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SITE CHARACTERIZATION REPORT

Available online at www.wapa.gov/transmission/grapevine.htm

Site Characterization Report

Grapevine Canyon Wind Resource Area
Coconino County, Arizona

Prepared for:

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May 6, 2010

EXECUTIVE SUMMARY

At the request of Foresight Flying M, LLC, (Foresight), Western Ecosystems Technology, Inc. has prepared this Site Characterization Report. The purpose of the report is to characterize biological resources within the proposed Grapevine Canyon Wind Resource Area (GCWRA), as well as a two-mile buffer (Evaluation Area). Biological resources were evaluated through a search of existing data, as well as a site visit.

The proposed project is located in central Arizona, along the southern edge of the Arizona/New Mexico Plateau Ecoregion. Vegetation communities in the region are characteristic of Great Basin shrublands and grasslands, with areas of higher elevation supporting pinyon pine and juniper woodlands and ponderosa pine forests. Elevations within the GCWRA range from approximately 1,700 –2,080 meters (m; 5,580 – 6,820 feet [ft]) above sea level. The primary vegetation communities comprising the GCWRA are scrub-shrub, juniper savannah/woodlands and grassland. Wetlands are very limited within the area, comprising less than 0.1% of the total GCWRA. There are no perennial streams in the GCWRA; however, several ephemeral creeks and stock tanks and ponds are present throughout the area.

Seven federal threatened, endangered, or candidate plant species or species of concern are listed as occurring in Coconino County and 16 state sensitive (i.e., highly restricted or salvage restricted) plants are listed as occurring in the Canyon Diablo and/or Middle Little Colorado Watersheds. The majority of these plants have limited distributions and specific habitat requirements and are not expected to occur in the GCWRA .

Based on a review of the federal endangered threatened wildlife species database maintained by the US Fish and Wildlife Service, 13 threatened, endangered, or candidate species are listed as occurring in Coconino County (four birds, one mammal, one reptile, one amphibian, five fish, and one snail). The majority of federal listed and candidate species have no potential to occur in the GCWRA; however, a few species have at least minimal potential to occur at some point in the year: southwestern willow flycatcher, western yellow-billed cuckoo, northern Mexican gartersnake, and Chiricahua leopard frog. A preliminary review of species from lists maintained by the Arizona Game and Fish Department found 14 state species of special concern with known occurrence in the Canyon Diablo and/or Middle Little Colorado Watersheds (seven birds, one mammal, two reptiles, two amphibians, and two fish). None of the bird species are likely to nest within the GCWRA, but several may occur as occasional winter visitors or pass through the GCWRA during migration (peregrine falcon, bald eagle, belted kingfisher, ferruginous hawk, northern goshawk, and osprey). Several additional state-listed species have at least some potential to occur in the GCWRA (Navajo Mexican vole, northern Mexican gartersnake, Chiricahua leopard frog, northern leopard frog, and Little Colorado sucker). Potentially suitable wetland and waterbody features which could support the Chiricahua leopard frog (federal threatened and state species of concern), northern leopard frog (state species of concern) and the little Colorado sucker (state species of concern) include stock ponds/tanks found within the GCWRA. Of these three species, only the Colorado sucker has been previously documented within a five–mile radius of the Evaluation Area. All three species are considered to have low probability of occurrence within the GCWRA. These species are restricted to aquatic features

located in canyon bottom ephemeral streams and pools, and waterbodies and wetlands associated with stock tanks and ponds found throughout the GCWRA. Project planning which avoids impacts to water bodies and wetlands would negate potential direct impacts on sensitive wildlife and plant species which could potentially occur at aquatic features found within the GCWRA. A final Project layout has not been determined at this time.

The raptors most likely to occur within the GCWRA are golden eagle, prairie falcon, American kestrel, sharp-shined hawk, Cooper's hawk, red-tailed hawk, great-horned owl, barn owl, burrowing owl, long-eared owl, and western screech-owl. Other raptor species which may occur in the area as winter residents, migrants, or as rare visitors from the surrounding region are: bald eagle, ferruginous hawk, northern goshawk, osprey, peregrine falcon, merlin, rough-legged hawk, common black hawk, Swainson's hawk, and zone-tailed hawk. Potential nesting habitat for raptors is located primarily along major drainages within the GCWRA: Canyon Diablo and Grapevine Canyon in the central portions of the GCWRA, Anderson and Yaeger Canyons in the northwest, and Jack's Canyon in the southeast. Stands of oak and cottonwood in the canyon bottoms, as well as canyon walls and rock outcroppings likely provide nest sites for raptors. Additionally, small areas of pinyon-juniper woodland, juniper savannah, and ponderosa pine forest may also provide nesting structures, particularly in the western-most Evaluation Area. Open, grassland habitat for ground-nesting species such as burrowing owls is present throughout the GCWRA, particularly within prairie-dog colonies which have been documented in Study Area "A".

The GCWRA lies within the Intermountain West region of the extensive American Pacific Flyway, one of five primary migratory routes for waterbirds, shorebirds, songbirds, and raptors. The seasonal migration of birds through Arizona generally occurs in a broad front throughout the state. The GCWRA contains a limited amount of stopover habitat for songbirds, waterfowl, and shorebirds in the forms of grassland, shrubland, pinyon-juniper woodland, and a few wetland/riparian areas, and it is likely that migrating birds utilize these areas during migration. The majority of the GCWRA is not likely to concentrate migrating birds; however, there is some potential for migrating birds that follow topography to concentrate along canyon rims, such as raptors that utilize updrafts and thermals created by topography. Additionally, the presence of prairie dog colonies and waterfowl/shorebirds concentrated at water sources, could concentrate resident and migrating raptors in portions of GCWRA.

At least 11 bat species have been recovered during carcass searches at wind-energy facilities throughout the U.S. and of these, five species are potential residents and/or migrants through the GCWRA: hoary bat, silver-haired bat, Mexican free-tailed bat, big brown bat, and western red bat. Of the 30 species of bat documented as occurring in Arizona, 20 species may occur within the GCWRA at some time during the year. Two bats with potential to occur in the GCWRA are listed as state species of special concern: spotted bat and western red bat. Seven species are documented within the Arizona Heritage Data Management System as occurring within the Canyon Diablo and/or Middle Little Colorado Watersheds: greater bonneted bat, Allen's big-eared bat, western small-footed bat, long-eared myotis, Arizona myotis, fringed myotis, and long-legged myotis. Potential roosting habitat for bats is located within caves, crevices, and rock outcrops along the canyon walls, riparian woodlands in canyon bottoms, and juniper

savannah/woodlands primarily in the western-most portions of the GCWRA. Bats undoubtedly forage at the creeks, springs, ponds, and stock tanks throughout the GCWRA

The GCWRA falls within the range of the Anderson Mesa herd of pronghorn antelope which have declined as a result of habitat degradation and drought over the past decades, and a focus of research and management effort within the state. Additionally, elk and mule deer are also likely to utilize the GCWRA at points throughout the year. Due to the lack of data regarding the potential impacts of wind energy development on big game, it is difficult to predict the effects of the Project on antelope, mule deer and elk populations, though based on information received from AZGFD the following is anticipated: 1) potential impacts including potential displacement is moderate for wintering individuals utilizing Study Area A; 2) potential impacts during parturition is low for the GCWRA, and; 3) potential avoidance of portions of Study Area A, and to a lesser extent Study Area B, by migrating pronghorn is possible. While potential impact areas of Study Area A overlap habitat improvement areas during migration periods (and possibly over-winter), overall use of habitat improvement areas within the GCWRA is low to moderate.

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1.0 INTRODUCTION

When exploring prospective wind power sites, knowledge of wildlife and other biological resource issues helps the wind industry identify and avoid potential ecological problems early in the development process. At the request of Foresight Flying M, LLC (Foresight), Western EcoSystems Technology, Inc. (WEST) has prepared this Site Characterization Report for the proposed Grapevine Canyon Wind Resource Area (GCWRA) in Coconino County, Arizona. The purpose of this report is to characterize biological resources within the proposed GCWRA as well as the surrounding area. The GCWRA is comprised of three distinct areas, defined as Study Areas A, B, and C (Figure 1.1). The area evaluated in this report includes: 1) the three study areas of the proposed GCWRA, which is comprised of infrastructure including but not limited to turbines, underground electrical collection lines, roads, substations and facility buildings, as well as the immediate vicinity of development which includes existing residential developments, agricultural, natural and semi-natural habitats, and; 2) a two-mile buffer surrounding the GCWRA defined as the Evaluation Area (Figure 1.1). Roads included in the GCWRA include existing and proposed access roads (Figure 1.1). The two-mile size used for the Evaluation Area has been determined by WEST as appropriate for evaluating potential effects of a wind-energy project on wildlife. For instance, potential nesting habitat for raptors within one or two miles of the Project could potentially influence raptor use within the GCWRA. In addition, the two-mile buffer allows for comparison of the GCWRA with the surrounding landscape and provides some data for evaluating whether landcover, habitats or biological resources found within the GCWRA are unique to the region. A separate report evaluating biological and botanical resources for the proposed transmission line inter-connection for the GCWRA has been prepared (Tidhar and Chatfield 2010).

Biological resources within the GCWRA and the Evaluation Area were evaluated through a search of existing data, and a site visit. Several sources of available data were used to identify biological resources including published literature, field guides, and public data sets. The Arizona Game and Fish Department (AZGFD) and U.S. Fish & Wildlife Service (USFWS) were contacted concerning the presence of sensitive species and habitats within the GCWRA. Agency correspondence is included in Appendix A. The site visit was conducted on November 10 and 12, 2009 by Mr. David Tidhar of WEST Inc. to evaluate land cover and habitats, potential for avian migratory pathways, and to look for important biological features such as raptor nests, prey populations, and other biological resources. Numerous photographs were taken of the GCWRA and Evaluation Area (Appendix B).

Pre-construction wildlife surveys were completed at Study Area A of the Project in 2007 and 2008 by WEST (Young et al 2009). In addition, pre-construction avian use and bat activity monitoring surveys were completed at the nearby Sunshine Wind Park (WEST 2006 and Gruver et al 2009). The primary objective of Grapevine A and Sunshine surveys was to generate data on seasonal and annual use by birds and bats that would be useful in evaluating potential impacts from the proposed wind-energy facility, provide

information that could be used in project planning to minimize impacts to birds and bats, and recommend further monitoring studies or potential mitigation measures, if warranted.

Wildlife surveys completed at Study Area A included: 1) year-round avian use surveys consisting of 20-minute diurnal surveys at fixed points; 2) seasonal bat surveys consisting of passive acoustic monitoring; 3) raptor nest surveys, and; 4) prairie dog colony mapping. The objective of this Site Characterization Report is to provide additional information on biological resources within the GCWRA and the Evaluation Area which may not have been directly addressed during pre-construction wildlife surveys completed at Study Area A in 2007 and 2008. For instance, while all sensitive wildlife species observed during pre-construction surveys were noted, some sensitive species may not have been detected due to the timing of surveys or potential restriction of rare habitats.

1.1 Environmental Setting

The proposed project is located in central Arizona along the southern edge of the Arizona/New Mexico Plateau Ecoregion, which covers much of northern Arizona and northwestern New Mexico (USEPA 2004). This Ecoregion is a transitional region between the semiarid, low relief tablelands in the east, the drier, shrubland/woodland covered, higher relief tablelands in the Colorado Plateau, and the lower, hotter, less-vegetated Mojave Basin and Range in the east and Chihuahuan Desert in the south. Higher, more forested, mountainous ecoregions border the Arizona/New Mexico Plateau to the northeast and southwest. Vegetation communities in the region are characteristic of Great Basin shrublands and grasslands. Higher elevations within the region support pinyon pine (*Pinus edulis*) and juniper (*Juniperus spp*.) forests. Historical grazing management has resulted in landscape changes throughout much of the region. Lack of regular fires and high grazing pressure may have led to conversion of some areas from native grassland to Great Basin desert scrub or conifer woodland (AZGFD 2006).

Immediately to the west of the GCWRA lies the Arizona/New Mexico Mountain Ecoregion, and portions of the western Evaluation Area extend into this region of higher elevations and more vegetation (USEPA 2004). Chaparral is common on the lower elevation slopes of the Arizona/New Mexico Mountain Ecoregion. Pinyon-juniper and oak (*Quercus* spp.) woodlands are found on lower and mid elevations, and open to dense ponderosa pine (*Pinus ponderosa*) forests occur at higher elevations. Forests of spruce (*Picea spp*.), fir (*Abies spp.*) and Douglas fir (*Pseudotsuga menziensii*) are found in only a few high-elevation parts of this ecoregion, and are absent from the GCWRA and Evaluation Areas.

The GCWRA is comprised of a combination of State Trust land managed by the Arizona State Land Department, and private lands owned by the Flying M Ranch and the Bar T Bar or Crater Ranch. State, federal, and private lands in the region are collectively managed as part of the Diablo Trust, a grassroots land management group comprised of ranchers, environmentalists, state and federal land managers and others working together to create research and educational programs, provide better habitat for wildlife and livestock, and protect open space in southern Coconino County. The GCWRA falls

within the Diablo Canyon Rural Planning Area, an amendment to the Coconino County Comprehensive Plan. The GCWRA is sparsely populated with very few houses, barns, or other structures. Topography within the GCWRA is generally very flat to gently sloping with the exception of a few low ridges and larger canyons with moderate to steep embankments or cliffs. The western-most portion of the Evaluation Area has greater topographic relief and is characterized by the edge of the Anderson Mesa, running in northwest to southeast orientation. While the vast majority of the GCWRA is characterized by Great Basin shrubland and grassland, the vegetation transitions into areas of juniper savannah, pinyon-juniper woodland, and ponderosa pine forest as the western portion of the Evaluation Area extends onto the Anderson Mesa (Figure 2.1). Elevations within the GCWRA range from approximately 1,700 –2,080 meters (m; 5,580 – 6,820 feet [ft]) above sea level, and elevations within the larger Evaluation Area range from approximately 1,650 – 2,100 m (5,410 – 6,890 ft; Figures 1.2 and 1.3). The western boundary of the GCWRA abuts the Coconino National Forest. The Raymond Wildlife Area, comprised of State Trust and Arizona Game and Fish Commission Lands, lies immediately to the north of the GCWRA. Jack's Canyon runs along the southeast corner of the GCWRA, Canyon Diablo and Grapevine Canyon cut through the center of the GCWRA, and Yaeger Canyon run through the northwest corner of the GCWRA (Figures 1.2 and 1.3).

Physiographic differences between Study Areas A, B, and C are apparent. Study Area C contains lower elevation sections, particularly in the northern half of the area compared with Study Areas A and B (Figures 1.2 and 1.3). Study Areas A and B both contain slightly more relief than Study Area C, and the proportion of canyon found within Study Area A is greater than that found within Study Areas B and C (Figures 1.2 and 1.3). The majority of canyon found within the Study Areas is located along GCWRA boundaries. Land use is similar between all three Study Areas, with low-density cattle grazing occurring throughout the area.

2.0 LAND COVER

The GCWRA encompasses approximately 94,950 acres in southern Coconino County. According to the National Landcover Dataset (NLCD 2001; Table 2.1; Figures 2.1 and 2.2), the dominant cover type is scrub-shrub which comprises 70,333.97 acres, or 74.1% of the GCWRA. The only other major land cover type is grassland, which comprises 23.7% (22,529.05 acres) of the GCWRA. The remaining 2.2% of the GCWRA consists of very small amounts of evergreen forest (1,587.92 acres; 1.7%), woody wetlands (375.11 acres; 0.4%), barren land (90.09 acres; 0.1%), cropland (13.10 acres; < 0.1%), pasture/hay fields (12.38 acres; <0.1%), and developed open space (9.60 acres; < 0.1%). According to NLCD maps, evergreen forest is primarily restricted to the northwest corner of Study Area A, and along the western and southern boundary of Study Area B (Figure 2.1). However, the NLCD database appears to be confounding desert scrub with juniper-savannah woodlands, which dominate extensive portions of the southern half of the GCWRA (based on site observations [Appendix B]), but are classified as desert scrub by the NLCD. Evergreen forests within the area consist mainly of juniper savannah,

however, some small areas of pinyon-juniper woodland do exist within the GCWRA and very small patches of ponderosa pine forest are found in isolated pockets of high elevation portions of the Evaluation Area; principally south of Study Areas A and B (Figure 2.1).

The Evaluation Area, which includes a 2-mile buffer surrounding the GCWRA, encompasses approximately 178,360 acres, and has a composition that is generally similar to that of the GCWRA according to the NLCD database (Table 2.1; Figures 2.1 and 2.2). The Evaluation Area has a slightly lower percentage of both scrub-shrub (69.2%) and grassland (18.4%) than the GCWRA, but a higher percentage of evergreen forest (11.9%). This is primarily due to the presence of pinyon-juniper woodland and pondersosa pine forest within higher elevation habitats in the western-most portions of the Evaluation Area, to the south of Study Areas A and B (Figure 2.1). Canyon bottoms within the GCWRA and Evaluation Area also contain Gambel's oak (*Quercus gambelii*) and cottonwood (*Populus fremontii*) trees, as well as several shrub species, not present within the vast majority of the GCWRA.

Landcover does not significantly differ among the three Study Areas of the Project (Table 2.2). Study Area C is the largest of the three Study Areas; constituting approximately 49,470 acres or 52% of the GCWRA. Study Area C contains slightly more grassland than the other Study Areas according to NLCD data. Study Area A contains the largest amount of woody wetlands (69 acres), due to the greater proportion of canyon found within the GCWRA compared with Study Areas B or C (Table 2.2, Figure 1.1).

Non-native plant species are present within the GCWRA, including regionally common noxious weeed species. Following turbine construction, site restoration activities should begin immediately to minimize the spread of noxious weeds. Temporary construction areas around turbines, access road corridors, any temporary crane paths, and other temporarily disturbed areas should be restored according to the construction plan and any applicable state or federal permits. In general, restoration activities should include subsoil de-compaction (as necessary), rock/gravel removal, re-establishing pre-construction contours, spreading of stockpiled topsoil, and re-vegetation by seeding and mulching.

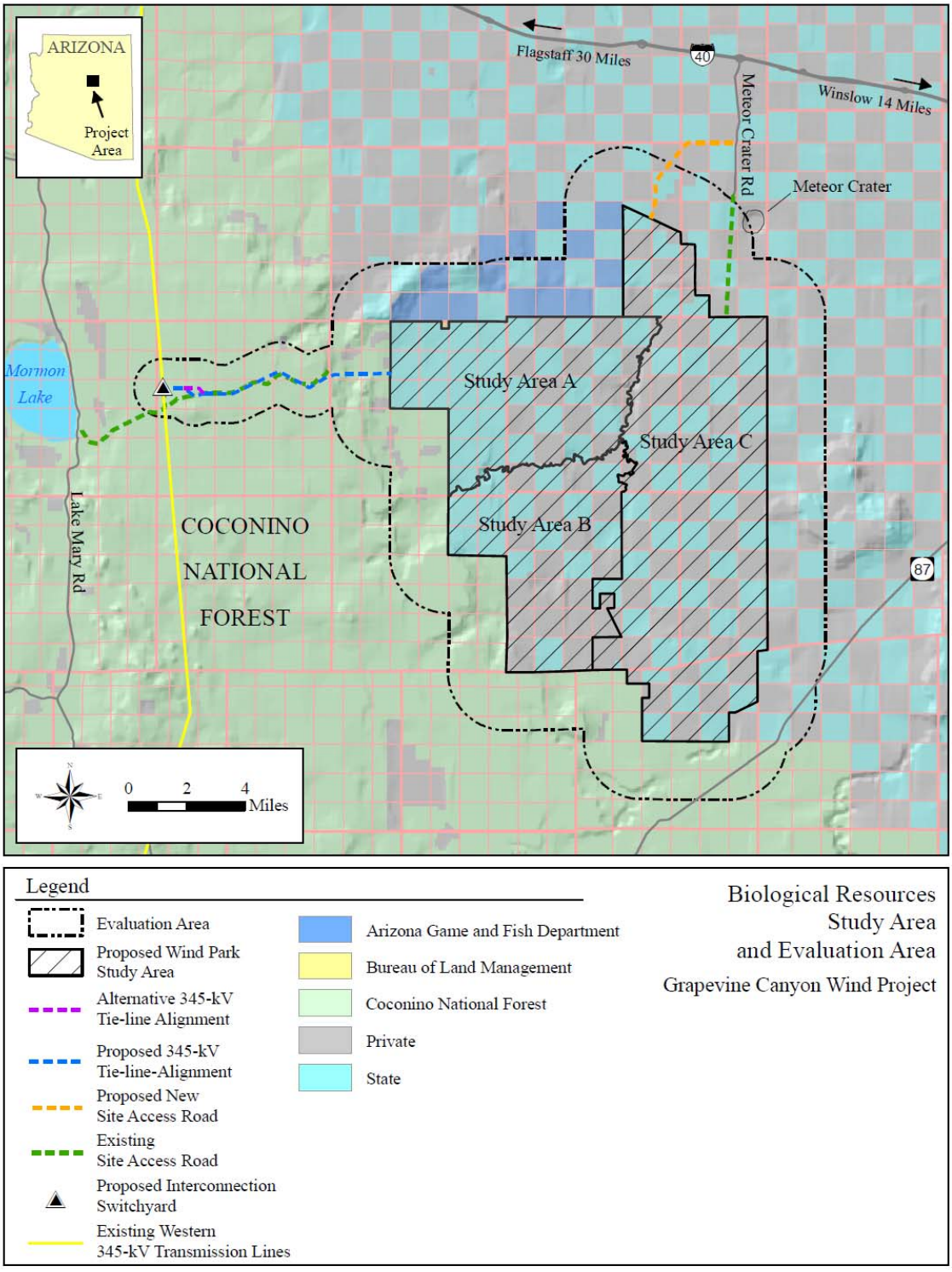

Figure 1.1 Location and composition of the Grapevine Canyon Wind Resource Area.

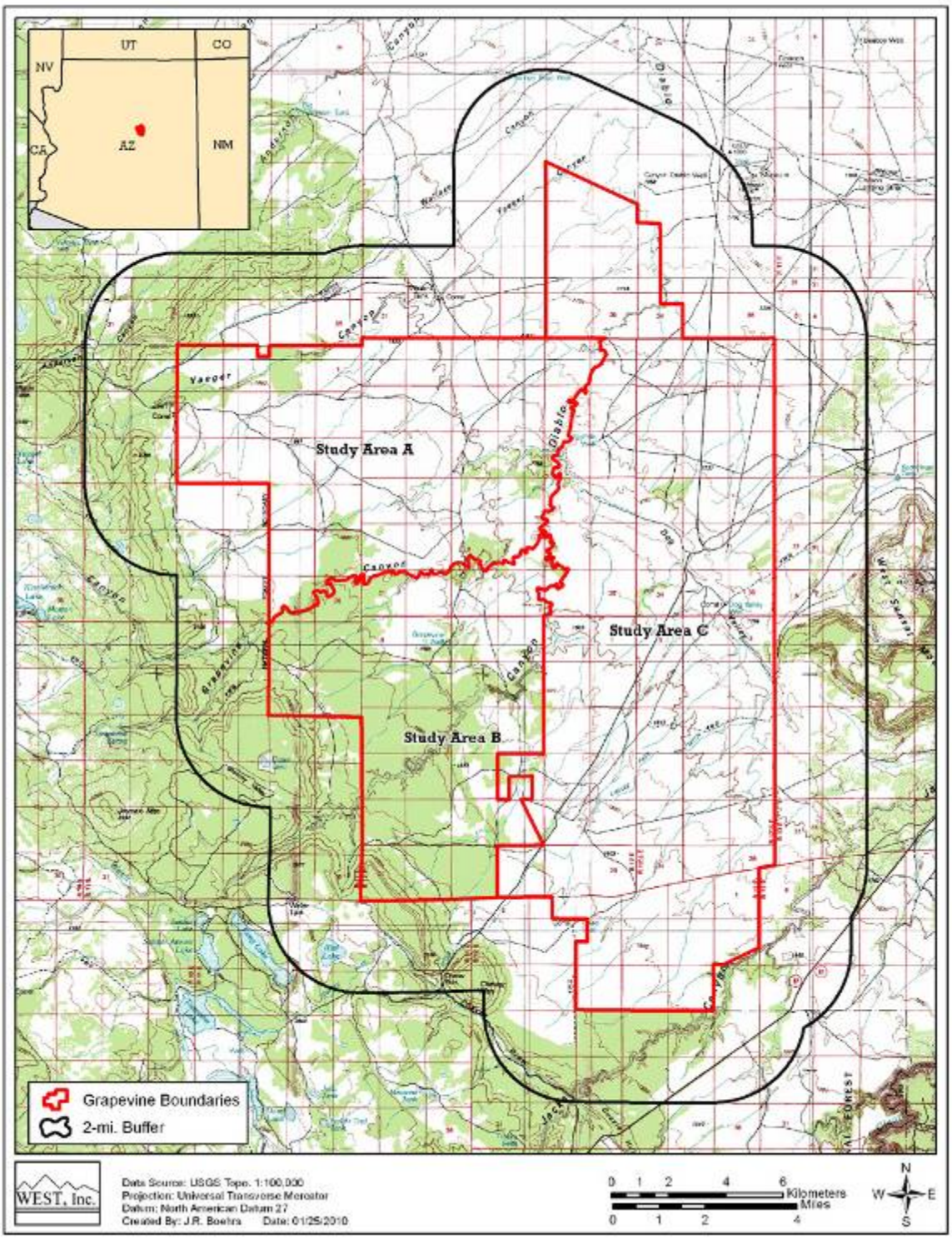

Figure 1.2 Topographic map of the Grapevine Canyon Wind Resource Area and Evaluation Area.

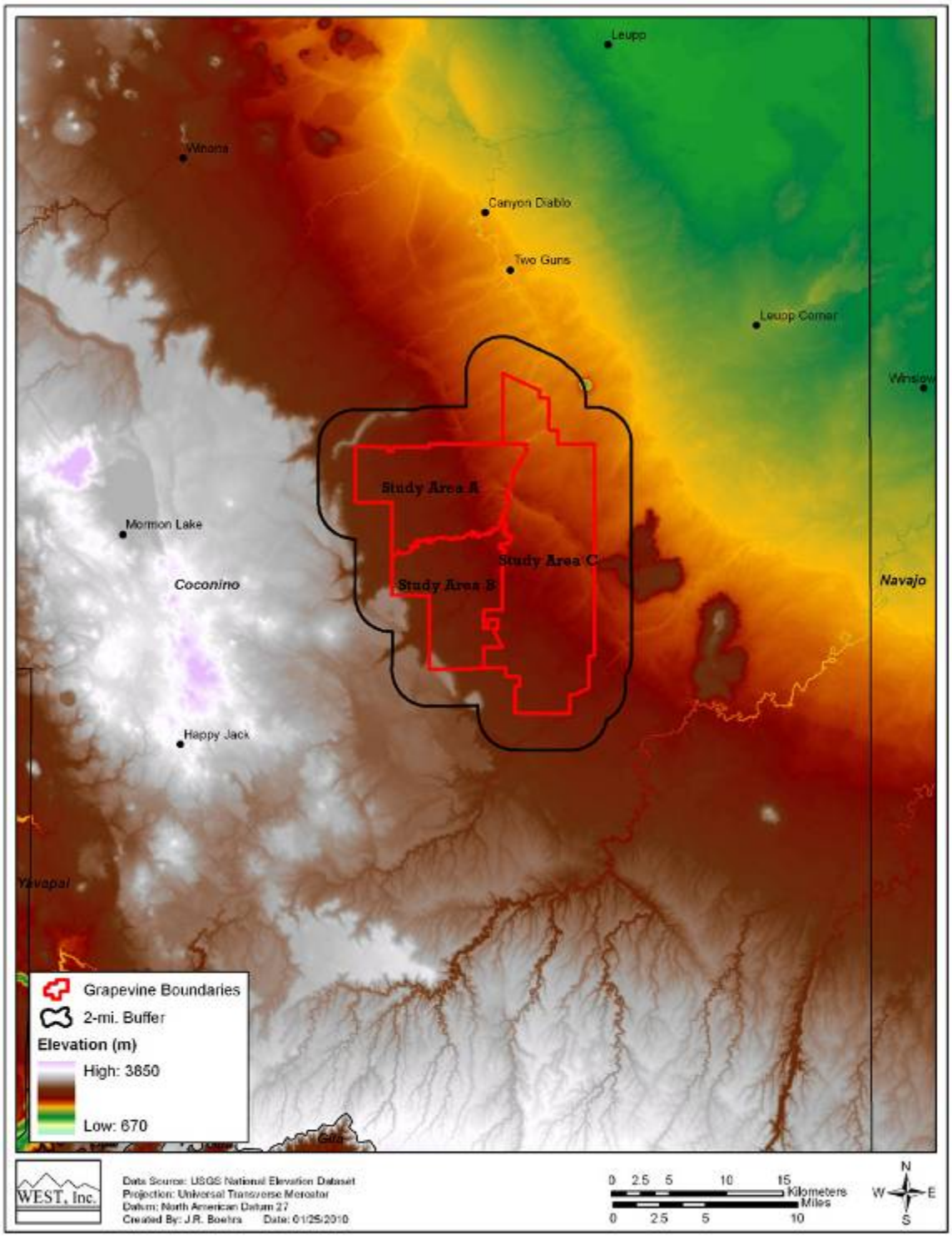

Figure 1.3 Digital elevation model of the Grapevine Canyon Wind Resource Area and Evaluation Area.

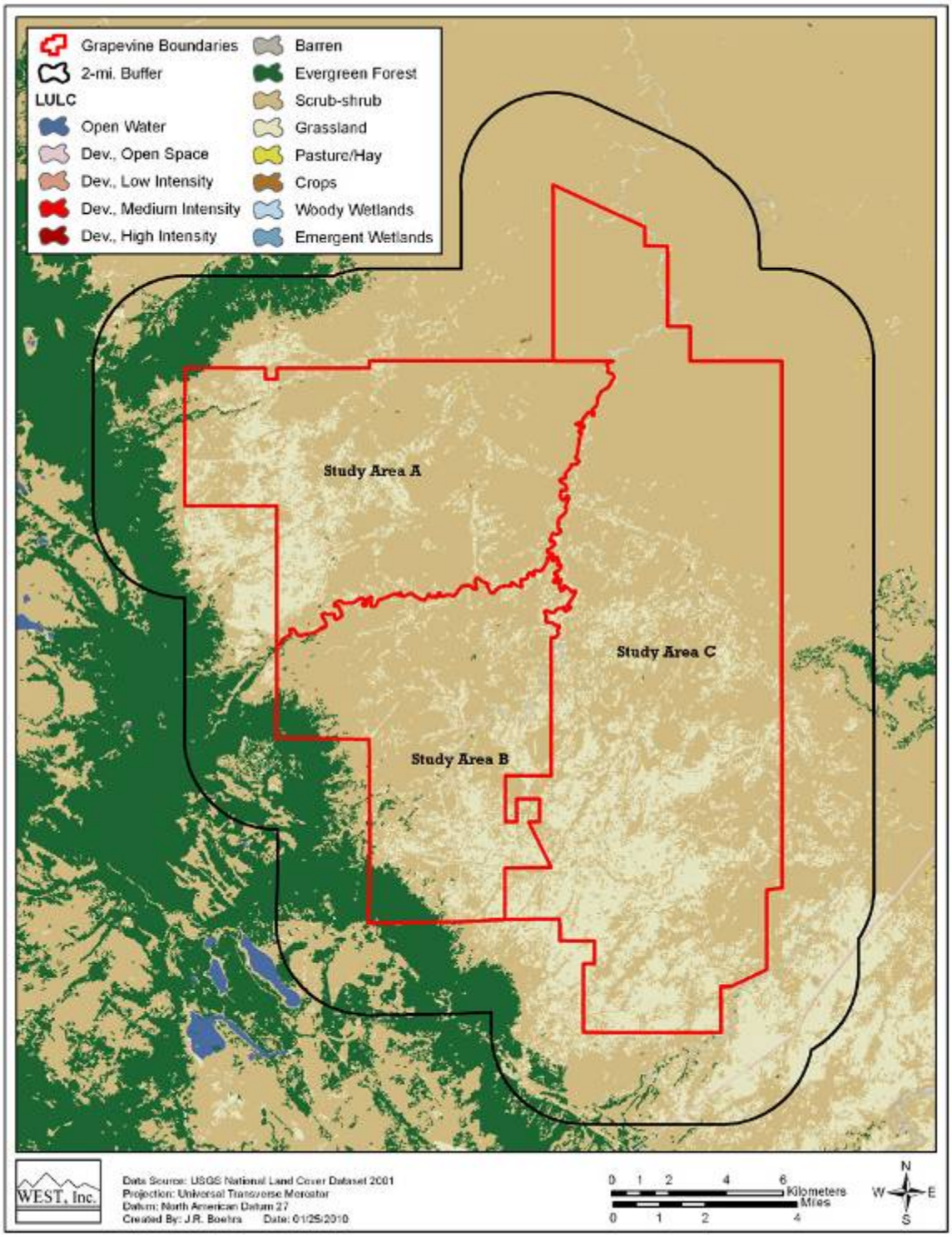

Figure 2.1 Land cover types within the Grapevine Canyon Wind Resource Area and Evaluation Area.

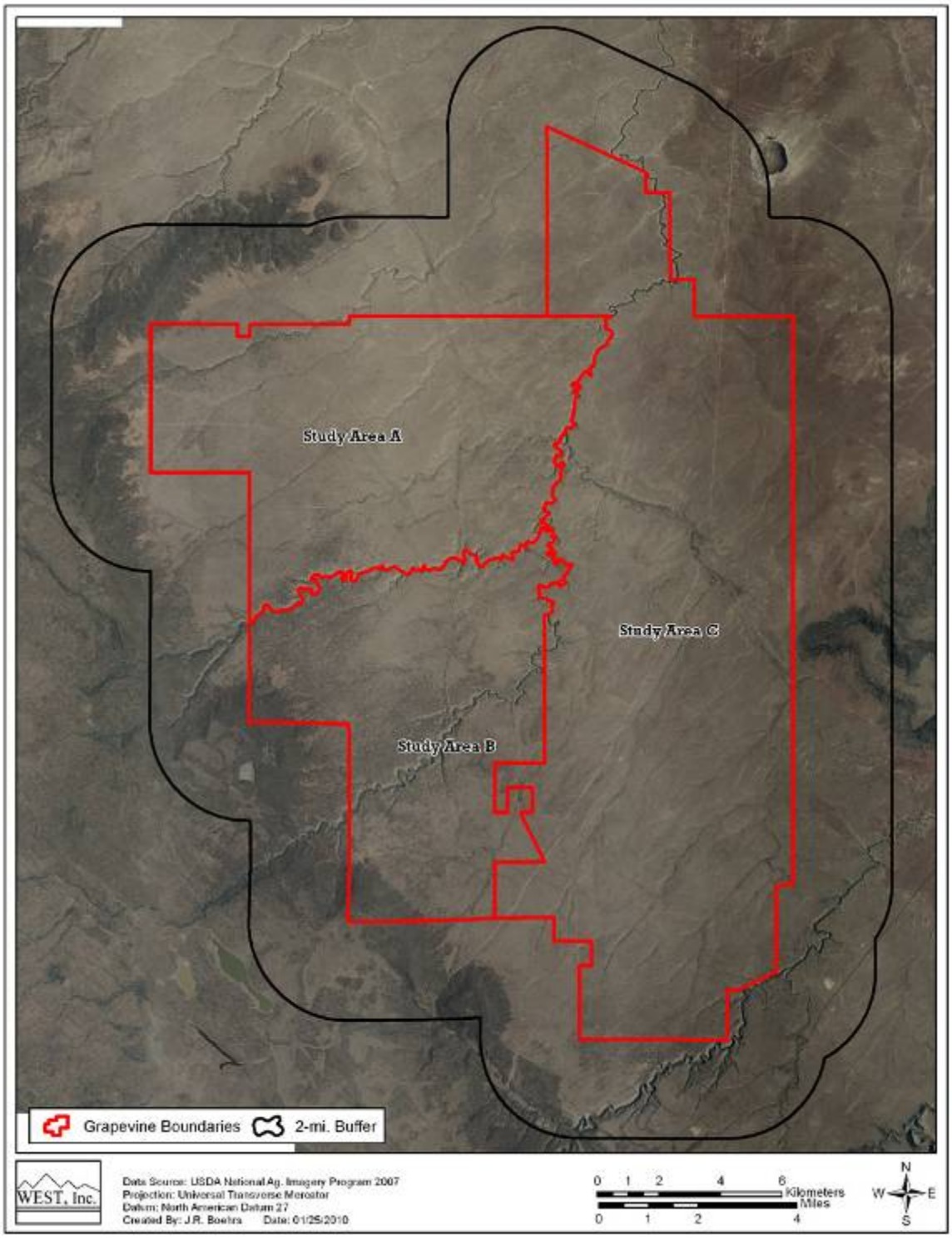

Figure 2.2 Aerial photograph of the Grapevine Canyon Wind Resource Area and Evaluation Area.

Table 2.1. Land use/habitat types present within the GCWRA and Evaluation Area. Data were obtained from USGS National Landcover Dataset compiled from satellite imagery (USGS 2001).

Cover Type	GCWRA		Evaluation Area	
	Acreage	% Composition	Acreage	% Composition
Open Water	0	0	2.39	< 0.1
Developed, Open Space	9.60	< 0.1	166.08	0.1
Barren	90.09	0.1	114.16	0.1
Evergreen Forest	1,587.92	1.7	21274.10	11.9
Scrub-shrub	70,333.97	74.1	123355.55	69.2
Grassland	22,529.05	23.7	32842.24	18.4
Pasture/Hay	12.38	< 0.1	38.57	< 0.1
Crops	13.10	< 0.1	44.54	< 0.1
Woody Wetlands	375.11	0.4	524.00	0.3
Total	**94,951.21**	**100**	**178,361.61**	**100**

2.2 Wetlands and Riparian Areas

Broad-scale information concerning wetlands is based on data from the USFWS National Wetlands Inventory (USFWS 2004; Figure 2.3), land cover mapping (Table 2.1; Figure 2.1), aerial photography (Figure 2.2), and the site visit. Only a very small percentage of the GCWRA is classified as wetland; based on USFWS National Wetland Inventory (NWI) data, < 0.1% (30.86 acres) of the GCWRA is comprised of wetland habitat, all of which is classified as pond habitat. Similarly, only 0.1% (212.04 acres) of the Evaluation Area is comprised of wetland habitat, 123.53 acres of which is classified as lake habitat and 88.51 of which is pond habitat. A large proportion of the wetland habitat identified through NWI is natural wetlands, with the majority of wetlands identified via NWI consisting of cattle stock tanks and ponds (Appendix B). While some of the stock tanks and ponds have likely been constructed on top of pre-existing wetlands, many of the estimated 25 water tanks and ponds located throughout the GCWRA appear to be located in areas which do not appear capable of supporting natural wetlands. Formal wetland delineations have not been completed. Irrespective of their origin or characteristics, ephemeral and perennial waterbodies provide important wildlife habitat and focal areas within the arid region.

The GCWRA falls within the east-central portion of the Canyon Diablo Watershed, and the western-most portion of the Middle Little Colorado Watershed. Water drains the GCWRA in a general southwest to northeast direction. Larger waterways include Jack's Canyon in the southeast corner of the GCWRA (Study Area C), Canyon Diablo and Grapevine Canyon in the central portion of the GCWRA (Study Areas A-C), and Yaeger Canyon in the northwest corner of the GCWRA (Study Area A) (Figure 2.3). These canyons generally do not hold water year-round; however, during the site visit in November, water was present in some areas of the streams indicating the presence of ephemeral springs. Livestock drinkers and earthen stock ponds are also present

Table 2.2. Land use/habitat types present within each Study Area of the GCWRA. Data were obtained from USGS National Landcover Dataset compiled from satellite imagery (USGS 2001).

Study Area A			Study Area B			Study Area C		
Habitat	**Acres**	**% Comp.**	**Habitat**	**Acres**	**% Comp.**	**Habitat**	**Acres**	**% Comp.**
Barren	68.59	0.3%	Barren	8.99	0.0004	Barren	12.51	0.0003
Evergreen Forest	123.03	0.5%	Evergreen Forest	1463.59	0.0714	Evergreen Forest	1.30	0.0000
Scrub-shrub	19532.33	78.2%	Scrub-shrub	14606.09	0.7129	Scrub-shrub	36195.55	0.7317
Grassland	5178.25	20.7%	Grassland	4283.84	0.2091	Grassland	13066.95	0.2641
Pasture/Hay	5.21	0.0%	Pasture/Hay	1.06	0.0001	Pasture/Hay	6.11	0.0001
Crops	4.83	0.0%	Crops	3.70	0.0002	Crops	4.56	0.0001
Woody Wetlands	69.63	0.3%	Woody Wetlands	121.78	0.0059	Woody Wetlands	183.70	0.0037
						Dev., Open Space	9.60	0.0002
Total	**24981.88**	**100.0%**	**Total**	**20489.06**	**1.0000**	**Total**	**49470.68**	**1.0000**

throughout the GCWRA; however, little to no natural wetland vegetation is present in these areas. Several small seasonal lakes are present within the western-most portions of the Evaluation Area, the largest of which are Red Lake and Comer Lake, approximately one mile to the southwest and west of Study Area B, respectively (Figure 2.3). A number of larger seasonal lakes and wetlands are present along Anderson Mesa to the west of the Evaluation Area (Figure 2.3).

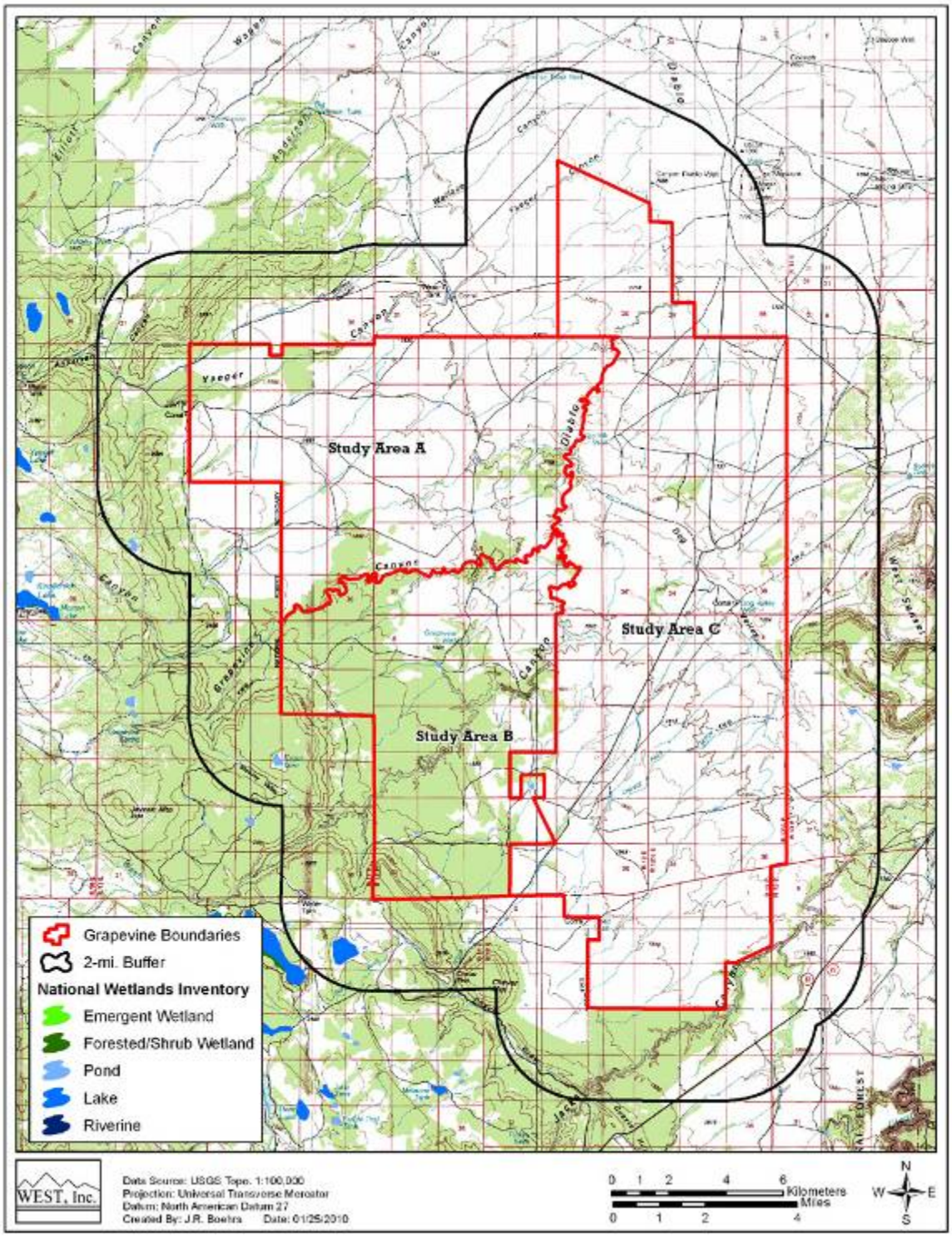

Figure 2.3 National Wetlands Inventory map of Grapevine Canyon Wind Resource Area and Evaluation Area.

2.3 Sensitive Plant Species

Plant species can be directly affected by wind power facilities due to loss of individuals and populations from construction and habitat alteration. All federal- and state-listed species recorded for Coconino County and/or considered by the USFWS (2009) or AZGFD (2009a) to have the potential for occurrence within the county were evaluated. Species habitat and distribution information was reviewed and species were ranked for potential of occurrence within the GCWRA qualitatively from no potential for occurrence ("none"), to highest probability for occurrence ("high") along the following scale:

Classification	Definition
None	No potential for occurrence. Known range and distribution do not overlap GCWRA. Potential habitat completely absent from GCWRA. No species accounts for GCWRA or surrounding area exist[2].
Extremely Low	Extremely low probability of occurrence. Known range and distribution may not include GCWRA. Very limited potential habitat is available within GCWRA. No species accounts for GCWRA or surrounding area exist[2].
Low	Low probability of occurrence. Known range and distribution include GCWRA. Potential habitat available patchily or in isolated areas within GCWRA. No species accounts for GCWRA or surrounding area exist[2].
Moderate	Moderate probability of occurrence. Range and distribution include GCWRA. Habitat present within GCWRA. Species accounts for GCWRA or surrounding area may exist[2].
High	Highest probability of occurrence. Range and distribution overlap GCWRA. Habitat abundant within GCRWA. Species accounts exist for GCWRA.

2= secondary qualifier for rank. Species accounts are not available equally across geographic regions and are influenced by survey effort, land ownership and access, financing of natural heritage programs and other factors. This information is useful for confirming that a given species was present in the GCWRA, but may not be sufficient information to confirm absence.

2.3.1 Federal Listed Species

The USFWS (2009) lists seven plant species designated as endangered, threatened, or candidate species with known or potential occurrence in Coconino County, Arizona (Table 2.3). The AZGFD (2009a), which maintains lists of sensitive plant and wildlife species at the watershed level, lists a further six plants considered federal species of concern and one federal endangered species having documented presence within the

Canyon Diablo and/or Middle Little Colorado Watersheds (Table 2.3). None of these plants have been documented as occurring within the GCWRA; however, it is likely that rare plant surveys have never been conducted in the area. Due to a very limited distribution and/or specific habitat requirements, six of the plants listed below are not likely to occur in the area (Table 2.3). Another three species have extremely low probability for potential to occur in the GCWRA or Evaluation Area based on species accounts and known distributions (AZGFD 2009b). A further four species have low probability for occurrence; while one species is ranked moderate, and zero are ranked as high. Based on information received from the AZGFD and USFWS (Appendix A), no federal threatened, endangered or sensitive plant species are known to occur within five miles of the GCWRA, and no critical habitat for federal listed species occurs within the GCWRA.

2.3.2 State Sensitive Species

The AZGFD (2009a) lists 16 state sensitive plant species with documented occurrence in the Canyon Diablo and/or Middle Little Colorado Watersheds (Table 2.4). These include three "Highly Restricted" species (i.e., no collection allowed) and 13 "Salvage Restricted" species (i.e., collection allowed only by permit). Of these, six species (blumer's dock [*Rumex orthoneurus*], gladiator milk-vetch [*Astragalus xiphoides*], Mogollon thistle [*Cirsium parryi mogollonicum*], paper-spined cactus [*Pediocactus papyracanthus*], Peebles Navajo cactus [*Pediocaactus peeblesianus var. peeblesianus*], and San Francisco Peaks groundsel [*Senecio franciscanus*]) are also listed as federal threatened or endangered species, or federal species of concern by the USFWS (see Table 2.3). Although the GCWRA contains relatively low diversity, there are areas of native shrub, grassland, juniper woodland, and wetland habitat that may support sensitive plant species. Of the state sensitive plant species with known occurrence in the Canyon Diablo and Middle Little Colorado Watersheds, seven species are not likely to occur due to their dependence on wetland, forest, or high-elevation habitats which are absent from the GCWRA and Evaluation Area. Three species have extremely low potential for occurrence; while five are ranked low, one is ranked moderate and zero are ranked high. Based on information received from the AZGFD (Appendix A), no state sensitive plant species are known to occur within five miles of the GCWRA, and there are no Critical Habitats documented within the GCWRA.

Table 2.3 Plant species listed as Federal endangered, threatened, candidate, or species of concern potentially occurring in the GCWRA. Results from USFWS (2009) and AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Habitat[2]	Potential for Occurrence
blumer's dock *Rumex orthoneurus*	FSC	Mid- to high-elevation wetlands; moist, organic soil; adjacent to perennial springs or streams in canyons or meadow situations.	**Low.** Not likely to occur in GCWRA due to preference for perennial wetland habitat; increased potential to occur in Evaluation Area to west of Study Areas A and B.
brady pincushion cactus *Pediocactus bradyi*	FE	Gravelly alluvium on gently sloping benches and terraces with sparse vegetation of scattered shrubs, grasses, and annuals; open, exposed, sunny situations.	**Extremely Low.** Known only in northern portion of County, but potential habitat present in the GCWRA (all three Study Areas).
cinder phacelia *Phacelia serrata*	FSC	Primarily in volcanic cinder areas associated with volcanic cones but also roadcuts and abandoned quarries in open, exposed, sunny locations.	**None.** Documented occurrence in Canyon Diablo watershed, north of Flagstaff; no potential to occur in the GCWRA (all three Study Areas). GCWRA and Evaluation Area dominated by basalt.
fickeisen plains cactus *Pediocactus peeblesianus fickeiseniae*	FC	Ridge-tops and benches with slight to moderate slope in gravelly limestone/gravelly loam soils; also in grasslands at foot of cliffs.	**Extremely Low.** Known only in northern and central Coconino County; potential to occur in GCWRA in isolated pockets of limestone which may be present, however, GCWRA and Evaluation Area dominated by basalt.
gladiator milk-vetch *Astragalus xiphoides*	FSC	Grasslands and alluvial plains from 5,000 to 6,000 ft.; generally associated with badlands of broken sandstone and clay bluffs in washes, floodplains, or complexes of small arroyos.	**Low.** Known in the Middle Little Colorado watershed to east of GCWRA; potential to occur in GCWRA (all three Study Areas).

Table 2.3 Plant species listed as Federal endangered, threatened, candidate, or species of concern potentially occurring in the GCWRA. Results from USFWS (2009) and AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Habitat[2]	Potential for Occurrence
Mogollon thistle *Cirsium parryi mogollonicum*	FSC	Moist to very moist soils in the shaded riparian understory of perennial streams found in coniferous forests; newly discovered in AZ and little known about species.	**Extremely Low.** Very limited distribution in very south of Coconino County (along Mogollon Rim); not likely to occur in GCWRA due to habitat preference.
Navajo sedge *Carex specuicola*	FT	Shady seep/springs and hanging gardens, on vertical pink-red Navajo Sandstone cliffs and alcoves; found in juniper-pinyon woodlands.	**None.** Known only in northwest corner of County; not likely to occur in GCWRA due to habitat requirements and distribution.
paper-spined cactus *Pediocactus papyracanthus*	FSC	Open flats in grasslands and pinyon-juniper woodlands; associated with grama grass; restricted to fine, sandy clay loams and red sandy soils.	**Low.** Found in the middle Little Colorado watershed, to east of the GCWRA; potential to occur in GCWRA (all three Study Areas).
Peebles Navajo cactus *Pediocaactus peeblesianus var. peeblesianus*	FE	Exposed, sunny situations in weakly alkaline, gravelly soils of the Little Colorado Paleochannel; gently sloping hills to flat hilltops in desert scrub and grassland.	**Moderate.** Found in the middle Little Colorado watershed to east of GCWRA; potential to occur in GCWRA (all three Study Areas).
San Francisco Peaks groundsel *Senecio franciscanus*	FT	In cracks and crevices of talus slopes in alpine fellfields on San Francisco Peaks; primary succession species.	**None.** Known only from San Francisco Peaks north of Flagstaff; alpine species – no potential to occur in GCWRA based on habitat and distribution.
sentry milk-vetch *Astragalus cremnophylax var. cremnophylax*	FE	In uppermost layer of Kaibab limestone in open, pinyon-juniper-cliffrose plant communities above 4,000 ft.	**None.** Known only in central portion of County, near the Grand Canyon; not likely to occur in GCWRA due to habitat requirements and distribution.

Table 2.3 Plant species listed as Federal endangered, threatened, candidate, or species of concern potentially occurring in the GCWRA. Results from USFWS (2009) and AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Habitat[2]	Potential for Occurrence
siler pincushion cactus *Pediocactus sileri*	FT	Low red or gray gypsiferous badlands derived from the Moenkopi Formation; restricted to gypsum, selenium, and calcareous soils, high in soluble salts.	**None.** Found in very northeast of County; not likely to occur in GCWRA due to habitat requirements and distribution.
Welsh phacelia *Phacelia welshii*	FSC	Great Basin cold desert scrub communities, typically in the red shale outcrops of the Moenkopi Formation along roadsides and gravelly washes; also on black, sandy, volcanic ash.	**Low.** Found in the Little Colorado River drainage, north of the GCWRA; potential to occur in GCWRA (all three Study Areas).
Welsh's milkweek *Asclepias welshii*	FT	Open, sparsely vegetated semi-stabilized coral pink sand dunes in sagebrush, juniper, pine, and oak communities of Great Basin desert scrub.	**None.** Known only from north of County; not likely to occur in GCWRA due to habitat requirements.

[1]FE = Federal Endangered; FT = Federal Threatened; FC = Federal Candidate for listing; FSC = Federal Species of Concern

[2]Habitat and species distribution information from AZGFD (2005)

2.4 Vegetation Summary and Conclusions

The primary vegetation communities within the GCWRA are scrub-shrub, juniper savannah and woodland, and grassland. Wetlands. are very limited within the area, comprising less than 0.1% of the total GCWRA. Many waterbodies are comprised of artificial water tanks or ponds utilized for cattle. Seven federal listed plant species are listed as occurring in Coconino County and 16 state sensitive (highly restricted or salvage restricted) plants are listed as occurring in the Canyon Diablo and/or Middle Little Colorado Watersheds (AZGFD 2009a). The majority of these plants has limited distributions and specific habitat requirements and are not expected to occur in the GCWRA; however, the GCWRA does contain areas of native shrub, grassland, and woodland habitat, and a very small amount of wetland habitat that could potentially support some sensitive plant species. Upper-elevation portions of the Evaluation Area containing ponderosa pine forest may support some plant species not supportable within the GCWRA. Canyon bottoms containing riparian areas, deciduous woodlands, wetlands or waterbodies may support wetland and mesic plant species not found within the vast majority of the GCWRA. Canyon bottoms are not likely to be impacted by Project facilities or infrastructure. Based on information received from the AZGFD, no threatened, endangered, or sensitive plant species are known to occur within five miles of the GCWRA, and there are no Critical Habitats documented within the GCWRA (Appendix A). No sensitive plant species are considered to have high probability for occurrence within the GCWRA or Evaluation Area. Of federal- and state-listed plant species, only the Peebles Navajo cactus *Pediocaactus peeblesianus var.* was ranked as having moderate potential to occur within the GCWRA, based on availability of habitat and known distribution within the vicinity of the Evaluation Area; though no records exist within five-miles of the Evaluation Area. The species occurs on gently sloping sunny aspects with desert scrub or grassland vegetation on in weakly alkaline, gravelly soils.

Study Area A may contain more potential sensitive plant species habitat than Study Area B or C, due largely to the greater proportion of canyon bottom wetland habitat found within Study Area C (Table 2.2; Figure 1.2). In addition, there appear to be a greater number of wetland and waterbodies located within Study Area A and B compared with Study Area C.

Table 2.4 Plant species listed as state species of concern with known or potential occurrence the Canyon Diablo and Middle Little Colorado Watersheds, Coconino County, Arizona. Results from AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Watershed	Habitat[2]	Potential for Occurrence
blumer's dock *Rumex orthoneurus*	HS	MLC	Mid- to high-elevation wetlands; moist, organic soil; adjacent to perennial springs or streams in canyons or meadow situations.	**Low.** Not likely to occur in GCWRA due to preference for perennial wetland habitat; increased potential to occur in Evaluation Area to west of Study Areas A and B.
broadleaf twayblade *Listera convallarioides*	SR	MLC	Moist mixed deciduous/coniferous forests, growing in rich humus in open woods to boggy meadows; in Arizona grows along banks of perennial streams or seeps in mosses or damp soil.	**None.** Occurs in very south of County; not likely to occur in GCWRA due to habitat requirements; greater potential to occur in Evaluation Area, to west of Study Areas A and B.
Flagstaff pennyroyal *Hedeoma diffusum*	SR	CD	Open, ponderosa pine habitats; prefers weathered limestone solution pockets filled with 4-6 inches of soil, but also grows in vertical cracks and around edges of boulders.	**None.** Known west of GCWRA; not likely to occur in GCWRA due to habitat requirements. GCWRA and Evaluation Area dominated by basalt and very limited distribution of ponderosa pine in Evaluation Area.
gladiator milk-vetch *Astragalus xiphoides*	SR	MLC	Grasslands and alluvial plains from 5,000 to 6,000 ft.; generally associated with badlands of broken sandstone and clay bluffs in washes, floodplains, or complexes of small arroyos.	**Low.** Known in the Middle Little Colorado watershed to east of GCWRA; potential to occur in Study Areas A, B, C

Table 2.4 Plant species listed as state species of concern with known or potential occurrence the Canyon Diablo and Middle Little Colorado Watersheds, Coconino County, Arizona. Results from AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Watershed	Habitat[2]	Potential for Occurrence
Grand Canyon cottontop cactus *Echinocactus polycephalus var. xeranthemoides*	SR	MLC	Rocky hills, slopes, and ledges of canyons in Great Basin and Mojave Desert scrub; found on rocky, mostly south-facing ledges or canyons or on rocky hillsides in Navajoan Desert or on edge of juniper-pinyon woodland.	**Low.** Known to occur north of GCWRA in Middle Little Colorado Watershed; habitat in canyons of Study Areas A, B, C. GCWRA may be suitable.
green death camus *Zigadenus virescens*	SR	CD	Montane coniferous forests; generally above 6,500 ft.	**Extremely Low.** Not likely to occur in GCWRA due to habitat and elevation range; some potential to occur in Evaluation Area, to west of Study Areas A and B.
mazatzal triteleia *Triteleia lemmoniae*	SR	MLC	Sparse pine woodlands; typically understory plant along streams, in boggy areas, near ponds and lakes, in open meadows or pastures, and on rocky hillsides.	**Extremely Low.** Known to west and south of GCWRA; not likely to occur in GCWRAdue to preference for pine woodlands; increased potential to occur in Evaluation Area, to west of Study Areas A and B.
Mogollon columbine *Aquilegia desertorum*	SR	CD, MLC	In potholes and clefts of Kaibab limestone outcrops in ponderosa pine community; often shaded by pine overstory; moist to xeric sites.	**None.** Know to west and south of GCWRA; not likely to occur in GCWRA due to preference for ponderosa pine woodland; increased potential to occur in Evaluation Area, to west and south of Study Areas A and B.

