Penstemon haydenii*	Endangered	Sand blowouts or dunes
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 feet elevation

The USFWS reinstated ESA protection of the Preble's meadow jumping mouse in Wyoming on 5 Aug 2011 (USFWS 2011). Critical habitat has been designated in the state along the Cottonwood Creek, Chugwater Creek, and Lodgepole Creek drainages. None of these drainages are in or near the project area. *Zapus* species have been trapped along drainages of the North Platte River in Converse County (WYNDD 2004). This area of the state may contain western jumping mouse (*Z. princeps*), Preble's meadow jumping mouse, and/or hybrids of the two species. Western jumping mouse generally occupies montane and foothills

habitats similar to the project area, whereas Preble's occupies primarily prairie riparian sites with peripheral extensions into higher elevations (WYNDD 2004).

In Wyoming, blowout penstemon is found in sparsely vegetated sandy blowouts in the early stages of plant community development composed of blowout grass (*Redfieldia flexuosa*), lemon scurf-pea (*Psoralidium lanceolatum*), and thickspike wheatgrass (*Elymus lanceolatus*), or Indian ricegrass (*Achnatherum hymenoides*). No potential habitat for blowout penstemon exists within the Study Area and no surveys were performed for this species.

Mountain plovers (*Charadrius montanus*) nest in flat, open areas with low, sparse vegetation. In shortgrass prairies, they tend to use prairie dog towns or fields grazed by livestock. Potential habitat (i.e., black-tailed prairie dog towns) was identified in the Study Area, but species-specific surveys were not conducted. No mountain plovers were observed during other project-related surveys.

The Platte River species are listed for Converse County due to concerns of water depletions of the North Platte River that may affect downstream habitat (i.e., the Platte River in Nebraska). There is no suitable habitat for these species in the Study Area and they are not expected to occur on site.

Habitat for greater sage-grouse and Ute ladies'-tresses is present within the Study Area. Surveys were conducted for each of these species. See Section 5.0 for results of the greater sage-grouse surveys. Although not expected to occur within the Study Area, a Sprague's pipit was detected during an avian survey and is discussed below.

10.1.1 Sprague's Pipit

On 15 September 2010, the USFWS announced its 12-month finding on a petition to list Sprague's pipit as endangered or threatened throughout its range (USFWS 2010a). The USFWS determined that listing was warranted, but precluded by higher priority actions, designating the species as a Candidate under the ESA.

Wyoming is west of the species' traditional spring and fall migration route through the Great Plains (Jones 2010) and the species is not known to breed in the state (Cerovski et al. 2004; Faulkner 2010). There are only two documented records for Wyoming with one of those relatively close to the Study Area—six Sprague's pipits at Casper, Natrona County, on 27 September 1994.

A single adult Sprague's pipit was recorded at survey point MB19 on 6 October 2010. This individual was part of a relatively large avian migratory movement observed in the Study Area on that date (68 individuals were recorded at R3). The species' fall migration primarily occurs from late September through early November during which it generally exhibits solitary behavior (Jones 2010). The timing and behavior of the Sprague's pipit found in the Study Area is consistent with that known for the species; however, due to its status in Wyoming, this is likely an anomalous occurrence.

10.1.2 Ute Ladies'-tresses

Ute ladies'-tresses (*Spiranthes diluvialis*) is federally listed under the ESA as a threatened species (USFWS 1992). SWCA conducted surveys to evaluate the quality of potential habitat and determine presence or absence for this species within the Study Area. Based on habitat characteristics for this plant, the survey was limited to floodplain and riparian systems, which account for approximately 1,659 acres (7%) of the Study Area. This section summarizes the results of the Ute ladies'-tresses survey.

Ute ladies'-tresses is a perennial, terrestrial orchid with 7- to 32-inch stems (USFWS 2010b). The flowering stalks consist of a few to several small white or ivory flowers clustered into a spiraling spike arrangement at the top of the stem. The flowering period is generally from late July through September. Ute ladies'-tresses occur in mesic to wet areas scoured by periodic disturbance events where interspecific competition is not limiting (NatureServe 2010). Populations are generally found on low, flat floodplain terraces or abandoned oxbows within 150 to 200 feet of a perennial water source in a narrow band between emergent aquatic vegetation and adjacent dry upland prairie, growing in sandy loams that have developed from Quaternary alluvial deposits (Wyoming Natural Diversity Database 2010). Vegetation cover is typically 75% to 90% and is usually less than 18 inches tall.

Nine known populations of Ute ladies'-tresses are located in the eastern part of Wyoming in Converse, Goshen, Laramie, and Niobrara Counties (Heidel 2007). In Wyoming, this orchid is found at elevations of 4,750 to 5,400 feet (Heidel 2007). Common associated species are typical of wet meadow communities and include creeping bentgrass, switchgrass (*Panicum virgatum*), scratchgrass (*Muhlenbergia asperifolia*), seaside arrowgrass (*Triglochin maritima*), blue-eyed grass (*Sisyrinchium* spp.), rushes, fewflower spikerush (*Eleocharis quinqueflora*), smooth horsetail (*Equisetum laevigatum*), yellow sweetclover (*Melilotus officinalis*), meadow lousewort (*Pedicularis crenulata*), and common threesquare (*Schoenoplectus pungens*).

Potential habitat models for the target species were created by using a combination of aerial imagery with GIS layers of vegetation (LANDFIRE) and wetlands (National Wetland Inventory). Critical vegetation types included Rocky Mountain Montane Riparian Systems, Rocky Mountain Subalpine/Upper Montane Riparian Systems, Western Great Plains Floodplain Systems, and Western Great Plains Wooded Draw and Ravine (USGS 2006). Critical wetland types included Freshwater Emergent Wetland, Freshwater Forested/Shrub Wetland, Freshwater Pond, and Riverine systems (USFWS 2010c).

Surveys for Ute ladies'-tresses must occur during the fruiting and blooming period. This species typically blooms from late July to early September in Wyoming; however, it does not necessarily flower every year (Bureau of Land Management 2007). The peak of flowering occurs in Wyoming around mid-August, but this depends on temperature and moisture. SWCA botanists conducted a reconnaissance survey of potential habitat within the Study Area on 4–5 August 2010. The botanists searched approximately 1,700 acres (7%) of the Study Area, looking for plant populations and noting the quality of potential habitat. Photographs were taken of wetland areas and surrounding habitat to document habitat quality.

Ute ladies'-tresses were not observed in the Study Area. Surveys of five of the six sub-watersheds revealed that the wetland and riparian areas are non-suitable habitat for Ute ladies'-tresses. This determination was based on lack of habitat characteristics associated with the species. Dominant riparian vegetation included peachleaf willow, coyote willow, orchard grass, and various rushes and sedges (*Carex* spp.).

Upper reaches of Virden Creek in the Box Elder Creek-Virden Creek sub-watershed contained habitat characteristics suitable for Ute ladies'-tresses, which includes sub-irrigated hayfields surrounding the gentle-grade perennial stream. Common species found along upper Virden Creek include creeping bentgrass, redtop, coyote willow, Nebraska sedge, mountain rush, bulrush, foxtail, wild mint, and red clover. A large occurrence of hooded ladies'-tresses (*Spiranthes romanzoffiana*), which is a common look-alike species to Ute ladies'-tresses, was observed here. The entire reach of suitable habitat was surveyed and no Ute ladies'-tresses were identified within this population of hooded ladies'-tresses. Hooded ladies'-tresses are more common and occur at higher elevations. The Study Area is located at elevations of 5,500 to 6,700 feet above mean sea level, which is at elevations greater than the nine previously recorded occurrences of Ute ladies'-tresses in Wyoming (Heidel 2007).

11.0 BATS

WGFD *Recommendations* includes four pre-construction bat survey types: habitat evaluation, passive acoustic, active acoustic, and live capture. WGFD did not require live capture surveys for this project[1]. In addition to surveys recommended in WGFD (2010a), SWCA conducted mobile passive acoustic surveys at potential bat use sites identified through the habitat evaluation to further assess the Study Area for bat use.

This section summarizes the habitat evaluation for the Study Area, the MET-based passive acoustic surveys at METs B and C, and mobile passive and active acoustic surveys conducted in the Study Area.

11.1 DATA ANALYSIS

Most bats emit vocalizations (calls) and interpret the echo patterns (a system called echolocation) for orientation and to catch prey in complete darkness (Griffin 1944). These echolocation calls may range from 11 kiloHertz (kHz) to 212 kHz (Fullard and Dawson 1997; Fenton and Bell 1981). Human adults can typically hear sounds up to about 20 kHz. As a consequence, the use of devices (e.g., Anabat) that can detect and record sounds upwards of 200 kHz has become a popular and economically feasible tool for monitoring bats at wind-energy facilities (Arnett et al. 2007).

Anabat is a bat detection system that uses a broadband microphone and data storage unit to detect and record ultrasonic sounds. These sounds can be displayed as sonograms (frequency

[1] Meeting on 30 June 2010 at WGFD Cheyenne office between Christine Mikell and John Aubrecht (Pioneer Wind Park, LLC); Larry Semo (SWCA Environmental Consultants); and Mary Flanderka, Scott Gamo, Rick Huber, and Daryl Lutz (WGFD).

across time) using the AnalookW software. Bat species produce echolocation calls based on their ecological niche requirements, which may demand different frequency bandwidth, call note duration, and other characteristics. These parameters can be assessed for species identification; although, intraspecific variation based on confounding factors (e.g., habitat, presence of other bats) can make species identification difficult (Barclay and Brigham 2004). Furthermore, the microphones cannot discriminate between bat calls and other ultrasonic sounds (e.g., rain, insects, electrical or mechanical [collectively called noise]). Thus, data analysis includes separating files with bat calls from files containing noise.

An index of bat activity was calculated by counting the number of bat passes per detector per unit time (Hayes 1997). A bat pass was defined as a call sequence consisting of ≥2 individual calls that were separated by >1 second from the next sequence (White and Gehrt 2001). An index of activity is used because the number of bats cannot be quantified from acoustic data since individual bats are not identifiable. Data files without a bat call and those files with calls that did not meet the bat pass criteria were removed from analysis. All bat passes were categorized using a qualitative analysis approach (O'Farrell et al. 1999) by a trained biologist. Individual passes were labeled by characteristic frequency type (e.g., 25 kHz, 30 kHz, 40 kHz), then grouped into low (<30 kHz), mid- (30–50 kHz), and high (>50 kHz) frequency groups. Diagnostic call sequences were labeled by species. For reporting purposes, except where indicated, species-specific passes were combined with the appropriate frequency group (Table 26). Species voucher call sequences will be provided directly to WGFD.

Table 26. Bat Species Comprising Low, Mid-, and High Frequency Groups in Wyoming Based on Characteristic Call Frequency.[1]

Frequency	Common Name	Scientific Name
Low (<30 kHz)	Hoary Bat	*Lasiurus cinereus*
	Silver-haired Bat	*Lasionicteris noctivagans*
	Big brown Bat	*Eptesicus fuscus*
	Spotted Bat	*Euderma maculatum*
	Brazilian Free-tailed Bat	*Tadarida brasiliensis*
	Big Free-tailed Bat	*Nyctinomops macrotis*
Mid (30–50 kHz)	Western Small-footed Myotis	*Myotis ciliolabrum*
	Long-eared Myotis	*Myotis evotis*
	Northern Myotis	*Myotis septentrionalis*
	Little Brown Myotis	*Myotis lucifugus*
	Fringed Myotis	*Myotis thysanodes*
	Long-legged Myotis	*Myotis volans*
	Townsend's Big-eared Bat	*Corynorhinus townsendii*
	Pallid Bat	*Antrozous pallidus*
	Eastern Red Bat	*Lasiurus borealis*
	Tri-colored Bat	*Perimyotis subflavus*
High (>50 kHz)	California Myotis	*Myotis californicus*
	Yuma Myotis	*Myotis yumanensis*

[1] Species list and frequency adapted from Hester and Grenier (2005).

11.1.1 Low Frequency Bats

Six bat species (hoary bat, silver-haired bat, big brown bat, spotted bat, Brazilian free-tailed bat, and big free-tailed bat) found in Wyoming (Hester and Grenier 2005) are categorized as low frequency bats since their characteristic call frequencies are below 30 kHz. Hoary, silver-haired, big brown, and spotted bats are known to breed in Wyoming, while Brazilian free-tailed and big free-tailed bats are considered peripheral or accidental, respectively (Hester and Grenier 2005).

11.1.2 Mid-Frequency Bats

Hester and Grenier (2005) list 10 bat species that may be characterized as mid-frequency bats. Six of these species are found in the genus *Myotis* (western small-footed myotis, long-eared myotis, northern myotis, little brown myotis, fringed myotis, and long-legged myotis), while the others are of mixed genera (Townsend's big-eared bat, pallid bat, eastern red bat, and tri-colored bat). The eastern red bat is considered peripheral, while the tri-colored bat is considered accidental in Wyoming (Hester and Grenier 2005). Characteristic call frequencies for these bat species typically range between 30 and 50 kHz.

11.1.3 High Frequency Bats

Two bat species (California myotis and Yuma myotis) that are known to have occurred in Wyoming have characteristic call frequencies above 50 kHz. Both myotis species are considered peripheral in Wyoming (Hester and Grenier 2005).

11.2 HABITAT EVALUATION

To evaluate potential roost, foraging, and other use sites within the Study Area (Figure 11), SWCA overlaid spatial data from LANDFIRE (USGS 2006) and the National Wetland Inventory (USFWS 2010c) in a GIS format. Since bats are volant, they may fly through areas that are unsuitable for their life history requirements (e.g., foraging, roosting). Thus, the entire Study Area may have bat activity during the study period. Bat use sites are defined as areas that possess habitat characteristics that may concentrate bat activity for foraging or roosting (including maternity colonies and hibernacula). Areas that contained a combination of woodlands, rock outcroppings, or cliffs, with slow-moving or still surface water, were considered potential bat use sites for the analysis. Potential bat use sites were identified through a GIS-based analysis and further assessed using mobile passive acoustic surveys (presented below). The LANDFIRE dataset does not specifically identify rocky outcroppings or cliffs as habitat types. All mines associated with the Study Area are surface gravel mines and are likely unsuitable as roost or colony sites.

The combination of woodlands, rocky outcroppings, or cliffs, with slow-moving or still surface water is limited within the Study Area in general. The Willow Creek drainage provides a perennial, slow-moving/still water source for bats. Beaver dams check the creek's water flow through the Study Area. The riparian corridor is bordered by willows, which are generally unsuitable as roosting sites; thus, leaving the section of Willow Creek within the Study Area a potential foraging area only. Rocky outcroppings are limited in the Study Area. Several small, ephemeral waterbodies are scattered throughout and may provide suitable

foraging and/or drinking opportunities for part of the time period when bats are present (early April through early October).

11.3 MET-BASED SURVEYS

The WGFD *Recommendations* include placement of at least one acoustic monitoring device within the RSZ per MET. During MET tower placement in fall of 2009, Pioneer attached two Anabats (SD1 model) each on METs B and C (Figure 11). On both METs B and C, one Anabat was placed at a height of approximately 50 m in the expected RSZ, and a second Anabat at approximately 5 m above ground level.

The MET-based Anabats collected data between 15 April and 15 October in 2010 and 2011. In 2010, the units began operation on 10 March, but no bat calls were recorded until early April. Therefore, to allow for better comparison between years, only data for the WGFD recommended survey period of 15 April through 15 October are presented in this report. Anabat data cards were exchanged at approximately two-week intervals during the annual survey periods. New data cards were programmed to start data collection at least 0.5 hour prior to local sunset and to turn off at least 0.5 hour after local sunrise for their respective two-week survey period. Used data cards were downloaded and stored for analysis. The Anabat software produces a text-based status report at each download. SWCA reviewed these status reports to check for data collection and unit performance irregularities.

11.3.1 Results and Discussion

Anabat units at MET B (5 m), C (50 m), and C (5 m) were active for 168 detector-nights from 15 April to 15 October. The Anabat unit used for MET B (50 m) was replaced on 14 July due to hardware failure on June 30. Review of files recorded in June suggests that the unit may not have been functioning properly prior to the hardware failure. Bat passes were recorded in May and June. There were no issues with the replacement Anabat for the remainder of the survey period. SWCA used 29 and 18 detector-nights for calculating effort at MET B (50 m) in June and July, respectively, giving a total of 154 survey-nights for the 2010 survey period. Technician error resulted in all four MET-based Anabats being non-operational from 11 through 26 August 2010. Combined, all MET-based units were operational for 658 detector-nights in 2010 (Table 27). All MET-based units were operational during the 15 April through 15 October 2011 survey period for a total of 751 survey-nights (Table 27).

The number of total bat passes at the MET-based units ranged from 169 to 974 (Table 28). More low frequency bat passes were identified than any other frequency group in 2010 and 2011; however, the number of unidentified passes is sufficient to warrant caution regarding activity comparisons between low and mid-frequency groups.

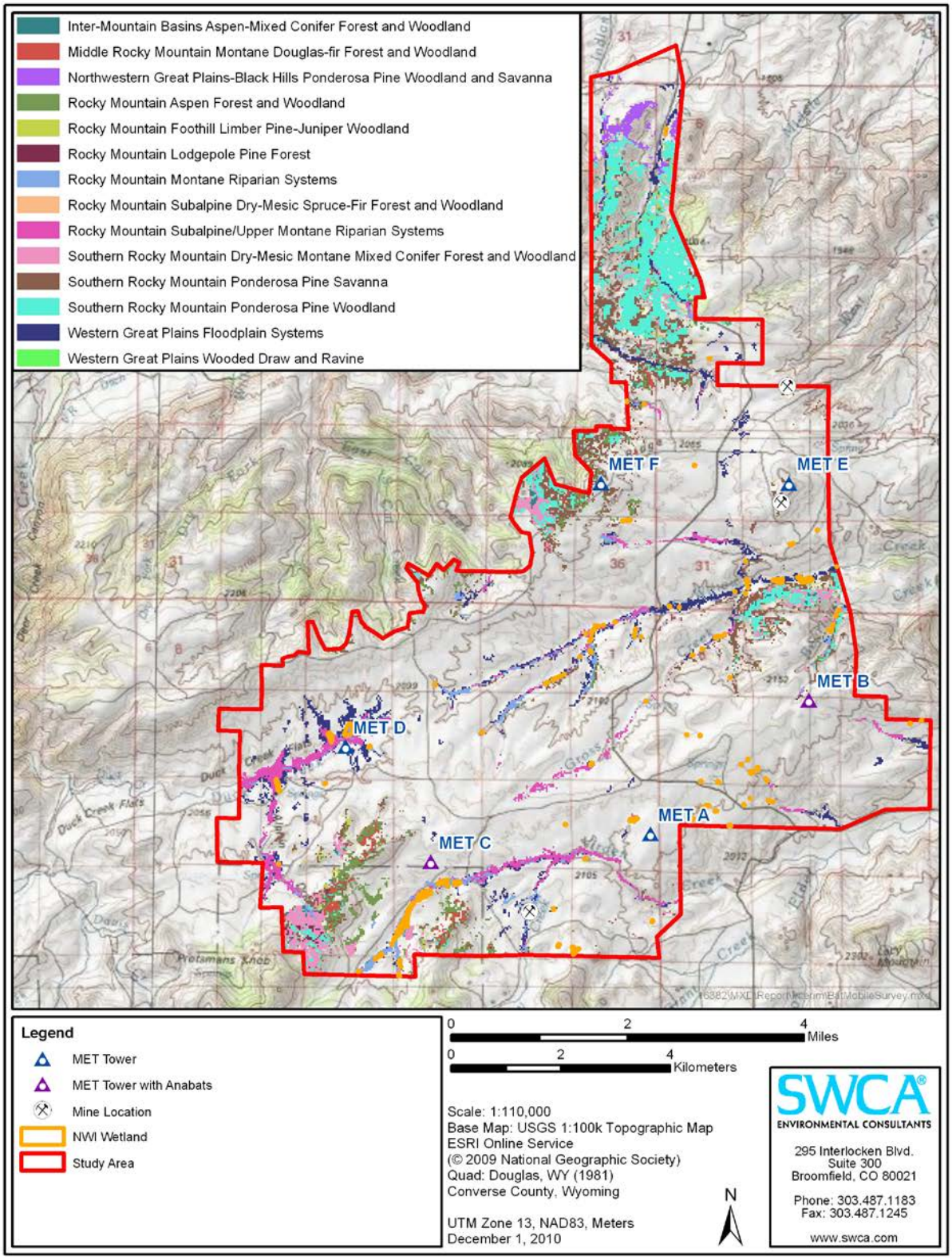

Figure 11. Potential bat use areas within the Study Area based on LANDFIRE spatial vegetation layers and National Wetland Inventory sites.