Table 2.4 Plant species listed as state species of concern with known or potential occurrence the Canyon Diablo and Middle Little Colorado Watersheds, Coconino County, Arizona. Results from AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Watershed	Habitat[2]	Potential for Occurrence
Mogollon thistle *Cirsium parryi mogollonicum*	SR	MLC	Moist to very moist soils in the shaded riparian understory of perennial streams found in coniferous forests; newly discovered in AZ and little known about species.	**Extremely Low.** Very limited distribution in very south of Coconino County (along Mogollon Rim); not likely to occur in GCWRA due to habitat preference.
paper-spined cactus *Pediocactus papyracanthus*	SR	MLC	Open flats in grasslands and pinyon-juniper woodlands; associated with grama grass; restricted to fine, sandy clay loams and red sandy soils.	**Low.** Found in the middle Little Colorado watershed, to east of the GCWRA; potential to occur in GCWRA (all three Study Areas).
Peebles Navajo cactus *Pediocaactus peeblesianus var. peeblesianus*	HS	MLC	Exposed, sunny situations in weakly alkaline, gravelly soils of the Little Colorado Paleochannel; gently sloping hills to flat hilltops in desert scrub and grassland.	**Moderate.** Found in the middle Little Colorado watershed to east of GCWRA; potential to occur in Study Areas A, B, C
purple adder's mouth *Malaxis porphyrea*	SR	MLC	Mixed conifer forest; near slightly damp, mossy, or grassy places in slightly open forests; generally above 7,000 ft.	**None.** Known to south of GCWRA; no potential to occur in GCWRA or Evaluation Area due to habitat requirements.
Rocky Mountain bristlecone pine *Pinus aristata*	SR	CD	Dry, rocky slopes and ridges near timberline in montane and subalpine areas; generally above 7,500 ft.	**None.** No potential to occur in GCWRA or Evaluation Area due to habitat and elevation range.

Table 2.4 Plant species listed as state species of concern with known or potential occurrence the Canyon Diablo and Middle Little Colorado Watersheds, Coconino County, Arizona. Results from AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Watershed	Habitat[2]	Potential for Occurrence
roundleaf errazurizia *Errazurizia rotundata*	SR	MLC	Exposed areas within Great Basin desert scrub habitats; found in sandy soils in sandstone, gravelly soils in calcareous outcrops, and deep alluvial cinders in sandstone breaks.	**Low.** Known to north and east of GCWRA; potential to occur in Study Areas A, B, C
San Francisco Peaks groundsel *Senecio franciscanus*	HS	CD	In cracks and crevices of talus slopes in alpine fellfields on San Francisco Peaks; primary succession species.	**None.** Known only from San Francisco Peaks north of Flagstaff; alpine species – no potential to occur in GCWRA based on habitat and distribution.
sunset crater beardtongue *Penstemon clutei*	SR	CD	Cinder fields devoid of soil covering and where other herbaceous vegetation is sparse; generally above 6,100 ft.	**None.** Found to northwest of GCWRA; not likely to occur in GCWRA due to absence of cinder fields in basalt dominated region

[1]HS = Highly Safeguarded – no collection allowed; SR = Salvage Restricted – collection only with permit
[2]Habitat and species distribution information from AZGFD (2005)

3.0 WILDLIFE

Wildlife can be directly affected by wind power facilities due to loss of individuals and populations from construction and habitat alteration (NWCC 2007, Young et al 2009). Wildlife may also be indirectly affected by construction or operation of wind-energy facilities (for more information please see NWCC 2007). All wildlife species observed within the GCWRA or Evaluation Area during the site visit conducted on November 10 and 12, 2009 were recorded (Table 3.1). None of the birds observed during the site visit were new to the GCWRA, as all bird species had previously been recorded during Study Area A preconstruction wildlife surveys (Young et al 2009). Black bear (*Ursus americanu)*, deermouse (*Peromyscus maniculatus*), woodrat (*Neotoma* spp.) and mountain lion (*Puma concolor)* sign were observed during the site visit within a remote canyon bottom; these species were not previously observed by WEST.

Table 3.1. Wildlife observed during the GCWRA site visit.

Common name	Scientific name
Birds	
Golden eagle	*Aquila chrysaetos*
Red-tailed hawk	*Buteo jamaicensis*
Common raven	*Corvus corax*
Western meadowlark	*Sturnella neglecta*
Pinyon jay	*Gymnorhinus cyanocephalus*
Mountain bluebird	*Sialia currucoides*
Horned lark	*Eremophila alpestris*
Mammals	
Deermouse	*Peromyscus maniculatus*
Unidentified woodrat	*Neotoma spp.*
Gunnison's prairie dog	*Cynomys gunnisoni*
Pronghorn antelope	*Antilocapra Americana*
Mule deer	*Odocoileus hemionus*
Elk	*Cervus elaphus*
Black bear	*Ursus americanu*
Mountain lion	*Puma concolor*

The potential for wildlife species to occur within the GCWRA or Evaluation Area and information regarding potential for relative abundance or distribution was evaluated. Species habitat and distribution information available from published reports and publically available data sets was reviewed. Species were ranked for potential of occurrence within the GCWRA qualitatively from no potential for occurrence ("none"), to highest probability for occurrence ("high") along the following scale:

Classification	Definition
None	No potential for occurrence. Known range and distribution do not overlap GCWRA. Potential habitat completely absent from GCWRA. No species accounts for GCWRA or surrounding area exist[2].
Rare	Extremely low probability of occurrence. Known range and distribution may not include GCWRA. Very limited potential habitat is available within GCWRA. Species may transient or disperse over/though GCWRA, however breeding habitat absent. No species accounts for GCWRA or surrounding area exist[2].
Low	Low probability of occurrence. Known range and distribution include GCWRA. Potential habitat available patchily or in isolated areas within GCWRA. No species accounts for GCWRA or surrounding area exist[2].
Moderate	Moderate probability of occurrence. Range and distribution include GCWRA. Habitat present within GCWRA. Species accounts for GCWRA or surrounding area may exist[2].
High	Highest probability of occurrence. Range and distribution overlap GCWRA. Habitat abundant within GCWRA. Species accounts exist for GCWRA.

2= secondary qualifier for rank. Species accounts are not available equally across geographic regions and are influenced by survey effort, land ownership and access, financing of natural heritage programs and other factors. This information is useful for confirming that a given species was present in the GCWRA, but may not be sufficient information to confirm absence.

3.1 Sensitive Wildlife Species

All federal- and state-listed species recorded for Coconino County and/or considered by the USFWS (2009) or AZGFD (2009) to have the potential for occurrence within the county were evaluated.

3.1.1 Federal Listed Species

A list of federal threatened, endangered, and candidate wildlife species potentially occurring within the GCWRA was compiled using online databases maintained by the USFWS (2009) and AZGFD (2009), as well as correspondence from the USFWS and AZGFD (Appendix A). Thirteen wildlife species listed as endangered, threatened candidate, or non-essential experimental special status species by the federal Endangered Species Act (ESA) occur within Coconino County, Arizona; including four birds, one mammal, one reptile, one amphibian, five fish, and one snail (Table 3.2). The species are discussed further below. Based on information received from the AZGFD and the

USFWS, no federal threatened, endangered, candidate or non-essential experimental wildlife species are known to occur within five miles of the GCWRA, and no critical habitat for listed species occurs within the GCWRA (Appendix A).

California Condor

The California condor (*Gymnogyps californianus*) inhabits high desert canyons and plateaus. In Arizona, condors roost and nest in steep terrain with rock outcroppings, cliffs, and caves. High perches are necessary to create strong updrafts required for flight, and open grasslands or savannahs are essential for searching for food. In the late 1970s the California condor was reduced to a population of less than 25 birds. At that point, all remaining condors were taken from the wild and a captive breeding program was initiated. In 1992 the Recovery Program began releasing birds back into the wild in California in 1992, and in northern Arizona is 1996. Successful breeding was first documented in Arizona in 2003. The current wild population in Arizona is 75 birds, located primarily near the Vermillion Cliffs and the Grand Canyon (AZGFD 2009c). While the California condor is currently listed as a federal endangered species throughout its range, the northern Arizona population is considered an experimental, nonessential population (USFWS 2009). An experimental/nonessential area has been designated for much of northern Arizona and southern Utah. In Arizona, this area is defined by a polygon formed by Highway 191 in the east, Interstate 40 in the south, and Highway 93 in the west. The GCWRA lies approximately 10 miles to the south of this polygon. Given their current limited distribution in north-central Arizona, California condors have an extremely low potential to occur in the GCWRA as transient birds or during foraging forays.

Table 3.2. Federal listed and candidate species with known or potential occurrence in Coconino County, Arizona. Results from USFWS (2009) and AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Habitat	Potential for Occurrence
Birds			
California condor *Gymnogyps californianus*	FE/ NE	High desert canyons and plateaus; in Arizona nest and roost in steep terrain with rock outcroppings, in cliffs and caves; high perches necessary to create strong updraft required for flight; open grasslands or savannahs essential for searching for food.	**Extremely Low.** Non-essential, experimental population occurs in northern AZ where population numbers 75 individuals; primarily occur near Vermillion Cliffs and Grand Canyon. May transient over project.
Mexican spotted owl *Strix occidentalis lucida*	FT	Nest in canyons and dense mixed-conifer forests with multi-layered foliage structure.	**None.** Known to occur in forested areas to south of Evaluation Area; habitat not suitable within GCWRA; some potential to occur in scattered pockets of ponderosa pine forests of Evaluation Area.
southwestern willow flycatcher *Empidonax traillii extimus*	FE	Cottonwood/willow and tamarisk vegetation communities along rivers and streams; prefers dense shrub canopy cover and surface water during the breeding season.	**Extremely Low.** Not known to occur in GCWRA; suitable riparian habitat appears to be absent; low potential to transient during migration.
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FC	Streamside cottonwood, willow, tamarisk and mesquite riparian habitats required for nesting and migrating.	**Extremely Low.** Not known to occur in GCWRA; suitable riparian habitat appears to be absent; low potential to transient during migration.
Mammals			
black-footed ferret *Mustela nigripes*	FE/NE	Grasslands; arid plains; generally associated with prairie dogs.	**None.** Two non-essential experimental populations located >100 miles from GCWRA. Suitable habitat and prey available in low proportions within GCWRA.
Reptiles			
northern Mexican gartersnake *Thamnophis eques*	FC	Densely vegetated habitats surrounding cienegas, stock tanks, large-river riparian woodlands and forests; strongly associated with presence of a native	**Low.** Known in central Arizona (Verde River drainage) to southwest of GCWRA; wetland habitat very limited in GCWRA and

megalops		prey base including leopard frogs and native fish	Evaluation Area.
Amphibians			
Chiricahua leopard frog *Rana chiricahuensis*	FT	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs; require permanent or nearly permanent water source.	**Low.** Known to south of GCWRA along the Mogollon Rim; aquatic habitat very limited in GCWRA.
Fishes			
Apache trout *Oncorhynchus apache*	FT	Cool, clear, streams and rivers generally above 6,000 ft. with adequate stream flow and shading; substrate composed of boulders, rocks, gravel and some sand and silt.	**None.** Currently restricted to drainages in the White Mountains of eastern Arizona; stream habitat not suitable.
humpback chub *Gila cypha*	FE	Large, warm turbid rivers especially canyon areas with deep fast water; typically below 4,000 ft.	**None.** In Arizona known in Colorado and Little Colorado Rivers in the Grand Canyon to north of GCWRA; stream habitat in GCWRA not suitable.
Little Colorado spinedace *Lepidomeda vittata*	FT	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate.	**None.** Known to occur in mainstem of Little Colorado, Nutrioso Creek, Clear Creek and Chevelon Creek; stream habitat in GCWRA not suitable.
Razorback sucker *Xyrauchen texanus*	FE	Riverine and lacustrine areas, generally not in fast moving water and may use backwaters; in impoundments prefer water depths of meter or more over sand, mud, or gravel substrate.	**None.** Currently known only in Lake Mohave, Lake Mead, and Lake Havasu; stream habitat in GCWRA not suitable.
roundtail chub *Gila robusta*	FC	Cool to warm waters of mid-elevation rivers and streams; adults often occupy the deepest pools and eddies of large streams.	**None.** Known to occur in Little Colorado and to east of GCWRA; stream habitat in GCWRA not suitable.
Snails			
kanab ambersnail *Oxyloma haydeni kanabensis*	FE	Travertine seeps and springs in Grand Canyon National Park; associated with watercress, monkey flower, and other wetland vegetation.	**None.** Extremely geographically isolated – known only in one location in Arizona (Grand Canyon).

[1]FE=Federal Endangered; FT = Federal Threatened; FC=Federal Candidate for listing; NE = non-essential experimental population

Mexican Spotted Owl

In Arizona, Mexican spotted owls (*Strix occidentallis lucida*) are distributed patchily throughout forested mountains statewide, but also in steep canyons of the Colorado Plateau including the Grand Canyon (AZGFD 2009b). They generally nest and roost in dense, old-growth mixed-conifer forest with multi-layered foliage structure located on steep slopes, especially deep, shady ravines. In Arizona, they occur primarily in mixed-conifer and pine-oak forests, but may also occur in ponderosa pine forests and rocky canyonlands. Mexican spotted owls are known to occur in the forested mountains and canyons to the west and south of the GCWRA (AZGFD 2009b; Henry Provencio USFS, personal communications); however, suitable forest habitat is not present within the GCWRA itself, and there is no potential for the species to occur. A limited amount of nesting and foraging habitat is available in the ponderosa pine forests at the higher elevations of the Evaluation Area, to the south of Study Areas A and B, and there is some potential for the species to occur in these areas.

Southwestern Willow Flycatcher

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a riparian-obligate, migratory species. The flycatcher arrives at its breeding territory in Arizona in late April through early May, and migrates southward again in August and September. Their preferred nesting habitat is mature cottonwood and willow (*Salix* spp.) woodland along still or slow-moving watercourses, but they are also found in tamarisk (*Tamarix pentandra*) thickets and pure willow stands (AZGFD 2009b). The willow flycatcher's breeding range in Arizona includes sites along the Colorado River in Grand Canyon near the mouth of the Little Colorado River; at the Little Colorado River headwaters near Greer and Eagar; very locally along the middle Gila, Salt, and Verde Rivers; the middle to lower San Pedro River; and the upper San Francisco River near Alpine (AZGFD 2009b). Riparian habitat is very limited within the GCWRA, and the southwestern willow flycatcher is not known to occur within the vicinity (AZGFD 2009b). While the species is not likely to nest within the GCWRA, there is low potential for transient occurrence during spring and fall migration periods.

Yellow-billed Cuckoo

The yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a neotropical migrant, arriving on its breeding territories in Arizona in May and June, and departing for its Mexican wintering grounds in August and September. In the arid southwest, the species is primarily restricted to densely wooded rivers and streams and damp thickets. Yellow-billed cuckoo nests are found along lowland drainages within stands of multi-structured native riparian vegetation, mainly mature cottonwood/willow woodland and sometime large mesquite (*Prosopis* spp.) bosques (AZGFD 2009b; Corman and Wise-Gervais 2005). Suitable nesting habitat within the GCWRA is not present. There is extremely low potential for yellow-billed cuckoos to use the few riparian habitats found within canyon bottoms as stopover areas during migration periods.

Black-footed Ferret

In Arizona, the historic range of the black-footed ferret (*Mustela nigripes*) is characterized as plains and Great Basin grassland communities (AZGFD 2009b). Black-

footed ferrets are closely associated with prairie dogs which comprise more than 90% of their diet. An estimated 40-60 ha of prairie dog colony is necessary to support a single ferret (AZGFD 2009b). In the late 1900s a national effort to eradicate prairie dogs resulted in a drastic decline in black-footed ferret populations due to the ferrets' extreme dependence on prairie dogs. After an approximate 60 year absence in Arizona, the AZGFD reintroduced 35 captive-breed ferrets in Aubrey Valley, located approximately 100 miles west of the GCWRA in west-central Coconino County (AZGFD 2009d). In addition, AZGFD recently initiated a second reintroduction site northwest of Williams, Arizona, approximately 120 miles from the GCWRA. These populations are listed as non-essential experimental populations under the federal Endangered Species Act (ESA). While a single active Gunnison's prairie dog colony was documented in the GCWRA (Young et al 2009), black-footed ferrets do not currently occur within approximately 120 miles of the GCWRA, and less than 40-60 ha of prairie dog colony are believed to exist within the GCWRA (at this time prairie dog town mapping has only been completed within Study Area A (Young et al 2009). No prairie dog towns were observed within the GCWRA or Evaluation Area during the site visit aside from those already mapped by WEST during 2007-2008 surveys.

Northern Mexican Gartersnake

The northern Mexican gartersnake (*Thamnophis eques megalops*) is most abundant in densely vegetated habitat surrounding cienegas, cienega-streams, and stock tanks and in or near water along streams in valley floors and generally open areas (AZGFD 2009b). They are strongly associated with the presence of a native prey base including native fish and leopard frogs (USFWS 2009). In Arizona, the species is known to occur in the central portion of the state (in the mid and upper Verde River drainage; AZGFD 2009b), but not in the vicinity of the GCWRA. Wetland habitat is very limited within the GCWRA; however, there is some potential for the species to occur in perennial pools found within canyon bottoms or near water tanks surrounded by suitable vegetation. There is low potential for the species to occur at suitable habitats within the GCWRA and Evaluation Area, however, no observations of the species have been recorded within 5-miles of the Evaluation Area (Appendix A).

Chiricahua Leopard Frog

The Chiricahua leopard frog (*Rana chiricahuensis*) is a highly aquatic habitat generalist. They require a permanent or nearly permanent water source that is mostly free from introduced fish, crayfish, and bullfrogs. These can range from natural aquatic systems (streams, rivers, backwaters, and ponds) to man-made systems (earthen stock ponds, livestock drinkers, irrigation sloughs and abandoned swimming pools). Their primary habitat type is oak, mixed-oak, and pine woodlands; however, other habitat types include chaparral, grassland, and even desert (AZGFD 2009b). In Arizona, there are two distinct populations: the northern population which extends from montane central Arizona along the Mogollon Rim into New Mexico, and another population in the southeast corner of the state. Aquatic habitats are very limited within the GCWRA and largely restricted to water tanks and impoundments, and ephemeral streams. There is low potential for the species to occur at suitable habitats within the GCWRA and Evaluation Area, however,

no observations of the species have been recorded within 5-miles of the Evaluation Area (Appendix A).

Apache Trout

The Apache trout (*Oncorhynchus apache*) inhabits cool, clear, high elevation rivers and streams, generally above 6,000 feet elevation (AZGFD 2009b). In Arizona, Apache trout are currently restricted to drainages in the White Mountain in the east-central portion of the state (USFWS 2009). Due to the restricted range of the species, and a lack of suitable stream habitat within the GCWRA, there is no potential for the Apache trout to occur.

Humpback Chub

The humpback chub (*Gila cypha*) inhabits large, warm turbid rivers especially canyon areas with deep fast water. In Arizona, the species is found in the Colorado and Little Colorado Rivers in the Marble and Grand Canyons (USFWS 2009). Stream habitat within the GCWRA is not suitable for the humpback chub and there is no potential for the species to occur.

Little Colorado Spinedace

The Little Colorado spinedace (*Lepidomeda vittata*) inhabits moderate to small streams where they prefer pools and riffles with water flowing over fine gravel and silt substrate (USFWS 2009). The fish is found in water ranging from 0.5-4.3 feet in depth, but most abundant in depths of around 1.9 feet (AZGFD 2009b). They are most common in slow to moderate water currents, over fine gravel bottoms, preferring unshaded pools with rocks or undercut banks for cover. Four populations presently exist in Arizona: the mainstem of the Little Colorado, Nutrioso Creek, Chevelon Creek, and Clear Creek, all of which are located to the east and southeast of the GCWRA (AZGFD 2009b). Stream habitat within the GCWRA is not suitable for the Little Colorado spinedace and there is no potential for the species to occur.

Razorback Sucker

The razorback sucker (*Xyrauchen texanus*) is a large fish, reaching sizes of up to three feet in length. The species inhabits riverine and lacustrine areas, generally not in fast moving water, and may use backwaters (USFWS 2009). In impoundments they prefer depths of a meter or more over sand, mud or gravel substrates. In Arizona, the historical range of the razorback suckers included the Colorado, Gila, Salt, Verde, and San Pedro rivers. Presently, natural adult populations exist only in Lake Mohave, Lake Mead, and Lake Havasu (AZGFD 2009b). Stream habitat within the GCWRA is not suitable for the razorback suckers, and there is no potential for the species to occur.

Roundtail Chub

The roundtail chub (*Gila robusta*) inhabits cool to warm waters of rivers and streams, often occupying the deepest pools and eddies of large streams (USFWS 2009). Cover is usually present and consists of large boulders, tree roots, submerged large trees and branches, undercut cliff walls, or deep water. Smaller chubs generally occupy shallower, low-velocity water adjacent to overhead bank cover (AZGFD 2009b). The historical range of the roundtail chub included both the upper and lower Colorado River Basins. In 2009, the lower Colorado population (Arizona and New Mexico) was determined to be a

distinct vertebrate population segment (DPS), and is considered a candidate for federal listing (USFWS 2009). In Arizona, the species is currently limited to two tributaries of the Little Colorado (Chevelon and East Clear Creek) to the southeast of the GCWRA, as well as the Bill Williams and Gila River basins in the south of the state (USFWS 2009; AZGFD 2009b). Suitable perennial stream habitat is not present in the GCWRA, and the species has no potential to occur.

Kanab Ambersnail

The Kanab ambersnail (*Oxyloma haydeni kanabensis*) inhabits marshes fed by springs and seeps at the base of sandstone cliffs or limestone (AZGFD 2009b). The snail is associated with a perennial wet surface or shallow standing water, not under logs or other microhabitats commonly frequented by other land snails. The presence of cattails (*Typha domingensis*), or at least the permanently wet ground around cattails, is believed to be an important component of the species' habitat (AZGFD 2009b). The Kanab ambersnail is extremely geographically isolated. There are three historical populations, and only two remain; one in Utah and the other in Grand Canyon National Park (USFWS 2009). Due to its very limited distribution and habitat requirements, the species has no potential to occur in the GCWRA.

3.1.2 State Sensitive Species

The AZGFD (2009a) lists 14 wildlife species as state species of special concern with documented presence within the Canyon Diablo and/or Middle Little Colorado Watersheds; including seven birds, one mammal, two reptiles, two amphibians, and two fish (Table 3.3). Four of the species of special concern (Mexican spotted owl, northern Mexican gartersnake, Chiricahua leopard frog, and Little Colorado spinedace) also have federal endangered, threatened, or candidate status under the ESA, and are addressed in the preceding section (Section 3.1.1). The remaining state sensitive species are further addressed below. Based on correspondence received from the AZGFD (Appendix A), two state wildlife species of special concern have been documented within five miles of the GCWRA: bald eagle (wintering individuals [*Haliaeetus leucocephalus*]) and Little Colorado sucker (*Catostomus* spp.).

Table 3.3 State-designated wildlife of special concern with known or potential occurrence within Canyon Diablo and/or Middle Little Colorado Watersheds, Coconino County, Arizona. Results from AZGFD (2009a); accessed November 12, 2009.

Species	Status[1]	Watershed[2]	Habitat	Potential for Occurrence
Birds				
American peregrine falcon *Falco peregrinus anatum*	WSC	CD, MLC	Found where sufficient prey is present near tall cliffs; optimum habitat considered steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance.	**Extremely Low.** In Arizona most nesting occurs in cliff areas of Mogollon Rim, Grand Canyon, and Colorado Plateau; not likely to nest in GCWRA, but may occur as migrant.
bald eagle *Haliaeetus leucocephalus*	WSC	CD, MLC	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; roost communally especially in winter	**Low.** Historically nested on the Anderson Mesa including at Mormon Lake; not likely to nest in GCWRA, but may occur as occasional winter visitor/transient.
belted kingfisher *Megaceryle alcyon*	WSC	MLC	Rivers, ponds, lakes, brooks, swamps, and estuaries with nearby branches, snags, or power lines for perching; typically nest in a burrow in a bank near water.	**Extremely Low.** Known to nest along smaller streams in White Mountain and along Mogollon Rim; not likely to occur within GCWRA due to scarcity of water; some potential to occur in suitable habitats found in canyon bottoms.
ferruginous hawk *Buteo regalis*	WSC	MLC	Inhabits open country, primarily prairies, plains, and badlands; nests in tall trees along streams or on steep slopes, cliff ledges, hillsides, or power line towers	**Extremely Low.** Currently nest in northern and southeastern Arizona; not likely to nest in GCWRA; more likely to occur as rare winter resident or migrant.
Mexican spotted owl *Strix occidentallis lucida*	WSC	CD, MLC	Nest in canyons and dense mixed-conifer forests with multi-layered foliage structure.	**None.** Known to occur in forested areas to south of Evaluation Area; habitat not suitable within GCWRA some potential to occur in scattered pockets of ponderosa pine forests of Evaluation Area.
northern goshawk *Accipiter gentilis*	WSC	CD, MLC	Nest is variety of forest types including deciduous, conifer, and mixed forests;	**Low.** Nest along Mogollon Rim to southwest of GCWRA; no potential to nest

			typically nest in large tracts of mature or old-growth forest.	in GCWRA but may occur as rare winter visitor or migrant; limited nesting habitat available in ponderosa pine forests in Evaluation Area.
osprey *Pandion haliaetus*	WSC	CD, MLC	Nest in coniferous trees alongside or near rivers and lakes.	**Extremely Low.** In Arizona primarily nest in White Mountains and across the Mogollon Plateau; not likely to nest in GCWRA but may occur as rare transient/migrant.
Mammals				
Navajo Mexican vole *Microtus mexicanus navaho*	WSC	CD	Prostrate shrub thickets that provide dense cover; also dry, grassy areas usually adjacent to pine forests but sometime juniper woodland or sagebrush.	**Low.** Known from Flagstaff area to northwest of GCWRA; low potential to occur in GCWRA.
Reptiles				
narrow-headed gartersnake *Thamnophis rufipunctatus*	WSC	MLC	Pinyon-juniper and pin-oak woodland into ponderosa pine forest; in permanently flowing streams.	**None.** Known along Mogollon Rim south and southeast of GCWRA; habitat for species does not occur in GCWRA or Evaluation Area.
northern Mexican gartersnake *Thamnophis eques megalops*	WSC	MLC	Densely vegetated habitats surrounding cienegas, stock tanks, large-river riparian woodlands and forests; strongly associated with presence of a native prey base including leopard frogs and native fish	**Low.** Known in central Arizona (Verde River drainage) to southwest of GCWRA; wetland habitat very limited in GCWRAand Evaluation Area.
Amphibians				
Chiricahua leopard frog *Rana chiricahuensis*	WSC	MLC	Aquatic systems (both natural and man-made) in a variety of habitat types from oak and pine woodlands to chaparral, grassland, and desert.	**Low.** Known to south of GCWRA along the Mogollon Rim; aquatic habitat very limited in GCWRA.
northern leopard frog *Lithobates pipiens*	WSC	CD, MLC	Variety of habitats including grassland, shrubland, woodlands, and forests;	**Low.** Occurs in northern and central Arizona; aquatic habitat very limited in

			typically in permanent water with rooted aquatic vegetation.	GCWRA.
Fishes				
Little Colorado spinedace *Lepidomeda vittata*	WSC	CD, MLC	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate.	**None.** Known to occur in mainstem of Little Colorado, Nutrioso Creek, Clear Creek and Chevelon Creek; stream habitat in GCWRA not suitable.
Little Colorado sucker *Catostomus sp. 3*	WSC	MLC	Creeks, small to med. Rivers, and impoundments; usually in pools with abundant cover; also found in riffles.	**Low.** Endemic to upper portion of Little Colorado River and many of its north-flowing tributaries; moderate probability to occur in GCWRA in suitable aquatic habitat.

[1]WSC = Wildlife of Special Concern
[2]CD = Canyon Diablo; MLC = Middle Little Colorado

American Peregrine Falcon

The American peregrine falcon (*Falco peregrinus anatum*) is generally found in open country with tall cliffs for roosting or nesting and with open water, woodland, or riparian areas nearby that support abundant avian prey species. In Arizona, the majority of peregrine falcon nesting occurs in the tall cliffs of the Mogollon Rim, the Grand Canyon, and the Colorado Plateau (AGFD 2009b). The species is unlikely to nest within the GCWRA or Evaluation Area due to the scarcity of suitable cliffs for nesting; however, there is potential for peregrine falcons to occur as a rare winter visitor or migrant through the GCWRA. During one year of avian use surveys conducted at Study Area A no peregrine falcons were observed, and none were observed incidentally by WEST biologists (Young et al 2009). No records exist with the AZGFD natural heritage database within five miles of the Evaluation Area (Appendix A).

Bald eagle

Delisted from the federal endangered species act in 2007, the bald eagle (*Haliaeetus leucocephalus*) remains protected under the federal Bald and Golden Eagle Protection Act, and is a state species of special concern in Arizona. In 2008, the USFWS determined the Sonoran Desert population of bald eagles occurring in central Arizona and northwestern Mexico to be a distinct population segment (DPS); however, on February 25, 2010 the USFWS released a finding stating that neither this population nor it's habitat warrants protection under the federal Endangered Species Act. The Sonoran Desert DPS occurs to the south and west of Coconino County. Breeding bald eagles are found near large lakes, reservoirs, or perennial streams throughout central Arizona, where they perch in large riparian trees, pines, or on cliffs (Corman and Wise-Gervais 2005). Bald eagles generally construct nests in the tallest trees in an area near water; however, in Arizona, they frequently nest on cliff faces, ledges, or pinnacles. Within the State's 56 known bald eagle breeding areas, all but two nests are located within one mile of water (McCarty and Jacobson 2008). Historically, bald eagles nested along the Mogollon Rim including at Mormon Lake and Lake Mary, approximately ten miles to the west and 12 miles to the northwest of the GCWRA, respectively (AZGFD 2009b). While eagles are no longer known to nest in these areas, the lakes do support wintering populations. There is no suitable nesting habitat within the GCWRA, and the nearest known bald eagle breeding area is greater than 10 miles away (McCarty and Jacobson 2008). There is some potential for wintering or transient eagles to occur in the GCWRA. Bald eagles have been observed at the Raymond Wildlife Area immediately to the north of the GCWRA (AZGFD 2009e), and seven observations were recorded during the 2007/2008 baseline avian studies conducted at Study Area A of the proposed project (Young et al. 2008).

Belted Kingfisher

The belted kingfisher (*Megaceryle alcyon*) inhabits a variety of wetland habitats including rivers, brooks, ponds, lakes, streams, tidal creeks, mangroves, swamps and estuaries with nearby branches, snags, or power lines for perching. The kingfisher prefers clear, still water for fishing. The nest is typically a burrow within a bank, usually near freshwater. Wetland habitat is limited within the GCWRA, and the species is not likely to nest or overwinter in the area; however, there is extremely low potential for the species to use riparian areas at stopover habitat during migration. During one year of avian use

surveys conducted at Study Area A none were observed, and none were observed incidentally by WEST biologists (Young et al 2009). No records exist with the AZGFD natural heritage database within five miles of the Evaluation Area (Appendix A).

Ferruginous hawk

Ferruginous hawks (*Buteo regalis*) are found in various open habitats such as grasslands, shrublands, and deserts where rodent and lagomorphs prey species are available. In Arizona, ferruginous hawks generally breed in open scrublands, woodlands, grasslands, and semi-desert grasslands in the northern Colorado Plateau and southeastern portion of the state (AZGFD 2009b). Nests in Arizona are primarily constructed in isolated juniper trees (Corman and Wise-Gervais 2005). In winter, ferruginous hawks can be found statewide in these same habitats along with agricultural areas. Hunting typically occurs in open grasslands and agricultural fields; preferably with low hills or short trees which serve as perches. While potential nesting habitat is present within the GCWRA, the species is not currently known to nest within this region of the state (Corman and Wise-Gervais 2005; AZGFD 2009a). They are more likely to occur as occasional winter visitors or migrants through the GCWRA. Ferruginous hawks have been observed at the Raymond Wildlife Area immediately to the north of the GCWRA (AZGFD 2009e), though no records exist within five miles of the Evaluation Area (Appendix A), none were observed during one year of avian use surveys conducted at Study Area A, and none were observed incidentally by WEST biologists (Young et al 2009).

Northern Goshawk

Northern goshawks (*Accipiter gentilis*) inhabit a wide range of forest types including deciduous, coniferous, and mixed forests. They typically nest in large tracts of mature or old-growth forests. In Arizona, goshawks nest in high, forested mountains and plateaus, and are most abundant in ponderosa pine forests along the Mogollon Rim, on the Kaibab Plateau, and in the southeastern mountains (AZGFD 2009b). Suitable forested nesting habitat for northern goshawks is not present within the GCWRA and they are not likely to occur during summer months. While goshawks in Arizona are primarily resident, some may move to lower elevations in the winter when food resources become scarce (Corman and Wise-Gervais 2005), and there is some potential for the species to occur in the GCWRA as a rare winter visitor. A limited amount of nesting habitat is available within ponderosa pine forests found in patches at the higher elevations of the Evaluation Area and there is some potential for goshawk to occur in these areas. No recorded observations have been made within five miles of the Evaluation Area (Appendix A) and none were observed during one year of avian use surveys conducted at Study Area A, and none were observed incidentally by WEST biologists (Young et al 2009).

Osprey

Ospreys (*Pandion haliaetus*) nest primarily in coniferous trees alongside or near rivers and lakes, feeding almost exclusively on fish. In Arizona, ospreys breed in the White Mountain and along the Mogollon Plateau. There is also some nesting at lower elevations along the Salt and Gila Rivers in the southeast of the state; however, no desert nest sites have been documented (AZGFD 2009b). Suitable nesting and foraging habitat is not present within the GCWRA, and ospreys are not likely to occur as residents; however,

there is extremely low potential for the species to occur as a very rare transient or during migration. No recorded observations have been made within five miles of the Evaluation Area (Appendix A) and none were observed during one year of avian use surveys conducted at Study Area A, and none were observed incidentally by WEST biologists (Young et al 2009).

Navajo Mexican Vole

The Navajo Mexican vole (*Microtis mexicanus navaho*) is found in a wide range of vegetation communities from Great Basin desert scrub and Great Basin woodland to Rocky Mountain montane and subalpine forests. They generally inhabit prostrate thickets of various shrub species that provide a dense cover; however, they may also occur in dry, grassy areas usually adjacent to ponderosa pine forest, but also juniper or sagebrush at lower elevations (AZGFD 2009b). In Coconino County, the species is known to occur on the south rim of the Grand Canyon and approximately 20 miles west of the GCWRA in Walnut Canyon National Monument (AZGFD 2009b, USGS unpublished data). Shrub, grassland, and juniper woodland habitats are present within the GCWRA, and there is potential for the Navajo Mexican vole to occur.

Narrow-headed Gartersnake

The narrow-headed gartersnake (*Thamnophis rufipunctatus*) inhabits pinyon-juniper woodlands, oak-pine forests, and ponderosa pine forests where they are found in or beside clear, rocky streams. The species is almost strictly aquatic, foraging under water, seeking shelter under rocks and boulders in the streambed, and basking on rocks and vegetation along stream banks. Hibernation takes place in rocky outcropping in late fall and winter. In Arizona, narrow-headed gartersnakes are found primarily in upland drainages in the White Mountains and along the Mogollon Rim. Suitable woodland and stream habitat is not present within the GCWRA, and there is no potential for the species to occur. The species has not been recorded within five miles of the Evaluation Area (Appendix A).

Northern Leopard Frog

Northern leopard frogs (*Lithobates pipiens*) inhabit a variety of habitats throughout northern and central Arizona including grassland, shrubland, woodland, and forest ranging high into the mountains (AZGFD 2009b). They are typically found in permanent water with rooted aquatic vegetation, ranging from springs, ponds, and marshes to irrigation ditches, small streams, and rivers. Wetland habitat is limited throughout the GCWRA; however, there is low potential for the northern leopard frog to occur in these areas. Northern leopard frogs have been documented in the Raymond Wildlife Area immediately to the north of the GCWRA (AZGFD 2009e), but have not been recorded within five miles of the Evaluation Area (Appendix A).

Little Colorado Sucker

The Little Colorado sucker (*Catostomus sp. 3*) occurs in creeks, small to medium rivers, and impoundments, primarily in pools with abundant cover. The species is endemic to the upper portion of the Little Colorado River and many of its north-flowing tributaries (AZGFD 2009b). According to Heritage Data Management System (AZGFD 2009a), the

species has been documented in drainages within five miles to the south and southeast of the GCWRA (Appendix A). There is some potential for the Little Colorado sucker to occur in several of the larger drainages or springs within the Evaluation Area, particularly within Canyon Diablo, Grapevine Canyon, or Jack's Canyon.

3.1.3 Sensitive Species Summary and Conclusions

In general, probability for federal or state-listed wildlife species to occur within the GCWRA or Evaluation Area is low. Sensitive wildlife species with relatively greater likelihood of potential to occur were primarily species dependent on wetland or aquatic habitats. Of the federally-listed wildlife species known to occur within Coconino County, none have high or moderate potential for occurrence within the GCWRA or Evaluation Area. Only five have extremely low or low probability of occurrence within the GCWRA or the Evaluation Area (Table 3.2). Of the seven state listed bird species, one is considered to have no potential for occurrence, while four are considered extremely low and two considered low (Table 3.3). No state-listed bird species were considered to have moderate or high probability of occurrence within the GCWRA. The single state-listed mammal was ranked low. Of the two reptiles, one was ranked with no potential and one considered low. Both amphibians were ranked low, while one fish was ranked low and one ranked as having no potential for occurrence. No federally-listed birds, mammals or fish have the potential to occur, with the exception of the southwestern willow flycatcher and the western yellow-billed cuckoo, which may rarely stopover within suitable riparian areas isolated to canyon bottoms during spring and fall migration seasons. The northern Mexican garter snake (federal candidate) and Chiricahua leopard frog (federal-threatened) have low probability to occur within the GCWRA at suitable aquatic features or immediately adjacent to those features. Suitable habitats include water tanks and ponds, or perennial pools or streams, which have natural or semi-natural vegetation present, as well as potential to support fish, including native species. No records exist for these species within five-miles of the Evaluation Area, however, the presence of suitable habitat and records from other location within the region suggest some possibility that the species could be found at suitable habitats within the GCWRA. The same conclusion has been made for potential for the northern leopard frog and Little Colorado sucker, state species of concern. Wintering bald eagles (state species of concern) may occasionally transient the GCWRA, and results from pre-construction avian use surveys conducted at Study Area A (Young et al 2009) suggest only extremely low use of that portion of the GCWRA.

Study Areas A and B may contain more potential sensitive wildlife habitat compared with Study Area C, due largely to the greater proportion of canyon bottom wetland habitat found within those Study Areas, which could provide potential stopover habitat for western yell-billed cuckoo and southwestern willow-flycatcher. In addition, there appear to be a greater number of wetland and waterbodies located within Study Areas A and B compared with Study Area C, which have the potential to support sensitive amphibians or the Colorado sucker. Having said that, overall landcover and potential wildlife habitats do not generally differ between the Study Areas, when evaluated separately (Table 2.2) or compared with the GCWRA or Evaluation Area (Table 2.1).

3.2 Raptors

3.2.1 Species likely to occur in the area

Raptor information was collected from the Arizona Breeding Bird Atlas (Corman and Wise-Gervais 2005) and Sibley (2001). Seventeen diurnal raptor species have the potential to occur as residents and/or migrants in the GCWRA at some point during the year. In addition, one species of vulture, and five species of owls occur in the region.

Of the 17 diurnal raptors with the potential to occur in the GCWRA, six species have the potential to nest or reside year-round within the GCWRA: sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), American kestrel (*Falco sparverius*), prairie falcon (*Falcon mexicanus*), and peregrine falcon (*Falco peregrinus*). A further three species may occur as winter residents and/or migrants in the GCWRA: northern harrier (*Circus cyaneus*), ferruginous hawk (*Buteo regalis*), and rough-legged hawk (*Buteo lagopus*). Eight species are not likely to reside in the area due to specific habitat requirements, but may pass through the GCWRA as migrants and/or occassional visitors from the surrounding region: zone-tailed hawk (*Buteo albonontatus*), Swainson's hawk (*Buteo swainsonii*), northern goshawk (*Accipiter gentilis*), common black hawk (*Buteogallus anthracinus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), peregrine falcon (*Falco peregrinus*), and merlin (*Falco columbarius*). Additionally, turkey vultures (*Cathartes aura*) are likely summer residents of the GCWRA. Of the diurnal raptors and vultures potentially occurring within the GCWRA, six species are considered wildlife of special of concern by the AZGFD (2009a): northern goshawk, common black hawk, ferruginous hawk, bald eagle, osprey, and peregrine falcon. The Evaluation Area has low potential to support nesting northern goshawk due to the presence of potential breeding and foraging habitat in the form of ponderosa pine forest located patchily at higher elevations. Bald eagle, ferruginous hawk, and sharp-shinned hawk have been documented within the Raymond Wildlife Area immediately to the north of the GCWRA (AZGFD 2009e), though state natural heritage records from within five miles of the Evaluation Area include only the bald eagle (Appendix A).

Five owl species have the potential to nest or reside year-round within the GCWRA: barn owl (*Tyto alba*), long-eared owl (*Asio otus*), burrowing owl (*Athene cunicularia*), great-horned owl (*Bubo virginianus*) and western screech-owl (*Megascops kennicottii*). Of the owl species potentially occurring within the GCWRA, burrowing owls are considered a species of concern by the USFWS, and have been observed at the Raymond Wildlife Area (AZGFD 2009e). The western-most portions of the Evaluation Area have some potential to support nesting northern saw-whet owl (*Aegolius acadicus*), northern pygmy owl (*Glaucidium gnoma*), and flammulated owl (*Otus flammeolus*) due to the presence of potential breeding and foraging habitat in the form of ponderosa pine forest at higher elevations of the Evaluation Area . Additionally, while nesting habitat for Mexican spotted owl (*Strix occidentalis lucida*), a federal threatened and state species of special concern, is not likely present within the Evaluation Area, there may be some suitable

foraging habitat within forested areas. No records exist for Mexican spotted owl within state natural heritage records from within five miles of the Evaluation Area.

During baseline wildlife studies conducted by WEST at Study Area A of the project in 2007 and 2008 (Young et al. 2008), ten raptor species were observed using the GCWRA either as residents or during migration: Cooper's hawk, sharp-shined hawk, red-tailed hawk, northern harrier, bald eagle, golden eagle, American kestrel, merlin, prairie falcon, and burrowing owl. Raptor species richness may be less in portions of Study Areas B and C, which contain greater proportions of grassland and desert scrub. This difference is suggested by avian survey results conducted at the Sunshine Wind Park, where fewer species (six) were sighted (WEST 2006). Similarly, abundance of raptors is likely to be less in open grassland or desert scrub areas where nesting and roost structures are less abundant (see Section 3.2.3) and prey density is lower (see Section 3.2.4). Avian use surveys conducted at Sunshine indicate lower abundance of raptors, particularly for golden eagle, relative to surveys conducted at Grapevine A (WEST 2006 and Young et al 2009).

Young et al. (2009) compared annual mean raptor use at Study Area A with 36 other proposed or existing wind-energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these facilities ranged from 0.09 birds/20-min survey to 2.34 birds/20-min survey. Mean raptor use at Study Area A was 0.67 birds/20-min survey which is in the mid-range of all the sites studied. Raptor use at the nearby Sunshine Wind Park was lower than that observed at Grapevine A in 2007-2008, with a peak seasonal use of 0.58 observed during the Fall, while winter use was only 0.08 raptors observed per 30-minute fixed point survey (WEST 2006). A regression analysis of raptor use and mortality for 12 new-generation wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 71.7%; see Young et al. 2008). Using this regression to predict raptor collision mortality at the Study Area A, based on an adjusted mean raptor use of 0.67 birds/20-min survey, yields an estimated fatality rate of 0.10 raptors/MW/year, or 10 raptor fatalities per year for a 100-MW wind-energy facility. A 90% prediction interval around this estimate is zero to 0.35 raptors/MW/year for Study Area A of the Grapevine Wind Resource Area.

3.2.2 Potential for raptor migration in the area

The GCWRA lies within the Intermountain West region of the extensive American Pacific Flyway, one of five primary migratory routes for waterbirds, shorebirds, songbirds, and raptors. Several factors influence the migratory pathways of raptors; the most significant of which is geography. Two geographical features primarily used by raptors during migration are ridgelines and the shorelines of large bodies of water. Updrafts formed as the wind hits the ridges, and thermals created over land (and not water) make for energy-efficient travel over long distances (Liguori 2005). It is for this reason that raptors tend to follow corridors or pathways, for example along prominent ridges with defined edges or shorelines, during migration.

While it is certain that raptors migrate through the GCWRA, the majority of the GCWRA is characterized by a flat upland plain that would generally not be expected to concentrate or funnel raptors during migration. However, there are several larger canyons is the area (particularly the Canyon Diablo and Grapevine Canyon through the central portions of the GCWRA, Yaeger and Anderson Canyons in the northwest corner of the GCWRA, and Jack's Canyon in the southeast) which may serve as important stopover areas for some raptor species during migration The potential exists for migrating birds that follow topography to concentrate along these canyon rims, such as raptors that utilize updrafts and thermals created by topography. Additionally, the presence of prairie dog (*Cynomys gunnisoni*) colonies and waterfowl/shorebirds concentrated at water sources, could attract resident and migrating raptors. The western-most portions of the Evaluation Area, to the west of Study Areas A and B, have greater topographic relief, as well as a greater number of seasonal ponds and lakes and therefore, may be more likely to attract migrating raptors. Avian use studies conducted at Study Area A (Young et al 2009) indicate fall raptor use was relatively high (1.68 raptors/plot/20-minute survey) compared with other seasons (winter: 0.13; spring: 0.24; summer 0.51 raptors/plot/20-minute survey). 2007 fall raptor use resulted primarily from increased observations of red-tailed hawk, but also included greater species diversity relative to other seasons (Young et al 2009). Raptor observations also peaked during the fall migration period at Sunshine (WEST 2006); however, with less overall activity than observed at Grapevine A. These observations suggest the area is used by migrating raptors but in low abundance.

3.2.3 Potential raptor nesting habitat

Potential nesting habitat for raptors is located primarily along the major drainages within the GCWRA: Canyon Diablo, Grapevine Canyon, Yaeger Canyon, and Jack's Canyon. Stands of oak and cottonwood in the canyon bottoms, as well as canyon walls and rock outcroppings likely provide nest sites for raptors such as golden eagles, red-tailed hawks, American kestrels, prairie falcons, barn owls, and great-horned owls. Additionally, small areas of pinyon-juniper woodland, juniper savannah, and ponderosa pine forest, particularly in western portions of Study Areas A and B, may also provide nest structures for raptors. Open, grassland habitat for ground-nesting species such as burrowing owls is present throughout the GCWRA, especially within prairie-dog colonies which have been documented in the GCWRA (Young et al. 2008). More extensive stands of ponderosa pine and pinyon-juniper forests are present within the western Evaluation Area, and there is some potential for forest-dwelling raptors such as northern goshawk, Cooper's hawk, sharp-shinned hawk, western screech-owl, northern saw-whet owl, northern pygmy owl, and flammulated owl to occur in these areas. During raptor nest surveys conducted by WEST in Study Area A of the project in 2008, one active red-tailed hawk nest was observed in Yaeger Canyon, and two inactive golden eagle nests were observed within Grapevine Canyon (Young et al. 2008; Figure 3.1). Canyon edges and mature ponderosa pine trees represent the best available nesting structures for golden eagles in the Evaluation Area. Open grasslands, desert scrublands and pinyon-juniper woodlands have low potential for nesting golden eagles. Consequently, there is low potential for the species to nest within large portions of Study Areas B and C. Although formal raptor nest surveys were not conducted at the Sunshine Windpark, extremely low numbers of

golden eagles were observed (one) during pre-construction avian use surveys (WEST 2006).

3.2.4 Areas of potentially high prey density

Studies indicate that raptor mortality at wind-energy facilities (for example, Altamont Pass WRA, California [APWRA]) may be in part due to behavioral differences between species, increasing the susceptibility of some for collision with turbines. Orloff and Flannery (1992, 1996) suggested that high golden eagle mortality at APWRA was in part due to the apparently high densities of ground squirrels (*Spermophilus beecheyi*) in the area (Thelander and Smallwood 2007). Continued research at the site revealed that the degree of aggregation of pocket gopher (*Thomomy bottae*) burrows around the turbines was positively correlated to red-tailed hawk fatality rates (Smallwood et al. 2001, Thelander et al. 2003, Thelander and Smallwood 2007). In addition, features providing cover for cottontails (*Sylvilagus audubonii*) appeared to be associated with areas where golden eagles were killed.

Two active and one inactive Gunnison's prairie dog colonies were mapped during baseline wildlife studies conducted in Study Area A (WEST 2008; Figure 3.2). Prairie dog colonies are important foraging grounds for several raptor species likely to occur at the GCWRA including golden eagle, red-tailed hawk, northern harrier, and ferruginous hawk. Colonies may serve to concentrate raptors in the GCWRA throughout the year; WEST (Young et al 2009) found significantly higher raptor use at observation points located near active prairie dog colonies (Figure 3.2). Baseline surveys for prairie dog towns have not been completed at this time in Study Areas B and C. There is potential for prairie-dog colonies to occur in suitable habitats in grassland, cleared or disturbed areas throughout the GCWRA. The AZGFD indicated in correspondence received April May 4, 2010 that 2007 surveys conducted by AZGFD indicated presence of colonies in Study Areas A and C (see Appendix A). Additionally, waterfowl and shorebirds using the few wetlands and ponds present in the GCWRA may also serve to concentrate raptor species. Other types of prey likely to be present throughout the GCWRA are rodent and shrew species associated with semi-arid to arid grassland, shrub, and juniper woodland areas. Lagomorphs that may occur in the area include desert cottontail (*Sylvilagus audubonii*), and black-tailed jackrabbit (*Lepus californicus*).

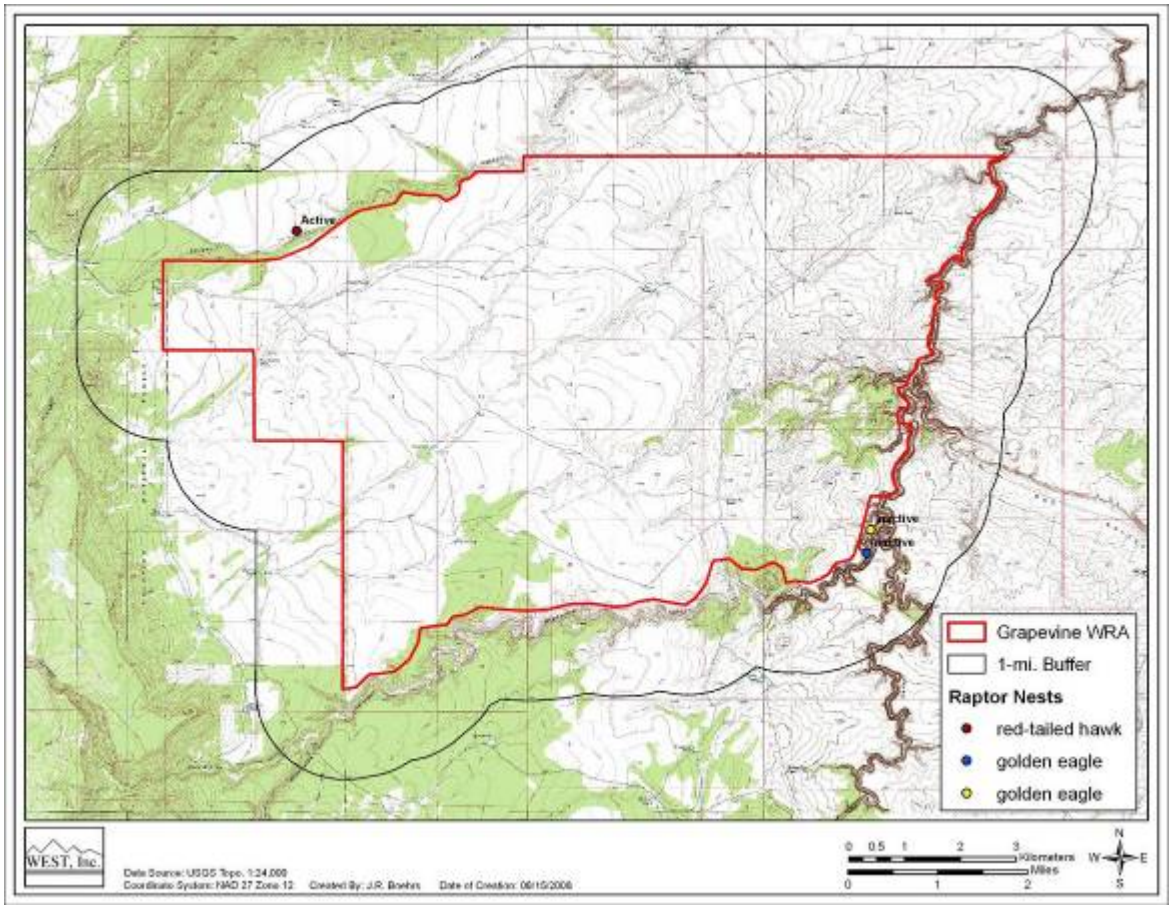

Figure 3.1 Raptor nests within Study Area A (Young et al. 2008).

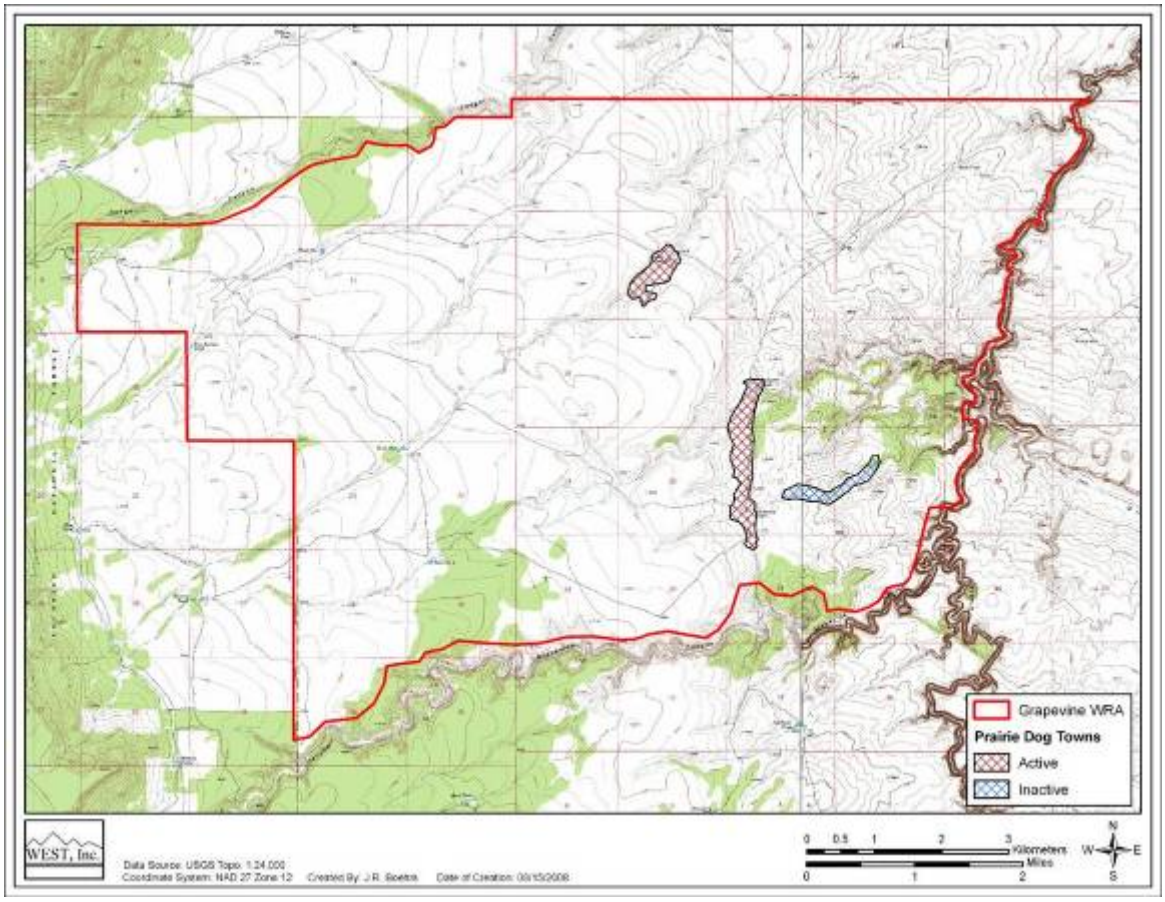

Figure 3.2 Location of prairie dog colonies within Study Area A (Young et al. 2008).

3.3 Avian Migration

The average overall bird fatality rate at wind power projects in the U.S. is 2.3 bird fatalities per turbine per year or 3.1 bird fatalities per MW per year (NWCC 2004). Most species of birds are protected by the Migratory Bird Treaty Act. Many species of songbirds migrate at night and may collide with tall man-made structures, though no large mortality events on the same scale as those seen at communication towers have been documented at wind-energy facilities in North America (NWCC 2004). It is generally assumed that nocturnal migrating passerines move in broad fronts rather than along specific topographical features (Gauthreaux et al. 2003, NRC 2007). Large numbers of songbirds have collided with lighted communication towers and buildings when foggy conditions and spring or fall migration coincide. Birds appear to become confused by the lights during foggy or low ceiling conditions, flying circles around lighted structures until they become exhausted or collide with the structure (Erickson et al. 2001). Most collisions at communication towers are attributed to the guy wires on these structures, which wind turbines do not have. Additionally, the large mortality events observed at communication towers occurred at structures greater than 150 m in

height (Erickson et al. 2001), likely because most birds migrate at elevations of 270 m or higher (Young et al. 2004, Young and Erickson 2006). Modern wind turbines are below 270 m in height.

The seasonal migration of birds through Arizona generally occurs in a broad front throughout the state. The GCWRA contains a limited amount of stopover habitat for songbirds, waterfowl, and shorebirds in the forms of grassland, shrubland, pinyon-juniper woodland, and a few wetland/riparian areas, and it is likely that migrating birds utilize these areas during migration.