Table 27. Dates and Survey Effort for MET-based Bat Surveys, 15 April–15 October 2010 and 2011.

Location	2010 Survey Dates	Survey-Nights	2011 Survey Dates	Survey-Nights
MET B (50 m)	15 April–29 June, 14 July–10 August, 27 August–15 October	154	15 April–15 October	187
MET B (5 m)	15 April–10 August, 27 August–15 October	168	15 April–15 October	188
MET C (50 m)	15 April–10 August, 27 August–15 October	168	15 April–15 October	188
MET C (5 m)	15 April–10 August, 27 August–15 October	168	15 April–15 October	188

Table 28. Total Bat Passes and Bat Passes by Frequency and Unidentified Groups for MET-based Bat Surveys, 15 April–15 October 2010 and 2011.

Location	Low Frequency		Mid-Frequency		High Frequency		Unidentified		Total Bat Passes	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
MET B (50 m)	149	146	6	7	0	0	14	16	169	169
MET B (5 m)	180	196	145	170	0	1	39	67	364	434
MET C (50 m)	212	294	40	37	0	0	37	11	289	342
MET C (5 m)	231	313	410	632	2	2	185	27	828	974
Total	772	949	601	846	2	3	275	121	1,650	1,919

The MET towers differed in the total number of bat passes detected. The MET C Anabats detected 1,117 bat passes (67.7%) in 2010 and 1,316 (68.6%) in 2011: MET C (5 m) unit accounted for 74.2% of MET C bat passes and 50.2% of all bat passes recorded at both MET C towers combined in 2010. The 2011 results were similar, with the MET C (5 m) unit accounting for 74.0% of MET C bat passes and 50.8% of all bat passes recorded at both MET towers.

11.3.1.1 Activity Level and Temporal Use Patterns

Review of bat pass data indicated that bats do not use the Study Area equally from spring to fall. Figure 12 shows the mean weekly number of bat passes (total number of bat passes divided by number of survey nights per week) during the 15 April through 15 October period when bats were recorded at the Study Area by MET-based Anabats in 2010 and 2011.

Spring bat activity was very low during April through mid-May in both years. Activity levels increased in late May in the Study Area, reaching peak summer activity from late July to early September. It is likely that bat activity levels remained elevated during the data gap for 11 to 25 August 2010 and that the period of 25 July to 1 September generally represents a period of consistently high bat activity in the Study Area.

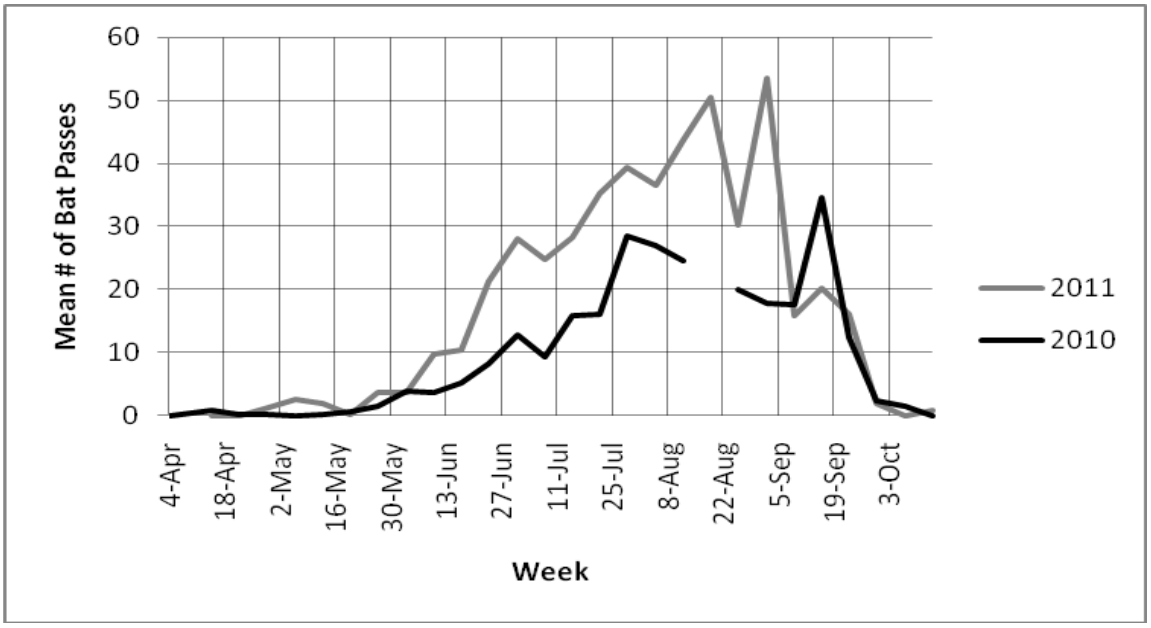

Figure 12. Mean weekly number of bat passes for the MET-based Anabats, 15 April–15 October 2010 and 2011.

Activity levels began to decrease in September. All MET-based Anabats recorded elevated numbers of bat passes during the nights of 3, 7, 12, and 13 September 2010, suggesting migratory pulses on those nights. A similar, but to a smaller degree, increase in mean bat passes is evident during mid-September 2011 as well. Activity levels continued to drop through mid- and late September and very few bat passes were recorded in October of either year.

As shown in Table 28, mean bat activity levels were not equal across all MET-based Anabats. Combining data from the 5 m and 50 m units at each site, the MET C site had higher mean activity level than the MET B site in both years. Furthermore, MET C (5 m) recorded more bat passes per detector-night on average than any other MET-based Anabat. The contrast in bat activity levels between the MET C and MET B sites may reflect habitat differences at those sites. For example, MET C is close to the Virden Creek corridor, which was identified as a potential bat use area in the habitat evaluation; whereas, MET B has lower adjacent exposure to potential bat use areas (see Figure 11).

11.4 MOBILE PASSIVE SURVEYS

Mobile Anabat units were used for site evaluation in the Study Area. Units were moved regularly between 10 sites in 2010 and 14 sites in 2011 as determined by the habitat evaluation described above. Anabat unit locations were microsited based on exposure to roads, availability of a suitable substrate to attach the Anabat system, and other logistical considerations (Figure 13).

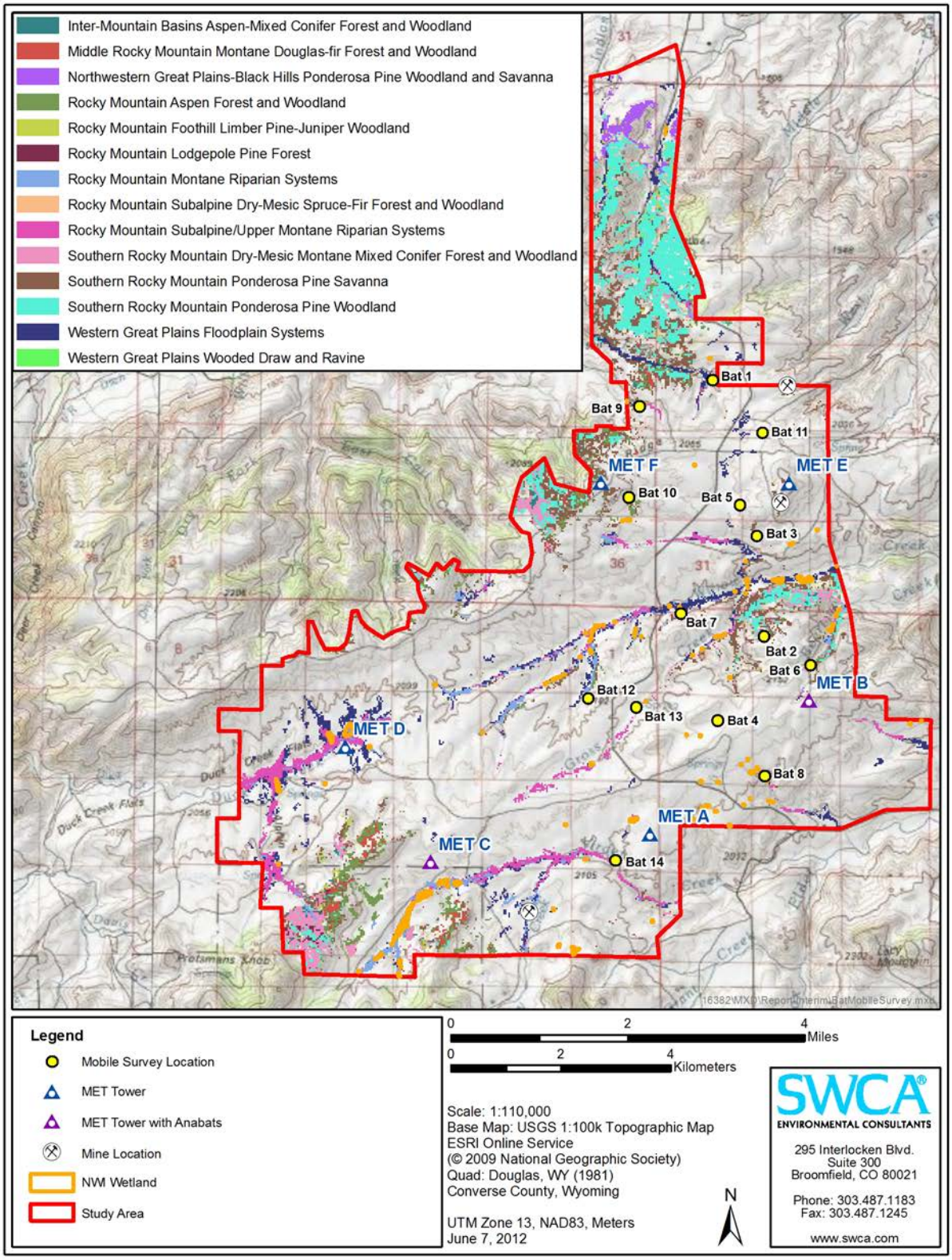

Figure 13. Mobile passive bat survey locations and areas considered potential bat use sites based on LANDFIRE-based habitat evaluation.

Anabat microphones were attached near the top of 10-foot poles (i.e., approximately 3 m above ground level) and attached to the SD2 Anabat unit with a 3-m Teflon cable. The poles could then be securely attached to fence posts and other suitable substrates within each survey area. Mobile Anabats were moved at approximately two-week intervals among these sites from 16 April through 15 October 2010 and 15 April through 15 October 2011. Data card logistics, status report review, and data analysis followed the same protocol used for the MET-based Anabats.

11.4.1 Results and Discussion

Temporal survey coverage and effort by the mobile Anabats varied by location (Table 29). Technician error resulted in Anabats not being operational from 11 to 23 August 2010.

Table 29. Dates and Survey Effort for Mobile Bat Surveys, 16 April–15 October 2010[1] and 15 April–15 October 2011.

Site	2010 Survey Dates	Survey-Nights	2011 Survey Dates	Survey-Nights
Bat 1	16 Apr–2 May; 15–26 Jul; 6–8 Oct	32	15 Apr–4 May; 19 Jul–1 Aug	33
Bat 2	18 Apr–12 May; 29 Jun–12 Jul; 23 Sep–5 Oct	51	8–22 Jun	15
Bat 3	4–16 May; 27 Jul–10 Aug	28	18 May–7 Jun	21
Bat 4	13–23 May; 14–25 Jul; 8–15 Oct	31	15 Apr–3 May; 4–15 Oct	34
Bat 5	17 May–2 Jun	17	8–18 Jul	11
Bat 6	26 May–14 Jun; 25 Aug–9 Sep	36	18 May–7 Jun; 27 Aug–17 Sep	43
Bat 7	3–15 Jun; 24 Aug–7 Sep	28	25 Jun–6 Jul; 4–10 Oct	19
Bat 8	15–27 Jun; 12–21 Sep	23	4–17 May	14
Bat 9	16–28 Jun; 12–19 Sep	21	8–22 Jun; 20 Sep–3 Oct	29
Bat 10	30 Jun–13 Jul	14	4–17 May	14
Bat 11	---	---	26 Jun–7 Jul	12
Bat 12	---	---	9–19 Jul; 4–17 Aug	25
Bat 13	---	---	20 Aug–2 Sep	14
Bat 14	---	---	18 Sep–3 Oct	12

[1] All Anabats were inoperable from 11–23 August 2010.

In 2010, spring bat activity at Bats 1, 3, 4, 5, 6, and 7 matched activity levels observed at the two MET-based units. MET-based data indicated very low activity levels between 16 April and 14 June, and that pattern was also evident in the low number of bat passes recorded at mobile survey sites. Due to the low spring/early summer activity level throughout the Study Area, identification of bat use areas during that time period may not be possible.

Similar to spring surveys, the number of bat passes at Bat 2 and Bat 4 (the only sites surveyed in late September and early October 2010) did not differ from MET-based Anabats. In

general, very little activity was recorded after 23 September in the Study Area with one exception of 10 bat passes recorded at Bat 2 on the night of 1 October 2010.

In 2011, no bats were recorded by one unit primarily used in the northern portion of the Study Area. A review of status reports upon each data download indicated that the unit was properly turning on and off, and recording files to the data card. It is possible that no bats were recorded, although there may also have been a malfunction with the unit or microphone that went undetected during the field season.

11.5 ACTIVE ACOUSTIC SURVEYS

Active acoustic surveys were performed in the Study Area to facilitate species identification. Active acoustic surveys differ from stationary passive surveys in that observers can purposefully follow individual bats while recording calls. This extended call recording tends to produce longer call sequences with less distortion. Thus, active acoustic surveys are preferred over passive acoustic surveys for obtaining high-quality, species-specific calls and producing a species list for the area of interest.

Active acoustic surveys were performed in the Study Area from 23 May to 6 October 2010 and 6 June to 30 August 2011. Surveys started approximately 0.5 hour before local sunset and the area/route monitored for 2.5 hours. Surveys were conducted by foot, vehicle, or a combination of both. Once a bat was encountered (i.e., call detected by the Anabat), observers attempted to get a visual detection with a spotlight. Individual bats were followed when possible, or if a specific location was repeatedly used by multiple bats (e.g., creek, pond), then surveyors remained at that location for an extended period of time. Since effort differed between surveys depending on the number of bats encountered, number of specific locations with extended stationary visits, and number of bat calls recorded by tracked individual bats, it is not possible to provide a comparison of temporal or spatial attributes of the number of bat calls as provided in the passive acoustic section above.

High-quality bat calls were recorded during active acoustic surveys allowing for identification of five species (Pallid Bat, Hoary Bat, Silver-haired Bat, Little Brown Myotis, and Big Brown Bat). Two additional *Myotis* species may also have been present in the Study Area in 2010 and 2011. Calls characteristic of long-eared bat and fringed bat were recorded in both years. However, both of these *Myotis* species produce steep-sloped calls in the 30 kHz range and are difficult to distinguish.

12.0 REFERENCES

Arnett, E. B., D. B. Inkley, D. H. Johnson, R. P. Larkins, S. Manes, A. M. Manville, J. R. Mason, M. L. Morrison, M. D. Strickland, and R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. Wildlife Society Technical Review 07-2. The Wildlife Society, Bethesda, MD.

Barclay, R. M., and R. M. Brigham. 2004. Geographic variation in the echolocation calls of bats: a complication for identifying species by their calls. In Bat Echolocation Research: Tools, techniques, and analysis. Bat Conservation International, Austin, TX.

Bureau of Land Management. 2007. Statewide Programmatic Biological Assessment: Ute Ladies'-Tresses Orchid (*Spiranthes diluvialis*). October 2005 with final edits, 7 March 2007. Submitted to Bureau of Land Management Wyoming State Office, Cheyenne.

Cerovski, A. O., M. Grenier, B. Oakleaf, L. Van Fleet, and S. Patla. 2004. Atlas of birds, mammals, amphibians, and reptiles in Wyoming. Wyoming Game and Fish Department Nongame Program, Lander, WY.

Chapman, S. S., S. A. Bryce, J. M. Omernik, D. G. Despain, J. ZumBerge, and M. Conrad. 2004. Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey (map scale 1:1,400,000), Reston Virginia.

Christiansen, T. 2007. Chapter 12: Greater Sage-Grouse (*Centrocercus urophasianus*). In Handbook of Biological Techniques, third edition, edited by S.A. Tessmann, pp. 12-1 to 12-51. Wyoming Game and Fish Department, Cheyenne.

Colorado Division of Wildlife. 2007. Recommended Survey Protocol and Actions to Protect Nesting Burrowing Owls When Conducting Prairie Dog Control. Colorado Division of Wildlife, Denver.

Conway, C. J., and J. C. Simon. 2003. Comparison of detection probability associated with Burrowing Owl survey methods. Journal of Wildlife Management 67:501–511.

Faulkner, D. W. 2010. Birds of Wyoming. Roberts and Company Publishers, Greenwood Village, CO.

Fenton, M. B., and G. P. Bell. 1981. Recognition of species of insectivorous bats by their echolocation calls. Journal of Mammalogy 62:233–243.

Fullard, J., and J. Dawson. 1997. The echolocation calls of the spotted bat *Euderma maculatum* are relatively inaudible to moths. Journal of Experimental Biology 200:129–137.

Griffin, D. R. 1944. Echolocation by blind men, bats and radar. Science 100:589–590.

Hayes, J. P. 1997. Temporal variation in activity of bats and the design of echolocation-monitoring studies. Journal of Mammalogy 78:514–524.

Heidel, B. 2007. Survey of *Spiranthes diluvialis* (Ute ladies'-tresses) in eastern Wyoming, 2005-2006. Prepared for Bureau of Land Management and the Medicine Bow/Routt National Forest/Thunder Basin National Grassland. Wyoming Natural Diversity Database, Laramie, Wyoming.

Hester, S. G., and M. B. Grenier. 2005. A conservation plan for bats in Wyoming. Wyoming Game and Fish Department, Nongame Program, Lander, WY.

Jones, S. L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.

Mosher, J. A., and M. R. Fuller. 1996. Surveying woodland hawks with broadcasts of great horned owl vocalizations. Wildlife Society Bulletin 24(3):531–536.

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available online at http://www.natureserve.org/explorer. Accessed October 2010.

O'Farrell, M. J., B. W. Miller, and W. L. Gannon. 1999. Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy 80:11–23.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. Condor 82:309–313.

Rosgen, D. L. 2009. Watershed assessment for river stability and sediment supply (WARSSS), second edition. Wildland Hydrology, Fort Collins, Colorado.

SWCA Environmental Consultants (SWCA). 2010a. Biological survey report for the Pioneer Wind Park Wildlife Study Area: Year 1. Prepared for Pioneer Wind Park, LLC. Prepared by SWCA Environmental Consultants, Broomfield, CO.

———. 2010b. Reconnaissance level assessment for Pioneer Wind Park, Converse County, Wyoming.

U.S. Environmental Protection Agency (EPA). 2008. Watershed assessment of river stability and sediment supply (WARSSS) Version 1.0. Available online at http://www.epa.gov/owow/watershed/tools/warss/index.htm. Accessed August 2010.

U.S. Fish and Wildlife Service (USFWS). 1983. Northern State Bald Eagle Recovery Plan. Prepared by Northern States Bald Eagle Recovery Team.

———.1992. Endangered and Threatened Wildlife and Plants; Final Rule to List the Plant *Spiranthes diluvialis* (Ute Ladies'-Tresses) as a Threatened Species. Federal Register. 50 CFR Part 17.

———. 2010a. Endangered and threatened wildlife and plants; 12-month finding on a petition to list Sprague's pipit as endangered or threatened throughout its range. Federal Register 75(178):56028–56050.

———. 2010b. Environmental Conservation Online System. Species Profile. *Spiranthes diluvialis* Ute Ladies'-tresses. Available online at http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q2WA. Accessed October 2010.