Wind plants with year-round waterfowl use have shown the highest waterfowl mortality, although levels of waterfowl/waterbird mortality appear insignificant compared to use of the sites by these groups. The recently constructed Top of Iowa Wind farm is located in cropland between three Wildlife Management Areas (WMAs) with historically high use by migrant and resident waterfowl. During a recent study, approximately one million total goose-use days and 120,000 total duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during concurrent and standardized wind project fatality studies (Koford et al. 2005). Similar findings were observed at the Buffalo Ridge Wind Project in southwestern Minnesota, which is located in an area with relatively high waterfowl use. Snow geese (*Chen caerulescens*), Canada geese (*Branta Canadensis*), and mallards (*Anas platyrhynchos*) were the most common waterfowl observed. Only three of the 55 fatalities observed during the fatality studies were waterfowl, including two mallards and one blue-winged teal (*Anas discors*; Johnson et al. 2002).

During avian baseline surveys conducted by WEST in 2007 and 2008, use by resident and migrating waterfowl and shorebirds was found to be low, comprising less than 3% of overall bird use (Young et al. 2008). While the GCWRA itself has very little wetland habitat, the wetland complex along the Anderson Mesa along the western boundary of the Evaluation Area has been documented as one of two major waterfowl use areas in Arizona during migration, particularly by dabbling ducks during spring migration (National Audubon Society 2009; see discussion of Important Bird Areas below).

3.4 Breeding Birds

3.4.1 Important Bird Areas

Songbirds (order Passeriformes) are by far the most abundant bird group in most terrestrial ecosystems and are the most often reported fatalities at wind-energy facilities (NRC 2007). The Audubon Society lists Important Bird Areas (IBAs) that are sites providing essential habitat for one or more species of bird (National Audubon Society 2009). These include sites for breeding, wintering and/or migrating birds and can range from a few, to thousands of acres in size. The proposed GCWRA lies immediately to the east of the Anderson Mesa Important Bird Area, located within the Coconino National Forest. Anderson Mesa begins about nine miles southeast of Flagstaff, and continuous as a gently sloping tableland for approximately 25 miles to the southeast. The GCWRA lies

along the northeastern edge of the Anderson Mesa with portions of the Evaluation Area extending up onto the Mesa.

Along the length of the Anderson Mesa are a complex of lakes, including permanent, semi-permanent, and ephemeral lakes and wetlands, grasslands, pinyon-juniper woodland, and conifer forests. The largest of the lakes, Mormon Lake, lies approximately 10 miles to the west of the GCWRA. The wetland complex within the Anderson Mesa IBA has been documented as one of two major waterfowl use areas in Arizona during migration, particularly by dabbling ducks during spring migration (National Audubon Society 2009). A variety of land birds also use the IBA for breeding and as a migration stopover site. The extensive pinyon pine and juniper woodlands in the area support populations of pinyon jay (*Gymnorhinus cyanocephalus*), a species of global conservation concern because of the limited distribution of pinyon pine on which the species depends (National Audubon Society 2009).

3.4.2 USFWS Birds of Conservation Concern

The GCWRA lies near the southwestern boundary of the Southern Rockies/Colorado Plateau Bird Conservation Region. Twenty-seven species are listed by the USFWS as birds of conservation concern within this region (USFWS 2008; Table 3.4). These species do not receive special protection unless they are also listed by the USFWS under the Endangered Species Act or by the AZGFD; but have been identified as vulnerable to population declines in the area by the USFWS (2008). Of these, four species have been documented by Arizona's Natural Heritage Program as occurring within the Canyon Diablo and/or Middle Little Colorado Watersheds: bald eagle, ferruginous hawk, peregrine falcon, and burrowing owl (AZGFD 2009).

During WEST's 2007/2008 baseline avian surveys at Study Area A, seven USFWS species of conservation concern were observed in the Study Area A of the Project: bald eagle, ferruginous hawk, prairie falcon, burrowing owl, gray vireo (*Vireo vicinior*), pinyon jay, and Cassin's finch (*Carpodacus cassinii*; Young et al. 2008). USFWS correspondence received for this study (Appendix A) identifies the gray vireo, loggerhead shrike (*Lanius ludovicianus*) and olive-sided flycatchers (*Contopus cooperi*) as species potentially affected by Project development. A total of three gray vireos, 32 loggerhead shrikes and zero olive-sided flycatchers were identified during Study Area A surveys (Young et al 2009). During avian surveys conducted at the Sunshine Wind Park, 13 loggerhead shrikes, zero gray vireos or olive-sided flycatchers were observed (WEST 2006). The potential for gray vireo and olive-sided flycatcher is greatest in open woodlands and associated areas primarily located west of the GCWRA atop Anderson Mesa. The potential for these species to occur declines from the Evaluation Area through Study Areas A, B and C. Data from the Sunshine Windpark studies indicate low breeding or occurrence probability for these species in open grasslands associated with large portions of the GCWRA. Loggerhead shrike habitat is available within the GCWRA and within the wider region; the species is not listed as a USFWS Bird of Conservation Concern (Table 3.4).

3.4.3 USGS Breeding Bird Survey

The USGS Breeding Bird Survey (BBS) is a large-scale survey of North American breeding birds. Each June over 3,500 designated routes in the continental U.S. and southern Canada are surveyed by experienced birders. Each BBS route is 24.5 miles long and consists of 50, three-minute point counts along the length of the route. Information gathered from these surveys allows some indication of species that may utilize the region either transiently or for breeding habitat during the summer. The BBS routes closest to the GCWRA are the Happy Jack and Forest Lakes routes (Figure 3.3); however, these routes are located in the higher-elevation, forested region to the west and south of the GCWRA, and generally do not contain habitat types representative of the GCWRA. Alternatively, the Castle Buttes route located approximately 40 miles to the northeast (Figure 3.4) is characterized by Great Basin shrub and grassland habitats more likely to support bird species found within the GCWRA. The Castle Buttes route has been monitored for seven years, between 1992 and 2007. A total of 38 species have been observed along this route, including four raptor species and one vulture species (red-tailed hawk, golden eagle, American kestrel, prairie falcon, and turkey vulture; Sauer et al. 2008). The most common species observed along this route were: horned lark (*Eremophila alpestris*), common raven (*Corvus corax*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), Cassin's kingbird (*Tyrannus vociferans*), and lark sparrow (*Chondestes grammacus*), with an average of >10 individuals sighted per year. This is generally similar to the most common species observed during the avian use surveys conducted by WEST during the summer of 2007 at Study Area A of the Project which included: lark sparrow, horned lark, and northern mockingbird (Young et al. 2008). No federal threatened or endangered species or state species of special concern have been observed along the Castle Buttes route, but two federal species of conservation concern have been observed: prairie falcon and pinyon jay (USFWS 2008; Table 3.4).

Additional raptors observed on the nearby Happy Jack and Forest Lakes routes include bald eagle, northern goshawk, sharp-shinned hawk, peregrine falcon, and great-horned owl. Of these, bald eagle, northern goshawk, and peregrine falcon are considered state species of special concern by the AZGFD (2009a).

3.4.4 Indirect Displacement Effects

The presence of wind turbines may alter the landscape so that wildlife habitat use patterns are altered, thereby displacing wildlife away from site facilities. For wind power projects, one of the greatest concerns related to displacement impacts are for wind energy projects placed in grasslands and other native habitats. Recently, research has been initiated to assess the potential displacement of grassland songbirds at wind power facilities, although uncertainty still exists over the actual effects. In Minnesota, researchers have found that breeding songbird density on Conservation Reserve Program (CRP) grasslands was reduced in the immediate vicinity of turbines (Leddy et al. 1999), but changes in density at broader scales were not detectable (Johnson et al. 2000). Erickson et al. (2003) documented a decrease in density of some native grassland songbirds such as grasshopper sparrows (*Ammodramus savannarum*) near turbines in Washington; however, they could not determine if a decrease in post-construction density was the result of behavioral disturbance or a loss of habitat. Piorkowski (2006) conducted a displacement study at a

wind power project in Kansas. Of the grassland species present on the facility in Kansas (horned lark, killdeer [*Charadrius vociferus*], dickcissel [*Spiza americana*], Cassin's sparrow [*Aimophila cassinii*], grasshopper sparrow, bobolink [*Dolichonyx oryzivorus*], scissor-tailed flycatcher [*Tyrannus forficatus*], and western meadowlark), only the western meadowlark showed significantly lower densities near turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining songbird breeding densities than the presence of wind turbines. Shaffer and Douglas (2009) of the USGS examined displacement effects of wind turbines in North Dakota and South Dakota, and found that three out of the five grassland species examined did not appear to avoid turbines.

Table 3.4. Species of Conservation Concern within the Southern Rockies/Colorado Plateau Bird Conservation Region (USFWS 2008)

Species	Scientific Name
Gunnison sage-grouse	*Centrocercus minimus*
American bittern	*Botaurus lentiginosus*
bald eagle (b)	*Haliaeetus leucocephalus*
ferruginous hawk	*Buteo regalis*
peregrine falcon (b)	*Falco peregrinus*
prairie falcon	*Falco mexicanus*
snowy plover (c)	*Charadrius alexandrinus*
mountain plover	*Charadrius montanus*
long-billed curlew	*Numenius americanus*
yellow-billed cuckoo (a)	*Coccyzus americanus*
flammulated owl	*Otus flammeolus*
burrowing owl	*Athene cunicularia*
Lewis's woodpecker	*Melanerpes lewis*
willow flycatcher (c)	*Empidonax traillii*
gray vireo	*Vireo vicinior*
pinyon jay	*Gymnorhinus cyanocephalus*
juniper titmouse	*Baeolophus ridgwayi*
Veery	*Catharus fuscescens*
Bendire's thrasher	*Toxostoma bendirei*
Grace's warbler	*Dendroica graciae*
brewer's sparrow	*Spizella breweri*
grasshopper sparrow	*Ammodramus savannarum*
chestnut-collared longspur	*Calcarius ornatus*
black rosy-finch	*Leucosticte atrata*
brown-capped rosy-finch	*Leucosticte australis*
Cassin's finch	*Carpodacus cassinii*

(a) ESA candidate; (b) ESA delisted; (c) non-listed subspecies or population of Threatened or Endangered species

The GCWRA and Evaluation Areas contain substantial amounts of grassland habitat (~24% and 18% of total land cover, respectively based on NLCD data – see Section 2.0), and some species of sensitive grassland songbirds may reside in, or migrate through, the

GCWRA. As more research is published, the potential impacts of wind turbines on breeding songbirds can be better defined.

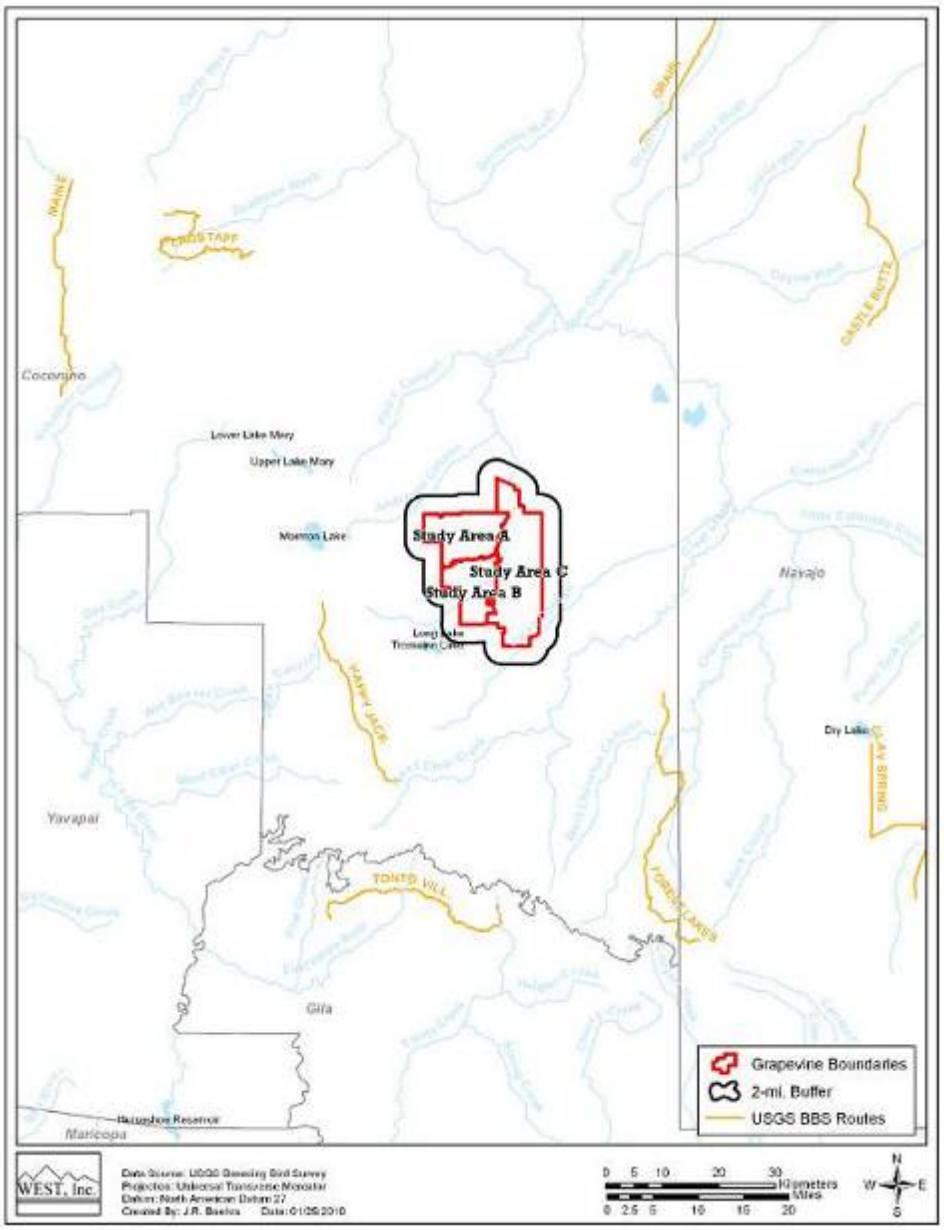

Figure 3.3 USGS Breeding Bird Survey routes closest to the GCWRA.

3.5 Bats

3.5.1 Species likely to occur in the area

Bat fatalities at wind-energy facilities were first noted during avian surveys in the early 1990s (Orloff & Flannery 1992); however it was not until reports estimated high numbers of bat fatalities in sites in West Virginia (Kerns & Kerlinger 2004) and Tennessee

(Fiedler 2004) that concern was elevated and alliances such as the Bats and Wind Energy Cooperative were established to determine the extent of bat mortality at wind power facilities and to develop solutions to the problem (Arnett 2007). The National Research Council recently published the findings of the Committee on Environmental Impacts of Wind Energy Projects whose task was to provide a comprehensive review of scientific literature pertaining to the effects of wind power facilities on the local environment (NRC 2007). Bat casualties have been reported from most wind power facilities where post-construction fatality data are publicly available. Reported estimates of bat mortality at wind power facilities have ranged from 0.02 – 53.3 per MW per year (Arnett et al. 2008). Though some wind power facilities have extremely high numbers of bat fatalities these figures are likely underestimations due to high levels of scavenger removal (70% of killed bats scavenged within 24 hrs) and low searcher efficiency, especially where vegetation is high (Arnett 2005). The small body size of bats also adds to lower detection ability, compared for example with detection rates for raptor carcasses.

Most of the bat casualties at wind power facilities to date are migratory species which conduct long fall migrations between summer roosts and winter areas (Gruver 2002, Johnson et al. 2003). The reason for disproportionate mortalities during fall are unknown; however it may be that tree bats fly at lower altitudes during spring migration than during fall migration. For example, hoary bats (*Lasiurus cinereus*) fly 1-5 m (3-16 ft) from the ground while migrating through New Mexico in the spring, but apparently not in the fall (Cryan & Veilleux, 2007). In contrast, a hoary bat collided with an aircraft above Oklahoma at an altitude of 2,438 m (7,999 ft) in October (Peurach 2003). At least eleven bat species have been recovered during carcass searches at wind-energy facilities throughout the U.S. (Johnson 2005, Kunz et al. 2007, NRC 2007, Arnett et al. 2008) and of these, five species are potential residents and/or migrants in the GCWRA (Table 3.4).

Table 3.4. Species composition of bat fatalities from wind-energy facilities in the U.S. (Adapted from NRC, 2007 p. 65)

Common name	Scientific name	Total (number & percentage)	
Hoary bat*	*Lasiurus cinereus*	1,023	41
Eastern red bat	*Lasiurus borealis*	580	23
Tri-colored bat (formally eastern pipistrelle)	*Perimyotis subflavus*	261	11
Silver-haired bat*	*Lasionycteris noctivagans*	209	8.4
Little brown myotis	*Myotis lucifugus*	145	5.8
Brazilian (or Mexican) free-tailed bat*	*Tadarida brasiliensis*	143	5.7
Big brown bat*	*Eptesicus fuscus*	59	2.4
Northern long-eared myotis	*Myotis septentrionalis*	8	0.4
Western red bat*	*Lasiurus blossivilli*	4	0.2
Seminole bat	*Lasiurus seminolus*	1	0.1
Unknown	-	53	2.1
Total	-	2,486	100

*Potential resident and/or migrant in the GCWRA

Due to the current lack of understanding of bat populations in North America, the species and relative abundance of bats occurring within the GCWRA are difficult to determine. Based on range maps and species accounts from Bat Conservation International (BCI 2009) and Harvey et al. (1999), 30 species of bat are known to occur in Arizona, with 20 species having an approximate range that includes the GCWRA or surrounding region (Table 3.5). Of these 20 species, 11 have the potential to roost or forage within the GCWRA; pallid bat (*Antrozous pallidus*), pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), big brown bat (*Eptesicus fuscus*), spotted bat (*Euderma maculatum*), California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), Arizona myotis (*Myotis occultus*), fringed myotis (*Myotis thysanodes*), big free-tailed bat (*Nyctinomops macrotis*), canyon bat (*Parastrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). An additional three species are likely seasonal migrants through the GCWRA; silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), and hoary bat. Based on known distributions and habitat preferences, a further six species are possible, though unlikely, residents of the GCWRA; Allen's big-eared bat (*Idionycteris phyllotis*), greater bonneted bat (*Eumops perotis*), southwestern myotis (*Myotis auriculus*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), and Yuma myotis (*Myotis yumanensis*). Of the bats with potential to occur within the GCWRA, 11 species are listed as federal species of concern by Arizona's Natural Heritage Program (AZGFD 2009): pale Townsend's big-eared bat, spotted bat, greater bonneted bat, Allen's big eared bat, western small-footed myotis, long-eared myotis, Arizona myotis, fringed myotis, long-legged myotis, Yuma myotis, and big free-tailed bat. In addition, two bats are designated as state species of special concern by the AZGFD (2009): spotted bat and western red bat. Of the bats with potential to occur within the GCWRA, seven species have been documented as occurring within the larger Canyon Diablo and/or Middle Little Colorado Watersheds: greater bonneted bat, Allen's big-eared bat, western small-footed bat, long-eared myotis, Arizona myotis, fringed myotis, and long-legged myotis (AZGFD 2009). Based on information provided by the AZGFD (Appendix A), fringed myotis and hoary bat have been documented within five miles of the GCWRA.

The highest numbers of bat fatalities found at wind-energy projects to date have occurred in eastern North America on ridge tops dominated by deciduous forest (NWCC 2004). However, Barclay et al. (2007) and Koford et al. (2005) have reported relatively high fatality rates from projects in Canada and Iowa located in grassland and agricultural habitats. The most likely roosting habitat for bats within the GCWRA is along the canyons in the southeastern, central, and northwestern portions of the GCWRA. Caves, crevices, and rock outcrops along the canyon walls likely provide habitat for roosting and hibernating bats. Juniper savannah/woodlands throughout the GCWRA and riparian woodlands in canyon bottoms may also provide roosting habitat for tree-roosting species. Bats undoubtedly forage at the creeks, springs, ponds, and stock tanks throughout the GCWRA and these areas are likely to concentrate both resident and migrant species. Free-tailed bats are known to occur in the region and can form colonies in caves and abandoned mines that contain hundreds of thousands of bats. Studies conducted at other wind-energy projects have documented use of areas within and around wind projects by

resident or breeding bats during the summer; however, these species are rarely found as casualties at turbines (Johnson 2005).

During acoustic bat monitoring conducted by WEST at Study Area A of the proposed project in 2007 and 2008, bat activity (mean = 9.11 bat passes per detector-night) was relatively high compared to that observed at facilities in Minnesota and Wyoming, where bat collision mortality was low, but it was much lower than activity recorded at sites in West Virginia and Tennessee, where bat mortality rates were high (Table 3.6). Bat activity at the nearby Sunshine Wind Park was considerably lower, with a mean of 2.48 bat passes per detector night (Gruver et al 2009), suggesting decreased bat activity may occur in grassland and desert scrub areas associated with large portions of Study Areas B and C compared with observed detections in Study Area A. Based on the presumed relationship between pre-construction bat activity and post-construction fatalities, it is expected that bat mortality at the proposed project would be greater than the 2.2 bat fatalities/turbine/year reported at Buffalo Ridge, Minnesota, but much lower than the 20.8 fatalities/turbine/year reported at Buffalo Mountain, Tennessee. While there are no known published studies of bat mortality at wind projects in the desert southwest, other western projects including those in California have generally shown lower impacts. The recently published Dillon California fatality project showed a bat fatality rate of 2.17 fatalities per turbine per year (2.17 fatalities per MW per year; Chatfield et al 2009). Due to the overall lack of understanding regarding bat and wind turbine interactions in Arizona, it is difficult to predict if the proposed project may potentially result in a high fatality rate for bats. No known bat hibernaculum or roosts of significance have been noted within the vicinity of the GCWRA by the AZGFD or the USFWS (Appendix A).

Table 3.5. Bat species determined from range-maps (Harvey et al. 1999; BCI website) with potential to occur within the GCWRA or Evaluation Area.

Species	Status	Habitat	Potential for Occurrence
pallid bat (*Antrozous pallidus*)		Inhabit rocky, outcrop areas of arid regions where they commonly roost in crevices, caves, and mines. May also roost in barns, hollow trees, or buildings.	**High.** Possible year-round resident.
pale Townsend's big-eared bat (*Corynorhinus towsendii pallescens*)	FSC,	Distribution correlated with rocky situations where caves or abandoned mine tunnels are available. In west, most typical habitat is arid western desert scrub and pine forest regions. In spring and summer form maternity roosts in mines, caves or buildings. Hibernate in caves or abandoned mines. Extremely sensitive to disturbance.	**Moderate.** Possible year-round resident if cave/mine roosting habitat available.
big brown bat † (*Eptesicus fuscus*)		Form maternity colonies beneath loose bark in forests and other trees, or in buildings and under bridges. Uses a variety of habitats including oak woodlands and areas with dense tree canopy. May forage over cleared meadows and trees in pastures or along streams. Hibernates in caves, mines, houses, hollow trees etc.	**Moderate.** Possible year-round resident.

Table 3.5. Bat species determined from range-maps (Harvey et al. 1999; BCI website) with potential to occur within the GCWRA or Evaluation Area.

Species	Status	Habitat	Potential for Occurrence
spotted bat (*Euderma maculatum*)	FSC	Inhabit a range of habitats: from high-elevation pine forests, pinyon -juniper woodland, and open scrub associations in desert areas. In summer roost in crevices in cliff walls and canyons. Little known about winter habits. Distribution not known to include portion of county.	**Low.** Possible year-round habitat present but range extant is great from nearest known location.
California myotis (*Myotis californicus*)		One of the most abundant bats in desert scrub habitat. Inhabit wooded canyons, open deciduous and coniferous forests, and brushy hillsides. Roost beneath loose bark, crevices of old snags and tree cavities. May also form small maternity colonies in cliff crevices, buildings, and bridges.	**High.** Possible year-round resident.
western small-footed myotis (*Myotis ciliolabrum*)	FSC	Inhabit deserts, semi-deserts, and desert mountains. Day roost in crevices and cracks in canyon walls, tunnels, loose bark and buildings. Can be found hibernating in caves and mines in winter. Little else known about the species.	**High.** Possible year-round resident.
Arizona myotis (*Myotis occultus*)	FSC	most commonly found in conifer forests in the 6,000 - 9,000 foot elevation range, although nursery colonies known from lower elevations, where affiliation with water common.	**High.** Possible year-round resident.
fringed myotis (*Myotis thysanodes*)	FSC	Roost in caves, mine tunnels, rock crevices, and old buildings. Hibernate in caves and buildings but little is known about wintering locations. Habitat ranges from mountainous pine, oak, and pinyon-juniper to desert scrub and grassland.	**High.** Possible year-round resident; documented within five miles of GCWRA.
big free-tailed bat (*Nyctinomops macrotis*)	FSC	Typically inhabit desert and arid grasslands, roosting in rock out-crops, canyons, and cliffs.	**Moderate.** Possible year-round resident
canyon bat (*Parastrellus hesperus*)		Common to deserts, woodlands, and shrublands where they are typically associated with rocky situations along watercourses. Roosts among boulders or in cracks and crevices in canyon walls or cliffs. Probably hibernate in mines and caves in winter.	**High.** Possible year-round resident.
Mexican free-tailed bat† (*Tadarida brasiliensis*)		Occupies a variety of habitats from desert communities to pinyon-juniper woodland and pine-oak forests. These are primarily cave-dwelling bats though some smaller maternity colonies are in hollow trees.	**Moderate.** Possible year-round resident – if suitable large caves/mines present.

Table 3.5. Bat species determined from range-maps (Harvey et al. 1999; BCI website) with potential to occur within the GCWRA or Evaluation Area.

Species	Status	Habitat	Potential for Occurrence
silver-haired bat† (*Lasionycteris noctivagans*)		Long-distant migrant and solitary tree-roosting bat. Forms maternity colonies in tree cavities and small hollows. Roosts and hibernates beneath lose bark, in snags and in manmade structures. Inhabit forested areas near streams and lakes.	**High.** Likely migrant through GCWRA
western red bat† (*Lasiurus blossevillii*)	FSC, WSC	Long-distant migrant and solitary tree-roosting bat. Prefer riparian areas dominated by cottonwoods, oaks, sycamore, and walnut in otherwise arid regions; though also found in desert scrub. Roosts in tree foliage.	**Moderate.** Possible summer resident, though suitable forested and riparian roosting habitat is limited; possible migrant.
hoary bat† (*Lasiurus cinereus*)		Long-distant migrant and solitary tree bat. Roosts in trees along forest borders and edges of forest clearings. Forages above water and forest openings such as grassy meadows.	**High.** Likely migrant through GCWRA; documented within five miles of the GCWRA.
Allen's big-eared bat (*Idionycteris phyllotis*)	FSC	Typically inhabit ponderosa pine, pinyon-juniper, and riparian habitats; roost in mines, boulder piles, and beneath loose bark of pine snags; most often found in rocky situations near riparian or woodland areas.	**Low.** Some potential to occur in wooded areas of Study Areas A and B; greater potential to occur in western Evaluation Area.
greater bonneted bat (*Eumops perotis*)	FSC	Roost in cliff-face crevices high above ground; severely limited by available drinking water – due to long, narrow wings, require ponds at least 100feet long.	**Low.** Possible year-round resident, though water limited in GCWRA; greater potential to occur in Evaluation Area.
southwestern myotis (*Myotis ariculus*)		Inhabit ponderosa pine forests, oak woodlands, and mesquite, chaparral, and pinyon-juniper scrub habitats; generally occur near rocky cliffs and water; roost in tree cavities or beneath loose bark; may hibernate in cliff-face crevices.	**Low.** Woodland habitat and water is limited in GCWRA; greater potential to occur in Evaluation Area.
long-eared myotis (*Myotis evotis*)	FSC	Found predominately in coniferous forest. Roost in tree cavities and beneath exfoliating bark. Hibernation sites poorly known.	**Low.** Possible year-round resident, though forested roosting habitat is limited; greater potential to occur in Evaluation Area.
long-legged myotis (*Myotis volans*)	FSC	Forest inhabitants, preferring high, open woods and mountainous terrain. Roost in buildings, cliff crevices, and hollow trees. Maternity roosts have been found beneath bark and in other cavities.	**Low.** Possible year-round resident, though suitable roosting habitat may be limited.
Yuma myotis	FSC	Inhabit range of habitats from humid forests	**Moderate.** Possible

Table 3.5. Bat species determined from range-maps (Harvey et al. 1999; BCI website) with potential to occur within the GCWRA or Evaluation Area.

Species	Status	Habitat	Potential for Occurrence
(*Myotis yumanensis*)		to deserts, always near water. Most often roost in buildings and bridges, but may also use rock crevices, caves, and mines. Thought to hibernate in caves or mines in winter. Primarily forage over open water.	year-round resident, though foraging habitat (water) is very limited; greater potential to occur in Evaluation Area.

†Found as fatalities at wind-energy facilities (NRC 2007); FSC = Federal Species of Concern, WSC = State Wildlife Species of Special Concern. Range, habitat and use data from Bat Conservation International (2009).

Table 3.6. Wind-energy facilities in the U.S. with both pre-construction AnaBat sampling data and post-construction mortality data for bat species (adapted from Kunz et al. 2007b).

Wind-Energy Facility	Activity (#/detector night)	Mortality (bats/turbine/year)	Reference
Grapevine, AZ	9.11	-	Young et al. 2008
Foote Creek Rim, WY	2.2	1.3	Gruver 2002
Buffalo Ridge, MN	2.1	2.2	Johnson et al. 2005
Buffalo Mountain, TN	23.7	20.8	Fiedler 2004
Top of Iowa, IA	34.9	10.2	Koford et al. 2005
Mountaineer, WV	38.3	38.0	Arnett et al. 2005

3.6 Big Game

The GCWRA provides habitat for several species of big game including pronghorn antelope (*Antilocapra americana americana*), elk (*Cervus elaphus*), and mule deer (*Odocoileus hemonius*). In 2007, Arizona's pronghorn population was estimated to be approximately 11,000 individuals, occurring mainly in north-central Arizona and scattered herds in the southeast (AZGFD 2007). Most pronghorn occur between 3,000 and 7,000 feet elevation and inhabit a variety of habitat types from desert grassland to forest and mountain meadows; however, they generally prefer flat, open grassland areas (AZGFD 2007). The GCWRA falls within the range of the Anderson Mesa herd of pronghorn antelope. This population declined throughout recent decades as a result of habitat degradation and drought. This herd has been a focus of research and management effort within the state (AZGFD 2007). On February 2, 2010, AZGFD provided information on the distribution of the Anderson Mesa herd requested for this report. AZGFD conducted a telemetry study on pronghorn between 2003-2006. In addition, AZGFD has implemented a number of habitat treatments projects for pronghorn within and adjacent to the GCWRA, though many of these treatments were implemented after the telemetry study was completed and therefore analysis of pronghorn use of treatment areas is not possible to complete with existing data (Figure 3.4).

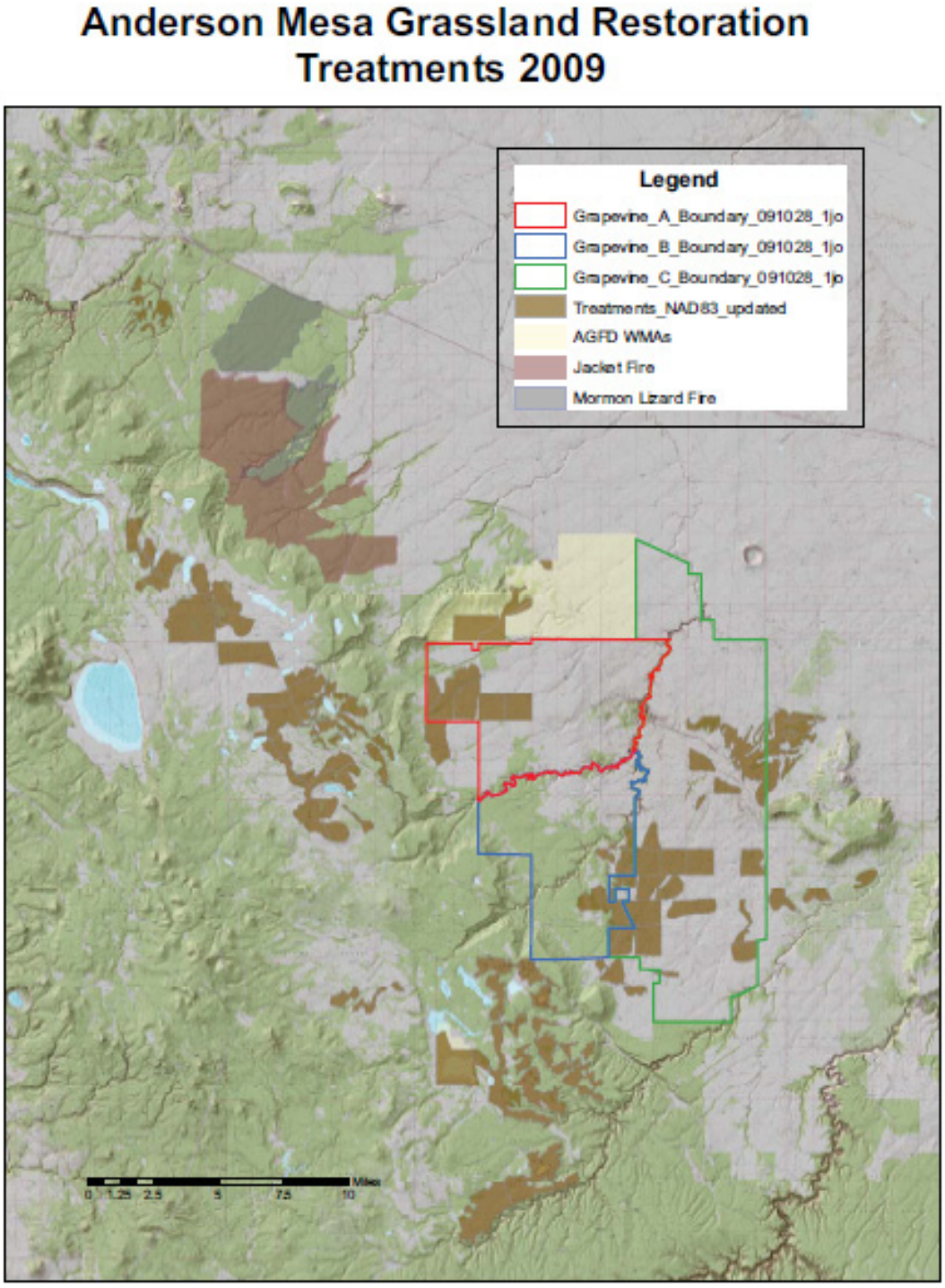

Figure 3.4 Pronghorn antelope habitat treatment areas in the vicinity of the GCWRA (AZGFD 2010).

The pronghorn in this area are functionally split into two groups; one group spends the winter at lower elevation lands and spends the rest of the year on Anderson Mesa, the second group lives year-round in the lower elevation habitat (Figures 3.5 and 3.6). The AZGFD study involved capture and radio-collaring of individuals atop Anderson Mesa, west of the GCWRA. Data from this study is informative of dispersal and/or migration of individuals captured atop Anderson Mesa. Overall use of habitat treatment areas by those pronghorn observed within the GCWRA was low (Figure 3.5). During the summer, individuals were primarily located atop the Anderson Mesa, with few telemetry locations recorded within Study Area A of the GCWRA (Figure 3.7).

The majority of winter locations of radio collared individuals were in the same grasslands and shrublands, primarily on State and private lands, including those which comprise the GCWRA (Figure 3.8). Winter locations compiled by AZGFD (Figure 3.8) comprised the majority of the total number of telemetered locations recorded within the GCWRA; however, the seasonal dates (October 1 – March 14) used in the data compilation include likely periods of fall and spring migration. Migration movement through the GCWRA is described in Figure 3.6 and shows moderate use occurring within a central corridor of Study Area A, with lesser use of a portion of Study Area B.

The primary management issue for the Anderson Mesa pronghorn herd is low fawn recruitment (AZGFD 2007). Location data among individuals during the parturition period included in the 2003-2006 AZGFD study (Figure 3.9) is sparse within Study Area B and absent within Study Area C, however, a portion of Study Area A overlapping pronghorn habitat treatment areas was used by collared individuals (Figure 3.4). Overall use of the GCWRA during parturition by radio collared individuals was low.

No scientific studies directly measuring the effects of wind-energy development on big game have been published at this time. There are a few published studies of big game habitat use that may be relevant to the development of wind turbines and wintering game (Sawyer et al. 2009, Sawyer et al. 2009; Johnson et al. 2000; Van Dyke and Klein 1996; Rost and Bailey 1979). At the Foote Creek Rim wind project in Wyoming, pronghorn observed during raptor use surveys were recorded year round (Johnson et al. 2000). The mean number of pronghorn observed at the six survey points was 1.07 prior to construction of the wind-energy facility and 1.59 and 1.14/survey the two years immediately following construction, indicating no reduction in use of the immediate area. Mule deer and elk also occurred at Foote Creek Rim, but their numbers were so low that meaningful data on wind plant avoidance could not be collected. By comparison, during 2007-2008 surveys at Study Area A (Young et al 2009) a use estimate of 0.3 all big game species (pronghorn, elk and mule deer) was calculated based on the number of big game species observed during fixed-point avian use surveys.

Sawyer et al. (2009 and 2006) examined the effects natural gas development on mule deer distribution and habitat selection in western Wyoming. Mule deer were less likely to occupy areas in close proximity to well pads than those far away (Sawyer et al. 2006). Furthermore, in an examination of how three different well pads with varying levels of vehicle traffic influenced winter habitat use of mule deer, Sawyer et al. (2009) found that

mule deer avoided all types of well pads, selecting areas further from well pads with high levels of traffic. Van Dyke and Klein (1996) documented elk movements through the use of radio telemetry before, during and after the installation of a single oil well within an area used year round by elk. Elk showed no shifts in home range between the pre- and post-drilling periods, however, elk shifted core use areas out of view from the drill pad during the drilling and post-drilling periods. The authors concluded that if drilling activities occupy a relatively small amount of elk home ranges, that elk are able to compensate by shifting areas of use within home ranges.

Studies have been conducted at the Starkey Research Unit, a large fenced experimental study area near La Grande, Oregon using radio-collared elk and deer. Results of spring studies (April – early June) suggest that elk habitat selection may be negatively related to traffic and other human disturbance (Johnson et al. 2000). Elk also tended to increase movement distances as a function of increased use by humans, including ATV use, hiking, and horseback riding (Wisdom et al. 2002). Alternatively, traffic and roads did not appear to be an important factor in spring distribution of mule deer. A study by Rost and Bailey (1979) found that wintering mule deer and elk avoided areas within 656 ft (200 m) of roads in eastern portions of their Colorado study area, where presumably greater amounts of winter habitat were present. The authors concluded that impacts of roads depended on the availability of suitable winter range away from roads, as well as the amount of traffic associated with roads. Availability of suitable big game winter range in the inter-mountain west is generally much less than that observed in north-central Arizona.

Due to the lack of data regarding the potential impacts of wind energy development on big game, it is difficult to predict the effects of the Project on antelope, mule deer and elk populations Information received from the AZGFD telemetry study suggests: 1) potential impacts including potential displacement is moderate for wintering individuals utilizing Study Area A; 2) potential impacts during parturition is low for the GCWRA, and; 3) potential avoidance of portions of Study Area A, and to a lesser extent Study Area B, by migrating pronghorn is possible. However, this effects analysis is based on telemetry data from individuals collared outside the GCWRA and it is possible that individuals trapped and collared within the GCWRA may exhibit different spatial use patterns.

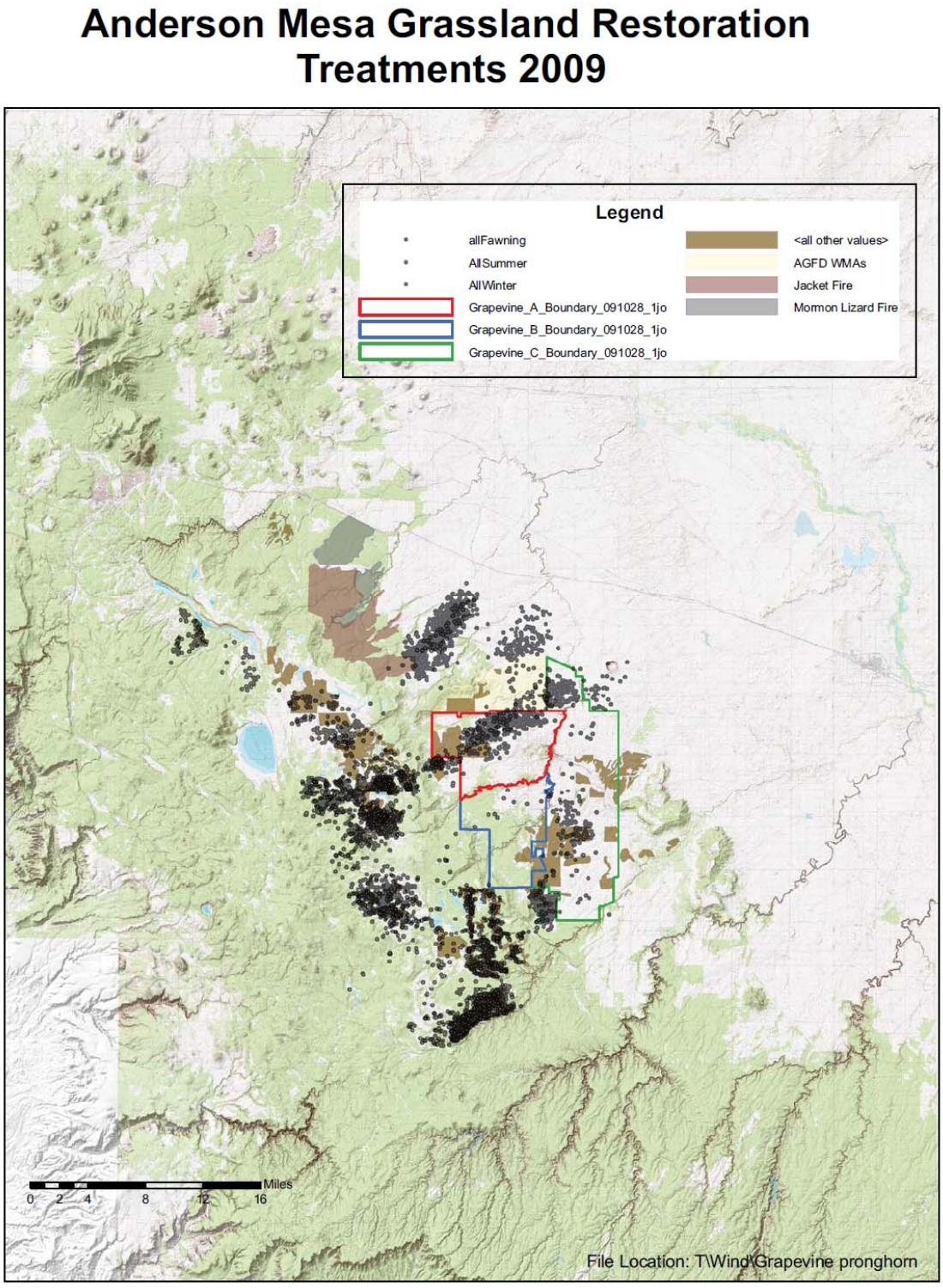

Figure 3.5 Pronghorn antelope telemetered locations for all season all years during the AZGFD 2003-2006 study in the vicinity of the GCWRA (AZGFD 2010).

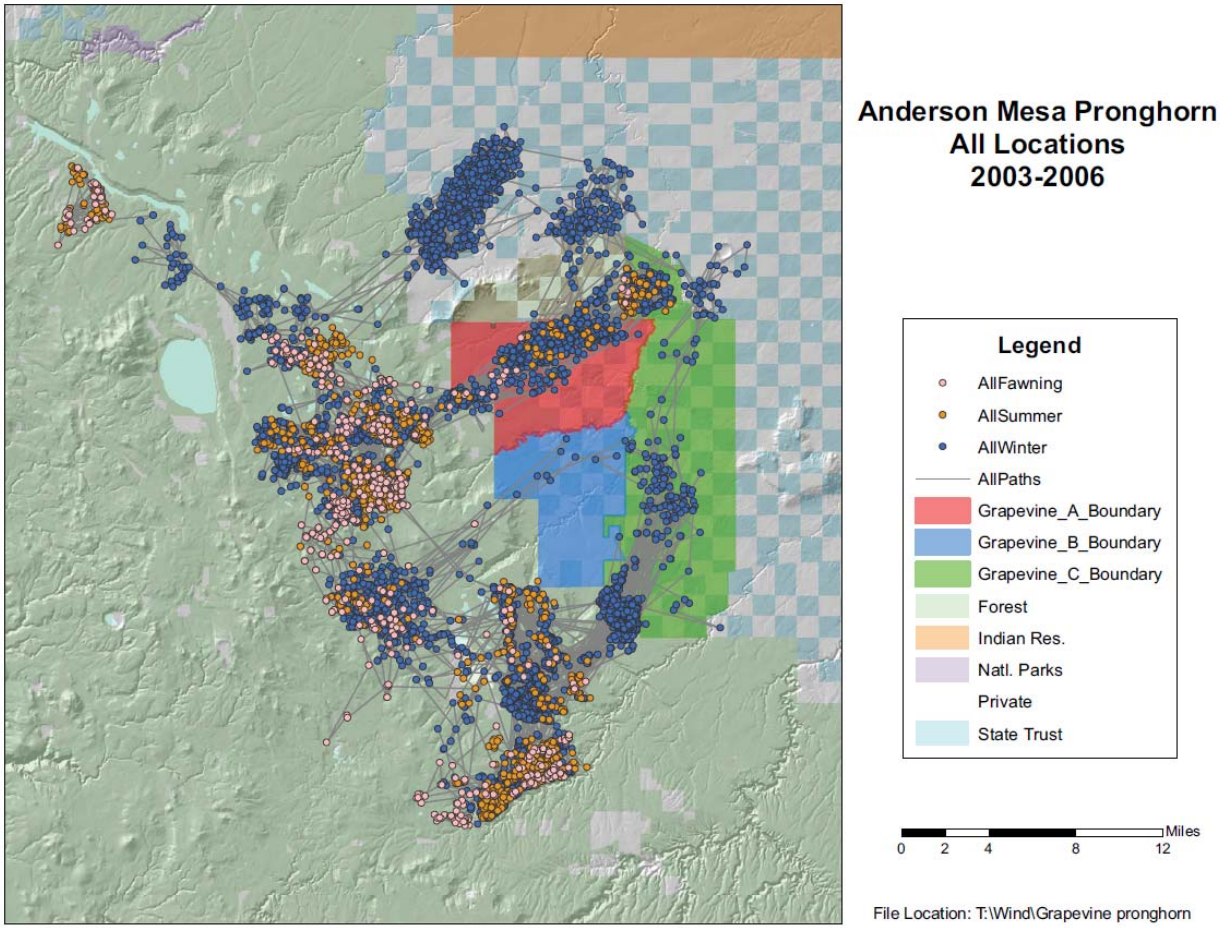

Figure 3.6. Pronghorn antelope telemetered locations for all season all years during the AZGFD 2003-2006 study in the vicinity of the GCWRA (AZGFD 2010).

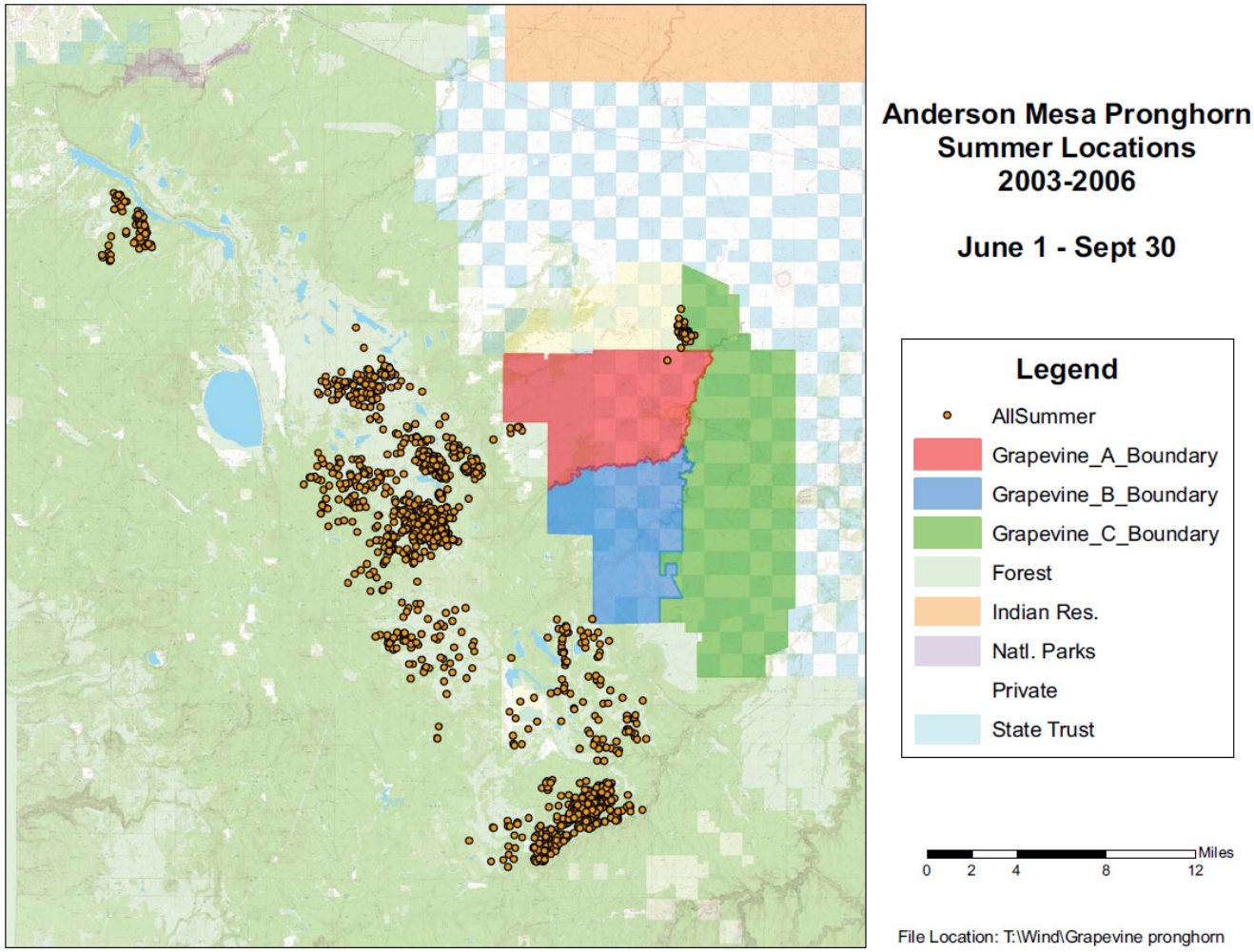

Figure 3.7 Pronghorn antelope summer locations in the vicinity of the GCWRA as determined through telemetry locations (summer 2003-2006; AZGFD 2010).

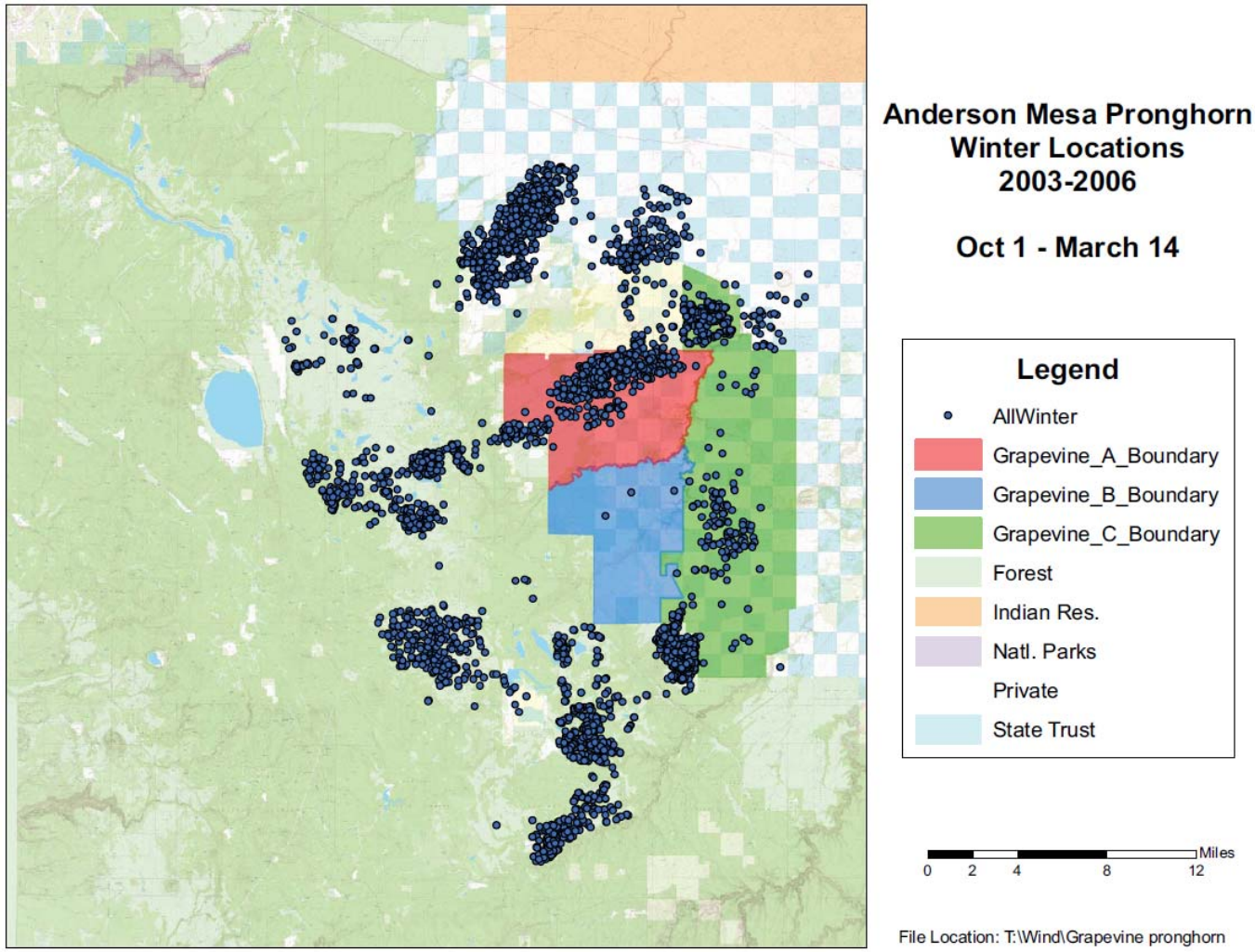

Figure 3.8 Pronghorn antelope winter locations in the vicinity of the GCWRA as determined through winter telemetry locations (winters 2003-2006; AZGFD 2010).

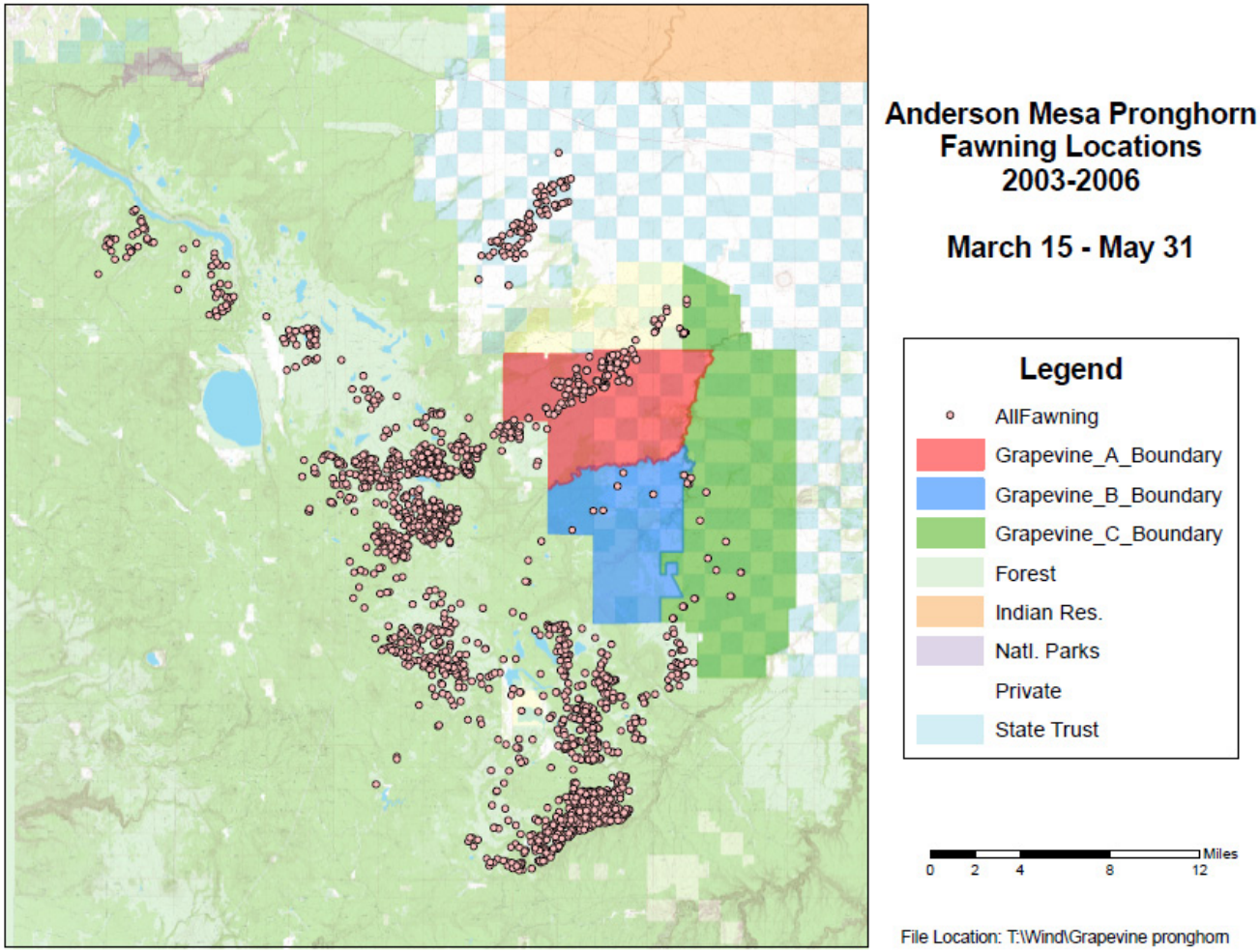

Figure 3.9 Pronghorn antelope telemetry locations recorded during parturition periods 2003-2006 in the vicinity of the GCWRA (AZGFD 2010).

4.0 SUMMARY

Potential impacts to biological resources evaluated herein are summarized in Table 4.1. Assessment of potential impacts were assessed using standards of significance for impacts to biological resources which are consistent with standards applied for other components of the Grapevine Wind EIS (Grapevine EIS 2010) where appropriate. Definitions and criteria for the effects analysis are provided below.