———. 2010c. Wetlands Mapper. National Wetland Inventory, U.S. Fish and Wildlife Service, U.S. Department of the Interior. Available online at http://www.fws.gov/wetlands/Data/Mapper.html. Accessed October 2010.

———. 2011. Endangered and threatened wildlife and plants; reinstatement of listing protections for the Preble's meadow jumping mouse. Federal Register 76(151):47490-47491.

U.S. Geological Survey (USGS). 2006. The National Map LANDFIRE. Available online at http://landfire.cr.usgs.gov/viewer/viewer.htm. Accessed October 2010.

White, E. P., and S. D. Gehrt. 2001. Effects of recording media on echolocation data from broadband bat detectors. Wildlife Society Bulletin 29:974–978.

Wyoming Natural Diversity Database. 2004. Species assessment for Preble's meadow jumping mouse (*Zapus hudsonius preblei*) in Wyoming. Prepared for U.S. Department of Interior, Bureau of Land Management, Wyoming State Office, Cheyenne, WY.

———. 2010. Plant Species of Concern: Species Abstracts. Available online at http://uwadmnweb.uwyo.edu/wyndd/info.asp?p=2655#PlantSpeciesAbstracts. Accessed October 2010.

Wyoming Game and Fish Department (WGFD). 2009. 2009 Greater Sage-Grouse Lek Database and associated files. Wyoming Game and Fish Department, Cheyenne.

———. 2010a. Wildlife protection recommendations for wind energy development in Wyoming. Wyoming Game and Fish Commission approved version dated April 23, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

———. 2010b. Sage-grouse core management areas version 3. Available online at http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp. Accessed February 2011.

———. 2010c. Wyoming State Action Plan. Available online at http://gf.state.wy.us/SWAP2010/Plan/index.asp. Accessed March 2011.

APPENDIX A

Biological Survey Protocols for Pioneer Wind Park, Converse County, Wyoming

WYOMING GAME AND FISH DEPARTMENT

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June 8, 2010

WER 12062
SWCA Environmental Consultants
Biological Survey Protocols for
Pioneer Wind Park
Wasatch Wind
Converse County

Chris Haas
SWCA Environmental Consultants
295 Interlocken Blvd. Suite 300
Broomfield, CO 80021

Dear Mr. Haas:

The staff of the Wyoming Game and Fish Department has reviewed the Biological Survey Protocols for the Pioneer Wind Park in Converse County. We offer the following comments for your consideration. As revised, we have no terrestrial wildlife or aquatic habitat concerns regarding the monitoring protocol for this project. We encourage SWCA to keep us periodically apprised of monitoring progress.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Scott Gamo, Staff Terrestrial Biologist, at 307-777-4509.

Sincerely,

For John Emmerich
Deputy Director

JE: MF: sg

cc: USFWS

Biological Survey Protocols for Pioneer Wind Park, Converse County, Wyoming

Prepared by

SWCA Environmental Consultants, Inc
Broomfield, CO 80021

Prepared for

Wyoming Game and Fish Department
5400 Bishop Boulevard
Cheyenne, WY 82006

May 14, 2010

Introduction

In accordance with the Wyoming Game and Fish Department's *Recommendations for Wind Energy Development in Crucial and Important Wildlife Habitat* (dated April 5, 2010; hereafter, WGFD *Recommendations*), SWCA has prepared biological survey protocols for the proposed Pioneer Wind Park for WGFD review and approval. These survey protocols are for field surveys to begin immediately upon approval by WGFD. Some surveys employ a before-after/control-impact (BACI) study design will allow comparison of changes, if any, in animal use patterns within treatment (i.e., turbine sites) sites with changes, if any, at an undeveloped control site. The Project Area is divided into two phases (Phase 1 and Phase 2) with a control site in close proximity to both Phase development areas. The control site is in similar habitat and elevation range to that found within the Phase 1 and Phase 2 sites (e.g., mixed grassland and sagebrush steppe) to minimize ecological differences between the sites (Figure 1). The control site is within the current Project Area; however, development of that area is uncertain. Regardless, development of the control site by Pioneer Wind Park, LLC, will not occur prior to collection of post-construction survey data for Phase 1 and Phase 2.

With approval from WGFD, the completion of 2010 surveys will satisfy pre-construction survey needs for Phase 1 in order for Pioneer Wind Park, LLC, to initiate Industrial Siting Council permit applications and other regulatory requirements. Pre-construction surveys will continue in Phase 1 in spring and summer of 2011 and will fulfill the two-year pre-construction survey recommendation for spring passerine and raptor migration, and breeding bird surveys.

Pioneer Wind Park, LLC and SWCA first met with WGF in Cheyenne on February 11, 2010 to give an overview of the project.[1] Notes attached at the end of protocols. As a follow up on March 19, 2010, representatives from WGFD, Pioneer Wind Park, LLC, and SWCA met in Cheyenne[2] to discuss preliminary biological survey protocols developed by SWCA. At that meeting WGFD provided copies of the latest draft of the WGFD *Recommendations* (dated March 19, 2010). Pioneer Wind Park, LLC subsequently provided a draft letter to WGFD summarizing the meeting discussions and providing species-specific protocols which reflected the October 26, 2009 WGFD *Recommendations*. Response by WGFD to this letter emphasized following the most recent (April 5, 2010) *Recommendations*; as such, these most recent protocols will be adhered to during future monitoring efforts and are reflected in the following sections.

Survey protocols are discussed in individual sections below. Each heading pertains to the specific survey type noted within Appendix B of WGFD *Recommendations*. These surveys specifically address only those that will be performed throughout the pre-, during, and post-construction phases. Additional post-construction surveys may be required. The need for additional post-construction surveys will be assessed at a later time pending pre-construction data analysis by SWCA and review of results by WGFD.

Acoustic Bat Monitoring

The WGFD *Recommendations* include six survey types: habitat evaluation, passive acoustic surveys on meteorological (MET) towers, roaming ground-based passive surveys, active acoustic surveys, capture surveys, and carcass search. SWCA proposes to combine the habitat evaluation, passive acoustic surveys, and roaming ground-based surveys as described below. Carcass surveys will be initiated post-construction and protocols for these surveys will be discussed with WGFD prior to initiating these surveys efforts.

Habitat Evaluation SWCA will conduct a pre-construction habitat evaluation of potential bat habitat, foraging areas, and roosting areas within the Project Area. Habitat evaluation measures will follow those identified in Hester and Grenier (2005). This evaluation will serve to identify potential conflict areas within the Project Area as well as survey locations and routes to document bat activity throughout the Project Area.

Passive Acoustic Monitoring The WGFD *Recommendations* include placement of at least one acoustic monitoring device within the rotor sweep zone per MET tower. During MET tower placement, Pioneer Wind Park, LLC, attached four Anabats™ on two towers, one tower each in Phase 2 and the control site. One Anabat™ on each tower was placed at a height of approximately 50 meters, while the second Anabat™ unit on each tower is at a height somewhere between two and five meters per BPM bat protocols. Due to the complex logistics and safety issues associated with attaching acoustic monitoring equipment to the other MET towers already erected in the Project

[1] Meeting on February 11, 2010, at WGFD Cheyenne office between John Aubrecht and Christine Mikell (WasatchWind Intermountain), Doug Faulkner and Spencer Martin (SWCA Environmental Consultants), and Mary Flanderka, Scott Gamo, and Rick Huber (WGFD).

[2] Meeting on March 19, 2010, at WGFD Cheyenne office between John Aubrecht and Christine Mikell (Wasatch Wind Intermountain), Doug Faulkner, Spencer Martin, and Larry Semo (SWCA Environmental Consultants), and Mary Flanderka, Scott Gamo, Rick Huber, Al Conder, and Daryl Lutz (WGFD).

Area, WGFD has approved SWCA's requests to consider the existing MET tower Anabats™ as an adequate sample size (2 units) to assess bat use near the rotor swept area.

In addition to the MET tower locations, SWCA proposes to use two mobile Anabat™ units to sample areas of potential high bat use. This effort is to supplement current sampling at two MET towers by Anabat™ units (four units total), and addresses the April 2010 *Recommendations* which require bat sampling beyond two years if less than or equal to two survey stations (MET towers) are established within the Project Area during the pre-construction survey period. By incorporating these additional surveys into the study design, two years of pre-construction monitoring will meet the April 2010 *Recommendations* requirements. SWCA will reference the preliminary habitat evaluation, as defined above. Placement of units will favor sites within and near Phase 1 and Phase 2 boundaries opposed to those sites more distant to the proposed turbine sites (e.g., not along the transmission corridor or Project periphery). The mobile units will be moved and data downloaded approximately every 2 weeks from April 15 to October 15. Anabat™ data interpretation for this project will be performed by a qualified, trained SWCA bat biologist. Bat calls will be grouped by high frequency (>35 kHz), typically given by small-bodied bats, and low frequency (<35 kHz) given by large-bodied bats. When feasible, the SWCA bat biologist will attempt to identify specific species in order to provide a species list for the Project Area. This survey is not designed as a BACI study since the objective is to determine bat use of the area in general and to identify high risk locations to inform the turbine siting process.

Active Acoustic Surveys According to the WGFD *Recommendations*, roaming/vehicle transects will be conducted to quantify bat species and relative abundance below the rotor zone (<50m) throughout the Project Area. Survey locations/routes will be identified as part of the habitat evaluation process and will occur in conjunction with the movement of Anabat™ units associated with the passive acoustic monitoring surveys. Units that are relocated to other sampling locations as part of the passive acoustic monitoring surveys will be moved starting at one half hour before sunset and monitor for 2.5 hours until they are relocated to another passive acoustic monitoring location.

Capture Surveys The WGFD *Recommendations* identify mist-netting capture techniques to determine abundance and distribution of bats within the Project Area. Based on the habitat evaluation and results of passive and active acoustic surveys, SWCA will consult with WGFD staff to determine the need for such surveys. Should surveys be required, additional consultation with WGFD will occur to determine appropriate locations throughout the Project Area where mist-netting may occur. The survey protocols recommend that capture surveys be conducted on at least three occasions per capture site between June 1 and August 30.