4.1 Standards of Significance
The Proposed Action would have a significant and adverse effect on biological resources if they:

- Adversely affect a listed endangered, threatened, or proposed plant or animal species or designated critical habitat.
- The Proposed Action resulted in a long-term loss of vegetation resulting in the listing or jeopardizing the continued existence of a plant or animal species.
- The Proposed Action would affect the biological viability of a local, regional, or national population of a listed wildlife species or one of concern/interest leading to a downgrading in its listing.
- The Proposed Action would violate the Endangered Species Act (ESA) or the Bald and Golden Eagle Protection Act.
- Substantially interfere with the movement of any native resident or migratory fish or wildlife species for more than one reproductive season.
- Reduce the value of habitat for fish, wildlife, or plants to an unusable level.
- Cause a native fish or wildlife population to drop below self-sustaining levels.
- Adversely and substantially affect important riparian areas, wetlands, or other wildlife habitats.

Short-term impacts are those that last through the construction phase of a project, or one or two reproductive cycles, whichever is longer.

Long-term impacts are those that last more than two reproductive periods, or as long as the life of the wind park.

Direct impacts are those that occur as a result of construction or operation of the wind park.

Indirect impacts are those that occur as a result of the wind park's presence. These are usually associated with increased human accessibility to a previously inaccessible area.

The extent of impacts to some resources resulting from construction and operation of the GCWRA is currently unknown. Additional bird and bat data collection should occur for potions of the project not already surveyed. For these areas, additional pre-construction

surveys prior to siting turbines associated with each of the subsequent phases of the GCWRA is recommended. These surveys may include:

- point count avian surveys during the spring;
- aerial surveys to identify raptor nests; and
- aerial and ground surveys for caves and/or ground fissures to identify potential bat roosting habitat within the wind park study area boundary as well as other potential roost sites in the general vicinity of the Project;.
- acoustic surveys for bats; and
- sensitive species surveys or habitat mapping.

4.1 Evaluation of Biological Resources

Overall, the three Study Areas do not differ significantly in terms of landcover or physiographic features, though some differences do exist. The presence of a greater proportion of canyons and associated wetland/waterbody and riparian features increases the potential for occurrence of some sensitive plant and wildlife species in Study Area A and Study Area B, relative to Study AreaC. However, differences are not great enough to warrant increased probability of occurrence of sensitive species within Study Areas A or B compared with the overall evaluation made for the GCWRA. All Study Areas contain similar landcover and physio-graphic features. The most notable difference between the Study Areas in terms of a potential habitat feature is the greater proportion of wetland or waterbodies (principally stock tanks and ponds) located with Study Area A and C compared with Study Area C.

The primary vegetation communitites comprising the GCWRA are scrub-shrub, juniper woodlands/savannah, and grassland. Wetlands and other waters of the U.S. are very limited within the GCWRA, comprising less than 0.1% of the GCWRA and are primarily restricted to stock tanks and ponds within upland areas of the GCWRA and ephermal streams and pools within canyon bottoms. Seven federal listed plant species are listed as occurring in Coconino County and 16 state sensitive (highly restricted or salvage restricted) plants are listed as occurring in the Canyon Diablo and/or Middle Little Colorado Watersheds (AZGFD 2009a, USFWS 2009). The majority of these plants have highly restricted distributions and very specific habitat requirements and are not expected to occur in the GCWRA. The Peebles Navajo cactus has moderate potential to occur within the GCWRA. Field surveys for the species have not occurred. Pre-construction surveys within construction zones are recommended to avoid direct impacts to the species.

Of the wildlife species protected under the Federal Endangered Species Act, 13 species are listed as occurring within Coconino County including four birds, one mammal, one reptile, one amphibian, five fish, and one snail (AZGFD 2009a, USFWS 2009). None of the fish species have the potential to occur in the GCWRA, and the remaining species have a very low probability of occurrence. Fourteen species considered wildlife of special concern by the AZGFD are listed as occurring in the Canyon Diablo and/or Middle Little Colorado Watersheds including seven birds, one mammal, two reptiles, two amphibians, and two fish. None of the bird species are likely to nest within the GCWRA, but several

may occur as rare winter visitors or pass through the GCWRA during migration. During these these periods, these species are at risk of turbine-collision, however, previous studies of Study Area A (Young et al 2009) do not suggest these species migrate in abundance over that portion of the GCWRA. Therefore, during migration periods impacts are not anticipated to occur which would result in significant impact to these species which would affect populations.

Breeding bird species found at Study Area A during 2007-2008 avian surveys (Young et al 2009) do not suggest the potential for breeding rare or sensitive bird species. Breeding habitats for the federal-listed western yellow-billed cuckoo, southwestern willow flycatcher and Mexican spotted owl are absent from the GCWRA and Evaluation Area, and therefore no potential exists for significant direct or indirect impacts to breeding populations. There is extremely low potential for these species to transient or disperse over the GCWRA. The Navajo Mexican vole has a low potential for occurrence based on habitat association, and both the bald eagle and the little Colorado sucker have been documented as occurring within five miles of the GCWRA according to the Arizona Natural Heritage database (Appendix 1). No surveys have been conducted for Navajo Mexican vole, however, existing ground disturbances in the forms of roads, ROWs and transmission lines exist. Construction may result in disturbance of habitat, though the extent of disturbance is unknown at this time. Construction impacts are not anticipated to result in impacts to populations as the GCWRA does not contain unique habitat to the region and no documented populations of the species have been recorded within the Project Area. Impacts to Colorado Sucker are not anticipated due to avoidance of aquatic features during project planning. BMP associated with minimization of impacts to watersheds are recommended to avoid potential indirect effects to the species. No suitable breeding habitat for bald eagle is present within the GCWRA.

Potentially suitable wetland and waterbody features exist within the GCWRA which could support the Chiricahua leopard frog (federal threatened and state species of concern), northern leopard frog (state species of concern) and the little Colorado sucker (state species of concern). Of these these three species, only the Colorado sucker has been previously documented within a five–mile radius of the Evaluation Area. All three species are considered to have low probability of occurrence within the GCWRA. These species are restricted to aquatic features located in canyon bottom ephemeral streams and pools, and waterbodies and wetlands associated with stock tanks and ponds found throughout the GCWRA. Project planning which avoids impacts to waterbodies and wetlands would negate potential direct impacts on sensitive wildlife and plant species which could potentially occur at aquatic features found within the GCWRA. A final Project layout has not been determined at this time. BMP associated with minimization of impacts to watersheds are recommended to avoid potential indirect effects to the species.

Seventeen diurnal raptor species have the potential to occur as residents and/or migrants in the GCWRA at some point during the year. In addition, five owl species and one vulture may also occur in the area. Potential nesting habitat for raptors is located primarily along the major drainages within the GCWRA: Canyon Diablo and Grapevine

Canyon in the central portion of the GCWRA, Yaeger and Anderson Canyons in the northwest, and Jack's Canyon in the southeast. Stands of oak and cottonwood in canyon bottoms, as well as canyon walls and rock outcroppings likely provide nest sites for raptors. Additionally, small areas of pinyon-juniper woodland, juniper savannah, and ponderosa pine forest, but may also provide nesting structures for tree-nesting species. Open, grassland habitat for ground-nesting species such as burrowing owls is present throughout the GCWRA, particularly within prairie-dog colonies which have been documented in Study Area A of the proposed project (Young et al 2009). Raptor nest surveys were completed at Study Area A in spring 2008 (Young et al 2009). Pre-construction raptor nest surveys are recommended for the spring immediately preceding construction in order to provide data on the location of raptor nest structures throughout the GCWRA and Evaluation Area so that Project planning may be informed by the location of nesting raptors. Avoidance of direct impacts to nesting structures and avoidance of construction activities within the immediate area of nests to avoid disturbance and potential nest failures is recommended. Breeding locations for nesting raptors are not located within likely construction zones or proposed turbine locations and therefore, impacts to breeding raptors may be minimized through pre-construction surveys and appropriate project planning.

The GCWRA lies within the Intermountain West region of the extensive American Pacific Flyway, one of five primary migratory routes for waterbirds, shorebirds, songbirds, and raptors. The seasonal migration of birds through Arizona generally occurs in a broad front throughout the state. The GCWRA contains a limited amount of stopover habitat for songbirds, waterfowl, and shorebirds in the forms of grassland, shrubland, pinyon-juniper woodland, and a few wetland/riparian areas, and it is likely that migrating birds utilize these areas during migration. The majority of the GCWRA is not likely to concentrate migrating birds; however, there is some potential for migrating birds that follow topography to concentrate along canyon rims, such as raptors that utilize updrafts and thermals created by topography. Additionally, the presence of prairie dog colonies and waterfowl/shorebirds concentrated at water sources could attract resident and migrating raptors to the GCWRA. Pre-construction prairie dog town mapping is recommended throughout the GCWRA and Evaluation Area for the spring immediately preceding construction in order to provide data on the location of concentrated prey sources, which have the potential to concentrate raptors. Direct impacts anticipated to migrating and resident birds within Study Area A is described in detail in Young et al 2009. A post-construction monitoring study is recommended to determine the overall level of avian fatalities resulting from operation of the GCWRA. In addition, avian and bat protection measures should be developed prior to construction to mitigate potential direct impacts to avian resources. Such measures may include construction requirements; post-construction avian survey and reporting requirements; avian mortality monitoring; and adaptive management practices.

High bat mortality at other wind-energy facilities is a concern and some species that appear to be at greatest risk are likely to occur in the GCWRA, for example red, hoary, and silver-haired bats. There are a number of bat species that occur in Arizona; 20 of which have the potential to occur within the GCWRA at some time during the year.

Caves, crevices, and rock outcrops along canyon walls likely provide habitat for roosting and hibernating bats. Riparian woodlands in canyon bottoms, pinyon-juniper woodlands, and ponderosa pine forests within the GCWRA and Evaluation Areas may also provide habitat for tree-roosting species. Creeks, springs, and stock tanks throughout the GCWRAare likely to concentrate both resident and migrant bats. Due to the lack of studies of wind turbines and bat interactions in this region, it is difficult to predict the potential for bat fatalities at the Project. Direct impacts anticipated to migrating and resident bats within Study Area A is described in detail in Young et al 2009. A post-construction monitoring study is recommended to determine the overall level of bat fatalities resulting from operation of the GCWRA. In addition, avian and bat protection measures should be developed prior to construction to mitigate potential direct impacts to bats. Such measures may include construction requirements; post-construction bat survey and reporting requirements; bat mortality monitoring; and adaptive management practices.

The GCWRA falls within the range of the Anderson Mesa herd of pronghorn antelope. Due to the lack of data regarding the potential impacts of energy development on big game, it is difficult to predict the effects of wind-energy development on pronghorn throughout the GCWRA.

Table 4.1. Summary of the potential for wildlife conflicts in the proposed GCWRA[1]. VH = Very High, H = High, M = Medium, and L = Low

Issue	VH	H	M	L	Notes
Potential for raptor nest Project Areas			✓		Limited nesting habitat within GCWRA; mainly within canyons; also in woodlands.
Raptor flight potential			✓		A number of raptors are likely to utilize the GCWRA; prairie dog colonies and waterfowl/shorebirds at water sources may attract raptors; raptors may concentrate along canyon rims and near prey concentrations. Raptor activity moderate-high during 2007-2008 study of Study Area A.
Potential for migratory pathway			✓		GCWRA lies within Intermountain West region of Pacific Flyway; birds likely migrate through GCWRA in broad front; some potential for raptors to concentrate along canyon rims during migration.
Potential for raptor prey species			✓		Potential for rodent and lagomorphs species within GCWRA; small active prairie dog colonies documented within GCWRA.
Potential for federal protected species to occur				✓	Thirteen federal-listed or candidate species listed for Coconino County, only four have at least some potential for occurrence.
Potential for State issues				✓	Fourteen state species of special concern listed as occurring in Canyon Diablo and/or Middle Little Colorado Watershed (seven birds, one mammal, two reptiles, two

					amphibians, and two fish); potential impacts to big game populations occurring in GCWRA.
Uniqueness of habitat at wind plant				✔	GCWRAitself generally not unique to area – dominant land cover within the GCWRA (scrub-shrub and grassland) is similar to the surrounding area; several canyons in Evaluation Area have important habitat features; Anderson Mesa immediately to west has wetland and forest habitat, important to wildlife.
Potential for rare plants to occur				✔	Numerous federal and state listed plant species known to occur in Coconino County and/or GCWRA's watersheds; potential for some sensitive plant species to occur in native shrub, grassland, woodland, or wetland habitats in Project and Evaluation Areas.
Potential for use by bats			✔		Twenty bat species have the potential to occur; bat species that have shown high fatalities at other Study Areas are likely to be present. Acoustic study (2007-2008) at Study Area A showed moderate bat activity.

[1] Summarized for the GCWRA as a whole but the habitat of the area varies throughout in its ability to support species of concern.

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APPENDIX A
Western EcoSystems Technology, Inc. correspondence with AZGFD and USFWS

WEST, Inc. Western EcoSystems Technology, Inc. 2003 Central Ave., Cheyenne, WY 82001
Phone: 307.634.1756 Fax: 307.637.6981 Web site: www.west-inc.com

November 17, 2009

Wally Murphy
US Fish and Wildlife Service
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, NM 87113
phone: 505-761-4726, fax: 505-346-2542

Subject: Proposed Grapevine Canyon Wind Energy Project,
Coconino County, Arizona
Sensitive Species/Sensitive Habitat Review Request

Dear Mr. Murphy:

Our client, Grapevine Wind, LLC, is evaluating the feasibility of developing a wind energy project in Coconino County, AZ (see attached map). The area of interest includes portions of the following Township/Ranges: T17N/R11E, T17N/R12E, T17N/R13E, T18N/R10E, T18N/R11E, T18N/R12E, T18N/R13E, T19N/R12E, T19N/R13E. We have been asked to do an environmental screening analysis for the project. The wind farm is in the early stage of development so specific attributes (i.e. project size, turbine types, etc.) and construction dates are currently unknown.

We request that you review the proposed project area and surrounding areas and provide us with information about listed, proposed, and candidate species (including plants) or sensitive environmental areas that could potentially be affected by the project. If your review indicates that threatened and endangered species may be affected by the project, please provide detailed location and life history information for each species. This information will be treated as confidential and will be used for project purposes only.

The proposed wind energy project is comprised of three distinct phases (A, B and C), as well as a proposed Tie-Line extending to the west from Area A, as indicated on the map. Please provide a separate review for each of the individual Areas and the Tie-Line.

Thank you for your assistance. If you have any questions or require additional information, please contact David Tidhar, Project Manager/Research Biologist at 802-377-2720.

Sincerely,

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western EcoSystems Technology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Mobile: 802.377.2720

WEST, Inc. Western EcoSystems Technology, Inc. 2003 Central Ave., Cheyenne, WY 82001
Phone: 307.634.1756 Fax: 307.637.6981 Web site: www.west-inc.com

17 November 2009

Arizona Game and Fish Department
WMHB - Project Evaluation Program
5000 W. Carefree Highway
Phoenix, AZ 85086-5000

Subject: Proposed Grapevine Canyon Wind Energy Project,
Coconino County, Arizona
Sensitive Species/Sensitive Habitat Review Request

To whom it may concern:

Our client, Grapevine Wind, LLC, is evaluating the feasibility of developing a wind energy project in Coconino County, AZ (see attached map). The area of interest includes portions of the following Township/Ranges: T17N/R11E, T17N/R12E, T17N/R13E, T18N/R10E, T18N/R11E, T18N/R12E, T18N/R13E, T19N/R12E, T19N/R13E. We have been asked to do an environmental screening analysis for the project. The wind farm is in the early stage of development so specific attributes (i.e. project size, turbine types, etc.) and construction dates are currently unknown.

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Thank you for your assistance. If you have any questions or require additional information, please contact David Tidhar, Project Manager/Research Biologist at 802-377-2720.

Yours truly,

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western EcoSystems Technology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Office: 802.244.1755
Mobile: 802.377.2720

WEST, Inc.
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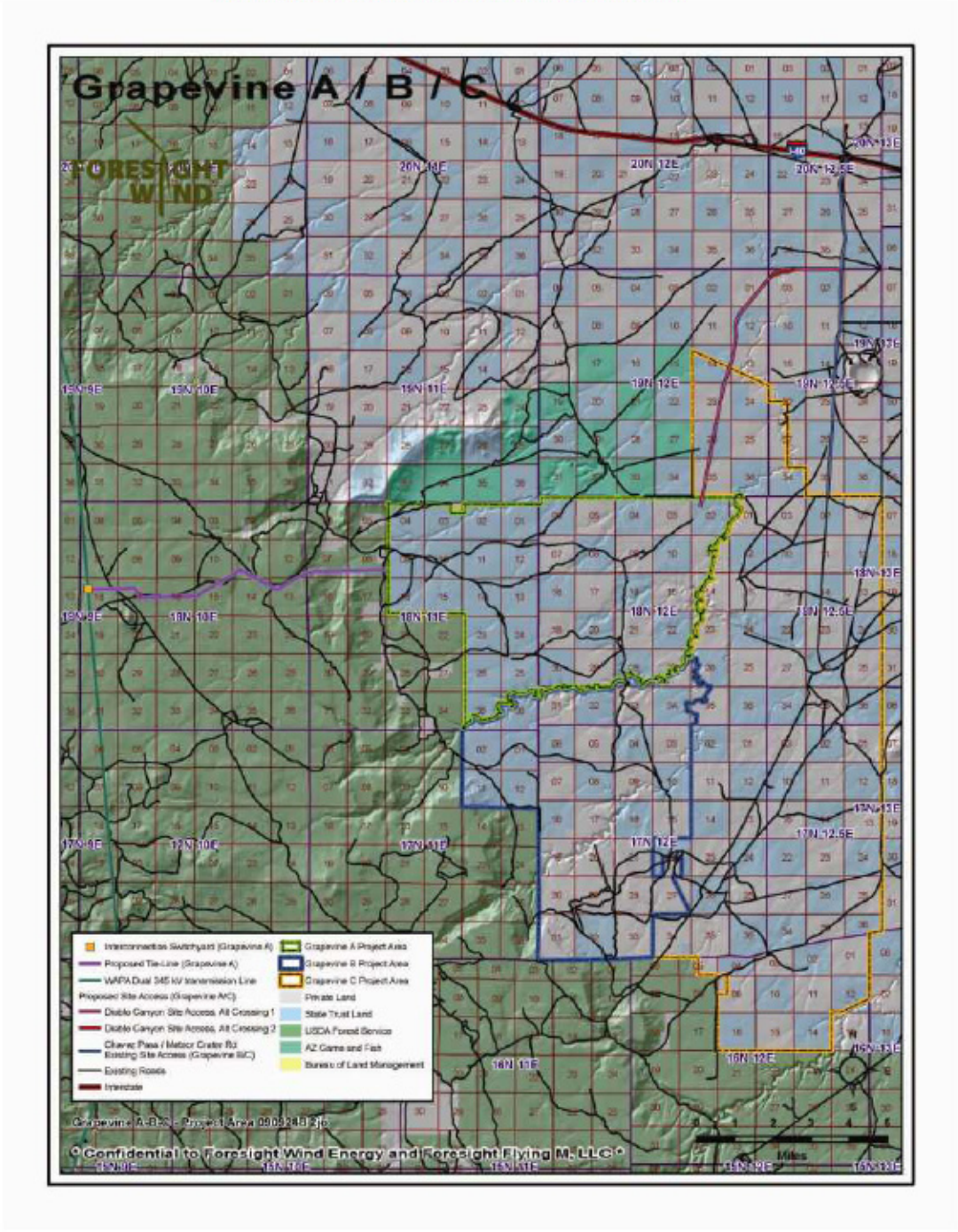

David Tidhar

From: Wally_Murphy@fws.gov
Sent: Tuesday, November 24, 2009 4:32 PM
To: David Tidhar
Subject: Re: Grapevine wind project
Attachments: Request_Grapevine_USFWS.doc

David if your in a big hurry please look at our web site for the appropriate county-wm

Wally "J" Murphy
US Fish and Wildlife Service
Supervisor
New Mexico Ecological Services Field Office
Albuquerque NM 87113
Off. 505/761-4781
CP 505/480-4821

"David Tidhar" <dtidhar@west-inc.com>

11/24/2009 08:18 AM

To <wally_murphy@fws.gov>, <Lynn_Gemio@fws.gov>
cc
Subject Grapevine wind project

Wally and Lynn,

I sent a hard copy of the attached information request for the proposed Grapevine wind project last week to your office. My client, Grapevine Wind, is very much hoping for a fast response from the USFWS regarding this Project. If you could please fast track a response for information pertaining to listed species and known information regarding sensitive species and/or habitats within the Project area I would be very grateful. If you have any questions please don't hesitate to contact me.

Have a very Happy Thanksgiving and thanks again for your time.

Best,
David

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western EcoSystems Technology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Office: 802.244.1755
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THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV
REGION II, 3500 S. LAKE MARY ROAD, FLAGSTAFF, AZ 86001

GOVERNOR
JANICE K. BREWER
COMMISSIONERS
CHAIRMAN, BOB HERNBRODE, TUCSON
JENNIFER L. MARTIN, PHOENIX
ROBERT R. WOODHOUSE, ROLL
NORMAN W. FREEMAN, CHINO VALLEY
JACK F. HUSTED, SPRINGERVILLE
DIRECTOR
LARRY D. VOYLES
DEPUTY DIRECTORS
GARY R. HOVATTER
ROBERT D. BROSCHEID

December 15, 2009

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western EcoSystems Technology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Office: 802.244.1755
Mobile: 802.377.2720

Re: Special Status Species Information for Township/Ranges: T17N/R11E, T17N/R12E, T17N/R13E, T18N/R10E, T18N/R11E, T18N/R12E, T18N/R13E, T19N/R12E, T19N/R13E.

Dear Mr. Tidhar:

The Arizona Game and Fish Department (Department) has reviewed your request, dated November 17, 2007, regarding special status species information associated with the above-referenced area. The Department's Heritage Data Management System (HDMS) has been accessed and current records show that the special status species listed on the attachment have been documented as occurring in the vicinity (5-mile buffer).

The Department's HDMS data are not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity.

Making available this information does not substitute for the Department's review of project proposals, and we appreciate the close coordination with West, Inc on this project. We look forward to continue opportunities to provide an evaluation of impacts to wildlife or wildlife habitats associated with project activities occurring in the subject area, when specific details become available. As you are aware, the Department is also concerned about other resource values, such as other wildlife, including game species, and wildlife-related recreation.

If you have any questions regarding this letter, please contact me at 928-214-1251. General status information, county and watershed distribution lists and abstracts for some special status species are also available on our web site at http://www.azgfd.gov/hdms.

Sincerely,

Andi Rogers

AN EQUAL OPPORTUNITY REASONABLE ACCOMMODATIONS AGENCY

Habitat Specialist, Region II, Flagstaff, Arizona

Attachment: Special Status Species Request

cc: Project Evaluation Program Supervisor
Habitat Program Manager, Region II

AGFD #M09-12155443

David Tidhar

From: Andi Rogers [ARogers@azgfd.gov]
Sent: Friday, April 02, 2010 5:30 PM
To: David Tidhar
Cc: Jeff Corcoran; Holly Hicks; Sarah Reif; Michael Rice
Subject: comments on Site Characterization Report

David,

Here are a few comments.. Overall, I think the Site Characterization is a good and fair assessment of the area. I had our aquatic's person look at portions and I think the raptor characterization is accurate. I didn't have as much time with it as I would have liked.. Hopefully you will find the comments on the T and E issues and more extensively on the pronghorn parts helpful..

Pg2: AGFD 2006 publication states "improper grazing".. I don't know if this is from the CWCS or the pronghorn literature, but it would sure help from a relationship standpoint to soften this language.. Either "improper **historic** grazing" or "improper in **portions** of the study area".. we work closely with the Diablo Trust on grazing issues and I would say that in 2010 we would not consider the area as improperly grazed.. these are very progressive ranchers by and large.

Pg 26: As a heads up, I would say that the USFWS would not concur that there is NO potential for the condor to be in this area. The Department would also agree that there is a chance these birds could be in the area, especially within the lifetime of a wind project. While these birds have not ventured to this area specifically, we have seen them on short trips to Sedona and other areas much further away than the Grapevine area. I would feel more comfortable calling this **extremely low**.

Pg 29.. The Department and Babbitt Ranches have been working together to release ferrets on Babbitt Ranches NW of Williams, AZ. There are ferrets there now on private and state lands.. This site is roughly 100 miles NW of the Grapevine Site, so there is obviously still not a likely effect on BFF's, but I thought you might want to include this area in the report. For more information on the site and the project contact Jeff Corcoran jcorcoran@azgfd.gov 928-422-0155. With respect to Gunnison's p-dogs, I pulled up the data from our 2007 survey effort and there seems to be several dog towns in Phase A and C. To get more information on this data contact Holly Hicks hhicks@azgfd.gov 623-236-7499

Pg iii, 56, 57: Related to the discussions of the pronghorn data and maps that we gave you, I think the results may have been a bit over analyzed in the report. I should have given you more detail on timing and scope of the project. I apologize for that.

1. The pronghorn that had transmitters on them (from 2003-2006) were animals that were captured on top of the Mesa (west of the project area). They were collared in order to gain information on migratory movements on and of the Mesa. Because the **migratory herd** was the focus, I don't think we can reliably say that "pronghorn don't spend much time in the study areas or in the treatment areas". It is only if we are able to transmitter animals from the year-round herd, on state and private lands, that we will be able to reliably say how much time is spend within the GCWRA and/or in the treatment areas.
2. With respect to the treatment areas, a majority of the habitat work (according to project personnel) was implemented and completed AFTER the pronghorn transmitters had fallen off.. Because of this fact, we cannot deduce that "overall use of habitat treatments areas by pronghorn within the GCWRA is low"- pg 56. We simply haven't had enough time to assess the use of these treatment areas yet.
3. Lastly, the map that we provided for "fawning locations" (pg 64) is a bit misleading.. The title says fawning locations, but cannot be interpreted as actual locations. Instead, this is a period of time in which fawning may have occurred. We need to be careful to talk about the impacts of the wind farm on fawning, because the

> "actual" fawning locations may not be focused on the lower elevation state and private lands for these migratory animals. Again we need more data from the year-round animals.

Generally speaking, I don't think that the data that we have provided can fully address the impact that the wind farm may or may not have on pronghorn, their movements, fawning, or how much time they may or may not spend in the treatment areas. I think it's best to be VERY general about the pronghorn issue and state what the data can and cannot tell us about this area. I also think it would be worthwhile mentioning that to fully address impacts we would need a subsequent study (something our Agency is still very interested in).

From the report it sounds as if you are having some trouble getting in touch with the USFWS. Who have you been trying to reach and not getting a response? I can rattle some cages for you if it can help.

Today is "officially" my last day.. Michael Rice (from my email) will be responding to any further questions you may have.. Feel free to contact the other two AGFD bios that I cc'd here and referred to in the comments for BFF and P-dog info. Thanks David for letting us review this early draft.. Are you guys doing any more field work out there this spring/summer? I'll be in touch in July..

Have a great spring..

Andi Rogers, Habitat Specialist, Region II
Arizona Game and Fish Department
3500 S. Lake Mary Road
Flagstaff, AZ 86001
Phone (928) 214-1251
Fax (928) 779-1825

United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer to:

AESO/SE
22410-2010-TA-0346

April 20, 2010

Mr. David Tidhar
Project Manager/Research Biologist
Northeast and Mid-Atlantic Region
Western EcoSystems Technology, Inc. (WEST)
26 North Main Street
Waterbury, Vermont 05676

RE: Proposed Grapevine Canyon Wind Energy Project, Coconino County, Arizona

Dear Mr. Tidar:

Thank you for your April 6, 2010, request for our review of the proposed Grapevine Canyon Wind Energy Project, Coconino County, Arizona. We received your request for comments on April 6, 2010. Foresight Flying M is evaluating the feasibility of developing a wind energy project east of Flagstaff on Arizona State Land Department and private lands. The U.S. Fish and Wildlife Service (FWS) supports the development of alternative energy sources, including wind energy. We fully recognize the importance of such development to both the Nation's economy and the global environment. Any form of energy production, however, including renewable energy, comes with certain environmental responsibilities. Through this letter, we offer you technical assistance in evaluating potential negative impacts on our Nation's trust wildlife and habitat resources from your proposed wind facilities in order to avoid or minimize such impacts.

We understand that the wind farm is in the early stages of development so specific attributes (e.g., project size, turbine type, etc.) and construction dates are currently unknown. However, the proposed energy project is comprised of three distinct phases (A, B, and C) as well as a proposed Tie-Line extending to the west of Area A. You requested that we provide you with any available information regarding wildlife movements, habitat issues, or seasonal concerns along the proposed action site and its immediate vicinity. You also requested a separate review for each of the individual areas and the Tie-Line. However, at this point, it is difficult for us to break-out individual recommendations for each area as habitats are very similar and the areas are adjoining. We will be as specific as possible for each area you noted on the map and note when recommendations apply to the entire project area.

Recently published studies indicate that wildlife can be negatively affected by wind energy development; for example, directly when birds or bats collide with wind turbine rotors, and

indirectly when sensitive wildlife species are displaced by altering or removing key components of their habitat. Such impacts likely can be reduced or avoided by strategic placement of turbines and associated infrastructure (e.g., access roads and distribution and transmission lines), as well as other best management practices that can minimize impacts of these structures.

The FWS holds certain resources in trust for the American people, including migratory birds, inter-jurisdictional fishes, federally-listed threatened and endangered species, and units of the National Wildlife Refuge System. The FWS administers natural resource protection laws germane to wind energy production and transmission. These statutes include the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d), the Endangered Species Act (ESA) (16 U.S.C. 1531 et. seq.), the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57), and the National Environmental Policy Act (NEPA) (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, et. seq.).

Migratory Birds and Eagles

The FWS is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species (e.g., waterfowl, shorebirds, birds of prey, songbirds) that spend all or part of their lives in the United States. The MBTA prohibits the taking, killing, possession, and transportation (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. Currently, the list of federally protected migratory birds includes 1007 species (50 CFR Part 10.13). The MBTA has no provision for allowing unauthorized take of migratory birds that may be killed or injured by otherwise lawful activities. Companies are encouraged to work closely with FWS biologists to identify available protective measures when developing project plans and/or avian (and bat) protection plans, and to implement those measures during construction and operation of facilities and equipment.

In order to avoid violations of the MBTA through destruction of active bird nests, habitat clearing for this project should occur outside the local avian nesting season. In this region the months September through March would constitute the non-breeding season for most species, although even in those months some nesting may occur. Once the specific region for the project is identified, this office (as well as our Migratory Birds Office and Arizona Game and Fish Department [AGFD]) will be able to identify potential nesting species during the "non-breeding" months.

The Bald and Golden Eagle Protection Act does provide for very limited issuance of permits that authorize take of eagles when such take is associated with otherwise lawful activities, cannot practicably be avoided, and is compatible with the goal of stable or increasing eagle breeding populations. This law also affords eagles additional protections beyond those provided by the MBTA, in particular, by making it unlawful to "disturb" eagles.

We understand that a Phase 1 study for the site was completed, but we have not received a copy of that report. Therefore, we may be recommending surveys or actions that you have already conducted. If you could send this report and other information you have collected to our office, we would be very appreciative.

We recommend you conduct an inventory of active raptor nests before construction begins to determine their locations and if there are any golden eagle territories in the vicinity. Golden eagles nest throughout this region wherever there are suitable cliffs and an appropriate food supply, thus it is likely that there will be some nesting pairs either within or adjacent to the project area. Wintering bald eagles are known to use the proposed project area and surrounding habitats on the Coconino National Forest. Bald eagles tend to me more numerous in this area from mid-October through mid-April.

In addition to eagles, other species of raptors that may nest in or near the project area include red-tailed, ferruginous, and Swainson's hawks, great horned, barn, and burrowing owls, and possibly peregrine and prairie falcons. Turbine placement should take into account nest locations and movement patterns of these species (particularly the eagles and falcons) and avoid those areas as much as possible. Further, eagle and other raptor movements through this region during spring and fall migrations are not well known; these should be monitored through each of those seasons during the pre-construction phase to identify concentration corridors that should potentially be avoided.

A thorough understanding of the status and distribution of all birds of conservation concern found in the project area will help to reduce impacts to declining species during the habitat-altering activities. This should include those species identified as conservation priorities in the USFWS 2008 list of Birds of Conservation Concern (http://www.fws.gov/migratorybirds), the Partners in Flight Species Assessments for that region (http://www.rmbo.org/pif/pifdb.html), and the Arizona State Wildlife Action Plan (http://www.azgfd.gov/w_c/cwcs.shtml). One of these species of concern is the gray vireo, which is a habitat specialist in the project area (pinyon-juniper and associated brushlands). Impacts to this species in particular should be addressed prior to construction and gray vireo locations avoided if possible. Other species of concern in the project vicinity include loggerhead shrike and olive-sided flycatchers.

Because bats are also an issue with wind energy facilities, seasonal and annual occurrence of bats, locations of hibernacula, breeding colonies, and roosts should be thoroughly assessed as well as locations of predictable flight lines. These assessments should include migratory bats such as those in the Lasiurine group (e.g. hoary bat, silver-haired bat), which have been shown to be particularly vulnerable to blade strikes.

These recommendations would apply to each of the individual areas (A, B, and C) and the Tie-line location as well.

Other Resources

The FWS's voluntary "Interim Guidelines to Avoid and Minimize Impacts from Wind Turbines" (http://www.fws.gov/habitatconservation/wind.html) might be helpful to evaluate your proposed wind energy facility. The guidance contains a site evaluation and ranking process to assess potential facility impacts, as well as recommendations for conducting post-construction monitoring. Appendices of the guidance also provide more information on wildlife laws and permitting. Agreed-on protocols for reducing the impact of wind energy facilities on wildlife

have been drafted by the Wind Turbine Advisory Committee (formed in accordance with the Federal Advisory Committee Act). On April 13, 2010, the FWS transmitted a set of final recommendations on how to minimize the impacts of land-based wind farms on wildlife and its habitat to Secretary of the Interior Ken Salazar. The document contains both policy recommendations and recommended voluntary guidelines for siting and operating wind energy projects in order to avoid or minimize potential impacts to wildlife and habitat. After the Interior Secretary's review, the FWS will use the Committee's recommendations to develop and publish its revised guidelines in the Federal Register and open them for public comment. The document, as well as a complete list of Committee members, is available for download at: http://www.fws.gov/habitatconservation/windpower/wind_turbine_advisory_committee.html. In addition, the AGFD created Wind Energy Guidelines entitled "Guidelines for Reducing Impacts to Wildlife from Wind Energy Development in Arizona." These guidelines can be found on AGFD's website at http://www.azgfd.gov/hgis/guidelines.aspx.

Comments Specific to the Proposed Grapevine Canyon Project Areas

Based upon information in our files, we do not know of any listed species that occur within or immediately adjacent to areas A, B, or C or the Tie-line. However, along the drainages that run off of Anderson Mesa, there may be winter bald eagle roosts in the ponderosa pine stringers. In addition, the topographic change from the rim of the mesa down to the pinyon-juniper and grassland areas provides a unique transition habitat that migratory birds likely use during migration and for breeding. In addition, there are many lakes on Anderson Mesa that draw birds and other wildlife (e.g., deer, elk, and pronghorn) from the brushland, pinyon-juniper, pine-stringer, and grassland habitats up to the Mesa and back down. We believe that the drainages running off the mesa are likely important wildlife corridors. We recommend that when siting any structures, the project avoid development in or near habitat features that congregate wildlife such as water resources, habitat edges, etc.

FWS Contacts

We hope you will accept our offer of technical assistance and engage in dialog with us early in your planning process. We are available to meet and discuss this facility, potential impacts to Federal trust resources, and appropriate best management practices with you. Additionally, we would like to discuss further pre-construction data collection. Please contact Shaula Hedwall, Senior Fish and Wildlife Biologist, Arizona Ecological Services (Flagstaff Suboffice) at 928-226-0614 (x103) or email shaula_hedwall@fws.gov for further information or to arrange a meeting.

We appreciate your coordination with us on this matter. In keeping with our trust responsibility to American Indian Tribes, for proposed actions that may affect Indian lands, Tribal trust resources, or Tribal rights, we encourage you to invite the affected Tribes and Bureau of Indian Affairs to participate in the comment process and, by copy of this letter, are notifying the Hopi Tribe and Navajo Nation. We also encourage you to coordinate the review of this project with the Arizona Game and Fish Department and Coconino National Forest.

Mr. David Tidhar 5

Should you require further assistance or if you have any questions, please contact Shaula Hedwall (x103) or Brenda Smith (x101) of our Flagstaff Suboffice at (928) 226-0614.

Sincerely,

Brenda H Smith

Steven L. Spangle
Field Supervisor

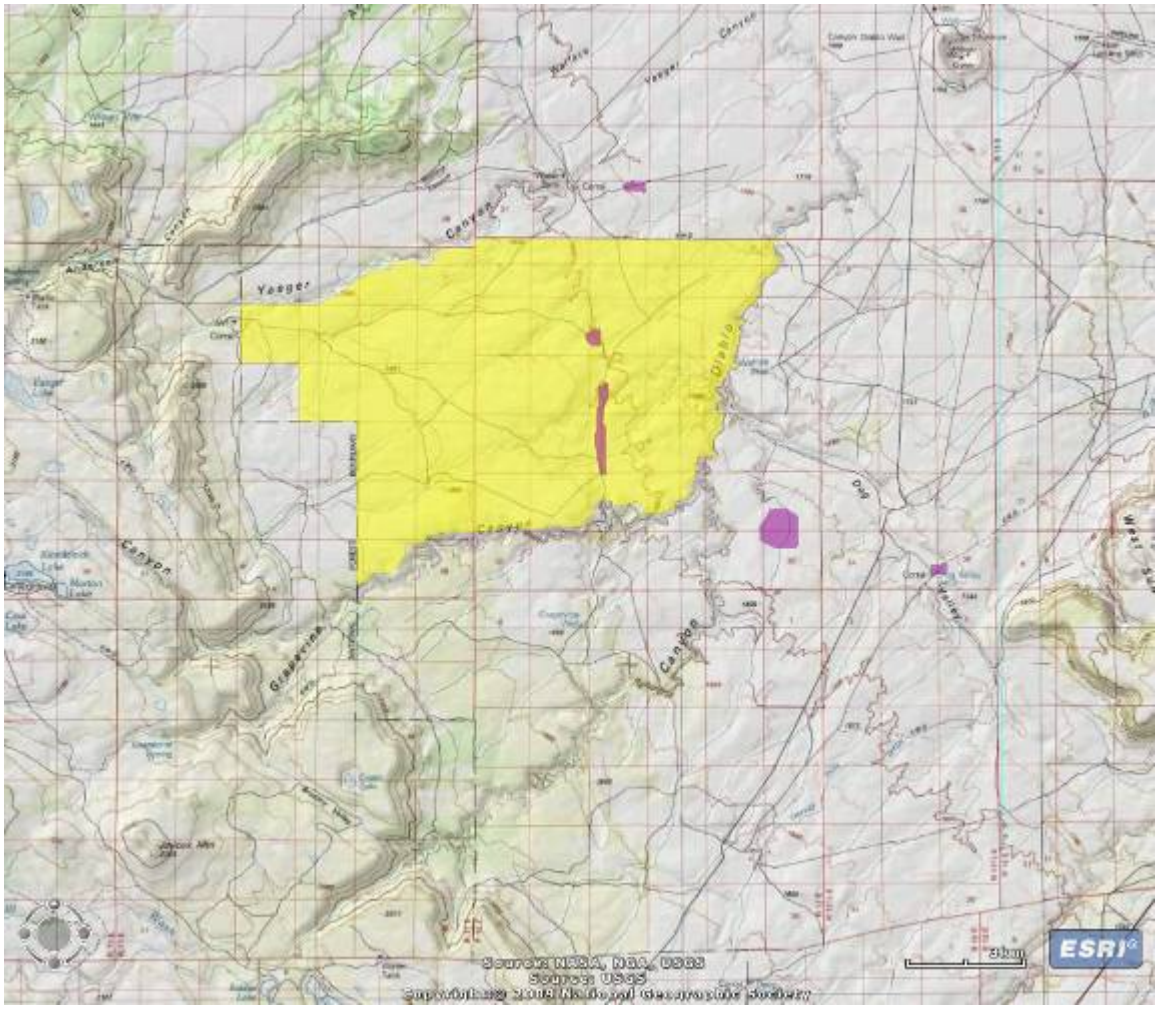
cc (electronic copy):
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Flagstaff, AZ
Forest Biologist, Coconino National Forest, Flagstaff, AZ
John Nystedt, Fish and Wildlife Service, Flagstaff, AZ

cc (hard copy):
Environmental Specialist, Environmental Services, Western Regional Office, Bureau of Indian Affairs, Phoenix, AZ
Director, Hopi Cultural Preservation Office, Kykotsmovi, AZ
Director, Historic Preservation Department, Navajo Nation, Window Rock, AZ

W:\Shaula Hedwall\Grapevine Canyon Wind Energy Project 4-19-10.docx:cgg

Hi David

After comparing your pictures with my data it looks like there is 1 other large colony that would fall in your study area c. The 2 that you mapped in 07-08 correspond pretty well with the data we collected in '07. All colonies on my map are active colonies. I am not sure if you are looking for any other information other than localities of other colonies but feel free to contact me again if you need additional information.



Thanks

Holly Hicks
Small Mammals Biologist
Nongame Branch
Arizona Game and Fish Department
5000 W Carefree Hwy
Phoenix AZ 85086
623-236-7499

Sign up for AZGFD eNews and receive the latest news and information on wildlife issues and events, outdoor tips, education programs, regulations, and more.
http://www.azgfd.gov/eservices/subscribe.shtml

From: David Tidhar [mailto:dtidhar@west-inc.com]
Sent: Friday, April 30, 2010 2:03 PM
To: Holly Hicks
Subject: Grapevine wind park prairie dog information

Hi Holly, please see the attached map of the entire Grapevine wind park, in addition to the map below which shows prairie dog maps we mapped during surveys we completed on Study Area A in 2007-2008.

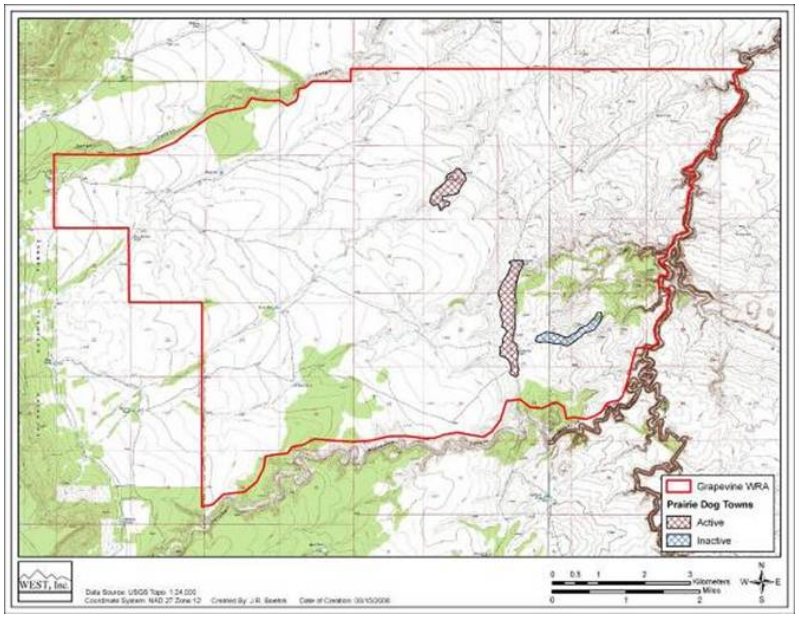


Figure 3.2 Location of prairie dog colonies within Study Area A (Young et al. 2008).

Best,

David

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western **E**co**S**ystems **T**echnology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Office: 802.244.1755
Mobile: 802.377.2720

From: Holly Hicks [mailto:HHicks@azgfd.gov]
Sent: Wednesday, April 28, 2010 2:58 PM
To: David Tidhar
Subject: RE: grapevine wind prairie dog towns

Hi David

Sorry for the delayed response. I didn't have much of a chance to discuss this with Andi before she left. Can you be more specific about where the Grapevine Wind park is located? We have prairie dog colonies all over northern Arizona and I am not familiar with this project location.

Thanks

Holly Hicks
Small Mammals Biologist
Nongame Branch
Arizona Game and Fish Department
5000 W Carefree Hwy
Phoenix AZ 85086
623-236-7499

From: David Tidhar [mailto:dtidhar@west-inc.com]
Sent: Sunday, April 11, 2010 5:35 AM
To: Holly Hicks
Cc: Michael Rice; Andi Rogers
Subject: grapevine wind prairie dog towns

Hi Holly, Andi mentioned in the email below that you have information related to Gunnison's prairie dogs in the Grapevine Wind park. If you could pass on any maps or data regarding these towns I would be grateful.

Best,
David

David Tidhar
Project Manager / Research Biologist
Northeast and Mid-Atlantic Region
Western **E**co**S**ystems **T**echnology Inc. (WEST)
26 North Main St., Waterbury VT 05676
Office: 802.244.1755
Mobile: 802.377.2720

Natural heritage data request response from AZGFD, December 15, 2009

Special Status Species within 5 Miles of the Grapevine Wind Energy Proposal Area (T16N,R12E; T17N,R11E; T17N,R12E; T17N,R12.5E; T18N,R10E; T18N,R11E; T18N,R12E; T18N,R12.5E; T18N,R13E; T19N,R12E; T19N,R13E)

NAME	COMMON NAME	FWS	USFS	BLM	STATE	QUAD	TOWNRANGE
Haliaeetus leucocephalus (wintering pop.)	Bald Eagle - Winter Population	SC,BGA	S	S	WSC	34111-F2	**150N110E**
Aquila chrysaetos	Golden Eagle	BGA				34111-G2	**160N110E**
Catostomus sp. 3	Little Colorado Sucker	SC	S	S	WSC	34110-G8	**160N130E**
Aquila chrysaetos	Golden Eagle	BGA				34110-G8	**170N140E**
Aquila chrysaetos	Golden Eagle	BGA				34110-H8	**180N130E**
Salvia pachyphylla ssp. *eremopictus*	Arizona Rose Sage					35111-A1	**190N125E**
Lasiurus cinereus	Hoary Bat	No Status				35111-A1	**200N125E**
Myotis thysanodes	Fringed Myotis	SC				35111-A1	200N125E
Haliaeetus leucocephalus (wintering pop.)	Bald Eagle - Winter Population	SC,BGA	S	S	WSC	35111-C5	**200N080E**

No Critical Habitats within Project area.

Arizona Game and Fish Department, Heritage Data Management System, November 20, 2009.

APPENDIX B
Photos taken during Project site visit on November 10 and 12, 2009

Desert Scrub/shrub and Grassland Habitats present in the GCWRA (Photos from Study Area C)

Desert Scrub/shrub and Juniper Savannah present in the GCWRA (Photos from Study Area)


Canyons present in the GCWRA (Photos from Study Area C – Diablo Canyon)


Canyons present in the GCWRA (Photos from Study Areas A and B – Grapevine Canyon)

Ephemeral stock pond and stream present in the GCWRA (Photos from Study Area A)

Stock tanks present in the GCWRA (Photos from Study Areas A and B)

APPENDIX D.2

WILDLIFE AND BOTANICAL REPORT

Available online at www.wapa.gov/transmission/grapevine.htm

Wildlife and Botanical Report

Grapevine Canyon Wind Resource Area
Transmission Line Right of Way
Coconino County, Arizona

Prepared for:

Grapevine Wind, LLC
c/o Foresight Wind Energy

Prepared by:

David Tidhar and Andrea Chatfield

Western **E**co**S**ystems **T**echnology, Inc.
2003 Central Avenue
Cheyenne, Wyoming

June 3, 2010

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1.0 INTRODUCTION

Grapevine Canyon Wind, LLC is proposing to construct an approximately 10-mile long transmission line inter-connection from the proposed Grapevine Canyon Wind Resource Area (GCWRA) to an existing transmission line located approximately three-miles east of the village of Mormon Lake, Coconino County, Arizona (Figure 1.1). At the request of Grapevine Canyon Wind, Western EcoSystems Technology, Inc. (WEST) has prepared the following Wildlife and Botanical Report for the proposed transmission line right of way (ROW) to satisfy data requests for the draft Environmental Impact Statement (EIS) for the GCWRA and for a Biological Assessment and Biological Evaluation (BABE) for the proposed transmission line ROW, which bisects US Forest Service (USFS) lands. The area evaluated in this report consists of 1) the proposed transmission ROW including the area within a 100-m (meter) buffer of the ROW and an 18-acre switchyard area at the interconnection of the existing WAPA 345-kV lines (jointly defined as the *Transmission Line*) and 2) a one-mile evaluation area[1] of the Transmission Line (*Evaluation Area*; Figure 1.2). The Transmission Line includes the *Proposed* t-line route and swithyard as well as the *Alternative* t-line route. Important wildlife and botanical differences between the Proposed and Alternative routes are noted in the report, as well as any important differences between the switchyard and the transmission line. The purpose of this report is to characterize wildlife and botanical resources within the proposed Transmission Line and Evaluation Area, and determine the potential effects of the proposed action on biological resources.

Biological resources within the Transmission Line and Evaluation Area were evaluated through a search of existing data, and a site visit. Several sources of available data were used to identify biological resources within the Transmission Line, including published literature, field guides, and public data sets. Arizona Game and Fish Department (AZGFD), USFS, and U.S. Fish & Wildlife Service (USFWS) were contacted concerning the presence of sensitive species and habitats within the Transmission Line (Appendix A). To date, responses have been received from the AZGFD and USFS and information provided is present in the report. A written response from the USFWS has not been received at this time. A site visit was conducted on November 11 and 12, 2009 by Mr. David Tidhar of WEST Inc. to evaluate: 1) landcover, habitats, and current land use within the area; 2) the potential for sensitive plants and wildlife to occur; 3) the potential for use of the area by breeding and migratory birds, and; 4) to look for raptor nests. Numerous photographs were taken of the Transmission Line and Evaluation Area (Appendix B).

In 2007 and 2008 WEST conducted pre-construction baseline wildlife surveys within Study Area A of the GCWRA, located immediately to the east of the Transmission Line (Figure 1.2:Young et al. 2008). The primary objective of those surveys was to generate data on seasonal and annual use by birds and bats that would be useful in evaluating potential impacts from the proposed wind-energy facility; however, the surveys also provide information on wildlife species potentially impacted by the proposed transmission line. Results of these surveys are referenced throughout this report. In addition, WEST is currently preparing a Site Characterization Report

[1] In general, when evaluating prospective wind-energy sites, a 2-mile buffer of project facilities is considered. However, due to differences in potential impacts between a transmission line and wind turbines, a one-mile buffer of the Transmission Line was deemed appropriate in this situation.

for the GCWRA (Tidhar and Chatfield 2010). The objective of the Site Characterization Report is to provide additional information on biological resources for the draft EIS which may not have been directly addressed during pre-construction wildlife surveys completed at Study Area A in 2007 and 2008; notably a determination of potential state and federal sensitive species and/or habitat within the GCWRA.

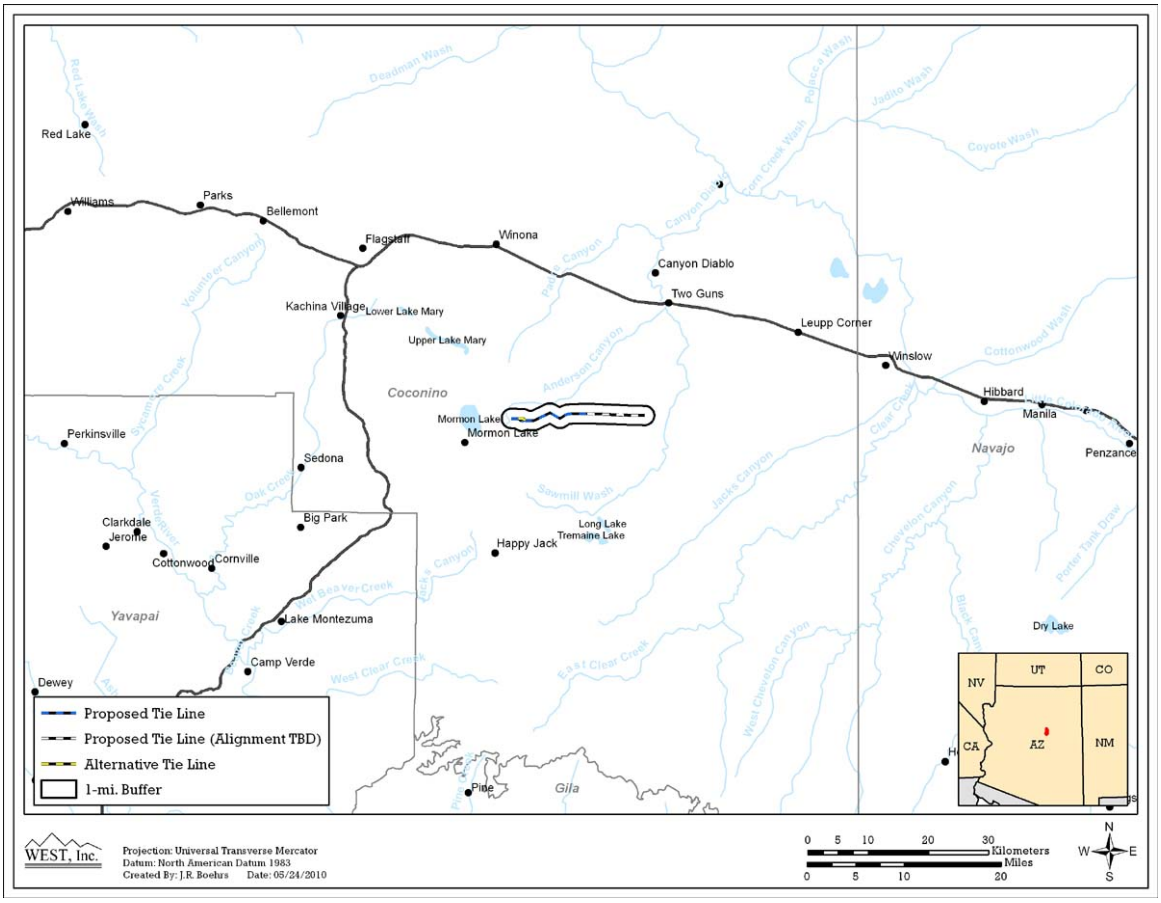

Figure 1.1 Location of the proposed and alternate transmission line right of way for the Grapevine Canyon Wind Resource Area.

1.1 Regional Environmental Setting

The proposed Transmission Line is located in south-central Coconino County in central Arizona. The Transmission Line lies in the transition zone between the Arizona/New Mexico Plateau Ecoregion which covers much northern Arizona and northwestern New Mexico, and the higher elevation Arizona/New Mexico Mountain Ecoregion immediately to the west (USEPA 2004). The vegetation of the Arizona/New Mexico Plateau Ecoregion is predominantly Great Basin shrublands and grasslands; however, higher elevations within the region may support pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus spp*.) woodlands. Improper grazing management has caused widespread habitat degradation throughout much of this region.

Some vegetation communities within the Transmission Line are more characteristic of the Arizona/New Mexico Mountain Ecoregion which lies immediately to the west of the

Transmission Line. Chaparral is common on the lower elevation slopes of this Ecoregion, but is not present within the proposed Transimission Line or Evaluation Area, with Pinyon-juniper and oak (*Quercus* spp.) woodlands found on lower and mid elevations, and open to dense ponderosa pine (*Pinus ponderosa*) forests occur at higher elevations. Forests of spruce (*Picea spp*.), fir (*Abies spp.*) and Douglas fir (*Pseudotsuga menziensii*) are found in only a few high-elevation parts of the region, and are not present within the proposed Transmission Line or Evaluation Area.

The Transmission Line is located within the east-central portion of the Coconino National Forest. Topography within the Project and Evaluation Areas is characterized as flat to gently sloping with the exception of a few small ridges and canyons. The eastern portion of the Transmission Line has greater topographic relief and is characterized by a low ridge running north to south. Two small canyons, Anderson Canyon and Yaeger Canyon, are present along the northern boundary of the Evaluation Area and the eastern Transmission Line, respectively. The western and central portion of the Transmission Line are located atop Anderson Mesa, which begins about nine miles southeast of Flagstaff, and continuous as a gently sloping tableland for approximately 25 miles to the southeast. Elevations within the Transmission Line range from approximately 1,930 –2,200 meters (m; 6,330 – 7,480 feet [ft]) above sea level, and elevations within the Evaluation Area range from approximately 1,900 – 2,280 m (6,230 – 7,480 ft; Figures 1.2 and 1.3). The proposed GCWRA, comprised of private and State Trust lands, lies immediately to the east of the Transmission Line and the Raymond Wildlife Area, comprised of State Trust and Game and Fish Commission Lands, lies approximately two miles northeast of the Transmission Line.

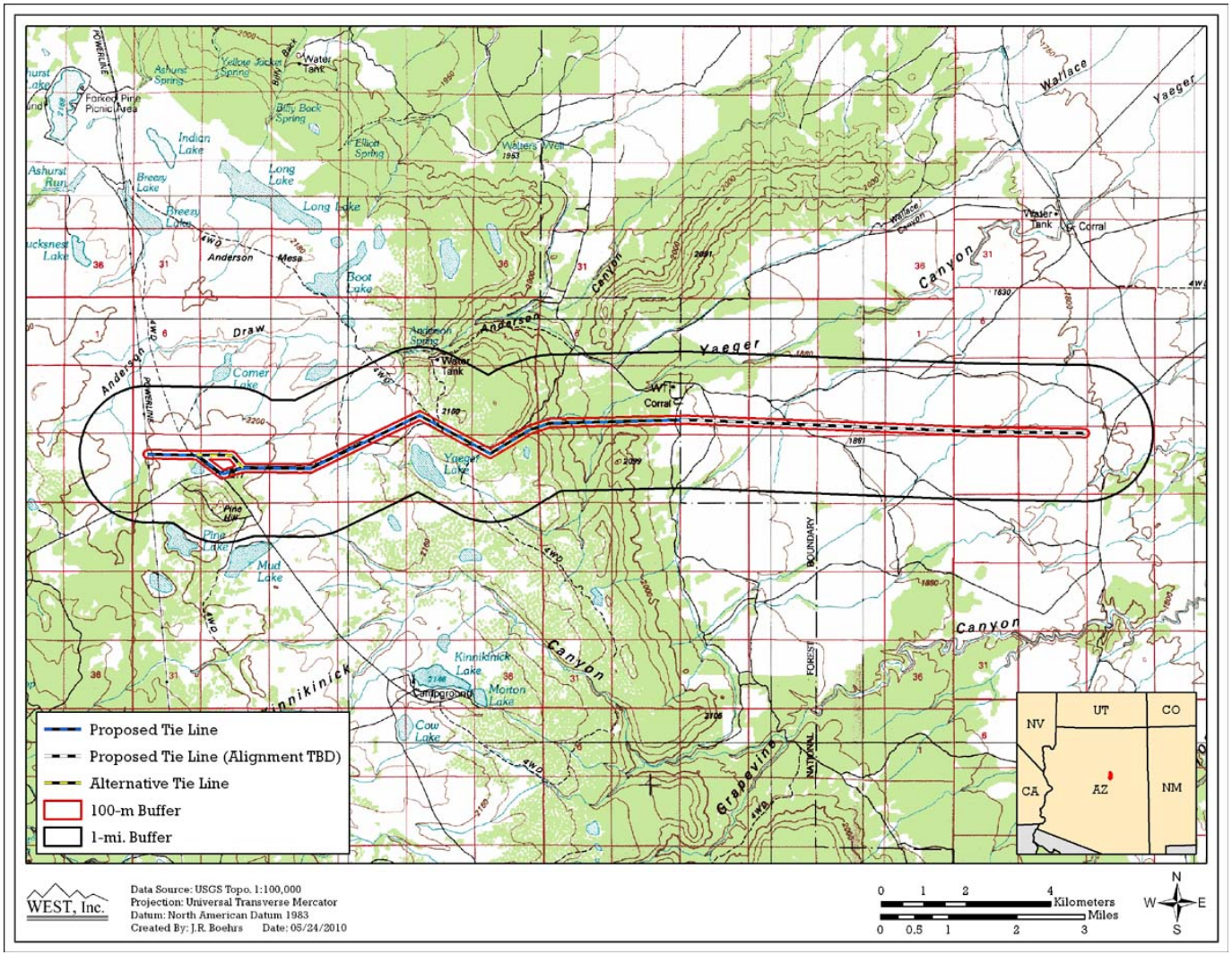

Figure 1.2 Topographic map of the Transmission Line and Evaluation Area.

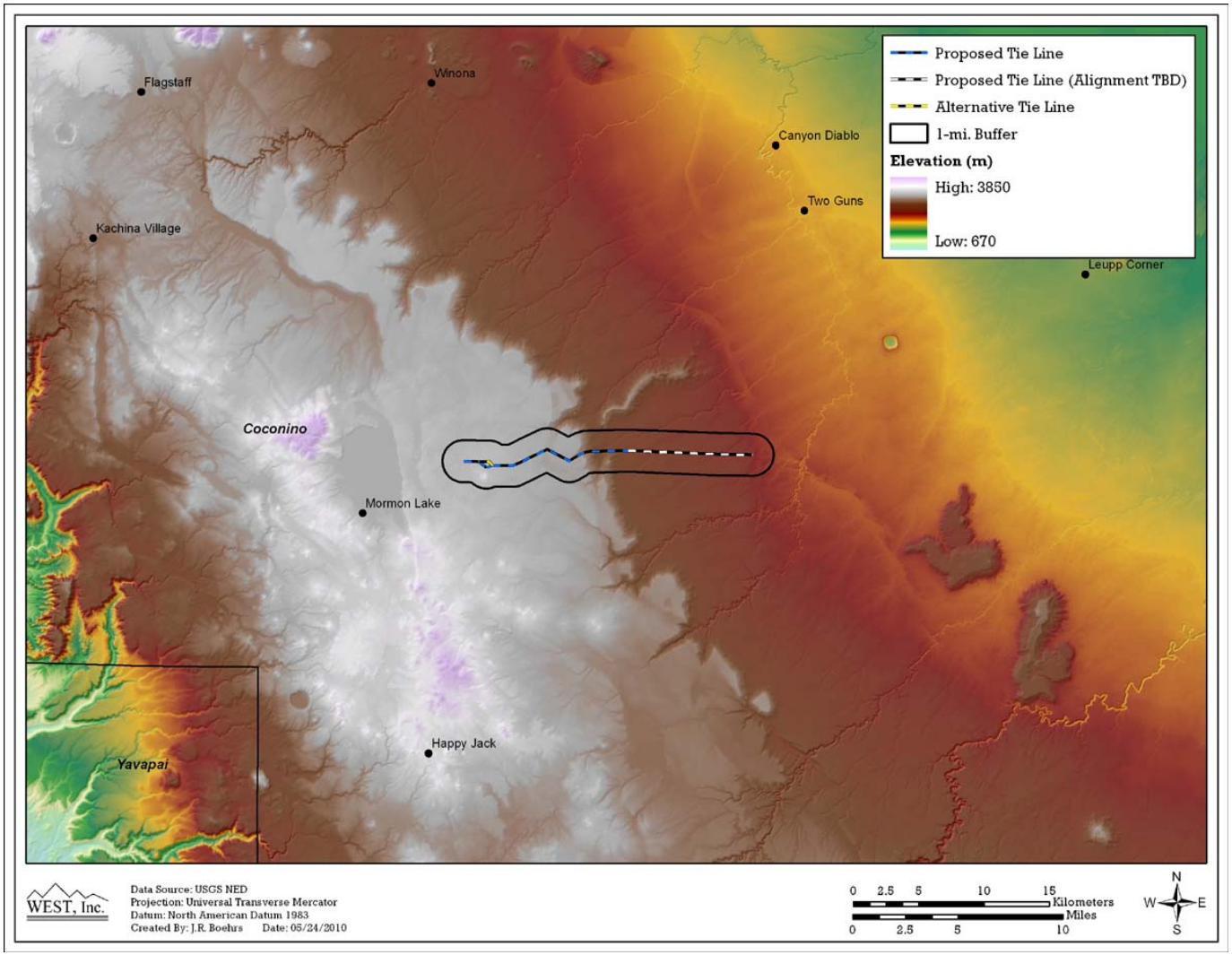

Figure 1.3 Digital elevation model of the Transmission Line and Evaluation Area.

2.0 LAND COVER

Land cover was analyzed using US Geological Survey (USGS) National Land Cover Database (NLCD) maps (2001). The Transmission Line encompasses approximately 678 acres in southern Coconino County. The dominant cover type within the Transmission Line is grassland which comprises 428.21 acres, or 63.2% of the Transmission Line, followed by pinyon-juniper woodland which comprises another 233.41 acres, or 34.4% of Transmission Line. The remaining 2.4% (16.07 acres) of the Transmission Line is comprised of very small amounts of ponderosa pine forest. Plains grassland which covers the majority of the Transmission Line consists of a grass-forb association dominated by western wheatgrass (*Agropyron smithii*). Pinyon-juniper woodlands are composed of Utah juniper (*Juniperus osteosperma*) intermixed with varying amounts of pinyon pine (*Pinus edulis*). The proposed transmission line transverses only a very small amount of ponderosa pine (*Pinus ponderosa*) habitat, limited to two small areas in the western portion of the proposed transmission corridor. The areas of pine forest that would be impacted by the proposed transmission line are located along the very edge of larger tracts of mature to intermediate-aged pure ponderosa pine forest to the south of the Transmission Line. Habitat types found along the alternative transmission line are generally similar to those of the proposed transmission line with the exception of an approximately one-mile long stretch of the route. This portion of the proposed route cuts through ponderosa pine forests, while the alternative route transverses the grasslands to the north (Figure 2.1).

The Evaluation Area, which includes a one-mile buffer surrounding the Transmission Line, encompasses approximately 12,669 acres, and has a composition that is generally similar to that of the Transmission Line (Table 2.1; Figures 2.1 and 2.2). The Evaluation Area has a slightly lower percentage of grassland (52.0%) than the Transmission Line, but a higher percentage of ponderosa pine forest (9.1%). The Evaluation Area also contains 103.29 acres (0.8%) of wetland which are not present within the Transmission Line. Forests within the Evaluation Area are restricted to the southwestern corner and consist mainly of pure stands of intermediate-aged to mature ponderosa pine. Additionally, canyon bottoms within the Evaluation Area contain oak (*Quercus* spp.) and cottonwood (*Populus fremontii*) trees, as well as riparian shrub species, not present within the Transmission Line.

Table 2.1. Land use/habitat types present within the Transmission Line and Evaluation Area (US Geological Survey (USGS) National Land Cover Database 2001).

	Transmission Line		Evaluation Area	
Cover Type	**Acreage**	**% Composition**	**Acreage**	**% Composition**
Grassland	428.21	63.2	6486.54	51.2
Pinyon/Juniper Woodland	233.41	34.4	4929.00	38.9
Ponderosa Pine	16.07	2.4	1150.63	9.1
Wetlands	0	0	103.29	0.8
Total	**677.68**	**100**	**12,669.46**	**100**

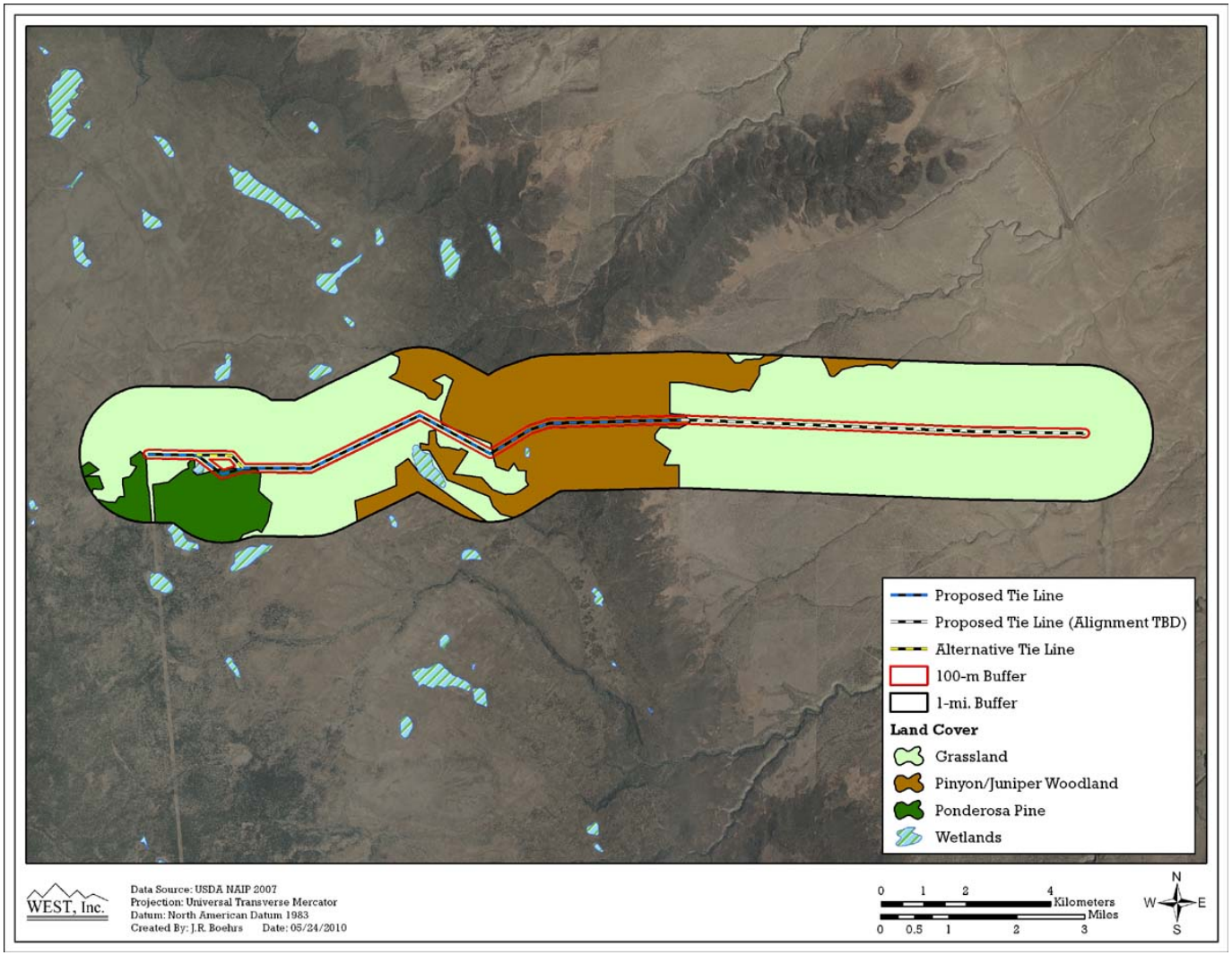

Figure 2.1 Land cover types within the Transmission Line and Evaluation Area.

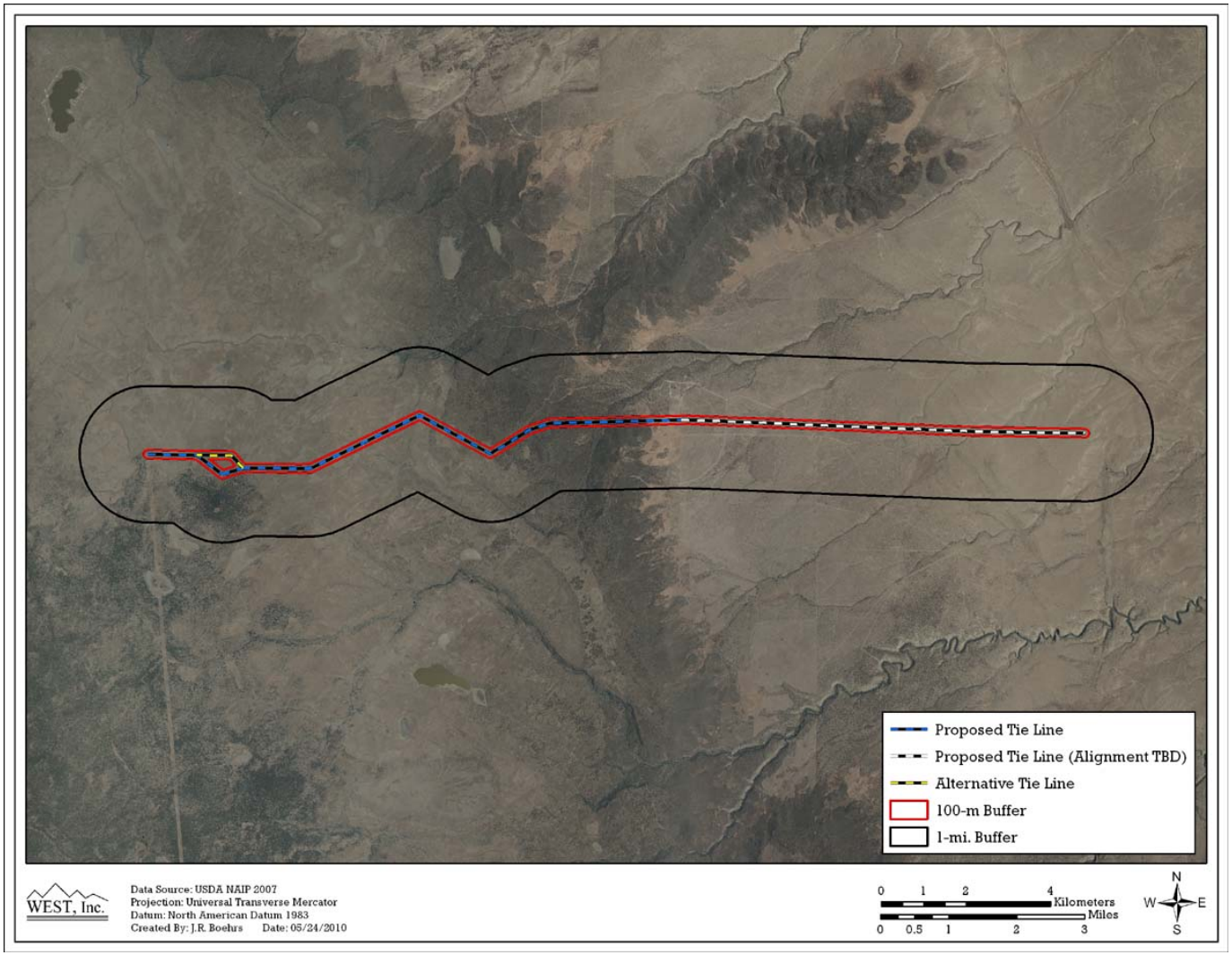

Figure 2.2 Aerial photograph of the Transmission Line and Evaluation Area.

2.1 Wetlands and Riparian Areas

Broad-scale information concerning wetlands is based on wetland delineations completed by the USFS (Table 2.1; Figure 2.1), data from the USFWS National Wetlands Inventory (USFWS 2004; Figure 2.3), aerial photography (Figure 2.2), and the site visit. Based on USFS wetland delineations and USFWS National Wetland Inventory data, there is no wetland habitat within the Transmission Line. Based on wetland delineations completed by the USFS, the Evaluation Area contains 103.29 acres of wetland habitat, or 0.8% of the total Evaluation Area (Table 2.1; Figure 2.1). According to USFWS National Wetland Inventory data, 163.77 acres or 1.2% of the total Evaluation Area is classified as wetland habitat (USFWS 2004). Of this, 140.41 acres are classified as lake habitat and 23.36 acres are classified as pond habitat.

The Transmission Line falls within the east-central portion of the Canyon Diablo Watershed. Water drains the Transmission Line in a general west to east direction. The Anderson Mesa, on which the majority of the Transmission Line and Evaluation Area lie, contains a network of small seasonal wetlands which contain water following periods of monsoon rainfall or winter snowfall, and provide habitat for a diversity of waterfowl and other wildlife and plant species. Seasonal wetlands are generally dominated by common spikerush (*Eleocharis macrostachya*) and wheatgrass (*Pascopyrum smithii*); however, grazing ungulates (cattle and elk) have severely degraded the herbaceous vegetation at the periphery of some of the wetlands (Appendix B). While none of these seasonal wetlands fall within the Transmission Line, several small lakes are present within the Evaluation Area including Pine Lake and Yaeger Lake. A number of additional lakes are located just outside of the Evaluation Area, the largest of which are Mud Lake and Corner Lake. A network of small intermittent creeks drains these wetlands, generally to the east and northeast. Larger waterways include Anderson Draw/Anderson Canyon along the northern boundary of the Evaluation Area and Yeager Canyon which crosses the eastern end of the Transmission Line (Figure 2.3).

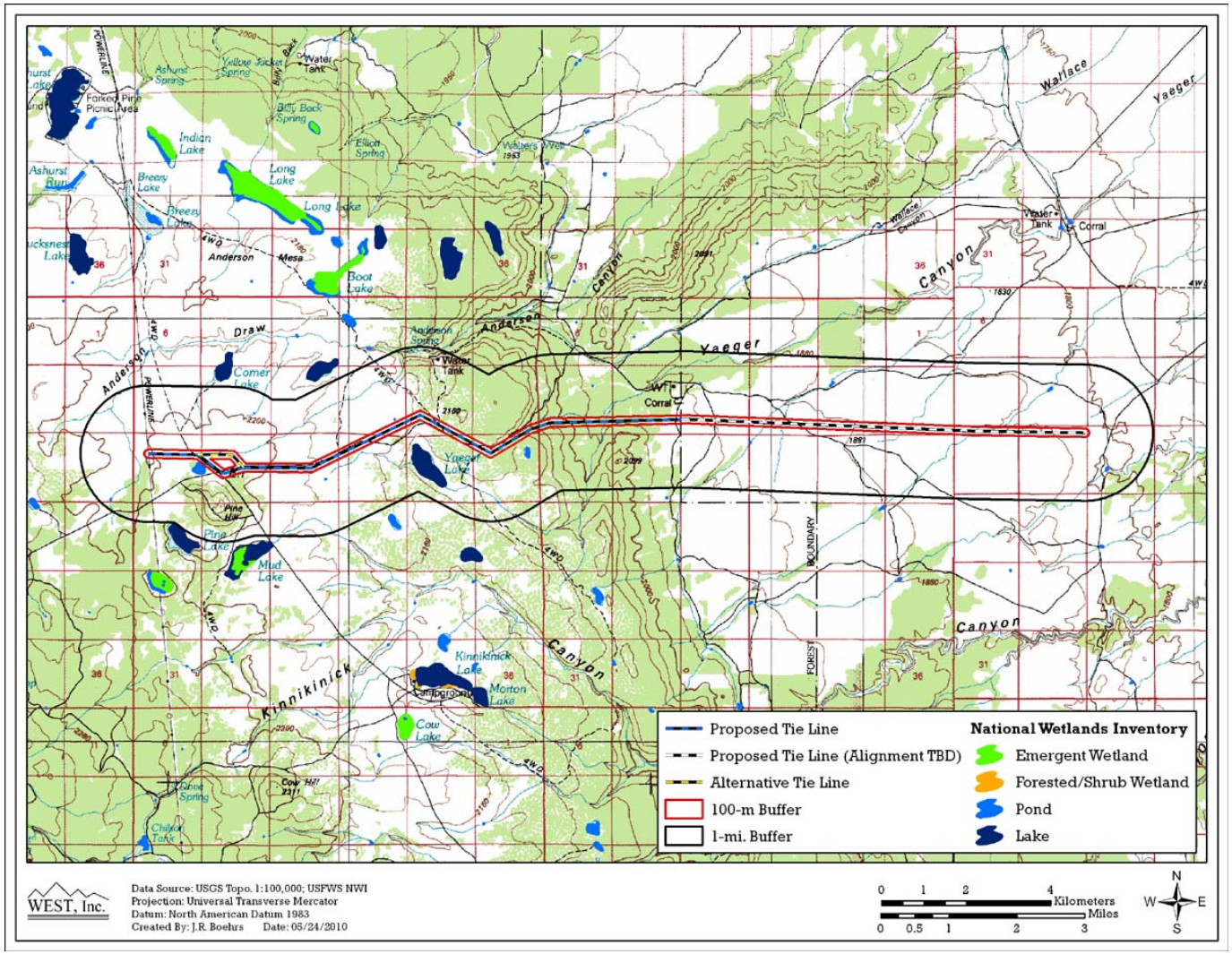

Figure 2.3 National Wetlands Inventory map of Transmission Line and Evaluation Area.

3.0 ASSESSMENT OF BIOLOGICAL RESOURCES

Species habitat and distribution information was reviewed and species were ranked for potential of occurrence qualitatively through a classification ranging from no potential for occurrence ("none"), to highest probability for occurrence ("high") (Table 3.1). Each classification was assigned a numerical score from 0-4. Wildlife classification distinctions were made when appropriate for breeding populations/seasons and other seasons.

Table 3.1 Rank classifications used for determining probability of occurrence.

Classification	Definition
None	No potential for occurrence. Known range and distribution do not overlap study area. Potential habitat completely absent from study area. No species accounts for study area or surrounding area exist[2].
Extremely Low	Extremely low probability of occurrence. Known range and distribution may not include study area. Very limited potential habitat is available within study area. No species accounts for study area or surrounding area exist[2].
Low	Low probability of occurrence. Known range and distribution include study area. Potential habitat available patchily or in isolated areas within study area. No species accounts for study area or surrounding area exist[2].
Moderate	Moderate probability of occurrence. Range and distribution include study area. Habitat present within study area. Species accounts for study area or surrounding area may exist[2].
High	Highest probability of occurrence. Range and distribution overlap study area. Habitat abundant within study area. Species accounts exist for study area[2].

2= secondary qualifier for rank. Species accounts are not available equally across geographic regions and are influenced by survey effort, land ownership and access, financing of natural heritage programs and other factors. This information is useful for confirming that a given species was present in the study area, but may not be sufficient information to confirm absence.

3.1 Special-Status Plant Species

3.1.1 Threatened, Endangered, and Sensitive Plant Species

The USFS (2009) has compiled a list of 14 threatened, endangered, and sensitive plant species for the Mormon Lake and Peaks Ranger Districts in the Coconino National Forest (Table 3.2). Due to a very limited distribution, and/or specific habitat requirements, thirteen of the species

have no potential to occur in the Transmission Line (Arizona bugbane [*Cimicifuga arizonica*], Arizona leatherflower [*Clematis hirsutissima var. hirsutissima*], Arizona sneezeweed [*Helenium arizonicum*], Arizona sunflower [*Helianthus arizonensis*], Bebb's willow [*Salix bebbiana*], Blumer's dock [*Rumex orthoneurus*], crenulate moonwort [*Botrychium crenulatum*], disturbed rabbitbrush [*Chrysothamnus molestus*], Flagstaff pennyroyal [*Hedeoma diffusa*]), rock fleabane [*Erigeron saxatilis*], San Francisco Peaks groundsel [*Senecio franciscanus*]), Rusby's milk-vetch [*Astragalus rusbyi*], and Sunset Crater beardtongue [*Penstemon clutei*]). One species has extremely low potential for occurrence (Flagstaff beardtongue [*Penstemon nudiflorus*]).

Within the Evaluation Area there was increased potential of occurrence for a few species due to the presence, or increase in the amount of, suitable habitat. These species included Arizona bugbane (Extremely Low), Arizona sneezeweed (Moderate), Arizona sunflower (Extremely Low), Bebb's Willow (Moderate). All other species concurred with the Transmission Line probability of occurrence classification. Correspondence received from the USFS indicates that suitable habitat is present within Transmission Line only for Flagstaff beardtongue (USFS 2009). Based on information received from the AZGFD (2009d), no threatened, endangered or sensitive plant species are known to occur within five miles of the proposed GCWRA. The switchyard does not contain suitable habitat for Flagstaff beardtongue.

Table 3.2 Threatened, endangered and sensitive plant species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
Arizona bugbane *Cimicifuga arizonica*	FSC/HS/SEN	Along moist, shady canyon bottoms or lower canyon slopes; occurs in mixed conifer and high elevation riparian deciduous forests.	**None.** Habitat very limited and no mixed forests present within Transmission Line	**Extremely Low.** Seasonal ponds/wetlands and Riparian habitat present within Evaluation Area.
Arizona leatherflower *Clematis hirsutissima var. hirsutissima*	---/HS/SEN	Limestone outcroppings in ponderosa pine forest or in moist mountain meadows, prairies, and open woods and thickets within limestone soils of ponderosa pine woodland of the Petrane Montane Conifer Forest between 2100-2438m (7,000 to 8,500 ft)or more.	**None.** Habitat not suitable within Transmission Line; mesa is created by basalt outcroppings not limestone.Known distribution does not overlap Transmission Line	**None.** Habitat not suitable within Evaluation Area; mesa is created by basalt outcroppings not limestone. Known distribution does not overlap Evaluation Area.
Arizona sneezeweed *Helenium arizonicum*	---/---/SEN	Found in regions of ponderosa pine forests, especially around wet places such as bogs, ponds, lakes, and roadside ditches	**None.** No ponds/wetlands within Transmission Line.	**Low.** Several seasonal ponds/wetlands occur within Evaluation Area and species range overlap Evaluation Area.
Arizona sunflower *Helianthus arizonensis*	---/---/SEN	Grows in dry, frequently sandy soil at 1219-2100m (4,000–7,000 ft); appears to grow in areas with regular grazing.	**None.** No sandy soil on the mesa where project is proposed; collected from east side of Anderson Mesa (USFS 2007).	**Extremely Low.** No sandy soil on the mesa where project is proposed; collected from east side of Anderson Mesa (USFS 2007).

Table 3.2 Threatened, endangered and sensitive plant species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
Bebb's willow *Salix bebbiana*	---/---/SEN	Dominate or co-dominate shrub in early seral willow communities along streambanks, overflow areas, and seeps.	**None.** No riparian habitat within Transmission Line.	**Moderate.** Seasonal ponds/wetlands and Riparian habitat present within Evaluation Area with possible range overlapping boundaries.
Blumer's dock *Rumex orthoneurus*	FSC/HS/SEN	Mid- to high-elevation wetlands; moist, organic soil; adjacent to perennial springs or streams in canyons or meadow situations.	**None.** No suitable habitat present and range does not appear to overlap with Transmission Line.	**None.** Several seasonal ponds/wetlands occur within Evaluation Area; however range does not appear to overlap.
crenulate moonwort *Botrychium crenulatum*	FSC/---/SEN	In Arizona, collected on San Francisco Peaks and White Mountains; found in bare, gravelly soils among spruce and fallen logs at high elevations.	**None.** No suitable habitat present and range does not appear to overlap with Transmission Line.	**None.** Several seasonal ponds/wetlands occur within Evaluation Area, although overall habitat appears unsuitable and range does not overlap.
disturbed rabbitbrush *Chrysothamnus molestus*	FSC/---/SEN	Found in open pinyon-juniper grasslands on low-moderate slopes and flats; found exclusively on calcareous / limestone soils.	**None.** Mesa is basalt although associated vegetation does exist. Range does not overlap with Transmission Line.	**None.** Known range is to north of Evaluation Area, but suitable habitat may be present.
Flagstaff beardtongue *Penstemon nudiflorus*	---/---/SEN	Occurs in dry ponderosa pine forests in mountainous regions south of the Grand Canyon, restricted to small, scattered limestone and sandstone outcrops.	**Extremely Low.** Mesa is basalt although associated vegetation does exist. No known locations within T-line though some nearby.	**Extremely Low.** Mesa is basalt although associated vegetation does exist. No known locations within T-line though some nearby.

Table 3.2 Threatened, endangered and sensitive plant species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
Flagstaff pennyroyal *Hedeoma diffusa*	---/SR/SEN	Open, ponderosa pine habitats; prefers weathered limestone solution pockets filled with 4-6 inches of soil, but also grows in vertical cracks and around edges of limestone/sandstone boulders.	**None.** Mesa is basalt although associated vegetation does exist.	**None.** Mesa is basalt although associated vegetation does exist. Range may overlap with Evaluation Area.
rock fleabane *Erigeron saxatilis*	---/---/SEN	Shaded canyon walls, moist north-facing slopes, and steep rock outcrops and boulders in the stream beds of shady canyons. 1,340-2,130m.	**None.** Habitat not suitable within Transmission Line and known range does not appear to overlap Project boundaries	**None.** Habitat not suitable within Transmission Line and known range does not appear to overlap Evaluation Area boundaries
Rusby's milk-vetch *Astragalus rusbyi*	---/---/SEN	Openings or meadows in ponderosa pine forests or at edge of thicket or aspen groves; grows on dry basaltic soils.	**None.** Species has limited range on the lower slopes of the San Francisco Peaks and Oak Creek Canyon. Extremely little suitable habitat (ponderosa pine forests).	**None.** Species has limited range on the lower slopes of the San Francisco Peaks and Oak Creek Canyon. Suitable habitat (ponderosa pine forests) and basalt soils exist.
San Francisco Peaks groundsel *Senecio franciscanus*	FT/HS/SEN	In cracks and crevices of talus slopes in alpine fellfields on San Francisco Peaks; primary succession species.	**None.** Known only from San Francisco Peaks north of Flagstaff; alpine species – no potential to occur in Transmission Line.	**None.** Known only from San Francisco Peaks north of Flagstaff; alpine species. No potential to occur in Evaluation Area.

Table 3.2 Threatened, endangered and sensitive plant species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
sunset crater beardtongue *Penstemon clutei*	FSC/SR/SEN	Cinder fields devoid of soil covering and where other herbaceous vegetation is sparse; generally above 6,100 ft.	**None.** Known only from volcanic fields north of Flagstaff; alpine species – no potential to occur in Transmission Line.	**None.** Known only from San Francisco Peaks north of Flagstaff; alpine species. No potential to occur in Evaluation Area.

[1]FT = Federal Threatened; FSC = Federal Species of Concern; HS = Highly Safeguarded (no collection allowed); SR = Salvage Restricted (collection only by permit); SEN = Forest Service sensitive species

[2]Habitat and species distribution information from AZGFD (2006); USFWS 2009

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Arizona Bugbane

Arizona bugbane is an herbaceous perennial that reaches 3-6 feet in height. This species produces rather showy white flowers (summer (Jul-Aug), which grow on long stalks and bloom in slender clusters of small, petal-less flowers. The seeds resemble furry little bugs. This is a rare plant that has very narrow habitat restrictions. It exists in only four small population areas in Arizona, but is not federally protected. It is often found in the transition zone between coniferous forest and riparian habitat at elevations of 5300 to 8300 feet (1829 to 2529 meters). This species is often found near perennial or intermittent streams, and appears to prefer locations with high humidity and moist, rich, fertile soils. The species often occurs in mixed coniferous forrest with deciduous understory. It does not spread into the forest although it appears to be adapted to deep shade. Arizona bugbane is only found in central Arizona, (Coconino and Gila counties). All known populations occur within three National Forests; the Coconino, Kaibab, and Tonto (CPC 2009). All known locations in the Coconino Forest are deep shady canyons. There is no likelihood of occurrence within the Transmission Line due to the limited riparian habitat available and lack of mixed-forest composition. However, it may be found within the Evaluation Area since there are seasonal ponds and wetlands present with Ponderosa pine.

Arizona Leatherflower

Arizona leatherflower is an herbaceous perennial understory species with purple nodding bell-shaped flowers. The showy purple flowers are displayed individually at the end of each stem and become heads of golden feathery seeds in late summer. This flower is found on limestone outcroppings in ponderosa pine forest or in moist mountain meadows, prairies, and open woods and thickets within limestone soils of Pinus ponderosa woodland of the Petrane Montane Conifer Forest between 7,000 to 8,500 or more feet. Its current range is from the Flagstaff vicinity along the Rio de Flag and Lower Lake Mary, upper Volunteer Canyon, San Francisco Peaks, and the Tusayan area, Coconino County (CPC 2009). Based on habitat requirements and known distribution, there is no potential that Arizona leatherflower will occur within either the Project or Evaluation Areas.

Arizona Sneezeweed

Arizona sneezeweed is a biennial or annual herb, up to 4 ft (12.2 dm) tall with dark green narrow leaves and yellow flowers occur singly at the tips of the stems, up to 2 inches wide. They bloom from July (August) to September. They are found in regions of ponderosa pine forests, especially around wet places such as bogs, ponds, lakes, and roadside ditches (NatureServe 2003). Arizona sneezeweed requires moist soils, often in association with seasonally wet meadows within ponderosa pine forests. Other associated species include *Populus tremuloides* (quaking aspen) and *Picea* (spruce). They can occur between 6,000 - 8,000 ft. (1830-2440 m) in elevation with a semi-open exposure. This plant is endemic to north-central Arizona, mainly in Coconino County, but also found in Apache, Gila and Navajo counties (AZGFD (2006). There is no suitable habitat within the Transmission Line to support Arizona sneezeweed, therefore the probability of occurrence is none. There is suitable habitat within the Evaluation Area in the form of seasonal ponds and wetlands with low potential for occurrence within those areas.

Arizona Sunflower

Arizona sunflower is an herbaceous perennial with long creeping roots that function like rhizomes with yellow flowers that bloom through the summer into the fall (USFS 2007). It

inhabits open pine woodlands; 1200–2100m (4,000-7,000 ft) in Arizona requiring dry, frequently sandy soil to grow. It has a fairly broad range but appears to be very rare. It is perhaps being confused with the more common blueweed (*Helianthus ciliaris*) that is taller and has reddish rather than yellow disk flowers. This plant appears to grow in habitats that are regularly grazed. There is a known collection from the east side of Anderson Mesa (NMRPTC 1999). The Transmission Line does not have evidence of sandy soil, therefore the potential to support the Arizona Sunflower is none. There does not appear to be sandy soil within the Evaluation Area either, however, with confirmed reports of the sunflower along the eastern side of the mesa, it may be possible to have an isolated population. Therefore, the potential for this species to occur within the Evaluation is considered extremely low.

Bebb's Willow

Bebb's willow is a large native shrub ten feet tall or a small bushy tree fifteen to twenty-five feet. The bark is thin, reddish, olive-green, or gray tinged with red and slightly divided by shallow fissures and produces long beaked and sparsely hairy capsule fruit. Bebb's willow is a fast growing but short-lived species that occurs most commonly under the shade of trees. It is adapted to a wide variety of soil textures and tolerates moderate alkaline soils but not extremely alkaline conditions. It prefers moist sites but is drought tolerant. It is frequently found in swamps, lakes, borders of streams, open woods and forests (EOL 2009). In the western U.S., Bebb's willow occurs along stream channels, on the edges of drainages, along seeps, and in perched sites that appear to be receiving little water. It's populations in the San Francisco Peaks and the White Mountains in Arizona represent the southernmost extent of its distribution in North America. Bebb's willow occurs in high elevation riparian habitats in New Mexico and Arizona. It occurs with alder (*Alnus tenuifolia*) and conifers, although it comprises up to 90% of the total tree density at some sites including Fern Mt., AZ, and Fenton Lake, NM. Willows are often replaced by alder and spruce at higher elevations and successionally in undisturbed habitats. Disturbances such as major flooding or fire stand to open up colonizable habitat for Bebb's willow, reducing competition for resources such as sunlight, space, water and nutrients. Bebb's willow does establish readily in disturbed sites (e.g. roadway margins). Bebb's willow populations face several threats; a lack of replacement by younger age classes and accelerated successional replacement. Prolonged suppression of fire in Bebb's willow habitat may pose a threat to the persistence of this species (NatureServe 2009). There is no potential for Bebb's willow to occur within the Transmission Line due to absence of suitable habitat. There is moderate potential for the species to occur in the Evaluation Area at wetland features.

Blumer's Dock

Blumer's dock is a robust long-lived perennial herb, up to 2 m tall with huge semi-succulent basal leaves and numerous small flowers in a branched cluster at the top of the flowering stem. It blooms from July to mid-August (NatureServe 2009). They prefer Mid- to high-elevation wetlands (4,480 - 9,660 ft. (1,366 - 2,946 m) with moist, organic, loamy soils adjacent to perennial springs or streams in canyons or meadow situations (CPC 2009). They are associated with Madrean Subalpine Grassland meadows (within the Madrean Montane Conifer or Mixed Conifer forests) or Interior Southwestern Riparian Deciduous Forest (AZGFD 2002). Several populations are known in Arizona, limited primarily to the sites in the Pinaleno, Chiricahua, Huachuca, and Sierra Ancha mountains (CPC 2009). However, this species is not well defined, and some populations now considered Rumex orthoneurus may actually be the more widespread

R. occidentalis. If so, then R. orthoneurus is even more restricted in distribution than currently thought (NatureServe 2009). Populations "in dispute" include those in the White Mountains (Apache County) and Pinaleno Mountains (Graham County) in Arizona (AZGFD 2002). Probability of occurrence within the Transmission Line is classified as none because no suitable habitat is present and the range of this species does not encompass the region. Within the Evaluation Area, there is suitable habitat present in the form of seasonal ponds and wetlands; however the species range does not overlap; therefore, there is no probability of occurrence.

Crenulate Moonwort

Crenulate moonwort is a small, perennial fern with a single aboveground frond. The frond is usually 10 cm or less tall, yellow-green, and divided into two segments which share a common stalk. The longer segment is branched (often like a tiny Christmas tree). It inhabits wet, marshy, and springy areas, including marshy meadows, edges of marshes, saturated soils of seeps, bottoms and stabilized margins of small streams, and (occasionally) wet roadside swales, ditches, and drainageways. Sites tend to be partly to heavily shaded and usually have a dense, diverse cover of forbs and graminoids. Dominant plant species may include spruce, alders, and dogwood; this species has also been reported from western red cedar habitats. Often found on soils influenced by reprecipitated calcium. It occurs at mid to high elevations (montane zone), 1200 - 2500 m (NatureServe 2009). In Arizona, it has been recorded to occur in the Inner Basin, San Francisco Peaks, Coconino County, and Mount Baldy, White Mountains, Apache County. The FNA (1993+) range map shows it in the extreme northwest part of the state. In the San Francisco Peaks (ASU-90357, in SEINet), it was usually observed in patches of bare gravelly soil in rocky terrain, among scattered spruce and fallen logs (AZGFD (2006). The USFS documents this species as only occurring on the San Francisco Peaks and indicates that it is rare and sporadic throughout its broader range in the western US and Canada (USFS 2007). There is no probability of occurrence within the Transmission Line or the Evaluation Area. There is no suitable habitat is present and it appears that the range of this species does not overlap the Evaluation Area.

Disturbed Rabbitbrush

Disturbed rabbitbrush is a perennial prostrate shrub or sub-shrub that produces profuse yellow rayless flowers in the fall and can be distinguished from common rabbitbrush by its hairy leaves which are less than 2 mm wide. This species is typically found in open pinyon-juniper grasslands where periodic natural fires naturally occur at an interval of every 15 to 30 years (CPC 2009). Habitat is lost when woodlands become denser from absence of fire (USFS 2007). It has only been documented on the Coconino Plateau in northern Arizona, patchily distributed on limestone-derived soils in Coconino County (CPC 2009). The Transmission Line and Evaluation Area do not have evidence of limestone soils; instead the mesa is built upon a basalt soil foundation. The probability of occurrence for disturbed rabbit bush within both areas of consideration is considered none due to the absence of limestone-derived soil.

Flagstaff Beardtongue

Flagstaff beardtongue is a perennial herb with blue-whitish leaves and stems which produces lavender flowers in summer. It occurs within dry ponderosa pine in mountainous regions south of the Grand Canyon, 1370-2130 m in elevation (NatureServe 2009). This species is endemic to Arizona, found only in Apache, Coconino, Gila, Navajo, and Yavapai counties (AZGFD 2003).

It is restricted to small, scattered limestone and sandstone outcrops of relatively undisturbed habitats. Associated vegetation includes ponderosa pine, gambel oak, blue grama, and alligator juniper (USFS 2007). Locations in the Coconino Forest include sites with similar forest characteristics to those found in portions of the Transmission Line and Evaluation Area: mixed oak and pinyon-juniper woodlands. The switchyard does not contain suitable habitat for the species. The Transmission Line and Evaluation Area do not have evidence of limestone or sandstone outcrops; instead the mesa is built upon a basalt soil foundation. The probability of occurrence for both areas of consideration is considered extremely low due to the absence of limestone-derived soil but the presence of mixed oak-pinyon juniper woodlands.

Flagstaff Pennyroyal

Flagstaff pennyroyal is an herbaceous perennial that forms dense, circular, prostrate mats, 15-23 cm (6-10 in.) in diameter, with numerous shoots branching prolifically at base. It flowers in late May. This plant prefers open spots with weathered limestone solution pockets filled with 4-6 inches of soil, but it can also grow in the shallow soil of the rock crevices and weathered pockets of exposed limestone and small outcrops; also found on sandstone outcrops and boulders. It does seem to be restricted to these small and scattered limestone and sandstone outcrops of relatively undisturbed habitat; openings within the ponderosa pine vegetation type, Pran Montane Conifer Forest. Associated species include: *Aquilegia desertorum* (desert columbine), *Bouteloua gracilis* (blue grama), *Festuca arizonica* (Arizona fescue), *Geranium caespitosum* (purple cluster crane's-bill), *Juniperus deppeana* (alligator juniper), *Pinus ponderosa* (ponderosa pine), and *Quercus gambelii* (gambel oak) (AZGFD 2003). This species has been recorded on the San Francisco Plateau of the Colorado Plateau Province; Flagstaff and southward in Coconino and Yavapai counties, including the rims of Oak Creek and Sycamore canyons (AZGFD 2003; USFS 2007). The Transmission Line and Evaluation Area do not have evidence of limestone or sandstone outcrops; instead the mesa is built upon a basalt soil foundation. The probability of occurrence for disturbed rabbit bush within both areas of consideration is considered none due to the absence of limestone-derived soil.

Rock Fleabane

Rock fleabane is an Herbaceous perennial with small stems and relatively large white ray flowers. It flowers between April - October, with a peak during May – July. All fleabane species are restricted to mountains within Arizona. The rock fleabane is the northernmost species found above the Mogollon Rim (AZGFD 2006). Its preferred habitat is shaded cliff-faces and boulders in streambeds of shady canyons above the Mogollon Rim, within Coconino and Yavapai counties, Arizona, elevation range of 1340-2130 m. Within Coconino County this species has been documented in Barbershop Canyon, East Clear Creek, Little Elden Mtn., Oak Creek Canyon, Tule Canyon, Walnut Canyon, and West Fork of Oak Creek Canyon. It is associated most with the Rocky Mountain Riparian Deciduous Forest communities. The potential for rock fleabane to occur in either the Transmission Line or Evaluation Area is none, due to the known range and habitat restrictions of this species.

Rusby's Milk-Vetch

Rusby's milk-vetch is a perennial herb, stems 1.5-4 cm tall, with white to lavender flowers which in bloom June-September. It inhabits meadows in yellow (ponderosa) pine forest, or edge of thickets and aspen groves, in dry or temporarily moist basaltic soils. Within Arizona, this species

has a very limited range on the lower slopes of the San Francisco Peaks and Oak Creek Canyon (USFS, 2007). It occurs within elevations ranging from 2130-2440 m (7,000-8,000 ft) down to 1650 m (5,400 ft) in Oak Creek Canyon (AZNPS 2008). Both the Transmission Line and the Evaluation Area contain suitable habitat (vegetation) and growing conditions (basaltic soils). However, the known range for this species is very limited and specific, which does not overlap the Evaluation Area. Evaluation Area, based on habitat availability. There is no probability for occurrence within the Transmission Line.

San Francisco Peaks Groundsel

San Francisco Peaks groundsel is a dwarf perennial alpine plant that grows low to the rocky ground to a height of only 3 to 10 cm (1.25-4 inches). Stems emerge from ruffled-edge leaves with purple undersides which hold clusters of 8 to 13 yellow ray flowers (CPC 2009). They Bloom in August and early September (NatureServe 2009). They require gravelly, sandy loams of talus in alpine fellfield; 11,000-12,400 ft (3350-3780 m) elevation (AZGFD 2003). The San Francisco Peaks groundsel is found only on the talus slopes in the alpine zone on San Francisco Peaks. San Francisco Peaks is a strato-volcano that rises abruptly from 2130 meters (7000 feet) to an elevation of 3852 meters (12,633 feet). This volcano is located north of Flagstaff, Arizona, and is the highest point in the southwestern United States. It is the home of the only true alpine zone in Arizona (CPC 2009). There is no potential for this species to occur within either the Transmission Line or Evaluation Area based on known distribution and habitat requirements.

Sunset Crater Beardtongue

Sunset crater beardtongue is an herbaceous plant that has one to several stems that grow up to 32 inches tall with bright pink tubular flowers that appear from late April through early August. They are only known from the Cinder Hills area northeast of Flagstaff, in the vicinity of the Sunset Crater and the Indian Flat area of Coconino County (USFS 2007; CPC 2009). They are found specifically within the volcanic fields associated with the Sunset Crater eruption at 6500-8500 ft elevation (CPC 2009). There are several discontinuous populations surrounding Sunset Crater. It grows in cinder fields with little soil development or other vegetation in ponderosa pine forest (USFS 2007). For successful growth, volcanic ash-cinders need to be approximately 5-10 cm thick with a layer of silty soil of similar thickness below. There is no potential for this species to occur within either the Transmission Line or Evaluation Area based on known distribution and habitat requirements.

3.1.2 Vegetation Summary and Conclusions

The primary vegetation community comprising the Transmission Line is grassland and pinyon-juniper woodland. There are no wetlands or waterbodies within the Transmission Line, based on USFS wetland delineations and USFWS National Wetland Inventory data. 1.2% of the larger Evaluation Area is classified as wetland habitat (primarily seasonal ponds and lakes). Based on information provided from the USFS, 14 federal or state-listed plant species, or USFS sensitive plant species are listed as occurring within the Mormon Lakes and Peaks Ranger Districts. The majority of these plants have limited distributions and specific habitat requirements and are not expected to occur in the Transmission Line. The Transmission Line does contain areas of native woodland containing oak and pinyon-juniper which could potentially support Flagstaff beardtongue; however, soils are basalt and therefore the potential for occurrence is considered

extremely low. The Evaluation Area has greater potential than the Transmission Line to support plant diversity, especially plants associated with wetland habitats and pine forests such as such as Arizona sneezeweed, Arizona sunflower, Bebb's willow and Flagstaff beardtongue. Canyon bottoms containing riparian areas within the Evaluation Area may also support wetland and mesic plant species not found within the Transmission Line, though the probability for occurrence for these species is generally very low.

3.2 Wildlife

3.2.1 Special-Status Wildlife Species

3.2.1.1 Endangered, Threatened, and Sensitive Species

Based on information provided by the USFS, 22 special-status wildlife species occur on the Mormon Lakes and Peaks Ranger Districts (Table 3.3). This list includes federal threatened, endangered, and candidate wildlife species, Arizona state wildlife of special concern, and USFS sensitive wildlife species. The species and their potential to occur (Table 3.3) is discussed below.

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence Transmission Line	Potential for Occurrence Evaluation Area
Birds				
American peregrine falcon *Falco peregrinus anatum*	FSC/WSC/SEN	Found where sufficient prey is present near tall cliffs; optimum habitat considered steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance.	**None (Nesting); Low (Presence)** In Arizona most nesting occurs in cliff areas of Mogollon Rim, Grand Canyon, and Colorado Plateau; not likely to nest in Transmission Line, but may occur as migrant.	**None (Nesting); Moderate (Presence).** Not likely to nest in Evaluation Area, they may use the wetlands areas for foraging and may occur as migrants.
bald eagle *Haliaeetus leucocephalus*	---/WSC/SEN	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; roost communally especially in winter	**None (Nesting); Moderate (Presence).** Historically nested on the Mogollon Rim including at Mormon Lake; not likely to nest in Transmission Line, but will likely occur as occasional winter visitor/transient.	**None (Nesting); Moderate (Presence).** Historically nested on the Mogollon Rim including at Mormon Lake; not likely to nest in Evaluation Area, but will likely occur as occasional winter visitor/transient.
Clark's grebe *Aechmophorus clarkia*	---/WSC/SEN	Marshes, lakes and bays; in migration and winter also sheltered seacoasts; less frequently along rivers. Nest among tall plants growing in water on edge of large areas of open water.	**None (Nesting), Extremely Low (Presence).** Suitable lake habitat not present within Transmission Line; some potential for species to occur during migration.	**Moderate (Nesting and Presence).** Suitable lake habitat present within Evaluation Area; may be utilized during breeding season, and during migration.

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
ferruginous hawk *Buteo regalis*	FSC/WSC/SEN	Inhabits open country, primarily prairies, plains, and badlands; nests in tall trees along streams or on steep slopes, cliff ledges, hillsides, or power line towers	**None (Nesting), Extremely Low (Presence).** Currently nests in northern and southeastern Arizona; not likely to nest in Transmission Line; may occur as migrant.	**None (Nesting), Extremely Low (Presence).** Currently nests in northern and southeastern Arizona; not likely to nest in Transmission Line; may occur as migrant.
Mexican spotted owl *Strix occidentalis lucida*	FT/WSC/SEN	Nest in canyons and dense mixed-conifer forests with multi-layered foliage structure.	**None (Nesting), Extremely Low (Presence).** Known to occur in forested areas to west of Transmission Line; habitat not suitable within Transmission Line;	**None (Nesting), Extremely Low (Presence).** Known to occur in forested areas to west of Evaluation Area; habitat overall not suitable.
northern goshawk *Accipiter gentilis*	FSC/WSC/SEN	Nest is variety of forest types including deciduous, conifer, and mixed forests; typically nest in large tracts of mature or old-growth forest.	**None (Nesting), Extremely Low (Presence).** Known to nest along Mogollon Rim; no potential to nest in pine forests in Transmission Line but may occur as rare transient, winter visitor, or migrant.	**Extremely Low (Nesting), Moderate (Presence).** Known to nest along Mogollon Rim; some potential to nest in pine forests in Evaluation Area but may also occur as occasional winter visitor or migrant.

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
western burrowing owl *Athene cunicularia hypugaea*	FSC/---/SEN	Open, well-drained grasslands, steppes, deserts, prairies, and agricultural lands; often associated with burrowing mammals.	**Extremely Low (Nesting and Presence)**. Open grassland present in the Transmission Line; little evidence of burrowing mammals.	**Extremely Low (Nesting and Presence)**. Open grassland present; little evidence of burrowing mammals.
Mammals				
Allen's lappet-browed bat *Idionycteris phyllotis*	FSC/---/SEN	Found most often in ponderosa pine, pinyon-juniper, and riparian forest areas; boulder piles, rocky outcrops, or lava flows at or near most collection sites; roost in caves and abandoned mineshafts.	**Extremely Low (Breeding); Low (Presence).** Woodland habitat present in Project; cracks and fissures within rocky features along mesa are present.	**Extremely Low (Breeding); Low (Presence).** Woodland habitat present in Project; cracks and fissures within rocky features along mesa are present.
black-footed ferret *Mustela nigripes*	FE, XN/WSC/SEN	Grasslands; arid plains; generally associated with prairie dog colonies.	**None.** Restricted to Aubrey Valley in west-central Coconino County where re-introduced in 1996.	**None.** Restricted to Aubrey Valley in west-central Coconino County where re-introduced in 1996.
dwarf shrew *Sorex nanus*	---/---/SEN	Alpine tundra, montane forests, rockslides, and dry short-grass prairies.	**None.** Extremely restricted range in northern Arizona; Suitable habitat also not present.	**None.** Extremely restricted range in northern Arizona; Suitable habitat also not present.

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
greater western mastiff bat *Eumops perotis californicus*	FSC/---/SEN	Lower and upper Sonoran desertscrub near cliffs; prefer rugged rocky canyons with abundant crevices. Roost in rock crevices, often allowing a vertical drop of 10 feet or more; typically roost in groups of 100 or more individuals; severely limited by availability of drinking water.	**None (Breeding) Presence (Extremely Low).** Suitable cliff habitat not present within Transmission Line; no waterbodies of minimum size present	**None (Breeding) Presence (Moderate).** May forage/drink at ponds and lakes in Evaluation Area.
long-tailed vole *Microtus longicaudus*	---/---/SEN	Mesic habitats with ample vegetative cover in mixed-conifer zone; prefers areas with grassy understory; good indicator of permanent water.	**None.** Mesic forest habitats not present in Transmission Line.	**Extremely Low.** Mesic forest habitats generally not present in Evaluation Area, but there is presence of wet areas; species not likely to occur.
Merriam's shrew *Sorex merriami leucogenys*	---/---/SEN	Arid, montane, coniferous forests.	**Low.** Montane conifer forest present within Transmission Line. Range is unknown.	**Low.** Montane conifer forest present within Evaluation Area. Range is unknown.

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
Navajo Mogollon vole *Microtus mogollonensis Navaho*	---/---/SEN	Variety of habitats depending on locale and elevation; thickets that provide dense cover, areas of high litter and bare ground, dry, grassy areas, usually adjacent to ponderosa pine forests, or sometimes as low as juniper woodland or stands of sagebrush, or as high as spruce-fir.	**Extremely Low.** Suitable habitat present within Transmission Line**,** range may overlap boundaries	**Low.** Increased suitable habitat available, including wetland areas, providing increased foraging opportunity. Range may overlap Area boundaries.
pale Townsend's big-eared bat *Corynorhinus townsendii pallescens*	FSC/--/SEN	In summer, day roosts are caves and mines from desertscrub up to woodlands and coniferous forests; night roosts may often be in abandoned buildings. In winter, hibernate in cold caves, lava tubes and mines mostly in uplands and mountains.	**None (Breeding) Presence (Low).** No caves/mines present within T-line; may occur during foraging or migration periods.	**None (Breeding) Presence (Low)..** No caves/mines present; may forage over wetlands, ponds and lakes in Evaluation Area and occur during foraging or migration periods..

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence	
			Transmission Line	Evaluation Area
spotted bat *Euderma maculatum*	FSC/WCS/SEN	Various habitats from low desertscrub to ponderosa pine and mixed-conifer forests to high desert and riparian habitats; may be an elevational migrant; roost site characteristics are poorly known, but observations suggest the species prefers to roost singly in crevices and cracks in cliff faces.	**None (Breeding) Presence (Extremely Low).** Rock outcrops and cliffs not present within Transmission Line; May occur during foraging or migration periods.	**None (Breeding) Presence (Low).** Rock outcrops and cliffs generally not present within Evaluation Area but may utilize rocky cracks. May occur during foraging or migration periods.
Wupatki Arizona pocket mouse *Perognathus amplus cineris*	FSC/---/SEN	Various types of desert scrub habitats (greasewood, rabbitbrush, creosote bush, cactus, mesquite, palo verde, scrub oak, etc.); sleeps and rears young in underground burrows.	**None.** Desert scrub habitat not present within Transmission Line.	**None.** Desert scrub habitat not present within Evaluation Area.
Reptiles				
narrow-headed gartersnake *Thamnophis rufipunctatus*	FSC/WSC/SEN	Pinyon-juniper and pin-oak woodland into ponderosa pine forest; in permanently flowing streams.	**None.** Known along Mogollon Rim of to west and south of Transmission Line; stream habitat for species does not occur in Transmission Line.	**None.** Known along Mogollon Rim of to west and south of Evaluation Area; stream habitat for species does not occur in Evaluation Area

Table 3.3 Threatened, endangered, and sensitive wildlife species for the Mormon Lake and Peaks Ranger Districts (USFS 2009).

Species	Status[1] Federal/State/USFS	Habitat[2]	Potential for Occurrence Transmission Line	Potential for Occurrence Evaluation Area
Amphibians				
northern leopard frog *Rana pipiens*	---/WSC/SEN	Variety of habitats including grassland, shrubland, woodlands, and forests; typically in permanent water with rooted aquatic vegetation.	**None.** Occurs in northern and central Arizona suitable wetland habitat not present.	**Low.** Occurs in northern and central Arizona; some potential to occur in Evaluation Area within seasonal ponds/wetland areas .
Insects				
blue-black silverspot butterfly *Speyeria nokomis nokomis*	---/---/SEN	Moist meadows, seeps, marshes, streamsides.	**None.** Suitable habitat not present within Transmission Line.	**Extremely Low.** Habitat present within Evaluation Area in the form of wetlands, ponds and lakes.
mountain silverspot butterfly *Speyeria nokomis nitocris*	---/---/SEN	Alpine meadows	**None.** Alpine species – no potential for occurrence.	**None.** Alpine species – no potential for occurrence.
spotted skipperling *Piruna polingii*	---/---/SEN	Moist woodland openings with lush vegetation, meadows, ravines and streamsides in the mountains.	**None.** Suitable habitat not present within Transmission Line.	**Extremely Low.** Suitable habitat present within Evaluation Area; wetlands, ponds, and lakes.

[1]FE = Federal Endangered; FT = Federal Threatened; FSC = Federal Species of Concern; WSC = Arizona State Wildlife of Special Concern; SEN = Forest Service sensitive species
[2]Habitat and species distribution information from AZGFD (2009b) and USFS (2007).

American Peregrine Falcon

The American peregrine falcon (*Falco peregrinus anatum*) is generally found in open country with tall cliffs for roosting or nesting and with open water, woodland, or riparian areas nearby that support abundant avian prey species. In Arizona, the majority of peregrine falcon nesting occurs in the tall cliffs of the Mogollon Rim, the Grand Canyon, and the Colorado Plateau (AZGFD 2009b). The species is unlikely to nest within the Transmission Line or Evaluation Area due to the lack of suitable cliffs for nesting; however, Peregrine falcons are regularly observed foraging at wetlands on the Anderson Mesa (H. Provencio, pers. comm.), and there is potential for peregrines forage at the lakes within the Evaluation Area. As a result, there is low and moderate potential, respectively for the species to pass through the Transmission Line and Evaluation Area while traveling between foraging areas, or during migration. There is no potential for the species to breed within the Transmission Line or Evaluation Area.