Statistical Analysis
Data analysis will consist of developing an index of activity (i.e., total calls per survey night per unit). Risk of bat mortality for this project will be evaluated by comparing the index of bat use with data from existing wind parks where bat use and mortality have been measured.

Passerine Surveys

The WGFD *Recommendations* include assessing breeding bird species composition and abundance using fixed-point counts placed within the affected area. SWCA will place a total of 18 fixed-point counts within Phases 1, Phase 2, and the control site. Each site will contain 6 fixed-point counts.

Fixed-point count locations will be randomly selected and stratified by habitat in proportion to a habitat's percent coverage within Phase 1, Phase 2, and control site. Fixed-point counts will be at least 400 meters apart to avoid double sampling. Point counts will be performed weekly over a 12-week period from April 1 through June 30 and a 12-week period from August 15 through November 15. Fixed-point counts surveys will follow the variable circular-plot method described in Reynolds et al. (1980). Surveys will be conducted from local sunrise to no later than 4-5 hours after sunrise. Individual point count duration will be 20 minutes to minimize the probability of recording individuals more than once. All birds detected within 200 meters of the point count will be recorded. Data collected the first time a bird or flock is detected will include: species, number of individuals, estimated or measured horizontal distance from point center, activity status, flight direction, and flight altitude. To more accurately estimate distance of birds from the center point, a laser rangefinder will be used.

Statistical Analysis
SWCA will calculate density estimates for breeding bird species with adequate sample sizes. For all other bird species, an index of abundance will be developed in lieu of a density estimate. Density estimate or the index of abundance will be the metric to examine annually and for the BACI study to assess displacement impacts, if any, of the wind project on breeding bird species.

Area Search Surveys for Wintering Birds

The WGFD *Recommendations* call for two area search surveys, one each in early (December 1 – January 15) and late (January 16 – February 28) winter. SWCA proposes to conduct walking area searches in representative sites for each major habitat type within the Project Area. These area searches are not time restricted and the entire Project Area will not be surveyed due to the size of the Project Area and the representative sampling methodology proposed. Data recorded during the area searches will include: species, number of birds, time, primary habitat, and UTM coordinates for each sighting, as suggested in WGFD *Recommendations* for winter surveys.

Statistical Analysis
No statistical analyses are expected for these surveys. These surveys will be used to assess composition, relative abundance, and habitat associations of bird species, particularly species of concern, wintering in the Project Area.

Raptor Nest Survey

Per the WGFD *Recommendations*, a raptor nest survey should be performed for the Project Area, as well as a 1-mile buffer, during the breeding season. Because breeding season differs among raptor species, SWCA will combine an aerial raptor nest survey for early-nesting species (e.g., bald eagle) concurrent with an aerial survey for greater sage-grouse leks in spring 2010 (April 1 – May 7). Raptor nest surveys in subsequent years will begin on March 1 to allow enough time to detect bald eagle nests. A UTM coordinate will be taken for all observed raptor nest structures and follow-up visits to assess nest activity and acquire additional data (e.g., nest substrate, nest height, condition of nest, primary habitat) will be conducted after the aerial survey. Inactive nests will be re-visited in late spring to re-assess activity during the appropriate breeding season for those raptor species that do not initiate nesting until after the sage-grouse aerial survey period. Due to private property access issues outside of the Project Area, surveys for raptor nests within the 1-mile buffer of the

Project Area will be completed by the above-described aerial survey and by vehicle from public roads, if feasible, in 2010. If adequate ground surveys are not possible due to private property issues, raptor nest surveys after 2010 will include aerial surveys. Nests observed incidental to other surveys (e.g., winter bird surveys) will be noted and revisited during the appropriate nesting season to determine activity status.

If prairie dog colonies are found within the Project Area, SWCA will perform burrowing owl surveys using standard protocols at those colonies. Burrowing owls typically nest in areas containing burrows created by ground squirrels, badgers, and/or prairie dogs. Thus, based on the discovery of prairie dog colonies and complexes, SWCA will establish a number of burrowing owl observation points in locations appropriate for ensuring clear and comprehensive views of prairie dog towns and ground squirrel concentration areas.

Due to the difficulty in observing nests placed in heavily forested sites containing conifers, as well as the proposed wind park's necessity to remove a linear length of forest for transmission line construction, SWCA proposes to conduct ground surveys along the transmission right-of-way (ROW) passing through forested habitats. Surveys will consist of three fixed-point count transects (one on the centerline and two placed 0.25 miles on either side of the centerline) using call playback protocol (Mosher and Fuller 1996) in late April. Observers will search areas with responding adults for nest sites. Fixed-point counts will be spaced 200 meters apart along each transect line covering the entire length of the transmission ROW through forested habitat. Care will be taken to minimize disturbance to nesting raptors during nest visits and surveys.

For all raptor surveys, SWCA will also coordinate with U.S. Fish and Wildlife Service personnel regarding their recommendations for the project.

Statistical Analysis

Nest status will be assessed annually for pre-, during, and post-construction periods. Raptor nest surveys during the pre-construction phase will serve to identify areas with a potential increased risk of disturbance or collisions by adults or young. During the post-construction phase, the distribution of active nests will be compared to the distribution of active nests found during the pre-construction phase to evaluate displacement of nesting raptors by the wind park.

Raptor and Large Non-Raptor Flocks Surveys

Weekly surveys will occur during a 12-week migration period from April 1 through June 30 and a 12-week period from August 15 through November to assess species composition and magnitude of early, mid-, and late season migrants passing through the Project Area. One avian biologist will perform a single, day-long (up to 12 hours) fixed-point count survey in the Phase 1, Phase 2, and control site, during each survey session for a total of twenty surveys per site in 2010. Fixed-point count sites will be initially identified via GIS vegetation and topographic maps and micro-sited in the field to take advantage of open viewsheds and maximize area coverage per survey location. Data collected the first time a bird or flock is detected will include species, number, activity status (e.g., powered flight, soaring), flight direction, and flight height. Flight paths will be marked on a large topographic map to identify regular pathways or routes used by raptor species within the Project Area. For raptors passing directly through or over a proposed turbine array, but first observed

outside the turbine array, a second height estimate will be taken to provide a more accurate collision risk assessment within the turbine array area.

Statistical Analysis
A collision risk analysis will be conducted to assess the potential of direct mortality from turbines. Spatial and temporal use analyses will also be completed to assess areas of high use by or concentration of migrating raptors to inform the turbine siting process. The BACI study analyses will focus on examining changes in migration use patterns within the developed wind park and the control site.

Greater Sage-Grouse Survey

The Project Area is outside of sage-grouse Core Areas. SWCA will perform counts of the Morman Canyon and Virden Creek leks in late March or April 2010 according to WGFD protocols. In addition, SWCA will conduct an aerial survey for additional leks in the Project Area and 2-mile buffer. If new leks are suspected during the aerial survey, SWCA will coordinate with WGFD to evaluate lek activity status via ground-based surveys.

SWCA will develop a habitat map for the Project Area delineating likely nesting and brood-rearing habitats prior to turbine siting. Habitat mapping will incorporate data, as available, from the Hat Six Habitat Use Research Project, as well as WGFD expertise, other biological resource databases (e.g., Wyoming Natural Diversity Database), incidental sightings during SWCA surveys, and peer-reviewed literature.

Statistical Analysis
WGFD has indicated that counts for the Morman Canyon and Virden Creek leks in 2009 will satisfy one year of pre-construction survey data for the Pioneer Wind Park. WGFD will determine appropriate leks to use as reference sites for comparative analyses. SWCA will coordinate with WGFD to perform counts at reference leks. Data analysis will consist of comparing trend data between the Project Area and reference area leks for the pre-, during, and post-construction survey periods.

Amphibian and Reptile Survey

No formal surveys are proposed at this time. Incidental sightings will be recorded on Wildlife Observation System forms and submitted to WGFD on a periodic basis. SWCA will contact WGFD regarding observations of species of concern as soon as reasonably possible. If development is to occur with 500 meters of a perennial waterbody, call surveys will be performed for northern leopard frog. If northern leopard frogs are detected, a follow-up survey to count egg masses will occur. If development is to occur within 500 meters of ephemeral waterbodies, call surveys will be performed for plains spadefoot within 3 days of a major rain event. Alternatively, a dip-net survey for plains spadefoot tadpoles will be conducted within 3 weeks of a major rain event in the case that a call survey could not be performed in the 3-day timeframe. Ephemeral waterbodies in the Project Area will be mapped during other project-related activities.

Aquatic Considerations

SWCA will perform a reconnaissance-level assessment (RLA) of streams within the Project Area in order to identify potential erosion hazards and associated siting constraints. Additionally, the RLA provides a broad overview of the landscape while focusing on processes that may affect sediment supply and channel stability. Once the RLA has been completed and the WGFD has had an opportunity to review the report, SWCA, Wasatch Wind, and WGFD will meet to discuss the results.

If the reconnaissance assessment indicates **low risk** to stream reaches or project refinements are implemented so that aquatic habitats **are at low risk**, monitoring will consist of a preconstruction site visit and yearly onsite visits. Examples of project refinements are: additional Best Management Practices (BMPs) that will prevent the movement of sediment into nearby waterways; avoidance/minimization measures, such as larger road offsets from channels; implementation of measures to mimic existing surface water runoff patterns; or site-specific engineering controls.

If the assessment indicates aquatic habitats **are at risk**, a more detailed assessment of the project's disturbance and potentially unstable stream reaches, sediment yield and transport potential such as the Rapid Resource Inventory for Sediment and Stability Consequence (RRISSC) will be conducted. Once the RRISSC has been completed and the WGFD has had an opportunity to review the report, SWCA, Wasatch Wind, and WGFD will meet to discuss the results.

If the detailed assessment indicated **low risk** to change from sediment or runoff changes due to the project or project refinements are implemented so that aquatic habitats **are at low risk**, monitoring will consist of a preconstruction site visit and yearly onsite visit. Examples of project refinements are: additional BMPs that will prevent the movement of sediment into nearby waterways; avoidance/minimization measures, such as larger road offsets from channels; implementation of measures to mimic existing surface water runoff patterns; or site-specific engineering controls.

If the detailed assessment indicates that aquatic habitats **may experience sediment or runoff changes** due to the project, then monitoring will consist of a preconstruction site visit, yearly onsite visits and culverts and roads will be monitored. There is a high probability that additional monitoring depending on site-specific conditions will be recommended by WGFD. This could entail a Rosgen II station with repeated measures, a Rosgen II station plus a reference station with repeated measures, or multiple Rosgen II stations.

Wasatch Wind will assist WGFD in obtaining private landowner permission to sample all perennial waters and tributaries within the Project Area. The WGFD will concentrate on sampling Willow Creek and Gross Creek in 2010. If time allows, WGFD will also sample Duck Creek and Virden Creek in 2010, but may not be able to get to them until 2011.

Rare Plant Survey

SWCA will conduct an assessment of vegetation communities throughout the Project Area. This effort will be supplemented with an assessment of the National Wetland Inventory map to further identify potential habitat for Ute ladies'-tresses. A single survey in 2010 will be conducted during

the flowering window (generally between mid-July and mid- to late August) in any wet meadow habitats along the various stream courses and in spring-fed wetland areas.

Big Game Survey

The WGFD *Recommendations* include the need for a telemetry study to determine habitat use, identify migration corridors, and changes in habitat use and population demographics. After review and discussion of big game populations in the area during the March 19, 2010 meeting, WGFD determined that no surveys would be necessary for this project. WGFD stated that their knowledge of big game population demographics, use of the area (e.g., a migration corridor has previously been identified), and the relatively small scale of this project did not warrant the need for a telemetry study. SWCA proposed conducting a pellet-group study; however, WGFD indicated that a pellet-group study would not add any significant information.

In an April 27, 2010, comment letter regarding a draft version of this document, WGFD recommended application of big game winter range timing stipulation to the construction period for the connecting powerline right-of-way. This stipulation states that construction activities should not occur from November 15 through April 30.

References

Hester, S.G. and M.B. Grenier. 2005. A conservation plan for bats in Wyoming. Wyoming Game and Fish Department, Nongame Program, Lander, WY.

Mosher, J. A., and M. R. Fuller. 1996. Surveying woodland hawks with broadcasts of great horned owl vocalization. Wildlife Society Bulletin 24:531-536.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82:309-313.

U.S. Fish and Wildlife Service. 2003. Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. Washington, D.C. Available online at: http://www.fws.gov/habitatconservation/wind.pdf. Accessed March 2010.

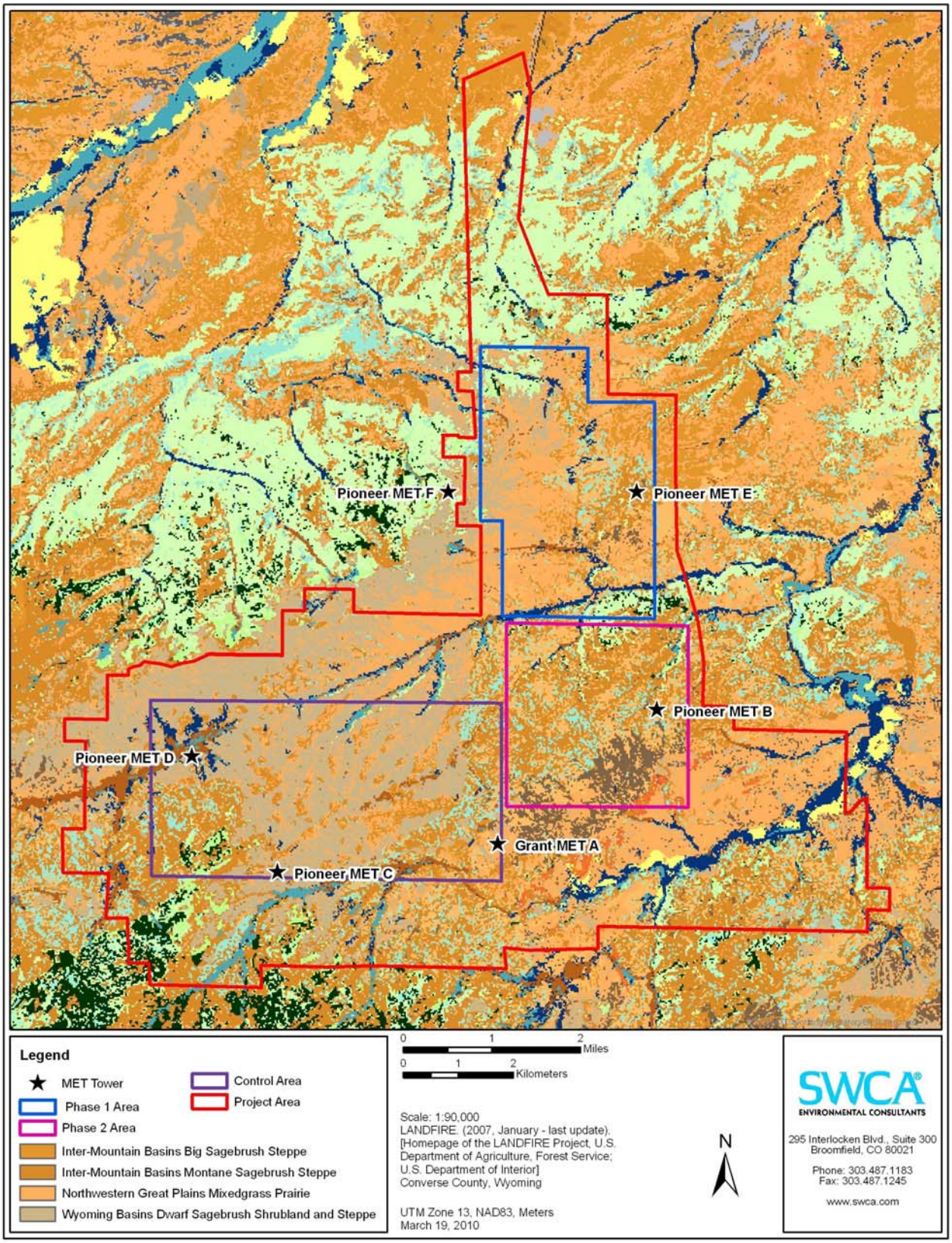

Figure 1. Pioneer Wind Park Vegetation.

APPENDIX B

Wildlife Species Observed within the Pioneer Wind Park Study Area

Wildlife Species Observed within the Pioneer Wind Park Study Area

Wildlife Group	Common Name[1]	Scientific Name
Birds	Snow Goose	*Chen caerulescens*
	Canada Goose	*Branta canadensis*
	Tundra Swan	*Cygnus columbianus*
	Mallard	*Anas platyrhynchos*
	Cinnamon Teal	*Anas cyanoptera*
	Red-breasted Merganser	*Mergus serrator*
	Gray Partridge	*Perdix perdix*
	Greater Sage-Grouse	*Centrocercus urophasianus*
	Dusky Grouse	*Dendragapus obscurus*
	American White Pelican	*Pelecanus erythrorhynchos*
	Great Blue Heron	*Ardea herodias*
	Turkey Vulture	*Cathartes aura*
	Osprey	*Pandion haliaetus*
	Bald Eagle	*Haliaeetus leucocephalus*
	Northern Harrier	*Circus cyaneus*
	Sharp-shinned Hawk	*Accipiter striatus*
	Cooper's Hawk	*Accipiter cooperii*
	Northern Goshawk	*Accipiter gentilis*
	Broad-winged Hawk	*Buteo platypterus*
	Swainson's Hawk	*Buteo swainsoni*
	Red-tailed Hawk	*Buteo jamaicensis*
	Ferruginous Hawk	*Buteo regalis*
	Rough-legged Hawk	*Buteo lagopus*
	Golden Eagle	*Aquila chrysaetos*
	American Kestrel	*Falco sparverius*
	Merlin	*Falco columbarius*
	Peregrine Falcon	*Falco peregrinus*
	Prairie Falcon	*Falco mexicanus*
	Sandhill Crane	*Grus canadensis*
	Killdeer	*Charadrius vociferus*
	Upland Sandpiper	*Bartramia longicauda*
	Wilson's Snipe	*Gallinago delicata*
	Franklin's Gull	***Leucophaeus pipixcan***
	Mourning Dove	*Zenaida macroura*
	Great Horned Owl	*Bubo virginianus*
	Long-eared Owl	*Asio otus*
	Short-eared Owl	*Asio flammeus*
	Common Nighthawk	*Chordeiles minor*
	Common Poorwill	*Phalaenoptilus nuttallii*
	White-throated Swift	*Aeronautes saxatalis*
	Broad-tailed Hummingbird	*Selasphorus platycercus*
	Red-naped Sapsucker	*Sphyrapicus nuchalis*
	Downy Woodpecker	*Picoides pubescens*
	Hairy Woodpecker	*Picoides villosus*
	Northern Flicker	*Colaptes auratus*
	Dusky Flycatcher	*Empidonax oberholseri*

Wildlife Group	Common Name[1]	Scientific Name
Birds (continued)	Say's Phoebe	*Sayornis saya*
	Western Kingbird	*Tyrannus verticalis*
	Loggerhead Shrike	*Lanius ludovicianus*
	Northern Shrike	*Lanius excubitor*
	Warbling Vireo	*Vireo gilvus*
	Clark's Nutcracker	*Nucifraga columbiana*
	Black-billed Magpie	*Pica hudsonia*
	American Crow	*Corvus brachyrhynchos*
	Common Raven	*Corvus corax*
	Horned Lark	*Eremophila alpestris*
	Tree Swallow	*Tachycineta bicolor*
	Violet-green Swallow	*Tachycineta thalassina*
	N. Rough-winged Swallow	*Stelgidopteryx serripennis*
	Cliff Swallow	*Petrochelidon pyrrhonota*
	Barn Swallow	*Hirundo rustica*
	Black-capped Chickadee	*Poecile atricapillus*
	Mountain Chickadee	*Poecile gambeli*
	Red-breasted Nuthatch	*Sitta canadensis*
	White-breasted Nuthatch	*Sitta carolinensis*
	Pygmy Nuthatch	*Sitta pygmaea*
	Rock Wren	*Salpinctes obsoletus*
	Canyon Wren	*Catherpes mexicanus*
	House Wren	*Troglodytes aedon*
	Eastern Bluebird	*Sialia sialis*
	Mountain Bluebird	*Sialia currucoides*
	Townsend's Solitaire	*Myadestes townsendi*
	American Robin	*Turdus migratorius*
	Gray Catbird	*Dumetella carolinensis*
	Sage Thrasher	*Oreoscoptes montanus*
	European Starling	*Sturnus vulgaris*
	American Pipit	*Anthus rubescens*
	Sprague's Pipit	*Anthus spragueii*
	Lapland Longspur	*Calcarius lapponicus*
	Chestnut-collared Longspur	*Calcarius ornatus*
	McCown's Longspur	*Rhynchophanes mccownii*
	Orange-crowned Warbler	*Oreothlypis celata*
	Virginia's Warbler	*Oreothlypis virginiae*
	Yellow Warbler	*Dendroica petechia*
	Yellow-rumped Warbler	*Dendroica coronata*
	Black-and-white Warbler	*Mniotilta varia*
	Wilson's Warbler	*Wilsonia pusilla*
	Green-tailed Towhee	*Pipilo chlorurus*
	Spotted Towhee	*Pipilo maculatus*
	Chipping Sparrow	*Spizella passerina*
	Clay-colored Sparrow	*Spizella pallida*
	Brewer's Sparrow	*Spizella breweri*
	Field Sparrow	*Spizella pusilla*
	Vesper Sparrow	*Pooecetes gramineus*