Bald Eagle

Delisted from the federal endangered species act in 2007, the bald eagle (*Haliaeetus leucocephalus*) remains protected under the federal Bald and Golden Eagle Protection Act (1940), and is a state species of special concern in Arizona. In 2008, the USFWS determined the Sonoran Desert population of bald eagles occurring in central Arizona and northwestern Mexico to be a distinct population segment (DPS), however, the USFWS announced on February 25, 2010 that neither this population nor its habitat warrants protection under the Endangered Species Act (1973). The Sonoran Desert DPS occurs to the south and west of Coconino County, and bald eagles occurring within the Evaluation Area are not listed under the federal Endangered Species Act. Breeding bald eagles are found near large lakes, reservoirs, or perennial streams throughout central Arizona, where they perch in large riparian trees, pines, or on cliffs (Corman and Wise-Gervais 2005). Bald eagles generally construct nests in the tallest trees in an area near water; however, in Arizona, they frequently nest on cliff faces, ledges, or pinnacles. Within the State's 56 known bald eagle breeding areas, all but two nests are located within one mile of water (McCarty and Jacobson 2008). Historically, bald eagles nested along the Mogollon Rim including at Mormon Lake and Lake Mary, approximately 3.5 miles to the west and eight miles to the northwest of the Transmission Line, respectively (AZGFD 2009b). Additionally, the lakes support wintering populations of bald eagles. The nearest known bald eagle breeding area is greater than three miles away (McCarty and Jacobson 2008); however, there is some potential for wintering or transient eagles to occur in the Transmission Line. Bald eagles have been observed at the Raymond Wildlife Area immediately to the north of the Transmission Line (AZGFD 2009c), and were observed during 2007/2008 baseline avian studies at study area A of the GCWRA (Young et al. 2008). There is no potential for the species to nest within the Transmission Line or Evaluation Area and moderate potential for the species to occur during transient flights.

Clark's Grebe

Clark's grebe (*Aechmophorus clarkia*) occurs on freshwater lakes and marshy areas, and less frequently along rivers. The species nests among tall plants growing in water, often building nests of floating vegetation on the edge of large areas of open water (AZGFD 2009b). In Arizona, Clark's grebe maintains local populations year-round in the lower Colorado River Valley (AZGFD 2009b). There is no suitable open water nesting habitat within the Transmission Line, and the species is not likely to occur (extremely low potential) as a summer or winter

resident in the area; however there is some moderate potential for Clark's grebe to use seasonal wetlands within the Evaluation Area for breeding or stopover habitat during migration.

Ferruginous Hawk

Ferruginous hawks (*Buteo regalis*) are found in various open habitats such as grasslands, shrublands, and deserts where rodent and lagomorphs prey species are available. In Arizona, ferruginous hawks generally breed in open scrublands, woodlands, grasslands, and semi-desert grasslands in the northern Colorado Plateau and southeastern portion of the state (AZGFD 2009b). Nests in Arizona are primarily constructed in isolated juniper trees (Corman and Wise-Gervais 2005). In winter, ferruginous hawks can be found statewide in these same habitats along with agricultural areas. Hunting typically occurs in open grasslands and agricultural fields; preferably with low hills or short trees which serve as perches. They are not currently known to nest within this portion of the state (Corman and Wise-Gervais 2005; AZGFD 2009b). There is no potential for the species to breed within the Transmission Line or Evaluation Area. They are more likely to occur as occasional winter visitors or migrants through both the Project and Evaluation Areas. Ferruginous hawks have been observed at the Raymond Wildlife Area approximately two miles northeast of the Transmission Line (AZGFD 2009c).

Mexican Spotted Owl

In Arizona, Mexican spotted owls (*Strix occidentallis lucida*) are distributed patchily throughout forested mountains statewide, but also in steep canyons of the Colorado Plateau including the Grand Canyon (AZGFD 2009b). They generally nest and roost in dense, old-growth mixed-conifer forest with multi-layered foliage structure located on steep slopes, especially deep, shady ravines. In Arizona, they occur primarily in mixed-conifer and pine-oak forests, but may also occur in ponderosa pine forests and rocky canyonlands. Mexican spotted owls are known to occur in the forested mountains and canyons to the west and south of the Project and Evaluation Areas (AZGFD 2009b); however, suitable nesting habitat is not present within the Project or Evaluation Area, and there is no probability of nesting in either the Project or Evaluation Area. Although unlikely, there is a slight possibility (extremely low) that the Mexican spotted owl may utilize (forage) or move through either the Transmission Line or Evaluation Area as coniferous forests occur within each.

Northern Goshawk

Northern goshawks (*Accipiter gentilis*) inhabit a wide range of forest types including deciduous, coniferous, and mixed forests. They typically nest in large tracts of mature or old-growth forests. In Arizona, goshawks nest in high, forested mountains and plateaus, and are most abundant in ponderosa pine forests along the Mogollon Rim, on the Kaibab Plateau, and in the southeastern mountains (AZGFD 2009b). While goshawks in Arizona are primarily resident, some may move to lower elevations in the winter when food resources become scarce (Corman and Wise-Gervais 2005). In 2001 there were 66 known nesting territories within the Coconino National Forest, 12 of which were occupied, and 7 of which successfully fledged young (USFS 2002). While the total number of territories has increased and the statewide Breeding Bird Survey data indicates a significant increase, some indicators of occupancy and productivity appear to be declining on the Forest (USFS 2002). Presently, the nearest known nesting territory is located approximately 1.5 miles from the Transmission Line (H. Provencio USFS, pers. comm.). While there is no suitable nesting habitat within the Transmission Line, approximately 9.1% of the Evaluation Area is

classified as ponderosa pine forest, and there is extremely low potential for goshawks to occur as residents, or more likely, as transients in this area.

Western Burrowing Owl

Western burrowing owls (*Athene cunicularia hypugaea*) are found in open, well-drained habitats such as grasslands, steppes, deserts, prairies, and agricultural lands. They typically roost and nest in burrows made by colonial mammals such as prairie dogs. Throughout most of Arizona the species occurs year-round; however in the northeastern portion of the state, burrowing owls are believed to be migratory with only a few winter records on the Colorado Plateau (AZGFD 2009b). The Project and Evaluation Areas contain a substantial amount of grassland habitat (63.2% and 52.0%, respectively), however, little evidence of colonial burrowing mammals were observed during the site visit. Burrowing owls have been documented within the Raymond Wildlife Area located approximately two miles to the northeast of the Transmission Line (AZGFD 2009c). While the lack of burrowing mammals diminish the probability for the species to nest within the Transmission Line or Evaluation Area, there is extremely low probability the species could transient or forage within these areas.

Allen's Lappet-Browed Bat

Allen's lappet-browed bat (*Idionycteris phyllotis*) occurs throughout much of Arizona but most collections have been made in the southern Colorado Plateau, the Mogollon Rim, and adjacent mountain ranges (AZGFD 2009b). They primarily inhabit ponderosa pine, pinyon-juniper, and pine-oak woodlands, and riparian areas of sycamore, cottonwood, and willow (BCI 2009), but have also been documented in white fir and Mohave desert scrub habitats (AZGFD 2009b). Maternity colonies and roosts have been found in caves, abandoned mines, rock piles, and beneath the loose bark of large ponderosa pine snags (BCI 2009). While the species is not listed by the AZGFD as occurring within five miles of the proposed GCWRA, the bat has been documented within the Canyon Diablo Watershed, in which the Transmission Line occurs. Suitable woodland habitat is present within the Project and Evaluation Area. There is extremely low potential for the species to breed within either the Transmission Line or Evaluation Area, and low potential for the species to occur during the migration or maternity seasons.

Black-Footed Ferret

In Arizona, the historic range of the black-footed ferret (*Mustela nigripes*) is characterized as plains and Great Basin grassland communities (AZGFD 2009b). Black-footed ferrets are closely associated with prairie dogs which comprise more than 90% of their diet. An estimate 40-60 ha of prairie dog colony is necessary to support a single ferret (AZGFD 2009b). In the late 1900s a national effort to eradicate prairie dogs resulted in a drastic decline in black-footed ferret populations due to the ferrets' extreme dependence on prairie dogs. After an approximate 60 year absence in Arizona, the AZGFD reintroduced 35 captive-breed ferrets in Aubrey Valley, located approximately 90 miles west of the Transmission Line in west-central Coconino County (AZGFD 2009a). While a single active Gunnison's prairie dog colony was documented during wildlife surveys in the GCWRA in 2008 (Young et al. 2008), the black-footed ferret population remains very restricted within the State and there is currently no potential for the species to occur in the Project or Evaluation Areas.

Dwarf Shrew

The dwarf shrew (*Sorex nanu)* is a true habitat generalist occurring in a variety of habitats, including rocky areas (fellfield, rock stripes and polygons) and meadows in alpine tundra and subalpine coniferous forest (spruce-fir), rocky slopes and meadows in lower-elevation forest (e.g., ponderosa pine, aspen, Douglas-fir) with a mixed shrub component, sedge marsh, subalpine meadow, arid sagebrush slopes, arid shortgrass prairie, dry stubble fields, and pinyon-juniper woodland. However, they have been reported most often from rocky habitats in alpine tundra and subalpine coniferous forests. Its range within Arizona includes the Kaibab Plateau, White Mountains, and San Francisco Peaks of northern Arizona. Dwarf shrews are active throughout the year and feed primarily on insects, soft-bodied spiders, and other small invertebrates. The dwarf shrew nests in underground burrows (Beauvais and Dark-Smiley 2003). There is no potential for the dwarf shrew to occur within the project or evaluation areas based on distribution and lack of suitable habitat.

Greater Western Mastiff Bat

The greater western mastiff bat (*Eumops perotis californicus*) is considered a year-round resident in Arizona; however, it is uncertain whether or not the species hibernates in winter (AZGFD 2009b). The greater western mastiff bat typically occurs in lower and upper Sonoran desertscrub habitats near cliffs. They prefer rugged rocky canyons with abundant crevices, often crowding into tight crevices to roost. They can roost singly or in small groups, but more frequently form colonies of up to 100 individuals (AZGFD 2009b). Greater western mastiff bats have very long, narrow wings which make launching difficult. For this reason, they regularly use roosts allowing a vertical drop of at least 10 feet. For the same reason, they are severely limited by available drinking water, and are precluded from drinking at ponds less than 100 feet in length (BCI 2009), of which none are found within the Transmission Line. Roosting habitat in cliffs is absent from the Transmission Line; however suitable cliff habitat may be available in the eastern Evaluation Area. Additionally, the species may forage at larger ponds within the Evaluation Area and surrounding region. The greater western mastiff bat has been documented by the AZGFD (2009b) as occurring within the Canyon Diablo Watershed in which the Transmission Line occurs. There is no potential and extremely low potential for the species to breed within the Transmission Line or Evaluation Area, respectively and extremely low potential for the species to occur during the migration or maternity seasons within the Transmission Line.

Long-Tailed Vole

The total range in Arizona in which the long-tailed vole (*Microtus longicaudus*) is restricted is the Pinaleno (=Graham) Mountains, Graham County, Arizona (AZGFD 2009b). Its primary habitat consists of grassy meadows and flats, along boggy stream bottoms, cienegas, and openings inconiferous forests and along roadsides. They may also be found on steep slopes with bunchgrasses. Its food consists of a variety of plant parts and species. Grasses form a major component of the diet. Green, succulent vegetation also seems to be very important. Other food items include grass seeds, the bark of willows and alders, roots and fungi. This animal builds runways through thick grass, providing easy access from its burrows to its grassy food supplies. Nests of grass are built within the burrows. This vole is active during the day and throughout the winter. At times it is semi-aquatic, freely swimming and diving. Given the estimated distribution and the lack of suitable habitat present within the Transmission Line, it is unlikely that this species will occur. Potential to occur within the Evaluation Area is considered extremely low as

there are seasonal wetlands and ponds present which may provide suitable habitat. Although distribution indicates that range does not overlap with Evaluation Area boundaries, there is a very slight possibility that an isolated population may exist.

Merriam's Shrew

Merriam's shrews (*Sorex merriami leucogenys*) are associated with sagebrush throughout their range. It is likely that a relatively wide range of habitat floristics and structure is suitable for Merriam's shrew, but not necessarily equally preferable. Characteristics that influence the presence and abundance of Merriam's shrew in any habitat are poorly understood. In Arizona, specimens have been taken in or near open ponderosa pine woodlands, spruce-fir stands, and grasslands with patches of aspen and spruce. Merriam's shrews are active at all hours, and their diet consists of spiders, beetles, caterpillars and other small invertebrates, and perhaps vertebrate carrion. Runways and burrows of small rodents are used extensively for foraging. (CDW 2005) There is some montane conifer forest present within the Transmission Line and Evaluation Area, which have a low potential of supporting this species.

Navajo Mogollon Vole

The Navajo Mogollon Vole's (*Microtus mogollonensis navaho*) range within Arizona includes the Navajo Mountain (Navajo County) and Defiance Plateau (Apache County), and more recently from the south rim of the Grand Canyon, and the Flagstaff and Williams area (Coconino County). They occupy a variety of habitats depending on locale and elevation; prostrate thickets of a variety of shrubs that provide dense cover, in areas of high litter and bare ground, dry, grassy areas, usually adjacent to ponderosa pine forests, or sometimes as low as juniper woodland or stands of sagebrush, or as high as spruce-fir. These voles forage for grasses, forbs and other vegetation which are clipped and eaten right away or taken back to the burrow. They have two daily activity peaks, one at mid-day and the other in early evening. Its globular nest, constructed of dried grass and forbs, is placed in a dense clump of vegetation, under a log or rock, in a depression on the ground, or in a chamber in its burrow (AZGFD 2009b). There is suitable habitat present within the Transmission Line, and slightly more within the evaluation area with the range of the species potentially overlapping Area boundaries, so the potential for this species to occur on the Project and Evaluation Areas is considered extremely low and low, respectively.

Pale Townsend's Big-Eared Bat

Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) is widespread in Arizona. They typically occur in arid desert scrub habitats up to woodlands and coniferous forests. In spring and summer, females form maternity colonies in mines, caves, or buildings, while males roost individually (BCI 2009). In winter they hibernate in cold caves and mines mostly in uplands and mountains (AZGFD 2009b). At roost sites, Townsend's big-eared bats prefer to hang form open ceilings, and typically do not use cracks or crevices, and are extremely sensitive to disturbance at roost sites (BCI 2009). There is no potential for the species to occur during breeding or over-wintering seasons due to the lack of suitable roost sites or hibernacula. The species is widespread and likely forages at wetlands, ponds and lakes and therefore, the potential for occurrence in the Transmission Area and Evaluation Area is considered low for foraging and/or migrating bats.

Spotted Bat

The spotted bat (*Euderma maculatum*) has been found from low desert habitat to high desert and riparian habitats to conifer forests. In Arizona, the species has primarily been collected in dry, rough, desert scrub habitats, with a few captured or heard (calls audible to the human ear) in ponderosa pine forest (AZGFD 2009b). Roost site locations and characteristics are poorly known but limited evidence suggests that spotted bats prefer to roost singly in crevices and cracks high in cliff faces, often near water sources (AZGFD 2009b; BCI 2009). Roosting habitat in cliffs is absent from the Transmission Line and Evaluation Area. The species may forage at ponds within the Evaluation Area and surrounding region. With known distribution and the presence of suitable foraging habitat nearby, the potential for occurrence of this species is considered extremely low and low for the Transmission Line and Evaluation Area, respectively; while no potential for breeding spotted bats has been determined due to the absence of suitable roost sites.

Wupatki Arizona Pocket Mouse

Wupatki Arizona Pocket Mouse (*Perognathus amplus cineris*) is distributed within the southwestern half of AZ and extreme northwestern Mexico (AZGFD 2009b). It ranges within a smaller disjunct range of a narrow swath of western Navajo Nation from northern Echo Cliffs south to Wupatki National Monument near Flagstaff, AZ. Potential range on Navajo Nation likely extends from the Colorado River (Marble Canyon) east to Kaibito Plateau, south through Cameron to Leupp area. The primary habitat for the Wupatki Arizona Pocket Mouse is Great Basin desert scrub, usually with sparse ground cover of greasewood*(Sarcobatus vermiculatus),* snakeweed *(Gutierrezia Sarothrae),* rabbitbrush (*Chrysothamnus ssp.)*, ephedra (*Ephedra sinica)*, shortgrass ssp, and possibly, short junipers. These pocket mice feed extensively, almost exclusively, on seeds of the creosote bush *(Larrea tridentata,)* Pectacarya spp, heronbill *(Erodium texanum)*, and plantain (*Plantago major LINN.).* They may occasionally consume insects and green vegetation. It appears that food is what limits populations of the Arizona pocket mouse, either because it restricts the number of young that females can produce, or because it determines survival probability, or both. There is no potential for the Wupatki Arizona Pocket Mouse to occur within the Project or Evaluation Area due to the lack of desert scrub habitat.

Narrow-Headed Gartersnake

The narrow-headed gartersnake (*Thamnophis rufipunctatus*) inhabits pinyon-juniper woodlands, oak-pine forests, and ponderosa pine forests where they are found in or beside clear, rocky streams (AZGFD 2009b) . The species is almost strictly aquatic, foraging under water, seeking shelter under rocks and boulders in the streambed, and basking on rocks and vegetation along stream banks. Hibernation takes place in rocky outcropping in late fall and winter. In Arizona, narrow-headed gartersnakes are found primarily in upland drainages in the White Mountains and along the Mogollon Rim. Suitable stream habitat is not present within the Transmission Line and Evaluation Area, and the likelihood of occurrence is considered none.

Northern Leopard Frog

Northern leopard frogs (*Lithobates pipiens*) inhabit a variety of habitats throughout northern and central Arizona including grassland, shrubland, woodland, and forest ranging high into the mountains (AZGFD 2009b). They are typically found in permanent water with rooted aquatic vegetation, ranging from springs, ponds, and marshes to irrigation ditches, small streams, and

rivers. Suitable wetland habitat is not present within the Transmission Line itself; however, seasonal wetlands are present throughout the Evaluation Area. Northern leopard frogs have been documented in the Raymond Wildlife Area to the northeast of the Transmission Line (AZGFD 2009c). Therefore, potential for the northern leopard frog to occur in the Transmission Line is considered none, while it is considered low within the Evaluation Area.

Blue-Black Silverspot Butterfly

Some taxonomists consider this subspecies to be a narrowly endemic subspecies found only at a few locations in Colorado and eastern Utah while others consider it a more broadly distributed taxon found in Colorado, Arizona, Utah, New Mexico and perhaps even Nevada. Regardless of the controversy, the blue-black silverspot butterfly (*Speyeria nokomis nokomis*) inhabits streamside meadows and open seepage areas with an abundance of violets in generally desert landscapes. The caterpillar host plant is northern bog violet (Viola nephropphylla). The adults feed on flower nectar including that from thistles. The colonies are often isolated (AZGFD 2009b). There is no potential for the blue-black silverspot butterfly to occur within the Transmission Line due to the lack of suitable habitat. The potential for occurrence within the Evaluation Area increases slightly due to the presence of suitable habitat occurring in the form of wetlands, ponds and lakes.

Mountain Silverspot Butterfly

The mountain silverspot butterfly (Speyeria nokomis nitocris) has been documented within the White Mountains of Arizona. The host plant for the caterpillar is northern bog violet (Viola nephropphylla). The adult butterfly feeds on flower nectar including that from thistles. This species is considered strictly an alpine species inhabiting Alpine meadows. Therefore, there is no potential for the mountain silverspot butterfly to occur within the Project or Evaluation Area (AZGFD 2009b).

Spotted Skipperling

The spotted skipperling (*Piruna polingii*) inhabits moist woodland openings with lush vegetation, meadows, ravines and streamsides in the mountains throughout central and southern Arizona (AZGFD 2009b). Caterpillars likely feed on a native grass; *Dactylis glomerata* (Poaceae) is strongly suspected although not confirmed. Adults feed on the nectar of various flowers including yellow composites. There is no suitable habitat present within the Transmission Line so potential for occurrence is considered none. There are wetlands, ponds and lakes present within the Evaluation Area, therefore the potential for the spotted skipperling to occur within the Evaluation area is considered extremely low.

3.2.2 USFS Management Indicator Species

The Coconino National Forest Plan identifies 17 Management Indicator Species (MIS; USFS 2002) defined as: "... plants or animals whose population change reflects a population change in other species within a group. Management Indicator Species respond to habitat changes early or at low levels of stress and, therefore, are sensors of the effect of management activities that occur in various habitat" (USFS 1987; Table 3.4). As such, MIS were selected to serve as a benchmark for potential effects of management actions on other species within the particular habitat type for which they were chosen.

Of the 17 indicator species identified for the Coconino National Forest, 10 have at least some potential to occur within the ponderosa pine, pinyon-juniper, and grassland habitats of the Transmission Line and eleven have the potential to occur within the Evaluation Area (Table 3.4): Abert squirrel (*Scirurus aberti*), northern goshawk, pygmy nuthatch (*Sitta pygmaea*), wild turkey (*Meleagris gallopavo merriamii*), elk (*Cervus elaphus*), hairy woodpecker (*Picoides villosus*), Mexican spotted owl, mule deer (*Odocoileus hemonius*), juniper titmouse (*Baeolophus griseus*), pronghorn antelope (*Antilocapra americana Americana*), and cinnamon teal (*Anas cyanoptera*). Management indicator species with at least some potential to occur in the Project and/or Evaluation Area are further discussed below.

Table 3.4 Coconino National Forest Management Indicator Species and their associated habitat type (USFS 2002).

Species	Habitat	Potential for Occurrence	
		Transmission Line	Evaluation Area
Birds			
cinnamon teal *Anas cyanoptera*	Wetlands/aquatic	**None.** No suitable wetland habitat within Transmission Line.	**High.** Several seasonal lakes present within Evaluation Area; species known to be common breeder of Anderson Mesa wetlands.
hairy woodpecker *Picoides villosus*	Snag component of ponderosa pine, mixed conifer, and spruce-fir	**Low.** Very limited ponderosa pine, mixed conifer, or spruce-fir habitat within Transmission Line.	**High.** ~9% of Evaluation Area is ponderosa pine forest; potential to occur as year-round resident.
juniper titmouse *Baeolophus griseus*	Late seral and snag component of pinyon-juniper	**High.** ~34% of Transmission Line is pinyon-juniper woodland; species likely to occur as year-round resident of Transmission Line.	**High.** ~39% of Evaluation Area is pinyon-juniper woodland; species likely to occur as year-round resident of Evaluation Area.
Lincoln's sparrow *Melospiza lincolnii*	Late seral, high elevation riparian (≥7000')	**None.** No suitable riparian habitat within Transmission Line.	**None.** No suitable riparian habitat within Evaluation Area.
Lucy's warbler *Vermivora luciae*	Late seral, low elevation riparian (<7000')	**None.** No suitable riparian habitat within Transmission Line.	**None.** No suitable riparian habitat within Evaluation Area.
Mexican spotted owl *Strix occidentalis lucida*	Late seral mixed conifer and spruce-fir	**None (Nesting), Extremely Low (Presence).** No mixed conifer or spruce-fir forest within Transmission Line.	**None (Nesting), Extremely Low (Presence).** No mixed conifer or spruce-fir forest within Evaluation Area; some potential for transient birds to occur within ponderosa pine forests within Evaluation Area.

Table 3.4 Coconino National Forest Management Indicator Species and their associated habitat type (USFS 2002).

Species	Habitat	Potential for Occurrence	
		Transmission Line	Evaluation Area
northern goshawk *Circus cyaneus*	Late seral ponderosa pine	**None (Nesting), Extremely Low (Presence).**Known to nest along Mogollon Rim; no potential to nest in pine forests in Transmission Line but may occur as rare transient, winter visitor, or migrant.	**Extremely Low (Nesting), Moderate (Presence).** Potential to nest and forage in pine forests in Evaluation Area; may also occur as occasional transient, winter visitor, or migrant.
pygmy nuthatch *Sitta pygmaea*	Late seral ponderosa pine	**Low.** Very limited ponderosa pine habitat within Transmission Line.	**High.** ~9% of Evaluation Area is ponderosa pine forest; species likely to occur as year-round resident.
Red-naped sapsucker *Sphyrapicus nuchalis*	Late seral and snag component of aspen	**None.** No suitable forest habitat within Transmission Line.	**None.** No suitable forest habitat within Evaluation Area.
wild turkey *Meleagris gallopavo merriamii*	Late seral ponderosa pine	**Low.** Very limited ponderosa pine habitat within Transmission Line; some potential to occur in other woodland habitats in Transmission Line.	**Moderate.** ~9% of Evaluation Area is ponderosa pine forest; potential to occur as year-round resident.
yellow-breasted chat *Icteria virens*	Late seral, low elevation riparian (<7000)	**None.** No suitable riparian habitat within Transmission Line.	**None.** No suitable riparian habitat within Evaluation Area.
Mammals			
Abert Squirrel *Scirurus aberti*	Early seral ponderosa pine, but species also associated with intermediate to late-seral pine forests.	**Low.** Very limited ponderosa pine habitat within Transmission Line.	**High.** ~9% of Evaluation Area is ponderosa pine forest; species likely to occur as year-round resident.

Table 3.4 Coconino National Forest Management Indicator Species and their associated habitat type (USFS 2002).

Species	Habitat	Potential for Occurrence	
		Transmission Line	Evaluation Area
elk *Cervus elaphus*	Early seral ponderosa pine, mixed conifer, and spruce-fir	**Moderate.** Very limited ponderosa pine forest within Transmission Line, but potential to occur in pinyon-juniper woodlands in Transmission Line.	**High.** Potential to occur in forest and woodland habitats within Evaluation Area.
mule deer *Odocoileus hemonius*	Early seral aspen and pinyon-juniper	**High.** ~34% of Transmission Line is pinyon-juniper woodland; species likely to occur at some point in the year.	**High.** ~39% of Evaluation Area is pinyon-juniper woodland; species likely to occur at some point in the year.
pronghorn antelope *Antilocapra americana Americana*	Early and late seral grasslands	**High.** ~34% of the Transmission Line is grassland; species likely to occur in these areas at some point during the year.	**High.** ~39% of the Evaluation Area is grassland; species likely to occur in these areas at some point during the year.
red squirrel *Tamiasciurus hudsonicus mogollonensis*	Late seral mixed conifer and spruce-fir	**None.** No suitable forest habitat within Transmission Line.	**None.** No suitable forest habitat within Evaluation Area.
Invertebrates			
Macroinvertebrates	Late seral, high and low elevation riparian	**None.** No suitable riparian habitat within Transmission Line.	**None.** No suitable riparian habitat within Evaluation Area.

Cinnamon Teal

Cinnamon teal were selected as indicators of wetlands/aquatic habitats, primarily because they are sensitive to livestock grazing in wetlands, and because they are economically important (USFS 2002). The Cinnamon teal is a small dabbling duck that is primarily a summer resident of the Coconino National Forest. The species inhabits seasonal and semi-permanent wetlands, typically nesting within tall, dense, concealing vegetation within 100 m of water (USFS 2002). At least forty-six seasonal and semi-permanent wetlands exist on the Coconino National Forest, the majority of which are on Anderson Mesa. The condition of wetlands and open water within the Forest are primarily driven by the amount and timing of precipitation and long-term climate change. Semi-permanent wetlands have improved due to management activities that have controlled recreation and grazing, while seasonal wetlands have had less active management and are considered to be stable, but well below their potential habitat value due to grazing by livestock and wild ungulates, and recreation impacts (USFS 2002). While there is no suitable wetland habitat within the Transmission Line, there are several seasonal lakes within the larger Evaluation Area. Cinnamon teal are one of the most common breeding ducks on the Anderson Mesa (Audubon 2009), and are likely summer residents of lakes within the Evaluation Area.

Hairy Woodpecker

The hairy woodpecker is listed as an MIS for the snag component of ponderosa pine, mixed conifer, and spruce-fir forest habitats. The species is most abundant in mature and intermediate-aged forests with a dense canopy and large old trees suitable for cavity nesting; however, they may also inhabit open woodlands, swamps, well-wooded towns and parks, and open areas with scattered trees (USFS 2002). Hairy woodpeckers nest and roost in live or dead tree cavities, typically excavating a new nest hole each year. Overall, snags in the ponderosa pine habitat type on the Coconino National Forest are being lost faster than they are being replaced, resulting in a downward trend in snag recruitment; however, the snag component of mixed conifer and spruce-fir is increasing (USFS 2002). Data from the Coconino National Forest, as well as statewide data, indicate that hairy woodpecker populations are stable or slightly increasing on a long-range scale, with large fluctuations on a short-term scale (USFS 2002). There are no mixed-conifer or spruce-fir forest habitats within the Transmission Line; however, the southwestern corner of the Evaluation Area is comprised of mature ponderosa pine forest which is likely to support a year-round population of hairy woodpeckers.

Juniper Titmouse

Juniper titmouse is an MIS for late-seral pinyon-juniper woodlands, particularly the snag component. The species is a year-round resident in Arizona, and an obligate inhabitant of pinyon-juniper woodlands. Juniper titmice are secondary cavity nesters, with the majority of nest cavities located in juniper trees. The Forestwide trend for the juniper titmouse is stable to slightly declining (USFS 2002). While the age class distribution of pinyon-juniper has been relatively stable throughout the recent decade, firewood cutting has probably reduced snag densities of both pinyon and juniper snags, especially near Flagstaff. Additionally, the loss of older pinyon pine trees due to drought creates new snags, but insect attacks result in rapid deterioration of the snag. Some change in pinyon-juniper woodlands has probably been from tree growth and increased density or infill. Juniper titmouse breeding bird density has been documented to decrease with increased tree density, increasing proportion of junipers in a stand, and increasing canopy cover (Latta et al. 1999). Approximately 34% of the Transmission Line (233 acres) is

classified as pinyon-juniper woodland, and juniper titmice are likely to occur, particularly if a snag component is present.

Mexican Spotted Owl

The Mexican spotted owl is an MIS for the late-seral stage of mixed conifer and spruce-fir forests. Additionally, the Mexican spotted owl is listed as a federal threatened species under the ESA, and is a USFS Sensitive species. As such, the owl is addressed in the preceding section on endangered, threatened, and sensitive wildlife species (Section 3.2.1).

Northern Goshawk

Northern goshawk is an MIS of late-seral stage ponderosa pine habitat. Additionally, the species is considered a USFS Sensitive species and, as such, is also addressed in the preceding section on threatened, endangered, and sensitive wildlife species (Section 3.2.1).

Pygmy Nuthatch

The pygmy nuthatch is an MIS for late-seral ponderosa pine forests. The species is generally associated with mature ponderosa pine forest, where it prefers open, park-like stands of pines; however, it is also found in dense pine forest, as long as large trees and snags are present (USFS 2002). Pygmy nuthatches typically excavate their own nest cavities near the top of pine snags, or in the underside of a dead branch; occasionally they nest in aspen snags. In the winter, groups of pygmy nuthatches roost communally in snag or live tree cavities. Due to their dependence on snags for roosting and nesting, declines in the rate of snag recruitment on the Coconino National Forest has been a concern for forest managers. Data for the species indicate that populations within the Coconino National Forest, as well as statewide, are stable on a long-term scale, with dramatic fluctuations on a short-term scale (USFS 2002). Ponderosa pine forest is very limited within the Transmission Line, and the species is not likely to occur; however, the Evaluation Area contains approximately 1,150 acres of mature ponderosa pine forest that likely supports a year-round population of pygmy nuthatches.

Wild Turkey

Wild turkey is listed as an MIS for late-seral ponderosa pine forest; however, other habitats used by turkeys include mixed conifer, springs and seeps, and pinyon-juniper (USFS 2002). The species is tied to stands of mature ponderosa pine for nest sites and summer and winter roost sites. Other important habitat attributes include an uneven-aged overstory structure, riparian areas around springs and seeps, and small forest openings for seedhead and invertebrate production. Mast production from ponderosa pine, pinyon pine, juniper, and oak is vital to how well turkeys overwinter and is tied to the amount and timing of precipitation. While ponderosa pine forest is very limited within the Transmission Line, turkeys have some potential to occur within other forest/woodland habitats along the Transmission Line. There is greater potential for turkeys to occur in the Evaluation Area, particularly in the mature ponderosa pine forests in the southwestern corner.

Abert Squirrel

Abert squirrel is as an MIS for early-seral stage ponderosa pine forest; however, research indicates the species has a strong association with intermediate to mature ponderosa pine forests (USFS 2002). The Abert squirrel is an obligatory herbivore on ponderosa pine, which it depends

upon for food, cover, and nest sites. Because little forest-specific data on the Abert squirrel exists, the population trend remains inconclusive; however statewide information indicates a stable population of hunter harvests throughout the state. Approximately 2% of the Transmission Line (16.07 acres) is comprised of ponderosa pine forest, the majority of which is mature pine forest, and the Abert squirrel is likely to occur in occur in these areas.

Elk

Elk is a big game MIS species for early-seral stage ponderosa pine, mixed-conifer, and spruce-fir habitats; however, grasslands and early-seral state woodlands are also important to the species. Elk populations within Arizona are considered to be demonstrably widespread, abundant, and secure state-wide (AZGFD 2009b), with the elk herds occurring in the Coconino National Forest and surrounding state and private lands considered the core of Arizona's elk population (AZGFD 2007a). The elk in this region typically summer in mountain meadows and montane coniferous forests, and winter in lower-elevation pinyon-juniper woodlands and grasslands (USFS 2002; AZGFD 2007a). During the 1980s and 1990s the elk population in the region increased, and resident herds began occurring year-round in pinyon-juniper habitats that were previously used only as winter foraging grounds. This caused concern over impacts to habitat and, as a result, management efforts over the past decade have focused on reducing elk populations back to levels observed in the early 1980s. This effort has been successful and the elk herd occurring in the 5BN Game Management Unit (GMU; AZGFD 2008) in which the Transmission Line and Evaluation Area lie, is considered stable (AZGFD 2007a). Ponderosa pine, pinyon-juniper woodland, and grassland habitats used by elk are present within the Transmission Line and the species is likely to occur during the winter, and possibly throughout the year.

Mule Deer

Mule deer is a big-game MIS for early seral-stages of aspen and pinyon-juniper woodlands; however, early seral-stages of ponderosa pine are also important to the species. Mule deer typically summer at high elevation aspen and ponderosa pine forests, and winter in lower elevation pinyon-juniper woodlands (USFS 2002). While mule deer populations within Arizona are considered to be demonstrably widespread, abundant, and secure state-wide (AZGFD 2009b), from 1985 to 2001 a declining trend in mule deer populations has been observed on the Coconino National Forest (USFS 2002). This may be due to a number of factors including disease, poaching, climatic conditions (drought), and habitat changes. Populations in the past few years appear to have stabilized, possibly in response to increased precipitation in recent years (AZGFD 2008). An important habitat trend affecting mule deer populations is the loss of early-seral stage aspen stands. Aspen regeneration has not been sufficient to provide replacement for stands lost to natural causes or management actions, and the future outlook for early seral aspen is poor (USFS 2002). While aspen are absent from the Project and Evaluation Area, other habitats used by mule deer spinyon-juniper woodlands and ponderosa pine forests are present within the Transmission Line and Evaluation Area and the species is likely to occur in these areas.

Pronghorn Antelope

Pronghorn antelope is an MIS for late-seral grasslands. Most pronghorn occur between 3,000 and 7,000 feet elevation and inhabit a variety of habitat types from desert grassland to forest and mountain meadows; however, they generally prefer flat, open grassland areas (AZGFD 2007b).

The Transmission Line falls within the range of the Anderson Mesa herd of pronghorn antelope. This population declined throughout recent decades as a result of habitat degradation and drought, and has been a focus of research and management effort within the state, with low fawn recruitment being the primary concern (AZGFD 2007b; USFS 2002). The pronghorn in this area are functionally split into two groups; one group spends the winter at lower elevation grasslands and spends the rest of the year on Anderson Mesa, the second group lives year-round in the lower elevation habitat. The overall trend for grasslands within the Coconino National Forest is stable to declining due to tree encroachment, fire suppression, long-term climatic trends, short-term drought, and ungulate grazing (USFS 2002). Management actions have converted some forest and shrub habitats to grasslands through fuelwood treatments, prescribed burns, restoration treatments and meadow maintenance (USFS 2002). Approximately 63.2% of the Transmission Line is comprised of grassland habitat and pronghorn antelope likely occur in these areas, particularly during the summer breeding season.

3.3 Raptors

3.3.1 Species Likely to Occur in the Area

Determinations were made through a desktop review of existing information (AZGFD 2009b; Corman and Wise-Gervais 2005; Sibley 2001). Seventeen diurnal raptor species have the potential to occur as residents and/or migrants in the Transmission Line at some point during the year. In addition, one species of vulture, and five species of owls occur in the region.

Of the 17 diurnal raptors with the potential to occur in the Transmission Line, eight species have the potential to nest or reside year-round within the Transmission Line or Evaluation Area: sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk, red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), bald eagle, American kestrel (*Falco sparverius*), and prairie falcon (*Falcon mexicanus*). A further three species may occur as winter residents and/or migrants in the area: northern harrier (*Circus cyaneus*), ferruginous hawk, and rough-legged hawk (*Buteo lagopus*). Eight species are not likely to reside in the area due to specific habitat requirements, but may pass through the Transmission Line as migrants and/or occasional visitors from the surrounding region: zone-tailed hawk (*Buteo albonontatus*), Swainson's hawk (*Buteo swainsonii*), common black hawk (*Buteogallus anthracinus*), osprey (*Pandion haliaetus*), peregrine falcon, and merlin (*Falco columbarius*). Additionally, turkey vultures (*Cathartes aura*) are likely summer residents and migrants. Of the diurnal raptors and vultures potentially occurring within the Transmission Line, four species are considered Arizona species of special concern and USFS sensitive species: American peregrine falcon, bald eagle, northern goshawk, and ferruginous hawk (see Section 3.2.1).

Five owl species have the potential to occur within the Transmission Line or Evaluation Area: barn owl (*Tyto alba*), long-eared owl (*Asio otus*), western burrowing owl, great-horned owl (*Bubo virginianus*), western screech-owl (*Megascops kennicottii*), northern saw-whet owl (*Aegolius acadicus*), northern pygmy owl (*Glaucidium gnoma*), and flammulated owl (*Otus flammeolus*). Of these, burrowing owl is a USFS sensitive species (see Section 3.2.1).

During baseline wildlife studies conducted at Phase A of the GCWRA by WEST in 2007 and 2008 (Young et al. 2008), ten raptor species were observed using the area either as residents or

during migration: Cooper's hawk, sharp-shined hawk, red-tailed hawk, northern harrier, bald eagle, golden eagle, American kestrel, merlin, prairie falcon, and burrowing owl. Bald eagles historically nested at Mormon Lake approximately 3.5 miles to the west of the Transmission Line (AZGFD 2009b; Section 3.2.1), bald eagles, ferruginous hawks, sharp-shinned hawks, and burrowing owls have been documented within the Raymond Wildlife Area approximately two miles to the northeast of the Transmission Line (AZGFD 2009c), and peregrine falcons are regularly observed foraging at seasonal wetlands on Anderson Mesa (H. Provencio USFS, pers. comm.).

3.3.2 Potential Raptor Nesting Habitat

Potential nesting habitat for raptors is located primarily within ponderosa pine forests and juniper woodlands located throughout the Project and Evaluation Areas. These forests provide nest structure for tree-nesting raptors such as northern goshawk, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, American kestrel, great-horned owl, western screech-owl, flammulated owl, northern saw-whet owl, and northern pygmy owl. Additional nesting habitat may be present within portions of Anderson and Yaeger Canyons in the east portion of the Evaluation Area. Stands of oak and cottonwood in the canyon bottoms, as well as canyon walls and rock outcroppings may provide potential nest sites for raptors. Open, grassland habitat for ground-nesting species such as burrowing owl is also present within the Project and Evaluation Areas. Burrowing owls are often associated with prairie-dog colonies, which have were observed in low density during the site visit in the Evaluation Area (Appendix B), as well as within Phase A of the GCWRA immediately to the east of the Transmission Line (Young et al. 2008). During the site visit a single occupied red-tailed hawk nesting territory and nest site was documented within the Evaluation Area adjacent to Corner Lake, approximately one mile from the proposed Transmission Line and 1.3 mile from the Alternative Transmission Line (Appendix B). No raptor nests were located within the Transmission Line and given the proximity of an existing road and general lack of optimal nest structures the likelihood of nesting raptors to occur in or proximate to the Transmission Line is low. During raptor nest surveys conducted at the GCWRA by WEST in 2008, one active red-tailed hawk nest was observed in Yaeger Canyon, approximately 1.5 miles northeast of the Transmission Line, and two inactive golden eagle nests were observed within Grapevine Canyon, approximately seven miles southeast of the Transmission Line (Young et al. 2008).

3.4 Migratory and Breeding Birds

3.4.1 Important Bird Areas

The Audubon Society lists Important Bird Areas (IBAs) that are sites providing essential habitat for one or more species of bird (Audubon 2009). These include sites for breeding, wintering and/or migrating birds and can range from a few, to thousands of acres in size. The western portion (approximately 6 miles) of the Transmission Line lies within the Anderson Mesa Important Bird Area, located within the Coconino National Forest (Figure 3.1).

Anderson Mesa begins about nine miles southeast of Flagstaff, and continuous as a gently sloping tableland for approximately 25 miles to the southeast. Along the length of the Anderson Mesa are a complex of lakes, including permanent, semi-permanent, and ephemeral lakes and wetlands, grasslands, pinyon-juniper woodland, and conifer forests. The largest of the lakes,

Mormon Lake, lies approximately 3.5 miles to the west of the Transmission Line, and a number of smaller lakes fall within the Evaluation Area. The wetland complex within the Anderson Mesa IBA has been documented as one of two major waterfowl use areas in Arizona during migration, particularly by dabbling ducks during spring migration (Audubon 2009). A variety of land birds also use the IBA for breeding and as a migration stopover site. The extensive pinyon pine and juniper woodlands in the area support populations of pinyon jay (*Gymnorhinus cyanocephalus*), a species of global conservation concern because of the limited distribution of pinyon pine on which the species depends (Audubon 2009).

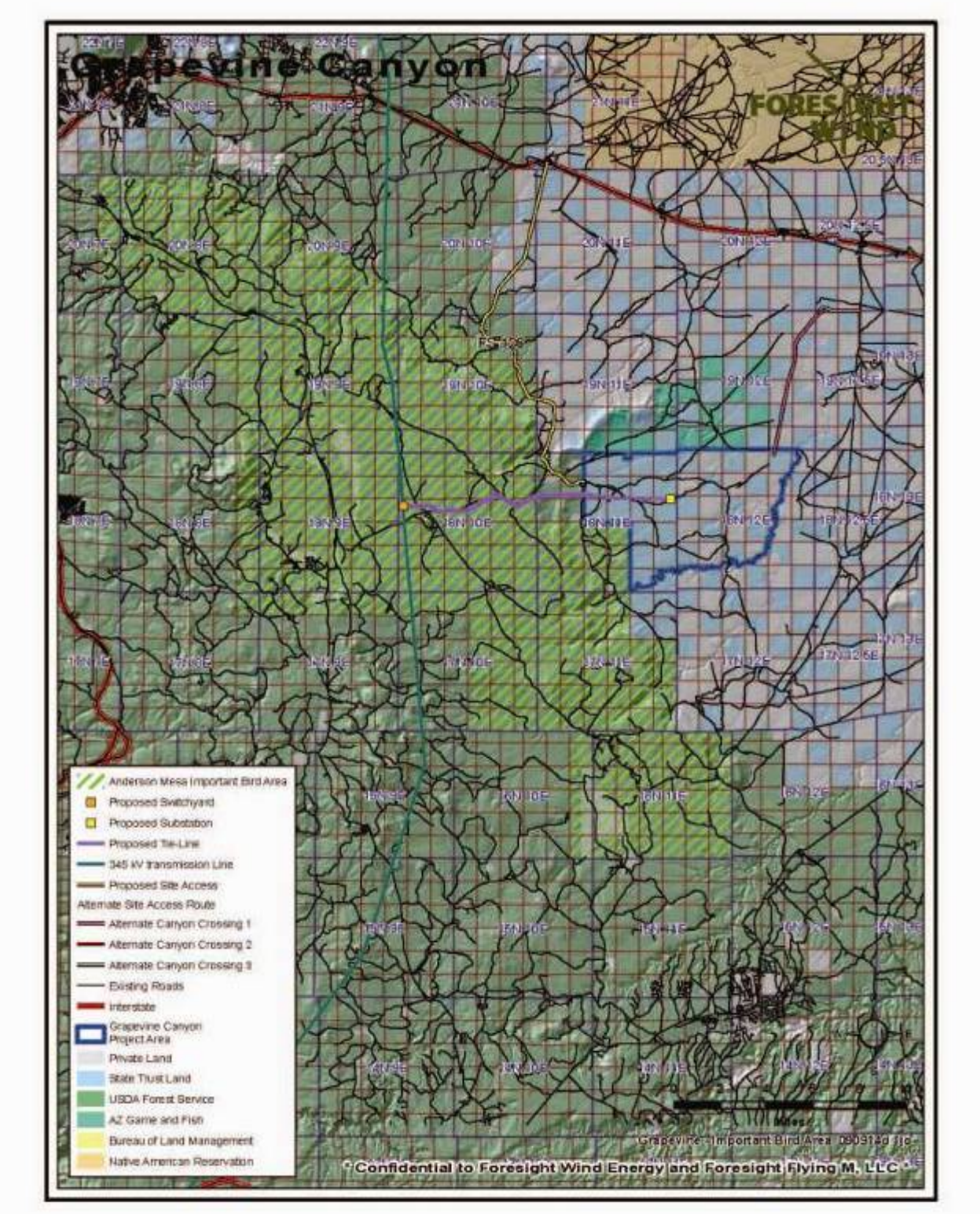

Figure 3.1 Map of the Anderson Mesa Important Bird Area in relation to the proposed transmission line right of way.

3.4.2 USFWS Birds of Conservation Concern

The Transmission Line lies near the southwestern boundary of the Southern Rockies/Colorado Plateau Bird Conservation Region. Twenty-seven species are listed by the USFWS as birds of conservation concern within this region (USFWS 2008; Table 3.5). These species do not receive special protection unless they are also listed by the USFWS under the Endangered Species Act or by the AZGFD; but have been identified as vulnerable to population declines in the area by the USFWS (2008). Of these, four species have been documented by Arizona's Natural Heritage Program as occurring within the Canyon Diablo Watershed: bald eagle, ferruginous hawk, peregrine falcon, and burrowing owl (AZGFD 2009d; see Section 3.2.1).

During WEST's 2007/2008 baseline avian surveys for the GCWRA, seven USFWS species of conservation concern were observed in the Phase A Transmission Line: bald eagle, ferruginous hawk, prairie falcon, western burrowing owl, gray vireo (*Vireo vicinior*), pinyon jay, and Cassin's finch (*Carpodacus cassinii*; Young et al. 2008).

3.4.3 USGS Breeding Bird Survey

The USGS Breeding Bird Survey (BBS) is a large-scale survey of North American breeding birds. Each June over 3,500 designated routes in the continental U.S. and southern Canada are surveyed by experienced birders. Each BBS route is 24.5 miles long and consists of 50, three-minute point counts along the length of the route. Information gathered from these surveys allows some indication of species that may utilize the region either transiently or for breeding habitat during the summer. The BBS route closest to the Transmission Line is the Happy Jack route which begins approximately eight miles to the southwest and extends to the south (Figure 3.2). The Happy Jack route has been monitored for seventeen years, between 1985 and 2007. A total of 65 species have been observed along this route, including six raptor species and one vulture species (bald eagle, sharp-shinned hawk, northern goshawk, red-tailed hawk, American kestrel, great-horned owl, and turkey vulture; Sauer et al. 2008). The most common species observed along this route were: pygmy nuthatch (*Sitta pygmaea*), American robin (*Turdus migratorius*), violet-green swallow (*Tachycineta thalassina*), dark-eyed junco (*Junco hyemalis*), Grace's warbler (*Dendroica graciae*), and plumbeous vireo (*Vireo plumbeus*), with an average of >10 individuals sighted per year. No federal threatened or endangered species have been observed along the route. Two state wildlife species of special concern and USFS sensitive species (bald eagle and northern goshawk) and two federal species of conservation concern (Grace's warbler, Cassin's finch [*Carpodacus cassinii*]) have been observed along the route (USFWS 2008; AZGFD 2009b; USFS 2009; see Section 3.2.1).

3.4.4 Arizona Partners in Flight Priority Species

Partners in Flight is an international program dedicated to conserving bird populations in North and South America. The program was initiated in 1990 as a cooperative effort among federal, state, and local government agencies, professional organizations, conservation groups, academia, industry, and private individuals. The Arizona Working Group of Partners in Flight (APIF) has developed a Bird Conservation Plan (Lattaet al. 1999) as part of the international Partners in Flight effort. The purpose of the plan is to identify avian species and habitats most in need of conservation and to establish objectives and conservation efforts for bird populations and habitats within Arizona. The plan addresses 280 breeding bird species within Arizona, including 43 priority species within 13 major habitat types. Of the major habitat types identified within the

plan, three are present within the Project and/or Evaluation Areas: ponderosa pine forest, pinyon-juniper forest, and high elevation grassland. Priority bird species identified for each of these habitat types, and their potential to occur in the Project and/or Evaluation Area is addressed in Table 3.6.

Table 3.5 Species of Conservation Concern within the Southern Rockies/Colorado Plateau Bird Conservation Region (USFWS 2008)

Species	Scientific Name
Gunnison sage-grouse	*Centrocercus minimus*
American bittern	*Botaurus lentiginosus*
bald eagle (b)	*Haliaeetus leucocephalus*
ferruginous hawk	*Buteo regalis*
peregrine falcon (b)	*Falco peregrinus*
prairie falcon	*Falco mexicanus*
snowy plover (c)	*Charadrius alexandrinus*
mountain plover	*Charadrius montanus*
long-billed curlew	*Numenius americanus*
yellow-billed cuckoo (a)	*Coccyzus americanus*
flammulated owl	*Otus flammeolus*
burrowing owl	*Athene cunicularia*
Lewis's woodpecker	*Melanerpes lewis*
willow flycatcher (c)	*Empidonax traillii*
gray vireo	*Vireo vicinior*
pinyon jay	*Gymnorhinus cyanocephalus*
juniper titmouse	*Baeolophus ridgwayi*
Veery	*Catharus fuscescens*
Bendire's thrasher	*Toxostoma bendirei*
Grace's warbler	*Dendroica graciae*
brewer's sparrow	*Spizella breweri*
grasshopper sparrow	*Ammodramus savannarum*
chestnut-collared longspur	*Calcarius ornatus*
black rosy-finch	*Leucosticte atrata*
brown-capped rosy-finch	*Leucosticte australis*
Cassin's finch	*Carpodacus cassinii*

(a) ESA candidate; (b) ESA delisted; (c) non-listed subspecies or population of Threatened or Endangered species

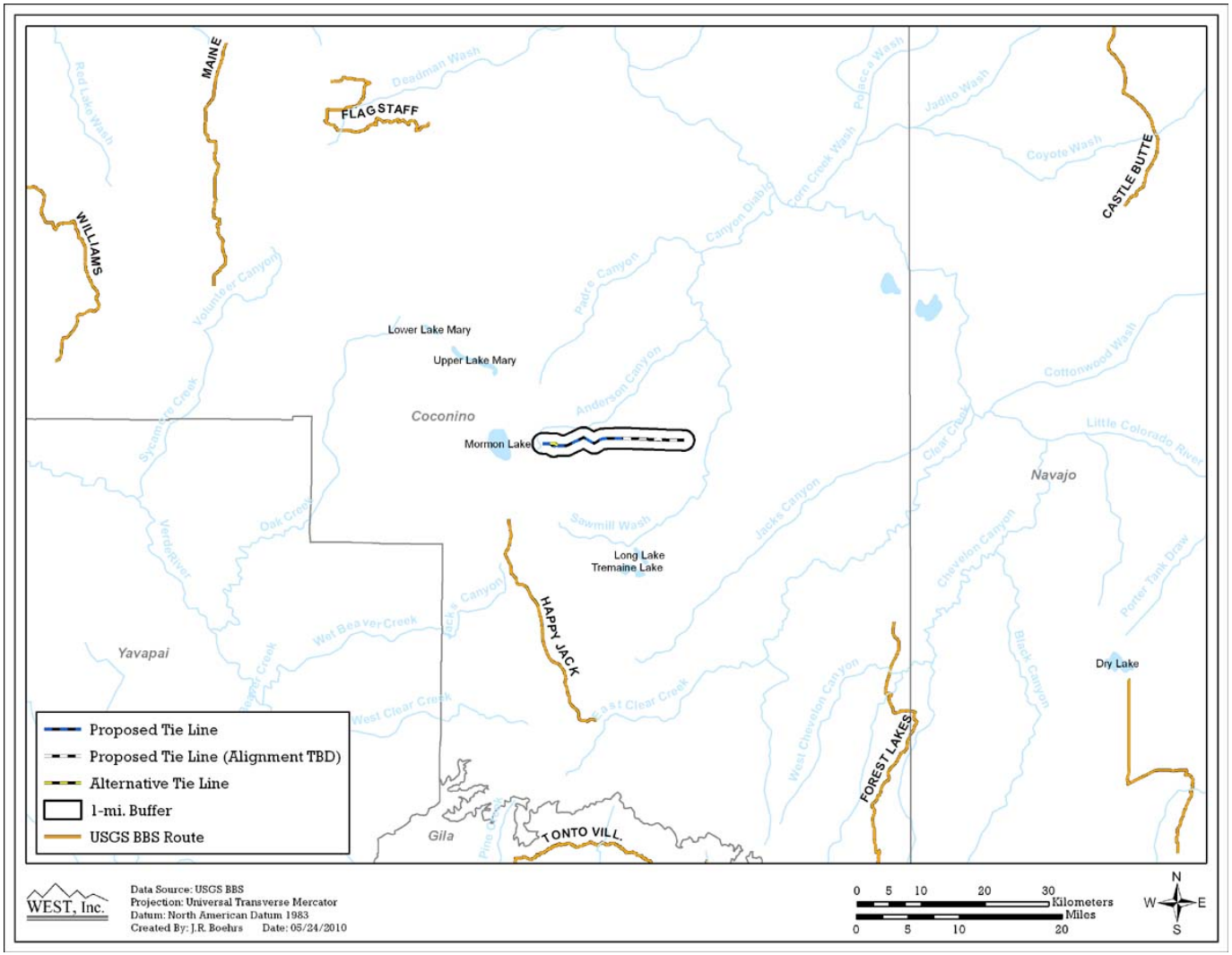

Figure 3.2 USGS Breeding Bird Survey routes closest to the Transmission Line.

Table 3.6. Priority avian species with potential to occur in the proposed Transmission Line (AFIF 1999).

Habitat Type	Species	Potential for Occurrence in Transmission Line
Ponderosa pine	northern goshawk *Accipiter gentilis*	**Extremely Low.** Known to nest along Mogollon Rim; no potential to nest in pine forests in Transmission Line but may occur as rare transient, winter visitor, or migrant.
	olive-sided flycatcher *Contopus cooperi*	**Low.** Very little pine forest within Transmission Line; very little probability of occurrence.
	cordilleran flycatcher *Empidonax occidentalis*	**Extremely Low.** Inhabit moist, shady, pine and mixed conifer forests; Transmission Line occurs on very edge of pine forest—habitat generally not suitable.
	purple martin *Progne subis*	**Low.** Very little pine forest and wetland habitat within Transmission Line.
Pinyon-juniper	gray flycatcher *Empidonax wrightii*	**Extremely Low.** Species range is generally outside of Transmission Line; some potential for the species to occur during migration.
	pinyon jay *Gymnorhinus cyanocephalus*	**High.** Known to occur in pinyon-juniper woodlands of Anderson Mesa.
	gray vireo *Vireo vicinior*	**High.** Species range includes Transmission Line and pinyon-juniper habitat is present.
	black-throated gray warbler *Dendroica nigrescens*	**Moderate.** Species range includes Transmission Line and pinyon-juniper habitat is present.
	juniper titmouse *Baeolophus ridgwayi*	**High.** ~34% of Transmission Line is pinyon-juniper woodland; species likely to occur as year-round resident.
High elevation grassland	ferruginous hawk *Buteo regalis*	**Extremely Low.** Uncommon breeder in region, may occur as winter resident/transient.
	Swainson's hawk *Buteo swainsonii*	**Extremely Low.** Uncommon breeder in region; may occur as winter resident/transient.
	burrowing owl *Athene cunicularia*	**Extremely Low.** Suitable habitat present within Transmission Line; very low prey density/burrows available for breeding.
	grasshopper sparrow *Ammodramus savannarum*	**None.** Species range is outside of Evaluation Area.

4.0 EFFECTS ANALYSIS AND DETERMINATION

The following effects analysis and determination is for resources included in Section 3.0. Standards of significance for impacts to biological resources which are consistent with standards applied for other components of the Grapevine Wind EIS (Grapevine EIS 2010) have been applied where appropriate. Definitions and criteria for the effects analysis are provided below.

4.0.1 Standards of Significance

The Proposed Action would have a significant and adverse effect on biological resources if they:

- Adversely affect a listed endangered, threatened, or proposed plant or animal species or designated critical habitat.
- The Proposed Action resulted in a long-term loss of vegetation resulting in the listing or jeopardizing the continued existence of a plant or animal species.
- The Proposed Action would affect the biological viability of a local, regional, or national population of a listed wildlife species or one of concern/interest *leading to a downgrading in its listing*.
- The Proposed Action would violate the Endangered Species Act (ESA), the Bald and Golden Eagle Protection Act, or the Migratory Bird Treaty Act, which all protect federally- and state-listed species.
- Substantially interfere with the movement of any native resident or migratory fish or wildlife species for more than one reproductive season.
- Reduce the value of habitat for fish, wildlife, or plants to an unusable level.
- Cause a native fish or wildlife population to drop below self-sustaining levels.
- Adversely and substantially affect important riparian areas, wetlands, or other wildlife habitats.

Short-term impacts are those that last through the construction phase of a project, or one or two reproductive cycles, whichever is longer.
Long-term impacts are those that last more than two reproductive periods, or as long as the life of the transmission line, and switchyard depending on the organism or habitat involved.
Direct impacts are those that occur as a result of construction or operation of the transmission line, and switchyard.
Indirect impacts are those that occur as a result of the transmission line and switchyard's presence. These are usually associated with increased human accessibility to a previously inaccessible area.

4.1 Special-Status Plants

Based on the information presented, it is determined that the proposed Project will have the following effects on special-status plant species.

4.1.1 Federal Threatened, Endangered, or Candidate Species

San Francisco Peaks Groundsel

The proposed Transmission Line will have no effect on San Francisco Peaks groundsel. This plant is an alpine species known only from high elevation habitats of the San Francisco Peaks north of Flagstaff, and has no potential to occur within the Transmission Line. The transmission line does not contain suitable habitat for the species.

4.1.2 Forest Service Sensitive Species

Arizona Bugbane

The proposed Transmission Line will have no effect on Arizona bugbane because suitable habitat is not present. Canyons containing high elevation riparian deciduous woodland, which is the species preferred habitat, is not present within the Transmission Line.

Arizona Leatherflower

The proposed Transmission Line will have no effect on Arizona leatherflower. Suitable limestone substrate is not present within the Transmission Line, and the species known distribution does not overlap the Transmission Line. The Transmission Line occurs over basaltic substrates not suitable for the species.