Wildlife Group	Common Name[1]	Scientific Name
Birds (continued)	Lark Sparrow	*Chondestes grammacus*
	Lark Bunting	*Calamospiza melanocorys*
	Savannah Sparrow	*Passerculus sandwichensis*
	Song Sparrow	*Melospiza melodia*
	Lincoln's Sparrow	*Melospiza lincolnii*
	White-crowned Sparrow	*Zonotrichia leucophrys*
	Dark-eyed Junco	*Junco hyemalis*
	Western Tanager	*Piranga ludoviciana*
	Black-headed Grosbeak	*Pheucticus melanocephalus*
	Lazuli Bunting	*Passerina amoena*
	Red-winged Blackbird	*Agelaius phoeniceus*
	Western Meadowlark	*Sturnell neglecta*
	Brewer's Blackbird	*Euphagus cyanocephalus*
	Common Grackle	*Quiscalus quiscula*
	Brown-headed Cowbird	*Molothrus ater*
	Bullock's Oriole	*Icterus bullockii*
	Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
	Pine Grosbeak	*Pinicola enucleator*
	Cassin's Finch	*Carpodacus cassinii*
	House Finch	*Carpodacus mexicanus*
	Red Crossbill	*Loxia curvirostra*
	Pine Siskin	*Spinus pinus*
	American Goldfinch	*Spinus tristis*
	Evening Grosbeak	*Coccothraustes vespertinus*
Mammals	North American Porcupine	*Erethizon dorsatum*
	American Beaver	*Castor canadensis*
	Black-tailed Prairie Dog	*Cynomys ludovicianus*
	Wyoming Ground Squirrel	*Spermophilus elegans*
	Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*
	Least Chipmunk	*Tamias minimus*
	Red Squirrel	*Tamiasciurus hudsonicus*
	Pocket Gopher sp.	*Thomomys* sp.
	American Deer Mouse	*Peromyscus maniculatus*
	Bushy-tailed Woodrat	*Neotoma cinerea*
	Vole sp.	*Microtus* sp.
	Cottontail sp.	*Sylvilagus* sp.
	White-tailed Jackrabbit	*Lepus townsendii*
	White-tailed Deer	*Odocoileus virginianus*
	Mule Deer	*Odocoileus hemoinus*
	Elk	*Cervus elaphus*
	Pronghorn Antelope	*Antilocapra americana*
	Coyote	*Canus latrans*
	Red Fox	*Vulpes vulpes*
	American Badger	*Taxidea taxus*
Amphibians	**Banded Tiger Salamander**	*Ambystoma mavortium*
	Boreal Chorus Frog	*Psuedacris maculata*
	Northern Leopard Frog	*Rana pipiens*

Wildlife Group	Common Name[1]	Scientific Name
Reptiles	**Bullsnake**	*Pituophis catenifer*
	Wandering Garter Snake	*Thamnophis elegans*
	Prairie Rattlesnake	*Crotalus viridis*

[1] Species in bold are WGFD Species of Greatest Conservation Need (Wyoming Game and Fish Department. 2005. A comprehensive wildlife conservation strategy for Wyoming. Wyoming Game and Fish Department, Cheyenne, WY.).

APPENDIX C

Upland and Wetland Plants Observed within the Pioneer Wind Park Study Area

Upland and Wetland Plants Observed in the Pioneer Wind Park Study Area

Growth Habit	Common Name	Scientific Name
Grasslike	Threadleaf Sedge	*Carex filifolia*
	Nebraska Sedge	*Carex nebrascensis*
	Sedge	*Carex* spp.
	Spikerush	*Eleocharis* spp.
	Horsetail	*Equisetum* spp.
	Mountain Rush	*Juncus arcticus*
	Rush	*Juncus* spp.
	Bulrush	*Scirpus* spp.
	Spikemoss	*Selaginella* spp.
Grasses	Letterman's Needlegrass	*Achnatherum lettermanii*
	Columbia Needlegrass	*Achnatherum nelsonii*
	Crested Wheatgrass	*Agropyron cristatum*
	Redtop	*Agrostis gigantea*
	Creeping Bentgrass	*Agrostis stolonifera*
	Foxtail	*Alopecurus* spp.
	Blue Grama	*Bouteloua gracilis*
	Smooth Brome	*Bromus inermis*
	Brome	*Bromus* spp.
	Orchard Grass	*Dactylis glomerata*
	Wildrye	*Elymus* spp.
	Fescue	*Festuca* spp.
	Prairie Junegrass	*Koeleria macrantha*
	Switchgrass	*Panicum virgatum*
	Western Wheatgrass	*Pascopyrum smithii*
	Reed Canarygrass	*Phalaris arundinacea*
	Timothy	*Phleum pratense*
	Sandberg Bluegrass	*Poa secunda*
	Dropseed	*Sporobolus* spp.
Forbs	Indian Mallow	*Abutilon* spp.
	Common Yarrow	*Achillea millefolium*
	Wild Onion	*Allium* spp.
	Pussytoes	*Antennaria* spp.
	Sandwort	*Arenaria* spp.
	Field Sagewort	*Artemisia campestris*
	Fringed Sagewort	*Artemisia frigida*
	White Sagebrush	*Artemisia ludoviciana*
	Aster	*Aster* spp.
	Milkvetch	*Astragalus* spp.
	Paintbrush	*Castilleja* spp.
	Canada Thistle	*Cirsium arvense*
	Wavyleaf Thistle	*Cirsium undulatum*
	Bastard Toadflax	*Comandra* spp.
	Cryptantha	*Cryptantha* spp.
	Springparsley	*Cymopterus* spp.

Growth Habit	Common Name	Scientific Name
	Larkspur	*Delphinium* spp.
	Fleabane	*Erigeron* spp.
	Matted Buckwheat	*Eriogonum caespitosum*
	Cushion Buckwheat	*Eriogonum ovalifolium*
	Sulphur-flower Buckwheat	*Eriogonum umbellatum*
	Spinystar	*Escobaria vivipara*
	Elkweed	*Frasera speciosa*
	Curlycup Gumweed	*Grindelia squarrosa*
	Sneezeweed	*Helenium* spp.
	Granite Prickly Phlox	*Leptodactylon pungens*
	Blazing Star	*Liatris* spp.
	Desertparsley	*Lomatium* spp.
	Lupine	*Lupinus* spp.
	Wild Mint	*Mentha arvensis*
	Bluebells	*Mertensia* spp.
	Pricklypear	*Opuntia* spp.
	Locoweed	*Oxytropis spp.*
	Beardtongue	*Penstemon* spp.
	Phlox	*Phlox* spp.
	Cinquefoil	*Potentilla* spp.
	Parry's Primrose	*Primula parryi*
	Buttercup	*Ranunculus* spp.
	Dock	*Rumex* spp.
	Stonecrop	*Sedum* spp.
	Ragwort	*Senecio* spp.
	Hooded Ladies'-tresses	*Spiranthes romanzoffiana*
	Goldenrod	*Solidago* spp.
	Red Clover	*Trifolium pratense*
Shrubs/Trees	Boxelder	*Acer negundo*
	Saskatoon Serviceberry	*Amelanchier alnifolia*
	Silver Sagebrush	*Artemisia cana*
	Black Sagebrush	*Artemisia nova*
	Big Sagebrush	*Artemisia tridentata*
	Mountain Big Sagebrush	*Artemisia tridentata* ssp. *vaseyana*
	Wyoming Big Sagebrush	*Artemisia tridentata* ssp. *wyomingensis*
	Wyoming Threetip Sagebrush	*Artemisia tripartita* ssp. *rupicola*
	Snowbrush Ceanothus	*Ceanothus velutinus*
	Alderleaf Mountain Mahogany	*Cercocarpus montanus*
	Yellow Rabbitbrush	*Chrysothamnus viscidiflorus*
	Dogwood	*Cornus* spp.
	Parry's Rabbitbrush	*Ericameria parryi*
	Juniper	*Juniperus* spp.
	Creeping Barberry	*Mahonia repens*
	Wild Bergamot	*Monarda fistulosa*
	Limber Pine	*Pinus flexilis*
	Ponderosa Pine	*Pinus ponderosa*

Growth Habit	Common Name	Scientific Name
	Narrowleaf Cottonwood	*Populus angustifolia*
	Quaking Aspen	*Populus tremuloides*
	Chokecherry	*Prunus virginiana*
	Antelope Bitterbrush	*Purshia tridentata*
	Skunkbush Sumac	*Rhus trilobata*
	Wax Currant	*Ribes cereum*
	Gooseberry Currant	*Ribes montigenum*
	Wild Rose	*Rosa woodsii*
	Peachleaf Willow	*Salix amygdaloides*
	Coyote Willow	*Salix exigua*
	Willow	*Salix* spp.
	Snowberry	*Symphoricarpos* spp.

[1]This list is of only plants observed in the Study Area through incidental observations; other species likely occur in the Study Area.