Arizona Sneezeweed

The proposed Transmission Line will have no effect on Arizona sneezeweed because suitable habitat is not present. Pond/wetland habitats required by the species are not present within the Transmission Line.

Arizona Sunflower

The proposed Transmission Line will have no effect on Arizona sunflower because suitable habitat is not present.. Dry, sandy soils required by the species do not occur in the Transmission Line and basaltic substrates dominate the Transmission Line.

Bebb's Willow

The proposed Transmission Line will have no effect on Bebb's willow because suitable habitat is not present. No riparian habitats are found within or immediately adjacent to the Transmission Line.

Blumer's Dock

The proposed Transmission Line will have no effect on blumer's dock because suitable habitat is not present. Wetland habitats required by the species are not present within the Transmission Line.

Crenulate Moonwort

The proposed Transmission Line will have no effect on crenulate moonwort. Suitable habitat for the species is not present with the Transmission Line, and known range does not overlap the Transmission Line.

Disturbed Rabbitbrush
The proposed Transmission Line will have no effect on disturbed rabbitbrush due to range and habitat unsuitability. Soils in the Transmission Line are generally derived from basalt, which are not suitable for the species.

Flagstaff Beardtongue
The proposed Transmission Line may have short-term direct impacts on Flagstaff beardtongue resulting in the loss of individuals during construction, if suitable habitat is available. Soils in the Transmission Line are generally derived from basalt, which are not characterized as suitable for the species, however, locations in the Coconino Forest include sites with similar forest characteristics to those found in portions of the Transmission Line: mixed oak and pinyon-juniper woodlands. The Transmission Line and Evaluation Area do not have evidence of limestone or sandstone outcrops; instead the mesa is built upon a basalt soil foundation. The probability of occurrence is considered extremely low due to the absence of limestone-derived soil. Surveys of potentially suitable habitat along the Transmission Line to identify the species may be warranted. Populations of the species located during pre-construction surveys should be avoided, if possible, or translocated if possible to avoid direct impacts. Indirect impacts to the species may be mitigated through habitat restoration, if necessary, following RMPs identified in the Grapevine EIS (2010). The switchyard does not contain suitable habitat for the species and there will be no effect of the switchyard on the species.

Flagstaff Pennyroyal
The proposed Transmission Line will have no effect on Flagstaff pennyroyal due to lack of suitable habitat. Soils in the Transmission Line are generally derived from basalt, which are not suitable for the species and vegetation characteristics associated with other locations where the species has been documented are not present.

Rock Fleabane
The proposed Transmission Line will have no effect on rock fleabane. Suitable habitat for rock fleabane is not present within the Transmission Line. The known range occurs outside the Transmission Line and the species has no potential to occur.

Rusby's Milk-vetch
The proposed Transmission Line will have no effect on Rusby's milk-vetch due to range, which does not include the Transmission Line or the immediate portion of the Coconino Forest. A very small proportion of suitable suitable habitat (pine forests) and soil (basalt) exist along the Alternative route, however, no suitable habitat exists along the Proposed route. Total available suitable habitat is extremely small (only 16 acres of ponderosa pine habitat will be impacted during construction of the proposed Alternative route).

Sunset Crater Beardtongue
The proposed Project will have no effect on sunset crater beardtongue due to range and habitat. Cinder field habitat in which the species grows is absent from the Transmission Line and the species has no potential to occur.

4.2 Special-Status Wildlife

Based on the information presented in this wildlife and botanical report, it is determined that the proposed project will have the following effects on special-status wildlife species:

4.2.1 Federal Threatened, Endangered, or Candidate Species

Mexican Spotted Owl

The proposed Transmission Line will have no effect on the Mexican spotted owl. Dense, mixed-conifer and pine-oak forest habitats required by the Mexican spotted owl are absent from the Transmission Line, and there have been no observations of the species in the Project or surrounding region. Construction of the Transmission Line will not affect habitat for the species or result in impediment to movement or direct impacts which may affect populations resulting in a downward population trend for the species. The species is unlikely to occur within the Transmission Line due to lack of habitat.

Black-footed Ferret

The proposed Transmission Line will have no effect on the black-footed ferret. The black-footed ferret has a very restricted range in Arizona and suitable habitat and prey density along the Transmission Line is absent.

4.2.2 Forest Service Sensitive Species

American Peregrine Falcon

The proposed project may result in direct impacts to the American peregrine falcon, but is not likely to result in a downward trend toward federal listing. Peregrine falcons are known to hunt waterfowl concentrated at seasonal wetlands occurring throughout Anderson Mesa. Several of these wetlands are located within the Evaluation Area; however, no wetlands exist within the Transmission Line, and no potential peregrine falcon foraging habitat will be impacted by the proposed action; therefore, no indirect impacts are anticipated. There remains, however, a very low risk for peregrine falcons foraging at these wetlands to collide with the proposed transmission line, which could result in (direct impacts) the fatality of individuals. Following guidance of the Avian Power Line Interaction Committee's (APLIC) Suggested Practices for Avian Protection on Power Lines (2006) will minimize and mitigate risk of potential avian collisions and electrocutions along the proposed transmission line.

Bald Eagle

The proposed Project may affect the bald eagle, but is not likely to result in a downward trend toward federal listing. Bald eagles historically nested on the Anderson Mesa including at Mormon Lake and Lake Mary, approximately 3.5 miles to the west and eight miles to the northwest of the Transmission Line, respectively. While eagles are no longer known to nest in these areas, the lakes do support wintering populations. There is no nesting or foraging habitat for bald eagles within the Transmission Line itself, and habitat for the species will not be affected by the proposed action; therefore, no indirect impacts are anticipated. However, individuals may pass through the Transmission Line as transients or during movement between foraging areas, and may even use transmission line poles/towers for perching. As a result, there remains a low risk of collision with or electrocution from the transmission line which may result in direct impacts to individuals. To minimize and mitigate risk of potential avian collisions and

electrocutions along the proposed transmission line, the Suggested Practices for Avian Protection on Power Lines (APLIC 2006) should be followed for transmission line construction.

Clark's Grebe

The proposed Project may result in direct impacts to Clark's grebe, but is not likely to result in a downward trend toward federal listing. There is no suitable open water nesting or stopover habitat for Clark's grebe within the Transmission Line, and habitat for the species will not be affected by the proposed action; therefore, no indirect impacts are anticipated. Seasonal wetlands are present within the surrounding region and there is potential for the species to use these wetlands for nesting or as stopover habitat during migration. As a result, there is some potential for individual Clark's grebe to collide with the proposed transmission line. To minimize and mitigate for risk of potential avian collisions and electrocutions along the proposed transmission line, the guidance of the Suggested Practices for Avian Protection on Power Lines (APLIC 2006) should be followed.

Ferruginous Hawk

The proposed Project may result in direct impacts to ferruginous hawk, but is not likely to result in a downward trend toward federal listing. There is no potential for ferruginous hawks to nest within within the Transmission Line and the species is rarely recorded as a transient visitor in the region during migration or over-wintering periods. Therefore, the potential for occurrence is extremely low. To minimize and mitigate for risk of potential avian collisions and electrocutions along the proposed transmission line, the guidance of the Suggested Practices for Avian Protection on Power Lines (APLIC 2006) should be followed.

Northern Goshawk

The proposed Project will have no effect on northern goshawk. The nearest known goshawk nesting territory is greater than one mile from the Transmission Line. There is no suitable nesting or foraging habitat for the species within the Transmission Line; however, ponderosa pine forests to the southwest likely support resident and transient individuals. No nesting or foraging habitat for northern goshawk will be impacted by the proposed Project.

Western Burrowing Owl

The proposed Project will not affect western burrowing owl. No suitable nesting habitat and abundant burrowing, colonial mammals are present along the Transmission Line. Extremely low potential exists for the species to transient through the area.

Allen's Lappet-Browed Bat

The proposed Project will not affect Allen's lappet-browed bat, Caves and mines used by the species for roosting are not present within the Transmission Line, therefore no breeding habitat or important potential hibernacula will be affected by the action. The species may pass through the Transmission Line in transit between foraging areas in the surrounding region.

Dwarf Shrew

The proposed Project will have no effect on the dwarf shrew. Suitable alpine habitat for this species is not present within the Transmission Line, and the species has a very restricted range in northern Arizona.

Greater Western Mastiff Bat
The proposed Project will have no effect on the greater western mastiff bat. Suitable habitat for the species in the form of cliffs for roosting and large ponds for drinking is not present within the Transmission Line. The species may pass through the Transmission Line in transit between wetland foraging areas in the surrounding region; however, habitat for greater western mastiff bat will not be impacted by the proposed Project.

Long-Tailed Vole
The proposed Project will have no effect on the long-tailed vole due to the absence of suitable habitat. Mesic forest habitats in which the species occurs are not present within the Transmission Line.

Merriam's Shrew
The proposed Project may affect Merriam's shrew resulting in indirect effects through loss of habitat. The Project is not likely to result in direct impacts which would lead toward a downward trend toward federal listing. There is very limited amount of dry forest habitat suitable for the species within the Transmission Line. the Project will remove approximately 16 acres of coniferous forest habitat, potentially used by the species. Because this is such a limited amount of habitat, the Project is not expected to result in loss of species viability. Construction operations may result in the destruction of individual burrows or loss of individuals, however, construction operations will be short-lived and operation of the Transmission Line will have no long-term effect on the species.

Navajo Mogollon Vole
The proposed Project may affect the Navajo Mogollon vole resulting in indirect effects through loss of habitat. The Project is not likely to result in direct impacts which would lead toward federal listing. Potential habitat for the species is present within the Transmission Line in the form of ponderosa pine forest and pinyon-juniper woodland. The Project will remove approximately 250 acres of woodland/forest habitat, potentially used by the species. Construction operations may result in the destruction of individual burrows or loss of individuals, however, construction operations will be short-lived and operation of the Transmission Line will have no long-term effect on the species.

Pale Townsend's Big-Eared Bat
The proposed Project will have no effect on pale Townsend's big-eared bat. Suitable habitat for the species in the form of caves and mines for roosting and large ponds for drinking is not present within the Transmission Line. The species may pass through the Transmission Line in transit between wetland foraging areas and roost sites in the surrounding region; however, habitat for pale Townsend's big-eared bat will not be impacted by the proposed Project.

Spotted Bat
The proposed Project will have no effect on the spotted bat. Suitable habitat for the species in the form of cliffs for roosting and large ponds for drinking is not present within the Transmission Line. The species may pass through the Transmission Line in transit between wetland foraging

areas and roost sites in the surrounding region; however, habitat for the spotted bat will not be impacted by the proposed Project.

Wupatki Arizona Pocket Mouse
The proposed Project will have no effect on the Wupatki Arizona pocket mouse. Desert scrub habitats preferred by the species area not present within the Transmission Line.

Narrow-Headed Gartersnake
The proposed Project will have no effect on the narrow-headed gartersnake. The species inhabits permanently flowing streams which are absent from the Transmission Line.

Northern Leopard Frog
The proposed Project will have no effect on the northern leopard frog. Wetland habitats required by the species are absent from the Transmission Line.

Blue-Black Silverspot Butterfly
The proposed Project will have no effect on the blue-black silverspot butterfly. Suitable wet meadow, marsh, or streamside habitat is not present within the Transmission Line.

Mountain Silverspot Butterfly
The proposed Project will have no effect on the mountain silverspot butterfly. The butterfly is an alpine species with no potential to occur in the Transmission Line.

Spotted Skipperling
The proposed Project will have no effect on the spotted skipperling. Moist woodland openings, meadows, and riparian habitats in which the species occurs are absent from the Transmission Line.

4.2.3 USFS Management Indicator Species
Abert Squirrel
The proposed Project will have no effect on Abert squirrel habitat or population trends. Ponderosa pine forests in which the species occurs is present in only very limited amounts; 16 acres of ponderosa pine habitat will be impacted during construction of the proposed Alternative route. Ponderosa pine forests are abundant in the region.

Pygmy Nuthatch
The proposed Project will have no effect on pygmy nuthatch habitat or population trends. The species primary habitat, late-seral ponderosa pine forest, is present within the Transmission Line in very small amounts; only 16 acres of ponderosa pine habitat will be impacted during construction of the proposed Project. Ponderosa pine forests are abundant in the region.

Wild Turkey
The proposed Project will have no effect on wild turkey habitat or population trends. The species primary habitat, mature ponderosa pine forest, is present within the Transmission Line is very small amounts; only 16 acres of ponderosa pine habitat will be impacted during construction of the proposed Project. Ponderosa pine forests are abundant in the region.

Elk

The proposed Project may have indirect impacts on elk, however, impacts will be small and will not affect overall elk habitat in the Forest or population trends for the species. Elk was selected as a big-game indicator species for early-seral stage ponderosa pine, mixed-conifer and spruce-fir habitat types. There are close to 700,000 acres of the non-Wilderness ponderosa pine cover type (which includes ponderosa pine-gambel oak), and cover type acreages have remained essentially the same since 1989 (USFS 2002). The project will result in the loss of approximately 16 acres of ponderosa pine forest, representing less than 0.01% of estimated ponderosa pine forest habitat. Age class composition of ponderosa pine within the Transmission Line is not specifically understood at this time, however, observations during the site visit indicate only individual trees classed as early seral ponderosa pine may be present within the 16 acres identified as ponderosa pine forest. The loss of individual early seral ponderosa pine within a total 16 acre ponderosa pine forest impact from the Project will not affect elk habitat, habitat use or population trends within the Forest. The species preferred summer habitat, mixed-conifer and spruce-fir forests are absent from the Transmission Line; however, pinyon-juniper woodlands in the Transmission Line likely support wintering elk. While the proposed Project will remove approximately 233 acres of pinyon-juniper woodland; there are roughly 630,000 acres of pinyon-juniper woodland on the Forest (FSVeg/RMRIS database, 6/13/02). This habitat type is abundant in the region and not a unique habitat feature. Construction operations may cause short-term disturbance on elk behavior or movement in the local area. Operation of the Transmission Line is not anticipated to have long-term effects on elk behavior or movement patterns.

Hairy Woodpecker

The proposed Project will have no effect on the hairy woodpecker. There are no suitable forest habitats for the species within the Transmission Line.

Red Squirrel

The proposed Project will have no effect on red squirrel. Mixed conifer and spruce fir habitat required by red squirrel is not present within the Transmission Line.

Red-Naped Sapsucker

The proposed Project will have no effect on the red-naped sapsucker. Aspen forests in which the species occurs is not present within the Transmission Line.

Mule Deer

The proposed Project may have indirect impacts on mule deer, however, impacts will be small and will not affect overall deer habitat in the Forest or population trends for the species. Mule deer were selected as an indicator species for early-seral stages of aspen and pinyon-juniper woodlands. Aspen forests are abscent from the Transmission Line and while the proposed Project will remove approximately 233 acres of pinyon-juniper woodland; there are roughly 630,000 acres of pinyon-juniper woodland on the Forest (FSVeg/RMRIS database, 6/13/02). This habitat type is abundant in the region and not a unique habitat feature. Population trends and habitat viability will not be affected for this species by the Project.

Juniper Titmouse
Juniper titmice are indicators for late seral pinyon-juniper, particularly the snag component. The proposed Project may have indirect impacts on juni[per titmouse, however, impacts will be small and will not affect overall habitat in the Forest or population trends for the species. While the proposed Project will remove approximately 233 acres of pinyon-juniper woodland; there are roughly 630,000 acres of pinyon-juniper woodland on the Forest (FSVeg/RMRIS database, 6/13/02). This habitat type is abundant in the region and not a unique habitat feature. Age classification of woodlands affected by the Project are not understood at this time, however, it is extremely unlikely that the area contains abundant late-seral populations. Population trends and habitat viability will not be affected for this species by the Project. Construction, depending on timing, may result in the loss of individual nests or the mortality of individuals. Avoidance of direct impacts may be accomplished through restricting clearing operations conducted as part of construction, during the breeding season (Grapevine EIS 2010).

Pronghorn Antelope
Antelope are a management indicator species for early and late seral grassland type. The proposed Project may have indirect impacts on antelope, however, impacts will be small and will not affect overall habitat in the Forest or population trends for the species. Open grassland, the species preferred habitat, is the dominant habitat type comprising the Transmission Line and totals approximately 428 acres. Construction may result in short-term impacts to grassland habitats preferred by the species, however, grassland occurs over 151,000 acres within MA10, which includes Anderson Mesa. Temporary construction impacts to grassland may be mitigated through vegetation restoration (see Grapevine EIS 2010). Construction may also result in short-term changes in pronghorn movement or behavior if pronghorn occur in the project area during construction. Operation of the Transmission Line is not anticipated to have an effect on pronghorn populations. Given the small acreage of grassland habitat impacted by the proposed Project, and the fact that this habitat type is abundant throughout the region, the Anderson Mesa pronghorn herd is not likely to be adversely affected by the Project.

Lincoln's Sparrow
It is our determination that the proposed Project will have no effect on Lincoln's sparrow. Suitable late-seral, high-elevation riparian habitats are not present within the Transmission Line.

Lucy's Warbler
The proposed Transmission Line will have no effect on Lucy's warbler. Late-seral, low-elevation riparian habitats in which the species occurs are not present within the Transmission Line.

Yellow-Breasted Chat
The proposed Transmission Line will have no effect on the yellow-breasted chat. Suitable late-seral, low-elevation riparian habitats are not present within the Transmission Line.

Macroinvertebrates
The proposed Transmission Line will have no effect on macroinvertebrate populations. Suitable late-seral, riparian habitats required by this group of species are not present within the Transmission Line.

Cinnamon Teal

The proposed Transmission Line will have no effect on cinnamon teal. There is no suitable open water nesting or stopover habitat for the teal within the Transmission Line, and habitat for the species will not be affect by the proposed action. Seasonal lakes are present within the evaluation area and cinnamon teal are a common breeder on wetlands in this region. It is likely that cinnamon teal use wetlands in the Project vicinity for nesting or as stopover habitat during migration.

4.2.4 Migratory Bird Treaty Act

Bird species protected under the Migratory Bird Treaty Act (1918) may be affected by the proposed Project both directly and indirectly; however, however these effects will not result in a downward trend toward federal listing for any of the species. While construction and maintenance of the transmission line will likely result in disturbance to, and removal of habitat for, some species, particularly those inhabiting grassland and pinyon-juniper woodland habitats within the transmission line corridor, the total area impacted will be relatively small (approximately 678 acres) compared to surrounding similar habitat and construction activities will be short-term. The major habitat types that will be impacted by the Project are abundant throughout the region and are not unique habitat features. Thus, removal of habitat for construction of the transmission line is not expected to have a significant impact on resident and migratory birds in the region. Direct impacts from the Project would result from avian collisions and electrocutions along the proposed transmission line. To minimize and mitigate risk of potential avian collisions and electrocutions along the proposed transmission line, the transmission line should be designed according to the Suggested Practices for Avian Protection on Power Lines (APLIC 2006).

4.2.5 Anderson Mesa Important Bird Areas

Bird species inhabiting the Anderson Mesa Important Bird Area in which the Transmission Line occurs, may be affected by the proposed Project; however, we believe these effects will not result in a downward trend toward federal listing for any of these species. Anderson Mesa is one of two major waterfowl migration stopover sites in Arizona. While several smaller lakes occur within the Evaluation Area, none occur within the Transmission Line. Larger lakes in the region (Lakes Mary and Mormon Lake), are both over three miles from the Transmission Line. The Transmission Line will be constructed across grasslands and pinyon-juniper woodlands which are important landcover components of the IBA; however, both of these habitat types are abundant throughout the Anderson Mesa and are not unique habitat features to the region. Removal of habitat for construction of the transmission line is not expected to have a significant impact on resident and migratory birds in the region. While avian collision with the proposed transmission line will remain an unavoidable risk, particularly for waterfowl species utilizing wetland areas adjacent to the Transmission Line, implementation of the APLIC standards will serve to minimize this potential threat.

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APPENDIX A. Western EcoSystems Technology, Inc. correspondence with USFS, AZGFD, and USFWS

APPENDIX B. Photos taken during Transmission Line visit on November 10 and 12, 2009

APPENDIX D.3

AVIAN AND BAT STUDIES FOR THE GRAPEVINE CANYON WIND ENERGY PROJECT

Available online at www.wapa.gov/transmission/grapevine.htm

Avian and Bat Studies for the Grapevine Canyon Wind Energy Project Coconino County, Arizona

Final Report

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July 20, 2009

EXECUTIVE SUMMARY

Foresight Flying M, LLC, managed by Foresight Wind Energy, LLC, is evaluating the feasibility of wind energy development in Coconino County, Arizona. The proposed wind-energy facility, the Grapevine Canyon Wind Resource Area (GWRA), is located approximately 40 miles (64 kilometers) southeast of Flagstaff, Arizona on the Flying M Ranch. Objectives of this study were to provide site specific bird and bat resource data that would be useful in evaluating potential impacts from the proposed wind-energy facility and assist in project planning, as well as recommending further monitoring studies and potential mitigation measures, if warranted. The field surveys consisted of fixed-point bird use surveys, raptor nest surveys, acoustic bat surveys, sensitive species surveys, and incidental wildlife observations within the proposed GWRA from June 2007 through July 2008.

A total of 446 twenty-minute fixed-point surveys were conducted to estimate the spatial and temporal use of the site by birds, and in particular, raptors. Surveys were conducted at 24 points located within the GWRA approximately once a month during the summer (June 1 – August 31) and weekly during the fall (September 1-November 15), winter (November 16-February 29), and spring (March 1 – May 31) seasons. During the peak of fall raptor migration (approximately mid-September to mid-October) surveys were conducted twice a week. A total of 55 bird species, representing 4,423 individual birds within 1,155 separate groups, were recorded during the fixed-point bird use surveys at the GWRA, of which 365 individuals were raptors representing 10 unique species.

Bird use, defined as the mean number of individuals per 800-m radius plot per 20-minute survey, of the GWRA was greatest in the winter (13.72 number of birds/plot/20-minute survey), followed by fall (11.60), spring (6.44), and summer (3.78). Waterfowl use was highest in winter (0.41 birds/plot/20-minute survey), compared to other times of the year (summer 0, fall 0.06, and spring 0.06). Shorebird use was highest in fall (0.23 birds/plot/20-minute survey), compared to spring (0.06), the only other season in which this bird type was observed. Raptor use was highest during the fall (1.68 birds/plot/20-minute survey) compared to other times during the year (summer 0.51, winter 0.13, and spring 0.24). Raptors comprised 14.4% of the overall bird use in the fall, 13.6% in the summer, and less than four percent during the winter and spring. Vulture use was highest in summer (0.53 birds/plot/20-minute survey), compared to other times of the year (fall 0.19, winter 0, and spring 0.19). Passerines had the highest use of any bird type during all four seasons. Passerine use was highest in the winter (13.11 birds/plot/20-minute survey), compared to fall (9.07), spring (6.31), and summer (2.53). Horned lark had the highest use by any one species in fall (2.52 birds/plot/20-minute survey), winter (7.35), and spring (2.71), while lark sparrow had the highest use in the summer (0.91). Passerines comprised nearly all of the overall bird use in winter and spring (95.5% and 90.5%, respectively) and comprised more than 66% of use in the summer and winter. Passerines were observed during more than 80% of the surveys in the fall, winter, and spring, and were observed during 66% of summer surveys.

During the fixed-point bird use surveys 818 groups totaling 3,563 individual birds were observed flying. The area between 115 to 443 feet (35 to 135 meters) above ground level was defined as the approximate zone of risk for potential collision with a turbine blade. For all groups combined, 92.9% of birds observed flying were below the zone of risk, 6.1% of birds observed flying were

within the zone of risk, and 0.9% of birds flying were above the zone of risk. Vultures had the highest percentage of flying birds within the zone of risk (52.5%), followed by raptors (13.3%) and passerines (4.5%). Most (80.2%) of flying raptors were observed below the zone of risk, 13.3% were within the zone of risk, and 6.5% were above the zone of risk. Passerines observed flying were primarily (97.8%) flying below the zone of risk. Six species had at least 45 groups observed flying; only turkey vulture was observed flying within the zone of risk during at least 50% of the observations (52.5%).

Mean use was plotted by bird survey point for raptors, passerines, and all birds combined. For the twenty-four survey points, passerine use was highest at point number 9 (36.1 birds per survey) with a wide range at all other points from 1.8 birds per survey to 16.5. Raptors were observed at all points and use varied from 0.32 to 1.84 birds per survey. For all bird species combined, use was highest at point number 9 (38.05 birds per survey) due to the large numbers of passerines, while use at other points ranged from 3.11 to 18.89. Within the GWRA, raptor use appeared to be strongly associated with proximity to prairie dog towns. Raptor use was highest at fixed bird use points 7, 11, and 16, which are either within or adjacent to active prairie dog towns (Figure 12). In general, raptor use was higher in the eastern half of the study area and was elevated near the available prey base found at prairie dog towns. At the GWRA, turbine placement in or immediately adjacent to active prairie dog towns may increase the susceptibility of some raptors (principally red-tailed hawk and golden eagle) to collision with turbines. The aggregation of burrows and prey density near turbines has been shown to be correlated with increased raptor mortality in studies completed at Altamont Pass, California.

A comparison of overall mean raptor use at the GWRA with other wind resource areas that have been studied with similar methods, assists in determining potential impacts from the proposed project. Overall use of the GWRA by raptors standardized to 20-minute surveys for comparison to other studies, was 0.67. Based on studies of 36 other wind resource areas that were studied for three or four seasons, mean overall raptor use typically ranged from 0.09 to 2.34 per 20-minute survey. Comparatively, mean raptor use at the GWRA is within the mid-range of these other studies, or low to moderate. A regression analysis of raptor use and mortality for 12 wind-energy facilities with modern wind turbines, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 71.7%). Using this regression to predict raptor collision mortality at the GWRA, based on a mean raptor use of 0.67 birds/20-minute survey, yields an estimated fatality rate of 0.10 raptors/MW/year, or 10 raptor fatalities per year for a 100-MW project. A 90% confidence interval around this estimate is zero to 0.35 raptors/MW/year.

The objective of the acoustic bat surveys was to estimate the seasonal and spatial use of the study area by bats. Three Anabat® II echolocation detectors were used for continuous passive monitoring at ground-based locations between June 26 – November 9, 2007 and April 12 – July 7, 2008. A fourth detector (a.k.a., Hi-Mic) was mounted on a met tower to sample bat activity near rotor height. For the ground-based Anabat units, a total of 4238 bat calls were recorded during 567 bat detector nights in 2007, and a total of 1949 bat calls were recorded during 214 bat detector nights in 2008. Mean bat activity during the 2007 season was 7.47 bat passes per detector night and 9.11 during the 2008 season. Approximately 71% of all recorded passes came from station GV20 during 2008, which was located near water that was likely used by bats for

drinking and foraging. GV20 recorded the highest level of bat activity during 2007; however, GV10 recorded higher levels of activity during 2007 compared with 2008. The ground unit at station GV16 recorded four times as many bat calls as the Hi-Mic unit, indicating higher relative bat activity near the ground than at approximate rotor (blade) height. Bat activity was greatest during late May and mid-June (2008) and between mid-July and mid-August (2007). Most (90%) of the calls were > 35 kHz (e.g., *Myotis* bat species), and the remaining calls were < 35 kHz in frequency (typically larger bodied bats, e.g., big brown bat, hoary bat). Species identification was possible for the hoary bat, which made up 5% of all calls in 2007, and 2% of all calls in 2008. Activity by hoary bats was highest in late August and early October of 2007, and May of 2008, suggesting this species migrates through the study area at these times of year. Big free-tailed bats were only detected between late September and late October of 2007 (1% of all passes), suggesting fall migration of this species through the area. Allen's big-eared bat were detected 4 times in 2007 (in October) and twice in 2008 (once in mid-April and once in mid-June), indicating this species makes infrequent use of the study area, possibly passing through in fall and spring. Spotted bats, which also produce distinctive calls, were not detected.

The mean number of bat passes per detector-night for ground-based locations was compared to existing data at five wind energy facilities where both bat activity and mortality levels have been measured. The level of bat activity documented at the GWRA (approximately 7.4 and 9.1 bats per detector-night for 2007 and 2008 respectively) was much lower than three wind facilities in the eastern U.S., where reported bat mortalities are highest. Bat activity at Grapevine was higher than that recorded at two facilities where subsequent bat mortality was low. Some bat mortality will likely occur in the study area, but the available data suggest mortality rates will be low to medium relative to other studies.

The objective of the raptor nest surveys was to locate raptor nests in the study area that may be subject to disturbance and/or displacement effects from the wind-energy facility construction and/or operation. One active red-tailed hawk nest was located during the aerial survey in Yaeger Canyon just outside the northwest GWRA boundary. Two inactive golden eagle nests were observed during ground raptor nest surveys near the confluence of Grapevine and Diablo Canyons. A ground check of all known raptor nests was conducted on June 6 and 8, 2008 and no nests were found to be active. Raptor nest density in this 67 square mile (173.5 square kilometer) area of the GWRA and the one-mile buffer was low (0.04 nests/square mile). All nests found are located in distinct physiographic portions (canyons) of the GWRA.

The objective of the sensitive species surveys was to determine the presence or absence and spatial distribution of federal and state listed species, species of conservation concern, or other species of interest within the study area and particularly within proposed development corridors. In general, sensitive species use at the GWRA is low. Sensitive species documented at the GWRA during all surveys or incidentally included seven bald eagles, four Cooper's hawks, and two western burrowing owls. Three Gunnison's prairie dog towns were also mapped: two active and one inactive. The Arizona (Sonora) population of bald eagles is characterized by the U.S. Fish and Wildlife Service as a Distinct Population Segment and this population is currently petitioned for listing under the Endangered Species Act. Bald eagles were only observed in the winter and spring, while Cooper's hawks were only observed during the fall and spring. One

western burrowing owl was observed at an inactive prairie dog town during the breeding season and one was observed incidentally; however no nests were discovered during nest searches.

The objective of recording incidental wildlife observations while observers were on site, was to provide occurrence information about wildlife outside the standardized surveys and survey areas, that might be affected by the proposed wind-energy facility. The most abundant bird species recorded was American kestrel (123 observations), followed by lark sparrow (120). Twenty species total were recorded, with a total of 542 individuals in 121 groups. Three species were observed incidentally that were not observed during fixed-point bird use surveys: common nighthawk, great blue heron, and white-faced ibis. The most abundant mammal species recorded as incidental wildlife was pronghorn antelope (301 observations). Other game animals observed included bison (63 observations), elk (58), mule deer (eight) and javelina (two). Nine mammal species were observed, with a total of 470 individuals in 73 groups.

Based on the results of the studies to date, there is no information to suggest that bird and bat mortality at the GWRA would be significantly different that that documented at other wind-energy facilities located in the western US, where collision mortality has been relatively low. Based on other monitoring study results the greatest impacts are most likely to occur on non-raptor species; however, due to low exposure risks and overall low relative abundance of most species, it is unlikely that non-raptor populations will be adversely affected by mortality from the operation of the wind-energy facility. The extent of disturbance or displacement related impacts are difficult to estimate. The density of nesting raptors was not high and is not expected to become high, and no significant displacement impacts are expected on nesting raptors. Passerines breeding in the grassland and pinyon-juniper habitat are likely to be displaced from construction zones during the breeding season but the overall loss of habitat is not expected to be significant and over time will be reduced as construction areas revert to native habitat.

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INTRODUCTION

Foresight Flying M, LLC, managed by Foresight Wind Energy, LLC, is evaluating the feasibility of wind energy development in Coconino County, Arizona. The proposed wind-energy facility, the Grapevine Canyon Wind Resource Area (GWRA), is located approximately 40 miles (mi; 64 kilometers [km]) southeast of Flagstaff, Arizona, on the Flying M Ranch. The current proposal is for a wind-energy facility up to 500MW in size, consisting of between 166 and 333 wind turbines. The study area for the project is approximately 34 square miles (mi^2; 88 square km [km^2]) in size and lies east of the Coconino National Forest and Mormon Lake and south of the Interstate 40 (I-40) corridor (Figure 1). The proposed development would be located on private land that is interspersed with public lands administered by the Arizona State Land Department (ASLD). The exact location and size of the project infrastructure will be determined based on factors including wind resource assessment, economics, electricity markets, transmission constraints, power purchase agreements, permitting, and results of site surveys.

This report presents the results of bird and bat surveys that were conducted to evaluate potential impacts from the proposed wind-energy facility. Based on a review of the existing knowledge base regarding wind-energy development throughout the western US, a one-year bird and bat study plan was developed for the GWRA. The study plan was developed with input from the Arizona Game and Fish Department (AZGFD) and the U.S. Fish and Wildlife Service (USFWS) and the expertise and experience of Western EcoSystems Technology, Inc. (WEST) in implementing and conducting similar studies for wind-energy development throughout the United States. Objectives of the study were to provide site specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed GWRA, provide information that could be used for project planning and design of the facility to minimize impacts to birds and bats, and recommend further monitoring studies or potential mitigation measures, if warranted.

This report provides the results of the study conducted at the GWRA from June 2007 through July 2008. The GWRA studies consisted of fixed-point bird use surveys, ground and aerial surveys for raptor nests, nocturnal acoustic bat surveys, sensitive species surveys, and incidental wildlife observations. The ability to estimate potential direct impacts to birds and bats at proposed wind-energy facilities is enhanced by operational monitoring data collected at existing wind-energy facilities. For several wind-energy facilities, standardized baseline data on bird use, has been collected followed by standardized post-construction (operational) monitoring, allowing comparisons of bird use to mortality. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities as part of the impact assessment.

STUDY AREA

The proposed wind-energy facility is located within the Pinyon-Juniper Woodland Ecozone of the Colorado Plateau Semi-Desert Province in the northeastern quarter of Arizona. The GWRA falls primarily within pinyon-juniper and desert scrub vegetation types north and east of the Mogollon Rim which delineates the Arizona-New Mexico Mountains Semi-Desert province to

the south. Elevation in the GWRA varies from approximately 5,600 to 6,300 feet (ft; 1,707 to 1,920 meters [m]) above sea level. The proposed wind-energy facility area lies just east of the Coconino National Forest and Mormon Lake area south of the I-40 corridor.

The land within the project is a mix of private and state owed land. Most of the GWRA is undeveloped and grazing is the primary land use. Several water tanks/stock ponds have been developed through the GWRA for livestock. The GWRA is also bisected by several unimproved roads (two-tracks). The proposed GWRA is situated primarily on a flat plateau topographic feature (Figure 1). Along the eastern and northern edge of the GWRA there are distinct canyons or breaks of varying topography and vegetation that drop off in elevation (see Figure 1).

METHODS

The primary objectives of the study were to provide site specific data on bird and bat use of the GWRA that could be helpful in estimating potential impacts from the proposed wind-energy facility and provide data that could be helpful in designing a facility that would minimize risk and impacts to bird and bat resources.

Fixed-Point Bird Use Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly raptors, defined here as kites, accipiters, buteos, harriers, eagles, falcons, owls, and vultures. Fixed-point surveys (variable circular plots) of twenty-minute duration were conducted using methods described by Reynolds et al. (1980). The points were selected to survey representative habitats and topography of the study area while also providing relatively even coverage with minimal overlap of points. Surveys at each point were 20 minutes (min) long and all birds seen during fixed-point surveys were recorded. Raptors and other large birds, species of concern, and species not previously seen in the study area that were observed between fixed-point surveys were recorded; UTM coordinates from global positioning system (GPS) units also were noted for species of concern.

Bird Use Survey Plots

Twenty-two points were selected to achieve optimal coverage of the study area and habitats within the study area (Figure 2). The ridgelines along the eastern and northern edge of the GWRA create a distinct physiographic feature that could experience different levels of bird use than the flat top of the mesa of the bulk of the GWRA. With this in mind, the points were established so that observations could be made that included both the areas over the flat mesa top as well as the steep slopes of the mesa (see Figure 2). Each survey plot was an approximate 800-m (~one-half mile) radius circle centered on the point. Surveys were conducted for 20 min at each point, and all species of birds observed during surveys were recorded. All large birds observed perched within or flying over the plot were recorded and mapped. Small birds (e.g., sparrows) within 100 m (~328 ft) of the point were recorded, but not mapped. Observations of birds beyond the plot were recorded, but were not included in the statistical analyses. A unique observation number was assigned to each observation.

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

Locations of raptors, other large birds, and species of concern seen during fixed-point bird use surveys were recorded on field maps by observation number. Flight paths and perched locations were digitized using ArcGIS 9.2 (ERSI™). Any comments or unusual observations were recorded in the comments section of the data sheet.

Observation Schedule

Sampling intensity was designed to document bird use and behavior by habitat and season within the study area. Surveys were conducted approximately weekly during 10 weeks of the fall (September 1- November 15) season. During the peak of fall raptor migration (approximately mid-September to mid-October) an additional four surveys were conducted resulting in approximately twice-weekly surveys during this period. During the winter (November 16 – February 29) season and during the spring (March 1 – May 31) season, surveys were completed approximately weekly. During the summer (June 1 – August 31) season two surveys were completed to assess breeding bird activity. To the extent practicable, each station was surveyed about the same number of times each season; however, the schedule varied somewhat in response to adverse weather conditions (e.g., winter snow storms, rain), which caused delays and/or missed surveys. During a given survey day, as many survey stations as possible were visited (generally 10-14), depending on length of daylight period and travel time between points. Surveys were rotated through the survey stations so that all stations were visited approximately the same number of times.

Raptor Nest Surveys

Two survey methods were used for the raptor nest surveys; aerial surveys and ground-based surveys. Surveys for raptor nests were conducted in the GWRA and an approximate one-mile (1.6-km) buffer. Results from the fixed-point surveys, in-transit incidental observations, and habitat reconnaissance surveys were used to help focus the raptor nest surveys in the most likely areas for nesting raptors. The objective of the raptor nest surveys was to locate raptor nests that may be subject to disturbance and/or displacement effects from construction and/or operation of the proposed wind-energy facility.

All raptor nests identified during aerial and ground-based surveys were monitored during the late breeding season (early June) to assess nest success or productivity, to the extent possible. Nests observed incidentally during other surveys at the GWRA were also mapped and included in the raptor nest data set.

Aerial Raptor Nest Survey

A single aerial raptor nest survey was scheduled after most species of raptor had finished courtship and were incubating eggs or brooding young. The aerial nest survey was conducted by searching habitat suitable for most aboveground nesting species, such as cottonwood, ponderosa pine, tall shrubs, and cliffs or rocky outcrops. The aerial survey effort largely focused on Diablo and Grapevine Canyons. During the survey, A Bell 206 Jet Ranger helicopter was flown at an altitude of tree-top level to approximately 250 ft (76 m) above the ground. If a nest was observed, the helicopter was moved to a position where nest status and species present could be determined. Efforts were made to minimize disturbance to breeding raptors, including keeping the helicopter a maximum distance from the nest at which the species could be identified, with distances varying depending upon nest location and wind conditions. Data recorded for each nest location included species occupying the nest, nest status (inactive, bird incubating, young present, eggs present, adult present, unknown or other), nest substrate (pine, oak, cottonwood, juniper, shrub, rocky outcrop, cliff or power line), number of young present, time and date of observation and the nest location (recorded with a handheld Garmin GPS 76 CSX unit). Nest sites identified during the aerial survey were ground-truthed during the late breeding season to assess productivity.

Ground-Based Raptor Nest Survey

Ground-based raptor nest surveys consisted of ground searches of selected areas within approximately one mile (1.6 km) of the proposed GWRA which were suspected of containing nests identified during the aerial survey and through land-owner contacts. Data recorded for each nest location included species occupying the nest, nest status (inactive, bird incubating, young present, eggs present, adult present, unknown or other), nest substrate (pine, oak, cottonwood, juniper, shrub, rocky outcrop, cliff or power line), number of young present, time and date of observation and the nest location (recorded with a handheld Garmin GPS 76 CSX unit).

Bat Acoustic Surveys

The objective of the bat use surveys was to estimate the seasonal and spatial use of the GWRA by bats. Bats were surveyed using Anabat® II (Anabat) bat detectors (Titley Electronics Pty Ltd., NSW, Australia) coupled with Zero Crossing Analysis Interface Modules (ZCAIM; Titley Electronics Pty Ltd., NSW, Australia). Bat detectors are a recommended method to index and compare habitat use by bats. The use of bat detectors for calculating an index to bat impacts has been used at several wind-energy facilities (Kunz et al. 2007b), and is a primary and economically feasible bat risk assessment tool (Arnett 2007). Bat activity was surveyed using three ground-based detectors and one detector connected to a raised Hi-Mic, that was elevated approximately 40 m above ground level on one of the project met towers.

Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are then translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16 was used for the study. Bat echolocation detectors also detect other ultrasonic sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. The calls were recorded via the ZCAIM which uses a CompactFlash™ memory

card with large storage capacity. The Anabat detectors were placed inside plastic weather-tight containers with a hole cut in the side of the container for the microphone to extend through. Microphones were encased in PVC tubing with drain holes that curved vertically outside the container to minimize the potential for water damage due to rain. Anabat units situated on the ground were raised approximately one meter (~3.3 ft) to minimize echo interference and lift the unit above vegetation. For the Hi-Mic Anabat setup, the microphone was attached to a 50 m audio (coaxial) cable and mounted at an elevation of approximately 40 m on a meteorological tower. The microphone was secured in a PVC protective casing and oriented approximately horizontal to minimize the possibility of rain damage. All units were programmed to turn on each night an approximate half-hour before sunset and turn off an approximate half-hour after sunrise.

Sensitive Species Surveys

The objective of the sensitive species surveys was to determine the presence or absence and spatial distribution of federal and state listed species, species of conservation concern, or other species of interest within the study area and particularly within proposed development corridors. Based on information from the Arizona Game and Fish Department (AZGFD 2008*a* and 2008*b*) and the U.S. Fish and Wildlife Service (USFWS) (ECOS 2008), several state- and federal-listed species and species of concern, including western burrowing owl (*Athene cunicularia* spp. *hypugaea*), and Gunnison's prairie dog (*Cynomys gunnisoni*), could occur in the project area. Some USFWS Birds of Conservation Concern (USFWS 2002), such as Cooper's hawk (*Accipiter cooperii*), loggerhead shrike (*Lanius ludovicianus*), and bald eagle (*Haliaeetus leucocephalus*) also potentially occur in the project area.

Appropriate habitat for sensitive species was identified and presence/absence surveys were focused in suitable habitat. Ground-based reconnaissance surveys of the GWRA were conducted in areas not routinely visited during bird use surveys to look for prairie dog colonies, burrowing owls, or other species that may not be detected during the bird use surveys. UTM coordinates for all sensitive species observations and prairie dog towns were recorded for mapping.

Incidental Wildlife Observations

The objective of the incidental wildlife observations was to provide use and occurrence information about wildlife outside the standardized survey areas that might be affected by the proposed wind-energy facility. Incidental wildlife observations were made while observers were within the study area conducting the various surveys or traveling between survey points. All sightings of raptors, raptor nests, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded. These observations were recorded in a similar fashion to those recorded during the standardized surveys discussed above. Information recorded for incidental wildlife observations included the observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), habitat, and, for sensitive species, the GPS coordinates.

Statistical Analysis

Quality Assurance and Quality Control

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

Data Compilation and Storage

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

Bird Diversity and Species Richness

A list of all bird species observed during all surveys, with the number of observations and the number of groups, including all observations of birds detected regardless of their distance from the observer, was generated for the GWRA. The total number of unique species and the mean number of species observed per survey (i.e., number of species/plot/20-min survey) was calculated to illustrate and compare differences between seasons.

Bird Use, Composition, and Frequency of Occurrence

Estimates of bird use were calculated as the number of individuals observed per 20-min survey from the standardized fixed-point surveys. For the bird use estimates, only observations of birds detected within 800 m of the survey point were used, standardizing for plot size. Avian use estimates were used to compare differences between bird types, seasons, survey stations, and other wind-energy facilities where similar surveys have been conducted.

The frequency of occurrence by species was calculated as the percent of surveys in which a particular species was observed. Species composition was represented by the mean use for a species divided by the total use for all species. Frequency of occurrence and percent composition provide relative estimates of risk to avian species in the study area. For example, a particular species may have high use estimates for the site based on just a few observations of large flocks, however, the frequency of occurrence will indicate that it occurs during very few of the surveys and therefore, may be less likely affected by a project.

Bird Flight Height and Behavior

To calculate potential risk to bird species, the first flight height recorded was used to estimate the percentages of birds flying within the likely "zone of risk" for typical turbines at the GWRA. Since the type of turbines that will be used at the GWRA is currently unknown, the likely zone of risk was defined as a flight height of between 35 to 135 m (115 to 443 feet) above ground level (AGL), which is the blade height of typical turbines that could be used at the GWRA.

Bird Exposure Index

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

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (observations within the plot) averaged across all surveys, P_f equals proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals proportion of all initial flight height observations of species *i* within the likely zone of risk. This index does not account for differences in behavior other than flight heights and percent of birds observed flying.

Spatial Use

The objective of mapping observed bird locations and flight paths within the GWRA was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the GWRA. Data were analyzed by comparing use among points or transects and the association of use to topographic features. This information was used to determine if avian use was significantly higher in any portion of the study area which in turn could aid in project planning or design to minimize exposure risk to birds.

Acoustical Bat Surveys

The units of activity to describe bat use were the number of bat passes or calls (Hayes 1997). A pass or call (terms used synonymously) was defined as a continuous series of at least two call notes produced by an individual bat with no pauses between call notes of more than one second (Gannon et al. 2003; White and Gehrt 2001). The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. To standardize the data between Anabat stations, the total number of passes was divided by the number of detector nights.

Bat calls were classified as either high-frequency calls (≥ 35 kHz) that are generally given by small bats (e.g. *Myotis* spp.) or low-frequency (< 35 kHz) that are generally given by larger bats (e.g. silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*], Townsend's big-eared bat [*Corynorhinus townsendii*], hoary bat [*Lasiurus cinereus*]). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified pass criteria were removed from the analysis. To establish which species may have produced the high- and low-frequency calls recorded, a list of species expected to occur in the study area was compiled based on published range maps (BCI website 2008; Harvey et al. 1999).

The total number of bat passes per detector night was used as an index for bat use in the GWRA. Bat pass data represented levels of bat activity rather than the numbers of individuals present, because individuals could not be differentiated by their calls. To predict potential for bat mortality (i.e. low, moderate, high potential), the mean number of bat passes per detector night across locations was compared to existing data from wind-energy facilities where both bat activity and mortality levels have been measured.

RESULTS

Wildlife surveys at the GWRA occurred from June 22, 2007 through July 7, 2008. Excluding bats, 67 animal species were identified: 58 birds and nine mammals.

Fixed-Point Bird Use Surveys

Fixed-point bird use surveys were conducted from June 22, 2007 through May 29, 2008 within the GWRA. A total of 446 twenty-minute fixed-point surveys were conducted (Table 1).

Bird Diversity and Species Richness

Fifty-five unique species were observed during the course of all fixed-point bird use surveys at the GWRA, with a mean number of species observed per survey of 2.19 (Table 1). A total of 4,423 individual bird observations within 1,155 separate groups were recorded during the fixed-point surveys (Table 2). Cumulatively, horned lark (*Eremophila alpestris*) composed 34.4% of the observations. Unidentified raven comprised another 10.3% of all observations, while all other species individually comprised less than 5% of the total observations. A total of 365 individual raptors were recorded within the GWRA, representing 10 species (Table 2).

Bird Use, Composition, and Frequency of Occurrence by Season

Overall bird use in the GWRA was greatest in the winter (13.72 number of birds/20-min survey/plot), followed by fall (11.60), spring (6.44), and summer (3.78) (Table 1).

Waterfowl

Waterfowl had the highest use in winter (0.41 birds/plot/20-min survey), compared to other times of the year (summer 0, fall 0.06, and spring 0.06; Table 3). High waterfowl use in winter was due to several large groups of unidentified duck (Table 2) that made up 2.5% of the overall bird use in this season (Table 3). Waterfowl as a whole comprised 3.0% or less of the overall bird use in the seasons in which they were observed. Waterfowl were observed more frequently in the winter (4.3%), compared to spring (2.8%), fall (2.1%) and summer (0%).

Shorebirds

Shorebirds had the highest use in fall (0.23 birds/20-min survey), compared to spring (0.06), the only other season in which this bird type was observed (Table 3). Shorebirds as a whole comprised 2.0% or less of the overall bird use for fall and spring. Shorebirds were more frequently observed during the fall (6.0%) followed by spring (4.9%).

Raptors

Raptor use at GWRA was highest during the fall (1.68 birds/20-min survey) compared to other times during the year (summer 0.51, winter 0.13, and spring 0.24; Table 3). This was primarily due to high use of the area by unidentified raptors (0.78) and American kestrels (*Falco sparverius*; 0.52) during the fall season. Summer use was primarily due to American kestrel (0.17) and red-tailed hawk (*Buteo jamaicensis*; 0.17), winter use was due to red-tailed hawk (0.05), and spring use was again primarily due to American kestrel (0.10) and red-tailed hawk (0.08). Raptors comprised 14.4% of the overall bird use in the fall, 13.6% in the summer, and

less than four percent during the winter and spring. Raptors were most frequently observed during the fall (63.5% of surveys) and summer (31.6%), and were observed less often during the winter (13.3%) and spring (18.8%).

Vultures

Use by vultures was due entirely to use by turkey vulture (*Cathartes aura*). Turkey vultures had the highest use in summer (0.53 birds/20-min survey), compared to other times of the year (fall 0.19, winter 0, and spring 0.19; Table 3). Vultures made up 13.9% of the overall bird use in the summer, but less than three percent of the overall bird use in the seasons in which they were observed. Vultures were observed more frequently in the summer (33.2%), compared to fall (13.1%), winter (0%), and spring (11.8%).

Passerines

Passerines by far had the highest use of any bird type during all four seasons (Table 3). Passerine use was highest in the winter (13.11 birds/plot/20-min survey), followed by fall (9.07), spring (6.31), and summer (2.53). Horned lark had the highest use by any one species in fall (2.52), winter (7.35), and spring (2.71), while lark sparrow (*Chondestes grammacus*) had the highest use in the summer (0.91; Table 3). Passerines comprised nearly all of the overall bird use in winter and spring (95.5% and 90.5%, respectively) and comprised more than 66% of use in the summer and winter. Passerines were observed during more than 80% of the surveys in the fall, winter, and spring, and were observed during 66.1% of summer surveys.

Bird Flight Height and Behavior

The proportion of observations of a bird species flying within the zone of risk provides a rough estimate of the propensity of that species to fly within the area swept by turbine blades and be exposed to turbines or at risk of collision. For the analysis, a generic zone of risk, 35 to 135 m above ground level, was used to calculate exposure indices. This results in a rotor-swept area of up to 100 m in diameter, which is generally larger than most turbines but provides a conservative measure for estimating collision risk.

Flight height characteristics were estimated for both bird species and types (Tables 4 and 5). During the fixed-point bird use surveys, 818 groups totaling 3,563 individual birds were observed flying (Table 5). Percentages of observations below, within, and above the likely zone of risk were reported. Overall, 6.1% of birds observed flying were recorded within, 92.9% were below, and 0.9% were flying above the zone of risk (Table 5). Most (80.2%) of flying raptors were observed below, 13.3% were within, and 6.5% were above the zone of risk. Vultures had the highest percentage of flying birds within the zone of risk (52.5%), followed by raptors (13.3%) and passerines (4.5%). Raptors had the second highest percentage of birds within the zone of risk, primarily due to 37.5% of eagle and 31.7% of buteo observations recorded at this height. All (100%) of flying waterfowl, shorebirds, doves/pigeons, other birds, and unidentified birds were observed below the zone of risk. Passerines were also observed typically flying below the zone of risk (95.4%; Table 5).

Six species had at least 45 groups observed flying; only turkey vulture was observed flying within the zone of risk during at least 50% of the observations (52.5%; Table 4).

Bird Exposure Index

A relative exposure index was calculated for each species (Table 4). This index is only based on initial flight height observations and relative abundance and does not account for other possible collision risk factors such as foraging, courtship, or avoidance behavior. Turkey vulture had the highest exposure index (0.13), followed by unidentified swallows (0.12), and unidentified raven (0.10) (Table 4).

Spatial Use

Mean bird use was plotted by point for all birds and major bird types (Figure 4). For all bird species combined, use was highest at point nine (38.05 birds/20-min survey), while bird use at other points ranged from 2.63 to 18.89. The high mean use at point nine was overwhelmingly due to high passerine use at this point (36.11). Passerine use at the other points ranged from 1.84 to 16.50 birds/20-min survey. Waterfowl use was highest at point 20 at 1.47, and ranged from 0.71 to 0.84 birds/20-min survey for the other two points at which this type was observed. Shorebirds were observed at seven points and use ranged from 1.33 birds/20-min survey at point three to 0.05 at points 1 and 11.

Raptors were observed at all points and use varied widely from 0.32 to 1.84 and was highest at points 11 (1.84), 7 (1.29) and 16 (1.21). Vultures were observed at all but five points and use ranged from 0.47 at point 12 to 0.05 at points 10, 14, and 20. Relatively high raptor use is associated with proximity to prairie dog towns at the GVWRA (Figures 4 & 12). Points 7, 11 and 13 are located within prairie dog towns, while point 16 is located approximately one mile from an active prairie dog town, and point 15 is located approximately 1.5 mile from two active prairie dog towns (Figure 12).

Raptor Nest Surveys

Aerial Raptor Nest Survey

A two-hour aerial survey for raptor nests was conducted via helicopter on the morning of April 15, 2008. Weather during the survey was clear with 10 mile (16 km) visibility, temperatures averaging 65^{o}F, cloud cover averaging 10%, and wind speeds averaging 19 mph (30 kph). The area surveyed included the GWRA and a one-mile (1.6-km) buffer, comprising a study area of approximately 67 mi^2 (173.5 km^2) and which contained portions of Grapevine, Yaeger and Diablo Canyons; forested areas; and features likely to provide nesting structures for raptors (Figure 5). One active red-tailed hawk nest was located during the aerial survey in Yaeger Canyon just outside the northwest project area boundary (Table 6; Figure 5). In addition, areas thought to contain golden eagle (*Aquila chrysaetos*) or other raptor nests were identified for further ground-based surveys.

Ground-Based Raptor Surveys

Portions of the GWRA identified during other surveys as having the potential to support nesting raptors were surveyed on foot on June 6 and 8, 2008. Two inactive golden eagle nests were observed during ground raptor nest surveys near the confluence of Grapevine and Diablo Canyons (Table 6; Figure 5). During the ground survey, no nests were found to be active. It is unclear if the Yaeger Canyon red-tailed hawk nest failed between first sighting on April 15 and June 6, 2008 or young had already fledged and left the nest area. Neither golden eagle nest

appeared to have been used during the 2008 breeding season. Raptor nest density in this 67 mi^2 (173.5 km^2) (GWRA and the one-mile buffer) was 0.04 nests/mi^2, which is low compared to most other wind-energy facilities in the western U.S. (Table 7).

Bat Acoustic Surveys

Bat activity was monitored at three ground locations and one Hi-Mic location using four Anabats on a total of 224 nights between June 26 – November 9, 2007 (137 nights), and April 12 – July 7, 2008 (87 nights). The Hi-Mic unit (GV16H) was paired with a ground unit (GV16L) at the same location. Hi-Mic data were analyzed separately from ground-based data because these detectors were sampling different airspace.

The three ground-based Anabat units operated for 64.42% of the sampling period in 2007 and 82.0% of the sampling period in 2008. Ground-based Anabat units recorded 4,237 bat passes on 537 detector-nights, for an average of 7.89 bat passes per detector-night during 2007 and 2008 seasons. Ground-based Anabat units recorded 2,288 bat passes on 325 detector-nights, for an average of 7.04 bat passes per detector-night in 2007, and recorded 1,949 bat passes on 214 detector-nights, for an average of 9.11 bat passes per detector-night in 2008. The Hi-Mic unit operated for 20.3% and 71.0% of the sampling periods in 2007 and 2008 respectively. The Hi-Mic unit recorded 16 bat passes on 62 detector-nights, for an average of 0.26 bat-passes per detector night during the 2008 season (Tables 8a and 8b).

Spatial Variation

The number of bat passes recorded varied widely among the three ground-based Anabat units during the 2007 and 2008 seasons, with GV20 recording the highest number of bat passes during both seasons (Figure 8a and 8b). Over the course of the 2007 season, GV 10 recorded 8.31 bat passes per detector-night, while GV20 and GV16L recorded a mean of 11.97 and 0.86, respectively. During the 2008 season GV10 recorded a mean of 1.00 bat passes per detector-night, GV20 a mean of 16.70, and GV16L a mean of 5.92 (Table 8b). There were more high-frequency (HF) bat passes per detector-night than low-frequency (LF) at all three ground-based Anabat locations for both 2007 and 2008 (Figures 7a and 7b), except at GV 16L in 2007, which had more low-frequency visits. GV10 recorded significantly higher bat activity during 2007 (839 total bat passes, 8.31 bat passes per detector-night; Figure 8a) than during 2008 (52 total bat passes, 1.00 bat passes per detector-night; Figure 8b).

The Hi-Mic unit (GV16H) recorded far fewer bat passes (2007 mean = 0.04 bat passes per detector night; 2008 mean = 0.26 bat passes per detector night) than the ground unit (GV16L) paired at the same location during both years (Tables 8a and 8b; Figure 7a and 7b). All of the bat passes for both 2007 and 2008 recorded by the Hi-Mic unit were made by low frequency bats.

Temporal Variation

During 2007 bat activity peaked between July 10 and August 28, and was highest during early to mid-August (Figure 8a). HF activity was highest between July 11 and August 21 (671 HF passes, 70.2% of all HF passes), while LF activity peaked between August 7 and September 12 (289 LF passes, 73.8% of all LF passes), though activity for both high- and low-frequency bats continued to spike into late September. During 2008 activity between April 12 and May 24 was irregular, with nights of relatively high activity interspersed with nights of low activity. Bat activity

increased after May 24, peaked on June 12, and then decreased after June 23 (Figure 8b). The pattern of activity for HF bats was mainly congruent with the overall trend, with the number of HF bat passes per detector-night peaking between May 29 and June 23 (62.2% of all HF passes). Activity by LF bats was low throughout the study period, with most LF bat passes recorded between June 11 and July 1 (42.6% of all LF passes; Figure 8b).

Species Composition

Species identification for specific passes is possible from Anabat data for the hoary bat, Allen's big-eared bat, spotted bat, and big free-tailed bat; therefore, passes by these species could be separated from passes by other LF or unknown bats. During 2007, hoary bats comprised 5% of total passes detected within the GWRA; during 2008, they comprised less than 2% of total passes. Hoary bat activity was highest at station GV16L in 2007 (0.48 passes per detector-night) and lowest at GV16H, with no passes detected (Figure 9a). In 2008, hoary bat activity was evenly distributed among Anabat stations (Figure 9b). During 2008, the Hi-Mic and ground unit at GV16 each recorded 9 passes by hoary bats during the survey period, but these were not always on the same night. Activity for hoary bats peaked in late August and in early October during 2007 (Figure 10a), and was highest between April 28 and May 20 in 2008 (68.4% of total hoary passes; Figure 10b).

Eighteen big free-tailed bat passes were detected in 2007, comprising 1% of all passes. All passes were detected between September 25 and October 21, with half the passes detected on October 9. Big free-tailed bats were not detected in 2008. Allen's big-eared bats were detected four times in 2007 and twice in 2008. In 2007, calls were detected between October 1 and 18; in 2008 they were detected on April 15 and June 16, 2008. Spotted bats were not detected during either year.

Sensitive Species Surveys

The objective of the sensitive species surveys was to determine the presence or absence and spatial distribution of federal and state listed species, species of conservation concern, or other special status species within the study area and particularly within proposed development corridors. Sensitive species documented at the GWRA during all surveys and as incidental wildlife observations (see Incidental Wildlife Observations section below) were western burrowing owl and Gunnison's prairie dog (Table 9). In addition, two USFWS Birds of Conservation Concern (USFWS 2002), Cooper's hawk and bald eagle, were observed in the GWRA. The Arizona population of bald eagles is recognized as a distinct population segment under ESA guidance and has been petitioned for listing under the ESA (ECOS 2008).

Three prairie dog towns were mapped in the GWRA and 21 observations of Gunnison's prairie dogs were recorded in the two active towns (Table 9; Figure 11). Sensitive species observed at the GWRA included seven bald eagles, four Cooper's hawks, and two western burrowing owls.

Incidental Wildlife Observations

Bird Observations

The most abundant bird species recorded incidentally was American kestrel (123 observations), followed by lark sparrow (120) (Table 10). Twenty species total were observed, with a total of 542 individuals in 121 groups. Three species were observed incidentally that were not observed during fixed-point bird use surveys: common nighthawk (*Chordelies minor*), great blue heron (*Ardea herodias*), and white-faced ibis (*Plegadis chihi*; Table 10).

Mammal Observations

The most abundant mammal recorded was pronghorn antelope (*Antilocapra americana*; 301 observations). Other game animals observed included bison (*Bison bison*; 63 observations), elk (*Cervus elaphus*; 58), mule deer (*Odocoileus hemionus*; 8) and javelina (*Tayassu tajacu*; 2). Nine mammal species were observed, with a total of 470 individuals in 73 groups (Table 10).

DISCUSSION AND IMPACT ASSESSMENT

Bird Impacts

The primary objectives of the study were to provide site specific data on bird and bat use of the GWRA that could be helpful in estimating potential impacts from the proposed wind-energy facility and in project planning to minimize risk and potential impacts to bird and bat resources. The proposed GWRA is situated primarily on a flat plateau topographic feature, with the primary land use being rangeland for livestock grazing. Along the eastern and a portion of the northern edge of the GWRA there are distinct canyons or "breaks" of varying topography and vegetation that drop off in elevation (see Figure 1). Also, a number of water developments for livestock operations and prairie dog colonies occur on site. These areas create distinct physiographic features that could influence wildlife use in the study area and therefore provide variable spatial density or abundance of birds and bats across the study area. The surveys were designed with this in mind so that observations could be made that included areas over the flat mesa top where turbine construction would be most likely, as well as the variable habitat features (see Figure 2).

Direct Effects

The most probable impact to birds from wind projects is direct mortality or injury due to collisions with turbines or guy wires of meteorological (met) towers. Collisions may occur with resident birds foraging and flying within the project area or with migrant birds seasonally moving through the area.

Substantial data on bird mortality at wind-energy facilities are available from studies in California and throughout the west and Midwest. Of 841 bird fatalities reported from California studies (>70% from Altamont Pass Wind Resource Area in California), 39% were diurnal raptors, 19% were passerines (excluding house sparrows [*Passer domesticus*] and European starlings [*Sturnus vulgaris*]), and 12% were owls. Non-protected birds, including house sparrows, European starlings, and rock doves (*Columba livia*), comprised 15% of the fatalities.

Other bird types generally made up less than 10% of the fatalities (Erickson et al. 2002b). During 12 fatality monitoring studies conducted outside of California, diurnal raptor fatalities comprised 2% of the fatalities and raptor mortality averaged 0.03/turbine/year. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising 82% of the 225 fatalities documented. For all bird species combined, estimates of the number of bird fatalities per turbine per year from individual studies ranged from zero at the Searsburg, Vermont (Kerlinger 1997) and Algona, Iowa facilities (Demastes and Trainer 2000) to 7.7 at the Buffalo Mountain, Tennessee facility (Nicholson 2003). Using mortality data from the last 10 years from wind projects throughout the entire United States, the average number of bird collision fatalities is 3.1 per megawatt per year or 2.3 per turbine per year (NWCC 2004).

Raptor Use and Exposure Risk

The annual mean raptor use at the GWRA was compared with other wind-energy facilities that implemented similar protocols and had data for three or four seasons. Similar studies were conducted at 36 other wind resource areas proposed for wind-energy facility construction. The annual mean raptor use at these wind-energy facilities ranged from 0.09 birds/20-min survey at San Gorgonio in California to 2.34 birds/20-min survey at High Winds, California (Figure 10). Mean raptor use at the GWRA was 0.67 birds/20-min survey which is in the mid-range of all the sites studies (Figure 10).

Although high numbers of raptor fatalities have been documented at some wind-energy facilities (e.g., Altamont Pass), a review of studies at wind-energy facilities across the United States reported that only 3.2% of casualties were raptors (Erickson et al. 2001a). Indeed, although raptors occur in most areas with the potential for wind-energy development, individual species appear to differ from one another in their susceptibility to collision (NRC 2007). Results from Altamont in California suggest that mortality for some species is not related to abundance (Orloff and Flannery 1992). American kestrels, red-tailed hawks, and golden eagles were killed more often, and turkey vultures were killed less often than predicted based on abundance estimates. A recent report from the Buffalo Gap wind-energy facility in Texas, however, suggests that turkey vultures, may show higher susceptible to collision at larger wind turbines than previously believed for smaller turbines (Tierney 2007). Also, reports from the High Winds wind-energy facility in California document high American kestrel mortality. Relative use by this species at High Winds is six times that at the Altamont (Kerlinger 2005). It is likely that many factors, in addition to abundance, are important in predicting raptor mortality.

Exposure indices may provide some insight into what species might be the most likely turbine casualties based on site specific data on abundance and flight behavior. The index considers relative probability of exposure based on abundance, proportion of activity recorded as flying, and observed flight height of each species. The analysis is based on observations of birds made during the studies and does not take into consideration varying ability among species to detect and avoid turbines, habitat selection, or other factors that may influence exposure to turbines such as breeding or hunting behavior. The actual risk may be lower or higher than indicated by these data. Based on this analysis, turkey vulture had the highest relative exposure index among raptors followed by red-tailed hawk at GWRA. While turkey vulture and red-tailed hawk casualties have been recorded at wind projects, they are generally not found in proportion to relative abundance. For example, at Altamont, red-tailed hawk casualties were found more often,

and turkey vultures less often than predicted based on abundance (Orloff and Flannery 1992). Altamont contains approximately 5,400 turbines, most of which are small, older, lattice tower turbines, which are not necessarily representative of new wind facilities. The latest raptor fatality estimates at Altamont, based on searches using 30-90 day search intervals, indicate that annual mortality averages 1.5 to 2.2 raptor fatalities/MW, when adjusted for searcher efficiency and scavenging bias (Smallwood and Thelander 2004). This estimate is generally higher than estimates of raptor mortality at modern wind farms (Erickson et al. 2001, NWCC 2004).

Based on species composition of the most common raptor fatalities at other western wind-energy facilities, species composition of raptors observed at the GWRA during surveys, and considering the exposure indices calculated, the diurnal raptors at the GWRA most likely at risk of turbine collision would be red-tailed hawk, American kestrel, and golden eagle. Small numbers of fatalities of other raptors, including other falcons, accipiters, harriers, and eagles may also occur over the life of the wind-energy facility, but are expected to be rare. Based on the seasonal use estimates, it is also expected that risk to raptors would be unequal across seasons with the lowest risk in the winter, when very few raptors were observed, and highest during the fall season, likely due to migrants passing through the area.

A regression analysis of raptor use and mortality for 12 new-generation wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 71.7%; Figure 13). In general, raptor fatalities at other western wind-energy facilities have been relatively low, between 0 and 0.14 raptors/MW/year, however, the High Winds and Diablo Winds (a portion of Altamont) projects in California had high raptor use and provided data for a larger regression analysis (Figure 14). Using this regression to predict raptor collision mortality at the GWRA, based on an adjusted mean raptor use of 0.67 birds/20-min survey, yields an estimated fatality rate of 0.10 raptors/MW/year, or 10 raptor fatalities per year for a 100-MW wind-energy facility. A 90% prediction interval around this estimate is zero to 0.35 raptors/MW/year for the GWRA.

Within the GWRA, raptor use appeared to be strongly associated with proximity to prairie dog towns. Raptor use was highest at fixed bird use points 7, 11, and 16, which are either within or adjacent to active prairie dog towns (Figure 12). In general, raptor use was higher in the eastern half of the study area and was elevated near the available prey base found at prairie dog towns. Studies indicate that raptor mortality at wind-energy facilities (especially Altamount Pass) may be in part due to behavioral differences between species, increasing the susceptibility of some for collision with turbines. Orloff and Flannery (1992, 1996) suggested that high golden eagle mortality at APWRA was in part due to the apparently high densities of ground squirrels (*Spermophilus beecheyi*) in the area (Thelander and Smallwood 2007). Continued research at the site revealed that the degree of aggregation of pocket gopher (*Thomomy bottae*) burrows around the turbines was positively correlated to red-tailed hawk fatality rates (Smallwood et al. 2001, Thelander et al. 2003, Thelander and Smallwood 2007). In addition, features providing cover for cottontails (*Sylvilagus auduboni*) appeared to be associated with areas where golden eagles were killed. At the GWRA, turbine placement in or immediately adjacent to active prairie dog towns may increase the susceptibility of some raptors (principally red-tailed hawk and golden eagle) to collision with turbines.

Non-raptor Use and Exposure Risk

Of the non-raptor avian groups, passerines have been the most abundant avian fatality at newer generation wind facilities, often comprising more than 80% of the avian fatalities (Erickson et al. 2001). Both migrant and resident passerine fatalities have been observed. Based on species and date information, in some studies up to 70% of fatalities found were believed to be migrants (Howe et al. 2002); however, the estimates are highly variable and range from 0 to 70%. In general, the number of migrant fatalities is higher in wind projects in the eastern United States (see Erickson et al. 2002b). The overall national average for passerine fatalities at wind projects has been approximately 2.2 birds/turbine/year (Erickson et al. 2002b).

Exposure indices of non-raptors indicate that unidentified swallow, raven, and pinyon jay (*Gymnorhinus cyanocephalus*) are most likely to be exposed to potential collision with wind turbines at the GWRA. Despite relatively high use and exposure, common ravens are rarely reported as fatalities according to monitoring studies at other wind-energy facilities (Erickson et al. 2001a; 2002b). At the Tehachapi Pass wind-energy facility in California, common ravens were found to be the most common large bird in the wind resource area, yet no fatalities for this species were documented during intensive studies (Anderson et al. 1996). Most non-raptors had relatively low exposure indices due to the majority of individuals flying below the zone of risk.

Predicting numbers of fatalities is difficult in large part due to the lack of monitoring studies in the desert southwest and similar environments as the GWRA. However, due to generally low impacts for western wind projects and the low exposure risks at GWRA, it is unlikely that non-raptor populations will be adversely affected by direct mortality from the operation of the wind-energy facility and any impacts would be on individuals and not species.

Indirect Effects

The extent of disturbance or displacement related impacts are difficult to estimate for the GWRA. Passerines breeding in the grassland and pinyon-juniper habitat are likely to be displaced from construction zones during the breeding season but the overall loss of habitat is not expected to be significant and over time will be reduced as construction areas revert to native habitat. Results from studies at the Stateline wind-energy facility in Oregon and Washington (Erickson et al. 2004) and the Combine Hills facility in Oregon (Young et al. 2005) suggest a relatively small-scale impact of wind-energy facilities on grassland steppe nesting passerines. Transect surveys conducted prior to and after construction of the facilities indicated that grassland passerine use was significantly reduced within approximately 164 ft (50 m) of turbine strings; areas further away from turbine strings did not have reduced bird use. The reduced use was attributed to temporary and permanent habitat loss/disturbance near the turbines. While it is likely that similar impacts would occur at GWRA, the species subject to these impacts are typically common in grassland and pinyon-juniper habitats and the impacts are not expected to be significant.

Raptor Nesting Disturbance

Some resources are considered more sensitive to indirect impacts such as disturbance or displacement, including nesting raptor and sensitive species. Indirect effects caused by disturbance-type impacts, such as construction activity near an active nest or primary foraging

area, have the potential to impact raptor species. Birds displaced from the wind-energy facility might move to areas with fewer disturbances, but lower quality habitat, with an overall effect of reducing breeding success. There have been few studies on raptor displacement at wind-energy facilities, and most of these have suggested indirect effects to be negligible or immeasurable (Howell and Noone 1992; Johnson et al. 2000b; Johnson et al. 2003; Madders and Whitfield 2006). Information concerning potential nesting displacement on specific species is limited; however, a Swainson's hawk was reported to have nested within 0.25 mile (0.8 km) of the turbine string at a wind-energy facility in Oregon, suggesting little disturbance to this species (Johnson et al. 2003). In addition, at Foote Creek Rim Wind-Energy Facility in southern Wyoming, one pair of red-tailed hawks nested within 0.3 mile of the turbine strings, and seven red-tailed hawk, one great horned owl, and one golden eagle nests located within one mile of the wind-energy facility successfully fledged young (Johnson et al. 2000b). The golden eagle pair successfully nested 0.5 miles from the wind-energy facility in three different years after the site became operational. Studies at the Stateline wind-energy facility in Oregon and Washington have not shown any measurable short-term effects to nesting raptors (Erickson et al. 2004).

In contrast to these studies, one study at the Buffalo Ridge wind-energy facility in Minnesota found evidence of harriers avoiding turbines on both a small scale (< 100 m from turbines) and larger scale in the year following construction (Johnson et al. 2000a) as well as lower raptor densities near turbines compared to densities in similar habitat away from turbines (Usgaard et al. 1997). Raptor nest density on 101 mi^2 (262 km^2) of land surrounding one project within the Buffalo Ridge wind resource area 0.15 per mi^2, yet no nests were present in the 12 mi^2 (31 km^2) wind-project itself, even though similar habitat was present (Usgaard et al. 1997). No red-tailed hawks or golden eagles are known to nest within the Altamont facility in California, suggesting that the large numbers of turbines or high human presence within that area may discourage nesting by raptors or that collision mortality prevents nesting in the Altamont.

During the 2008 raptor nesting season, one active and two inactive raptor nests were located in or within one mile of the GWRA (nest density of 0.04/mi^2), and nests are located in distinct physiographic portions (canyons) of the project area where project facilities will not be constructed. During sensitive species surveys and incidental observations, two burrowing owls were observed in the study area, but nesting could not be confirmed by this species. In general, due to the low density of nesting raptors, any disturbance or displacement related impacts are not expected to be significant and there is limited potential for nesting displacement of raptors at the GWRA. Observation of a no-disturbance buffer around known nests when siting turbines would further minimize potential for impact.

Bat Impacts

Potential Impacts

Assessing the potential impacts of wind energy development to bats at the GWRA is complicated by the current lack of understanding of why bats collide with wind turbines (Kunz et al. 2007a), combined with the inherent difficulties of monitoring elusive, night-flying animals (O'Shea et al. 2003). To date, monitoring studies of wind-energy facilities suggest that: (a) migratory tree-roosting species (eastern red bats [*Lasiurus borealis*], hoary bats, and silver-haired bats) comprise almost 75% of reported bats killed (Kunz et al. 2007b); (b) the majority of collisions

occur during the post-breeding dispersal or fall migration season (roughly August and September; Gruver 2002; Johnson et al. 2003); and (c) the highest reported fatalities occur at wind facilities located along forested ridge tops in the eastern U.S. (Kunz et al. 2007a), although recent studies in agricultural regions of Iowa and Alberta, Canada, report relatively high fatalities as well (Baerwald 2006; Jain 2005).

Some studies of wind projects have recorded both Anabat detections per night and bat mortality (Table 11). The number of bat calls per night as determined from bat detectors shows a rough correlation with bat mortality, but may be misleading because effort, timing of sampling, species recorded, and detector settings (equipment and locations) vary among studies. While it likely that relative abundance may influence bat mortality, the best predictor of potential impacts appears to be other regional wind projects that have been monitored. For example, impacts to bats at projects in the Pacific Northwest have all ranged from approximately 0.8 to 2.4 bats per MW per year (Arnett et al. 2008). While more variable, projects in the eastern U.S. have all shown higher impacts to bats and the continental-wide trend appears to be increasing bat mortality from west to east (Arnett et al. 2008). Thus, our best available estimate of mortality levels at a proposed wind project involves evaluation of on-site bat acoustic data in terms of activity levels, seasonal variation, species composition, topographic features of the project area, and regional monitoring studies.

Activity

Bat activity within the GWRA (2007 mean = 7.47 bat passes per detector-night; 2008 mean = 9.11) was relatively high compared to that observed at facilities in Minnesota and Wyoming, where bat collision mortality was low, but it was much lower than activity recorded at sites in West Virginia and Tennessee, where bat mortality rates were high (Table 11). Thus, based on the presumed relationship between pre-construction bat activity and post-construction fatalities, it is expected that bat mortality at GWRA would be greater than the 2.2 bat fatalities/turbine/year reported at Buffalo Ridge, Minnesota, but much lower than the 20.8 fatalities/turbine/year reported at Buffalo Mountain, Tennessee. While there are no known studies of bat mortality at wind projects in the desert southwest, other western projects including those in California have generally shown lower impacts. The average bat mortality over three projects in Oregon and Washington is 1.57 bats/turbine/year (Young and Erickson 2003). Under the assumption that western projects would be more representative, then it is expected that mortality at GWRA would be less than 2 bat fatalities/turbine/year.

Spatial Variation

Bat activity was much greater at station GV20 than at the other Anabat stations during both years (Figure 3). This unit was located near a stock pond, which likely attracted bats as a source of drinking water and insects for foraging. Elevated bat use at GV20 relative to other sampled sites reflects site-specific factors. The other stations were located in dry, open areas that were likely less attractive to bats. At station GV16, the ground unit recorded four times as many bat passes as the Hi-Mic unit during 2007 and 2008 seasons, indicating far less bat activity towards the rotor-swept zone at this site.

The proposed wind-energy facility is not located near any large, known bat colonies or other features that are likely to attract large numbers of bats. However, the GWRA is bordered by two

canyons (Grapevine and Yaeger canyons) which may harbor roost sites. The site lacks large tracts of forest cover, but does have pinyon-juniper habitat which also likely harbor roost sites for some species. In general, while bat use is likely to be ubiquitous over the whole site, there are some features which likely concentrate bat use and this was evident from the Anabat surveys. Despite these patterns, overall use averaged across all sampling was not extraordinarily high suggesting that exposure risk would change dramatically across the study area.

Temporal Variation

The number of bat calls detected per night at the GWRA peaked in late-May/mid-June and late July/mid August. Fatality studies of bats at other wind-energy facilities in the U.S. have shown a peak in mortality in August and September, and generally lower mortality earlier in the summer (see Johnson 2005). While the survey effort varies among the different studies, the studies that combine Anabat surveys and fatality surveys show a general association between the timing of increased bat call rates and timing of mortality, with both call rates and mortality peaking during the fall (Kunz et al. 2007a). While the temporal variation in bat numbers at GWRA does not necessarily reflect common trends in the U.S., it is not expected that risk to fall migrant bats would be less. Similar trends to all other wind projects monitored in the U.S. are expected with peak mortality occurring to long-distant migrant tree bats in August and September.

Species Composition

Of the 18 species of bat likely to occur in the study area, five are known fatalities at wind-energy facilities (Table 12). Acoustic bat surveys were largely unable to determine bat species present in the study area (see below), but they were able to distinguish high-frequency from low-frequency species.

High-frequency bat passes were recorded much more often (90.2% of all bat passes) than low-frequency passes at the ground stations, indicating higher relative abundance of species such as western red bat, western pipistrelle and *Myotis* sp. at these locations. The Hi-Mic station only recorded low-frequency passes. Many of the low-frequency species likely to be present at the GWRA (e.g., hoary bat [*Lasiurus cinereus*], silver-haired bat [*Lasionycteris noctivagans*], Brazilian free-tailed bat [*Tadarida brasiliensis*]) tend to forage at higher altitudes than most high-frequency species due to their wing morphology and echolocation call structure (Norberg and Rayner 1987). Therefore, low-frequency bat activity could potentially be under-represented if relying solely on data from ground-based detectors. However, the similar number of low-frequency bat passes recorded at the ground and Hi-Mic units at GV16 in 2008 suggests under-representation was not an issue in this study.

Hoary bats comprised 5% of total passes detected within the GWRA in 2007, and less than 2% of total passes in 2008. Activity by hoary bats appeared to peak in late August and early October in 2007, and in May of 2008, suggesting that fall and spring migration of this species through the area occurs at these times of year. The two peaks of activity in the fall may reflect migration of males and females (with juveniles) at different times of year, as has been observed in Alberta (E. Baerwald, pers comm.). Detection of hoary bats in June and July of both years suggest a small resident population as well which may be resident in the coniferous forest areas west of the GWRA. Allen's big-eared bat [*Idionycteris phyllotis*], spotted bat [*Euderma maculatum*], and big free-tailed bat [*Nyctinomops macrotis*] also produce distinctive calls that are readily identified

using Anabat. Big free-tailed bats were only detected between late September and late October of 2007, suggesting this species passes through the area at this time of year. Allen's big-eared bat was detected four times in October of 2007 and on two occasions (mid- April and mid-June) in 2008, suggesting infrequent use of the project area by this species, and possible fall and spring migration through the area. Spotted bats were not detected, suggesting these species do not make use of the area.

Sensitive Species Use and Exposure Risk

Few federal and state species of concern were recorded during surveys at the GWRA including Cooper's hawk, western burrowing owl, bald eagle, and black-tailed prairie dog. Use of sensitive species at the GWRA is very low. Bald eagles were only observed in the winter and spring while Cooper's hawks were only observed during the fall and spring. The Arizona (Sonora) population of bald eagles is recognized as a distinct population segment and this population is currently petitioned for listing under the Endangered Species Act (ECOS 2008). Bald eagles are likely to infrequently transient over the GWRA. Two active Gunnison's prairie dog towns were mapped at the GWRA, along with one inactive town (Figure 9). One western burrowing owl was observed at an inactive prairie dog town during the breeding season and one individual was observed as an incidental species; however no nests were discovered during foot searches of prairie dog towns. The potential exists for burrowing owls to nest within the GWRA, particularly within prairie dog burrows. Western burrowing owls are a federally-listed species of concern and are protected by the Migratory Bird Treaty Act. Primary threats across North American range, including Mexico, are habitat loss and fragmentation primarily due to intensive agricultural and urban land conversion, and habitat degradation due to control and extermination of colonial burrowing mammals (Sheffield 1997). Avoidance of prairie dog town destruction is recommended to reduce the potential for impacts to Gunnison prairie dog populations and potentially nesting burrowing owls at the GWRA.

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Table 1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29,2008.

Season	# of Visits	Mean Use	# Species /Survey	# Species	# Surveys Conducted
Summer	2	3.78	1.88	19	42
Fall	7	11.60	2.68	35	169
Winter	4	13.72	2.10	21	91
Spring	6	6.97	2.11	40	144
Overall	**19**	**8.37**	**2.19**	**55**	**446**

Table 2. Total number of groups and individuals for each bird type and species by season and overall during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

		Summer		Fall		Winter		Spring		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# Grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterfowl		**0**	**0**	**4**	**10**	**6**	**39**	**4**	**9**	**14**	**58**
bufflehead	*Bucephala albeola*	0	0	0	0	0	0	3	7	3	7
mallard	*Anas platyrhynchos*	0	0	0	0	1	4	0	0	1	4
redhead	*Aythya americana*	0	0	0	0	1	2	1	2	2	4
unidentified duck		0	0	4	10	4	33	0	0	8	43
Shorebirds		**0**	**0**	**12**	**38**	**0**	**0**	**7**	**9**	**19**	**47**
killdeer	*Charadrius vociferus*	0	0	5	10	0	0	7	9	12	19
unidentified dowitcher		0	0	5	25	0	0	0	0	5	25
unidentified yellowlegs		0	0	2	3	0	0	0	0	2	3
Raptors		**16**	**21**	**174**	**285**	**13**	**13**	**37**	**46**	**240**	**365**
Accipiters		*0*	*0*	*3*	*3*	*0*	*0*	*1*	*1*	*4*	*4*
Cooper's hawk	*Accipiter cooperii*	0	0	2	2	0	0	1	1	3	3
sharp-shinned hawk	*Accipter striatus*	0	0	1	1	0	0	0	0	1	1
Buteos		*5*	*7*	*23*	*23*	*6*	*6*	*12*	*16*	*46*	*52*
red-tailed hawk	*Buteo jamaicensis*	5	7	23	23	6	6	12	16	46	52
Northern Harrier		*0*	*0*	*6*	*6*	*1*	*1*	*1*	*1*	*8*	*8*
northern harrier	*Circus cyaneus*	0	0	6	6	1	1	1	1	8	8
Eagles		*2*	*2*	*4*	*4*	*2*	*2*	*5*	*8*	*13*	*16*
bald eagle	*Haliaeetus leucocephalus*	0	0	0	0	1	1	1	1	2	2
golden eagle	*Aquila chrysaetos*	2	2	4	4	1	1	1	1	8	8
unidentified eagle		0	0	0	0	0	0	3	6	3	6
Falcons		*5*	*7*	*66*	*98*	*3*	*3*	*16*	*18*	*90*	*126*
American kestrel	*Falco sparverius*	5	7	56	87	2	2	13	14	76	110
merlin	*Falco columbarius*	0	0	1	1	0	0	0	0	1	1
prairie falcon	*Falco mexicanus*	0	0	2	2	0	0	2	2	4	4

Table 2. Total number of groups and individuals for each bird type and species by season and overall during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

		Summer		Fall		Winter		Spring		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# Grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified falcon		0	0	7	8	1	1	1	2	9	11
Owls		*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*1*	*1*
western burrowing owl	*Athene cunicularia hypugaea*	0	0	0	0	0	0	1	1	1	1
Other Raptors		*4*	*5*	*72*	*151*	*1*	*1*	*1*	*1*	*78*	*158*
unidentified hawk		0	0	15	18	1	1	1	1	17	20
unidentified raptor		4	5	57	133	0	0	0	0	61	138
Vultures		**21**	**26**	**24**	**32**	**0**	**0**	**23**	**38**	**68**	**96**
turkey vulture	*Cathartes aura*	21	26	24	32	0	0	23	38	68	96
Doves/Pigeons		**5**	**9**	**0**	**0**	**0**	**0**	**1**	**3**	**6**	**12**
mourning dove	*Zenaida macroura*	3	5	0	0	0	0	1	3	4	8
unidentified dove		2	4	0	0	0	0	0	0	2	4
Passerines		**54**	**106**	**263**	**1,558**	**193**	**1,169**	**262**	**929**	**772**	**3,762**
American robin	*Turdus migratorius*	1	1	5	22	0	0	0	0	6	23
black-throated sparrow	*Amphispiza bilineata*	1	1	0	0	0	0	2	19	3	20
bronzed cowbird	*Molothrus aeneus*	0	0	0	0	0	0	1	2	1	2
brown-headed cowbird	*Molothrus ater*	0	0	0	0	0	0	1	1	1	1
canyon wren	*Catherpes mexicanus*	0	0	0	0	0	0	1	1	1	1
Cassin's finch	*Carpodacus purpureus*	0	0	0	0	1	1	1	1	2	2
common grackle	*Quiscalus quiscula*	0	0	0	0	0	0	2	3	2	3
common raven	*Corvus corax*	6	8	0	0	0	0	0	0	6	8
common yellowthroat	*Geothlypis trichas*	0	0	2	2	0	0	0	0	2	2
dark-eyed junco	*Junco hyemalis*	0	0	4	23	28	144	1	2	33	169
gray vireo	*Vireo vicinior*	0	0	0	0	0	0	1	3	1	3
horned lark	*Eremophila alpestris*	9	18	41	463	29	649	53	390	132	1,520
house finch	*Carpodacus mexicanus*	1	1	8	112	1	1	0	0	10	114
Juniper titmouse	*Baeolophus ridgwayi*	0	0	2	2	1	1	3	5	6	8

Table 2. Total number of groups and individuals for each bird type and species by season and overall during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

		Summer		Fall		Winter		Spring		Total	
Species/Type	Scientific Name	# grps	# obs	# grps	# obs	# Grps	# obs	# grps	# obs	# grps	# obs
lark sparrow	*Chondestes grammacus*	8	37	0	0	0	0	9	53	17	90
loggerhead shrike	*Lanius ludovicianus*	3	4	16	17	1	2	9	9	29	32
mountain bluebird	*Sialia currucoides*	1	4	37	194	27	104	4	6	69	308
northern mockingbird	*Mimus polyglottos*	10	11	0	0	0	0	33	59	43	70
pinyon jay	*Gymnorhinus cyanocephalus*	2	4	10	127	4	34	10	31	26	196
rock wren	*Salpinctes obsoletus*	1	1	3	4	0	0	1	1	5	6
Say's phoebe	*Sayornis saya*	4	5	0	0	0	0	4	5	8	10
Scott's oriole	*Icterus parisorum*	0	0	0	0	0	0	1	2	1	2
Steller's jay	*Cyanocitta stelleri*	0	0	1	1	0	0	0	0	1	1
tufted titmouse	*Baeolophus bicolor*	1	5	0	0	0	0	0	0	1	5
unidentified finch		0	0	18	122	0	0	2	21	20	143
unidentified flycatcher		0	0	16	28	0	0	1	2	17	30
unidentified jay		1	1	0	0	0	0	0	0	1	1
unidentified kingbird		0	0	2	10	0	0	6	7	8	17
unidentified meadowlark		0	0	0	0	0	0	3	5	3	5
unidentified passerine		2	2	0	0	0	0	0	0	2	2
unidentified raven		0	0	57	147	80	112	96	189	233	448
unidentified sparrow		0	0	3	48	0	0	3	14	6	62
unidentified swallow		3	3	12	92	0	0	9	80	24	175
unidentified vireo		0	0	1	1	0	0	0	0	1	1
unidentified wren		0	0	3	3	0	0	0	0	3	3
western bluebird	*Sialia mexicana*	0	0	7	63	15	101	0	0	22	164
western flycatcher	*Empidonax difficilis*	0	0	6	15	0	0	0	0	6	15
western meadowlark	*Sturnella neglecta*	0	0	5	29	5	19	2	2	12	50
western scrub-jay	*Aphelocoma californica*	0	0	0	0	1	1	0	0	1	1
western tanager	*Piranga ludoviciana*	0	0	0	0	0	0	1	1	1	1

Table 2. Total number of groups and individuals for each bird type and species by season and overall during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

		Summer		Fall		Winter		Spring		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# Grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
white-crowned sparrow	*Zonotrichia leucophrys*	0	0	3	8	0	0	2	15	5	23
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	0	1	25	0	0	0	0	1	25
Other Birds		**0**	**0**	**16**	**20**	**7**	**7**	**10**	**11**	**33**	**38**
broad-tailed hummingbird	*Selasphorus platycercus*	0	0	0	0	0	0	6	7	6	7
downy woodpecker	*Picoides pubescens*	0	0	1	2	0	0	0	0	1	2
greater roadrunner	*Geococcyx californianus*	0	0	0	0	1	1	0	0	1	1
northern flicker	*Colaptes auratus*	0	0	13	16	6	6	3	3	22	25
unidentified hummingbird		0	0	0	0	0	0	1	1	1	1
unidentified woodpecker		0	0	2	2	0	0	0	0	2	2
Unidentified Birds		**0**	**0**	**3**	**45**	**0**	**0**	**0**	**0**	**3**	**45**
unidentified bird		0	0	3	45	0	0	0	0	3	45
Overall		**96**	**162**	**496**	**1,988**	**219**	**1,228**	**344**	**1,045**	**1,155**	**4,423**

[a] All individuals included even those outside the half-mile (800-m) radius plot.

Table 3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

	Use				% Composition				% Frequency			
Species/Types	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
Waterfowl	**0**	**0.06**	**0.41**	**0.06**	**0**	**0.5**	**3.0**	**0.9**	**0**	**2.1**	**4.3**	**2.8**
bufflehead	0	0	0	0.05	0	0	0	0.7	0	0	0	2.1
mallard	0	0	0.04	0	0	0	0.3	0	0	0	1.0	0
redhead	0	0	0.02	0.01	0	0	0.2	0.2	0	0	1.0	0.7
unidentified duck	0	0.06	0.35	0	0	0.5	2.5	0	0	2.1	4.3	0
Shorebirds	**0**	**0.23**	**0**	**0.06**	**0**	**2.0**	**0**	**0.9**	**0**	**6.0**	**0**	**4.9**
killdeer	0	0.06	0	0.06	0	0.5	0	0.9	0	3.0	0	4.9
unidentified dowitcher	0	0.15	0	0	0	1.3	0	0	0	3.0	0	0
unidentified yellowlegs	0	0.02	0	0	0	0.2	0	0	0	1.2	0	0
Raptors	**0.51**	**1.68**	**0.13**	**0.24**	**13.6**	**14.4**	**1.0**	**3.5**	**31.6**	**63.5**	**13.3**	**18.8**
Accipiters	*0*	*0.02*	*0*	*0.01*	*0*	*0.2*	*0*	*0.1*	*0*	*1.8*	*0*	*0.7*
Cooper's hawk	0	0.01	0	0.01	0	0.1	0	0.1	0	1.2	0	0.7
sharp-shinned hawk	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
Buteos	*0.17*	*0.13*	*0.05*	*0.08*	*4.6*	*1.2*	*0.4*	*1.2*	*9.8*	*11.6*	*5.5*	*6.9*
red-tailed hawk	0.17	0.13	0.05	0.08	4.6	1.2	0.4	1.2	9.8	11.6	5.5	6.9
Northern Harrier	0	0.04	0.01	0.01	0	0.3	0.1	0.1	0	3.6	1.1	0.7
northern harrier	0	0.04	0.01	0.01	0	0.3	0.1	0.1	0	3.6	1.1	0.7
Eagles	*0.05*	*0.02*	*0.02*	*0.01*	*1.2*	*0.2*	*0.2*	*0.2*	*2.3*	*2.4*	*2.2*	*1.4*
bald eagle	0	0	0.01	0.01	0	0	0.1	0.1	0	0	1.0	0.7
golden eagle	0.05	0.02	0.01	0.01	1.2	0.2	0.1	0.1	2.3	2.4	1.2	0.7
unidentified eagle	0	0	0	0	0	0	0	0	0	0	0	0
Falcons	*0.17*	*0.58*	*0.03*	*0.13*	*4.5*	*5.0*	*0.2*	*1.8*	*12.0*	*30.7*	*3.3*	*9.7*
American kestrel	0.17	0.52	0.02	0.10	4.5	4.4	0.2	1.4	12.0	26.5	2.2	8.3
merlin	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
prairie falcon	0	0.01	0	0.01	0	0.1	0	0.2	0	1.2	0	1.4
unidentified falcon	0	0.05	0.01	0.01	0	0.4	0.1	0.2	0	3.0	1.0	0.7
Owls	*0*	*0*	*0*	*0.01*	*0*	*0*	*0*	*0.1*	*0*	*0*	*0*	*0.7*
burrowing owl	0	0	0	0.01	0	0	0	0.1	0	0	0	0.7

Table 3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

	Use				% Composition				% Frequency			
Species/Types	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
Other Raptors	*0.13*	*0.88*	*0.01*	*0*	*3.3*	*7.6*	*0.1*	*0*	*10.0*	*33.1*	*1.2*	*0*
unidentified hawk	0	0.11	0.01	0	0	0.9	0.1	0	0	7.7	1.2	0
unidentified raptor	0.13	0.78	0	0	3.3	6.7	0	0	10.0	25.4	0	0
Vultures	**0.53**	**0.19**	**0**	**0.19**	**13.9**	**1.6**	**0**	**2.8**	**33.2**	**13.1**	**0**	**11.8**
turkey vulture	0.53	0.19	0	0.19	13.9	1.6	0	2.8	33.2	13.1	0	11.8
Doves/Pigeons	**0.21**	**0**	**0**	**0.02**	**5.7**	**0**	**0**	**0.3**	**11.8**	**0**	**0**	**0.7**
mourning dove	0.11	0	0	0.02	3.0	0	0	0.3	6.8	0	0	0.7
unidentified dove	0.10	0	0	0	2.6	0	0	0	5.0	0	0	0
Passerines	**2.53**	**9.07**	**13.11**	**6.31**	**66.9**	**78.2**	**95.5**	**90.5**	**66.1**	**80.2**	**93.6**	**87.5**
American robin	0.03	0.13	0	0	0.7	1.1	0	0	2.5	2.4	0	0
black-throated sparrow	0.02	0	0	0.13	0.6	0	0	1.9	2.3	0	0	1.4
bronzed cowbird	0	0	0	0.01	0	0	0	0.2	0	0	0	0.7
brown-headed cowbird	0	0	0	0.01	0	0	0	0.1	0	0	0	0.7
canyon wren	0	0	0	0.01	0	0	0	0.1	0	0	0	0.7
Cassin's finch	0	0	0.01	0.01	0	0	0.1	0.1	0	0	1.0	0.7
common grackle	0	0	0	0.02	0	0	0	0.3	0	0	0	1.4
common raven	0.18	0	0	0	4.8	0	0	0	13.6	0	0	0
common yellowthroat	0	0.01	0	0	0	0.1	0	0	0	1.2	0	0
dark-eyed junco	0	0.14	1.61	0.01	0	1.2	11.7	0.2	0	2.4	31.0	0.7
gray vireo	0	0	0	0.02	0	0	0	0.3	0	0	0	0.7
horned lark	0.41	2.52	7.35	2.71	10.8	21.7	53.5	38.9	11.4	24.0	29.6	35.4
house finch	0.03	0.68	0.01	0	0.7	5.8	0.1	0	2.5	4.8	1.0	0
Juniper titmouse	0	0.01	0.01	0.03	0	0.1	0.1	0.5	0	1.2	1.0	1.4
lark sparrow	0.91	0	0	0.37	24.1	0	0	5.3	19.1	0	0	6.3
loggerhead shrike	0.10	0.10	0.02	0.06	2.6	0.9	0.2	0.9	7.3	8.7	1.0	6.3
mountain bluebird	0.10	1.17	1.17	0.04	2.6	10.1	8.5	0.6	2.5	20.8	26.1	2.8
northern mockingbird	0.25	0	0	0.41	6.6	0	0	5.9	13.6	0	0	20.1
pinyon jay	0.10	0.76	0.38	0.22	2.6	6.5	2.8	3.1	5.0	6.0	4.3	6.9

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	Use				% Composition				% Frequency			
Species/Types	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
rock wren	0.02	0.02	0	0.01	0.6	0.2	0	0.1	2.3	1.8	0	0.7
Say's phoebe	0.13	0	0	0.03	3.3	0	0	0.5	10.0	0	0	2.8
Scott's oriole	0	0	0	0.01	0	0	0	0.2	0	0	0	0.7
Steller's jay	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
tufted titmouse	0.11	0	0	0	3.0	0	0	0	2.3	0	0	0
unidentified finch	0	0.71	0	0.15	0	6.1	0	2.1	0	10.5	0	1.4
unidentified flycatcher	0	0.17	0	0.01	0	1.4	0	0.2	0	8.4	0	0.7
unidentified jay	0.03	0	0	0	0.7	0	0	0	2.5	0	0	0
unidentified kingbird	0	0.06	0	0.05	0	0.5	0	0.7	0	1.2	0	4.2
unidentified meadowlark	0	0	0	0.03	0	0	0	0.5	0	0	0	2.1
unidentified passerine	0.05	0	0	0	1.2	0	0	0	4.5	0	0	0
unidentified raven	0	0.88	1.22	1.17	0	7.5	8.9	16.7	0	28.6	67.4	52.8
unidentified sparrow	0	0.30	0	0.10	0	2.6	0	1.4	0	1.8	0	2.1
unidentified swallow	0.08	0.55	0	0.56	2.0	4.7	0	8.0	7.5	7.1	0	6.3
unidentified vireo	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
unidentified wren	0	0.02	0	0	0	0.2	0	0	0	1.8	0	0
western bluebird	0	0.38	1.09	0	0	3.3	7.9	0	0	4.2	13.8	0
western flycatcher	0	0.09	0	0	0	0.8	0	0	0	3.6	0	0
western meadowlark	0	0.17	0.22	0.01	0	1.5	1.6	0.2	0	3.0	5.5	1.4
western scrub-jay	0	0	0.01	0	0	0	0.1	0	0	0	1.0	0
western tanager	0	0	0	0.01	0	0	0	0.1	0	0	0	0.7
white-crowned sparrow	0	0.05	0	0.10	0	0.4	0	1.5	0	1.8	0	1.4
yellow-headed blackbird	0	0.15	0	0	0	1.3	0	0	0	0.6	0	0
Other Birds	**0**	**0.11**	**0.08**	**0.08**	**0**	**1.0**	**0.6**	**1.1**	**0**	**9.3**	**7.7**	**6.3**
broad-tailed hummingbird	0	0	0	0.05	0	0	0	0.7	0	0	0	4.2
downy woodpecker	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
greater roadrunner	0	0	0.01	0	0	0	0.1	0	0	0	1.0	0
northern flicker	0	0.09	0.07	0.02	0	0.8	0.5	0.3	0	7.5	6.6	2.1

Table 3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

	Use				% Composition				% Frequency			
Species/Types	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
unidentified hummingbird	0	0	0	0.01	0	0	0	0.1	0	0	0	0.7
unidentified woodpecker	0	0.01	0	0	0	0.1	0	0	0	1.2	0	0
Unidentified Birds	**0**	**0.27**	**0**	**0**	**0**	**2.3**	**0**	**0**	**0**	**1.8**	**0**	**0**
unidentified bird	0	0.27	0	0	0	2.3	0	0	0	1.8	0	0
Overall	**3.78**	**11.60**	**13.72**	**6.97**	**100**	**100**	**100**	**100**				

Table 4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying Initially in ZOR[a]	Exposure Index	% Within ZOR at any time
turkey vulture	60	0.25	97.6	52.5	0.13	77.5
unidentified swallow	23	0.34	90.9	39.6	0.12	42.8
unidentified raven	167	0.79	85.4	15.4	0.10	29.2
pinyon jay	19	0.35	86.7	11.2	0.03	11.2
red-tailed hawk	37	0.12	87.2	31.7	0.03	51.2
unidentified raptor	45	0.23	82.6	13.2	0.03	16.7
golden eagle	7	0.02	87.5	42.9	0.01	42.9
unidentified hawk	15	0.03	94.7	22.2	0.01	27.8
American kestrel	55	0.21	76.4	3.6	0.01	8.3
unidentified falcon	9	0.02	100.0	9.1	<0.01	27.3
horned lark	82	2.78	76.2	0	0	0
mountain bluebird	47	0.53	90.9	0	0	0
lark sparrow	10	0.36	76.7	0	0	0
dark-eyed junco	28	0.29	94.7	0	0	0
western bluebird	19	0.27	92.1	0	0	0
unidentified finch	14	0.23	93.0	0	0	0
northern mockingbird	18	0.20	58.6	0	0	0
house finch	7	0.18	63.2	0	0	0
unidentified sparrow	6	0.11	100.0	0	0	0
western meadowlark	7	0.08	90.0	0	0	0
loggerhead shrike	14	0.07	53.1	0	0	0
unidentified duck	5	0.07	79.1	0	0	0
unidentified bird	2	0.07	97.8	0	0	0
common raven	6	0.05	100.0	0	0	37.5
black-throated sparrow	3	0.05	100.0	0	0	0
unidentified flycatcher	13	0.05	76.7	0	0	0
white-crowned sparrow	5	0.05	100.0	0	0	0
Say's phoebe	5	0.04	70.0	0	0	0

[a]ZOR=likely zone of risk or 115-443 ft (35-135 m) above ground level.

Table 5. Flight height characteristics by bird type during the fixed-point bird use surveys in the GWRA, June 22, 2007 - May 29, 2008.

Type	# Obs Flying	# Groups Flying	Mean Flight Height	% Obs Flying	% within Flight Height Categories 0-115 ft (0-35 m)	115-443 ft (35-135 m)	> 443 ft (135 m)
Waterfowl	9	43	1.11	74.1	100.0	0	0
Shorebirds	8	21	0.75	44.7	100.0	0	0
Raptors	186	293	28.54	83.0	80.2	13.3	6.5
Accipiters	*4*	*4*	*11.25*	*100.0*	*100.0*	*0*	*0*
Buteos	*37*	*41*	*51.19*	*87.2*	*51.2*	*31.7*	*17.1*
Northern Harrier	*8*	*8*	*6.25*	*100.0*	*100.0*	*0*	*0*
Eagles	*8*	*8*	*69.50*	*80.0*	*50.0*	*37.5*	*12.5*
Falcons	*69*	*100*	*13.00*	*79.4*	*94.0*	*4.0*	*2.0*
Owls	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*60*	*132*	*31.12*	*84.1*	*78.8*	*14.4*	*6.8*
Vultures	60	80	70.88	97.6	33.8	52.5	13.8
Doves/Pigeons	5	9	1.00	75.0	100.0	0	0
Passerines	528	3048	8.23	81.5	95.4	4.5	0.1
Other Birds	20	25	1.95	65.8	100.0	0	0
Unidentified Birds	2	44	10.00	97.8	100.0	0	0
Overall	818	3563	17.10	81.5	92.9	6.1	0.9

Table 6. Summary of nesting raptor species, number of raptor nests observed, and nesting density for all raptor nest surveys at the GWRA, April 15 and June 8, 2008.

Species	# of Nests	Density (# nests/mi.^{2})
golden eagle	2	0.03
red-tailed hawk	1	0.01
Total # Nests	**3**	**0.04**
Total # Active Nests	**1**	**0.01**

Only includes nests within the boundaries of the areas searched at the GWRA. Area of the GWRA is 42,880 acres, or 67 mi^2 (173.5 km^2).

Table 7. Estimated raptor nest densities for the GWRA and from other existing and proposed wind-energy facilities located primarily in agricultural landscapes.

	Raptor Nest Density (#/mi^2)							
Facility Site	**All Raptors**	**SWHA[a]**	**RTHA[b]**	**FEHA[c]**	**GOEA[d]**	**PRFA[e]**	**GHOW[f]**	**SSHA[g]**
Grapevine, Arizona†	0.04	0	0.01	0	0.03	0	0	0
Biglow, Oregon[1]	0.15	0.04	0.08	0	0	0	0.02	0
Klondike III,Oregon[2]	0.16	0.04	0.08	0	0	0	0.04	0
Leaning Juniper, Oregon[3]	0.41	0.18	0.16	0.03	0	0.02	0.02	0
Stateline, Oregon-Washington[4]	0.21	0.03	0.08	0.03	0	0	0.07	0
Nine Canyon, Washington[5]	0.03	0	0	0	0	0	0	0
Zintel Canyon, Washington[6]	0.08	0.04	0.02	0.02	0	0	0	0
Buffalo Ridge, Minnesota[7]	0.15	0.07	0.06	0.01	0	0	0.02	0
Klickitat County, Washington[8]	0.12	0	0.09	0	0	0.01	0.03	0
Combine Hills, Oregon[9]	0.24	0.06	0.11	0.01	0	0	0	0
Columbia Hills, Washington[10]	0.3	0.04	0.18	0	0.02	0.02	0.02	0.02
Ponnequin, Colorado[11]	0.06	0.06	0	0	0	0	0	0
Hopkins Ridge, Washington[12]	0.43	0.01	0.27	0.01	0	0	0.08	0
Maiden, Washington[13]	0.18	0.05	0.04	0.03	0	0.03	0.02	0
Wild Horse, Washington[14]	0.16	0.12	0	0	0	0.02	0.02	0
Kittitas Valley, Washington[15]	0.09	0.09	0	0	0	0	0	0
Desert Claim, Washington[16]	0.34	0.23	0	0	0	0	0.04	0
Average	**0.19**	**0.06**	**0.07**	**0.01**	**<0.01**	**0.01**	**0.02**	**<0.01**

†Area of GWRA is 42,880 acres, or 67 mi^2 (173.5 km^2).

[a] Swainson's hawk (*Buteo swainsoni*); [b] red-tailed hawk (*Buteo jamaicensis*) ; [c] ferruginous hawk (*Buteo regalis*); [d] golden eagle (*Aquila chrysaetos*); [e] prairie falcon (*Falco mexicanus*); [f] great-horned owl (*Bubo virginianus*); [g] sharp-shinned hawk (*Accipiter striatus*).

[1] WEST 2005c; [2] Mabee et al. 2005; [3] NWC and WEST 2005b; [4] URS and WEST 2001; [5] Erickson et al. 2001b; [6] Erickson et al. 2002a; [7] Johnson et al. 2000a; [8]Erickson et al. 1999; [9]Young et al. 2003c; [10] BPA 1995; [11] Kerlinger et al. 2000; [12]Young et al. 2003*a*; [13] WEST and NWC 2002; [14] Erickson et al. 2003b; [15]Erickson et al. 2003a; [16] Young et al. 2003b

Table 8a. Results of bat acoustic surveys conducted at Grapevine WRA, June 26 – November 9, 2007.

Anabat Location	# of HF Bat Passes	# of LF Bat Passes*	Total Bat Passes	# of unknown	Detector-Nights	Bat Passes/ Night
GV10	734	105	839	300	101	8.31
GV20	956	397	1353	596	113	11.97
GV16L	4	92	96	77	111	0.86
TOTAL	1694	594	2288	973	325	6.44*
GV16H**	0	1	1	0	28	0.04

*mean of ratios

** Data for the Hi-Mic unit (GC16H) are not included in the totals.

Table 8b. Results of bat acoustic surveys conducted at Grapevine WRA, April 12 – July 7, 2008.

Anabat Location	# of HF Bat Passes	# of LF Bat Passes*	# of Hoary Bat Passes	Total Bat Passes	Detector-Nights	Bat Passes/ Night
GV10	29	23	7	52	52	1.00
GV20	1,363	90	13	1,453	87	16.70
GV16L	381	63	9	444	75	5.92
Total	**1,773**	**176**	**29***	**1,949**	**214**	**8.85**
GV16H**	0	16	9	16	62	0.26

*Passes by hoary bats are included in low-frequency numbers.

** Data for the Hi-Mic unit (GV16H) are not included in the totals.

Table 9. State and federal special/sensitive status species observed at the GWRA.

Common Name	Scientific Name	Federal Status	State Status	Occurrence within study area
Birds				
bald eagle	*Haliaeetus leucocephalus*	DPS	WSC	Two observations of one individual in pinion juniper zones during fixed-point bird use surveys; five observations as incidental wildlife species.
western burrowing owl	*Athene cunicularia hypugaea*	SC	SC	One observation at documented prairie dog town; one observation during fixed-point bird use surveys.
Cooper's hawk	*Accipiter cooperii*		WSC	Three observations in the fall and spring; one observation as an incidental wildlife species.
Bird Subtotal				**3 species; 13 observations**
Mammals				
Gunnison's prairie dog	*Cynomys gunnisoni*	SC	WSC	Three prairie dog towns present within the GWRA, including two active towns.

Status Codes: SC = Species of Concern, DPS = USFWS Distinct Population Segment, WSC = Wildlife of Special Concern in Arizona (AZGFD 2008b).

Table 10. Incidental wildlife observed while conducting all surveys at the GWRA, June 22, 2007 – July 7, 2008.

Species		#grps	#obs
American kestrel	*Falco sparverius*	35	123
lark sparrow	*Chondestes grammacus*	1	120
unidentified raptor		3	100
pinyon jay	*Gymnorhinus cyanocephalus*	1	75
red-tailed hawk	*Buteo jamaicensis*	30	30
golden eagle	*Aquila chrysaetos*	13	14
turkey vulture	*Cathartes aura*	6	13
unidentified duck		2	11
loggerhead shrike	*Lanius ludovicianus*	5	9
mountain bluebird	*Sialia currucoides*	1	9
killdeer	*Charadrius vociferus*	3	8
greater roadrunner	*Geococcyx californianus*	5	5
bald eagle	*Haliaeetus leucocephalus*	2	5
northern harrier	*Circus cyaneus*	3	3
great blue heron	*Ardea herodias*	1	3
unidentified wren		1	3
prairie falcon	*Falco mexicanus*	2	2
sharp-shinned hawk	*Accipter striatus*	2	2
common nighthawk	*Chordeiles minor*	1	2
common raven	*Corvus corax*	1	2
western burrowing owl	*Athene cunicularia hypugaea*	1	1
Cooper's hawk	*Accipiter cooperii*	1	1
white-faced ibis	*Plegadis chihi*	1	1
Bird Subtotal		**121**	**542**
pronghorn antelope	*Antilocapra americana*	32	301
bison	*Bison bison*	2	63
elk	*Cervus elaphus*	10	58
black-tailed prairie dog	*Cynomys ludovicianus*	11	21
coyote	*Canis latrans*	10	11
mule deer	*Odocoileus hemionus*	3	8
bobcat	*Lynx rufus*	2	2
javelina	*Tayassu tajacu*	1	2
badger	*Taxidea taxus*	1	1
Mammal Subtotal		**73**	**470**
Total		**194**	**1012**

Table 11. Wind-energy facilities in the U.S. with both pre-construction Anabat sampling data and post-construction mortality data for bat species (adapted from Kunz et al. 2007b).

Wind-Energy Facility	Activity (#/detector night)	Mortality (bats/turbine/year)	Reference
Grapevine, AZ	9.11	-	This study
Foote Creek Rim, WY	2.2	1.3	Gruver 2002
Buffalo Ridge, MN	2.1	2.2	Johnson et al. 2005
Buffalo Mountain, TN	23.7	20.8	Fiedler 2004
Top of Iowa, IA	34.9	10.2	Koford et al. 2005
Mountaineer, WV	38.3	38.0	Arnett et al. 2005

Table 12. Bat species determined from range-maps (Harvey et al. 1999; BCI website) as likely to occur within the GWRA, sorted by call frequency.

High-frequency (≥ 35 kHz)		Low frequency (< 35 kHz)	
western red bat	*Lasiurus blossevillii*	pallid bat	*Antrozous pallidus*
California bat	*Myotis californicus*	Townsend's big-eared bat	*Corynorhinus townsendii*
western small-footed bat	*Myotis ciliolabrum*	big brown bat†	*Eptesicus fuscus*
western long-eared bat	*Myotis evotis*	spotted bat	*Euderma maculatum*
little brown bat†	*Myotis lucifugus*	Allen's big-eared bat	*Idionycteris phyllotis*
long-legged bat	*Myotis volans*	silver-haired bat*†	*Lasionycteris noctivagans*
Yuma bat	*Myotis yumanensis*	hoary bat*†	*Lasiurus cinereus*
western pipistrelle	*Parastrellus hesperus*	fringed bat	*Myotis thysanodes*
		big free-tailed bat	*Nyctinomops macrotis*
		Brazilian free-tailed bat†	*Tadarida brasiliensis*

*long-distance migrant; †species known to have been killed at wind-energy facilities

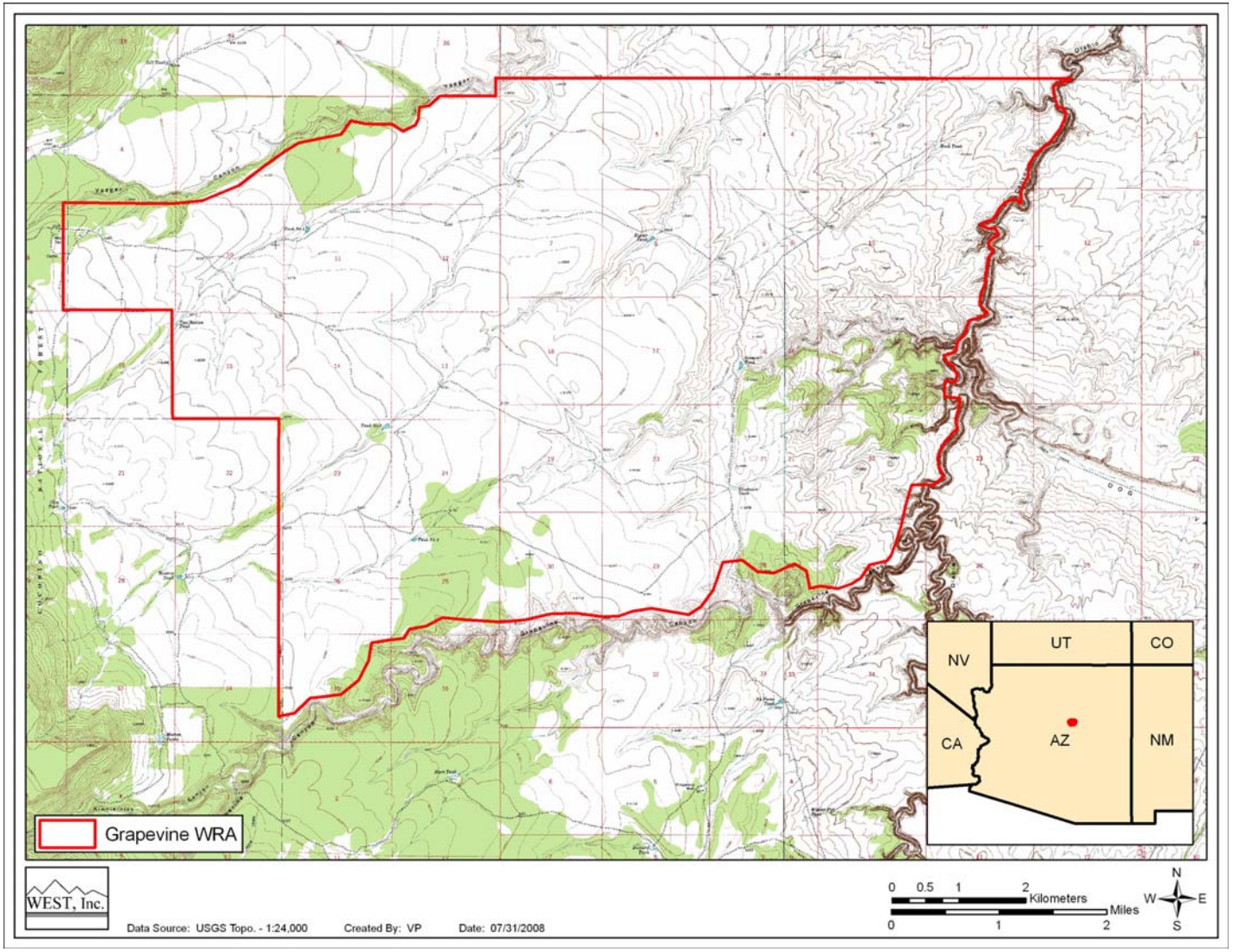


Figure 1. Location and overview of the Grapevine Wind Resource Area (GWRA).

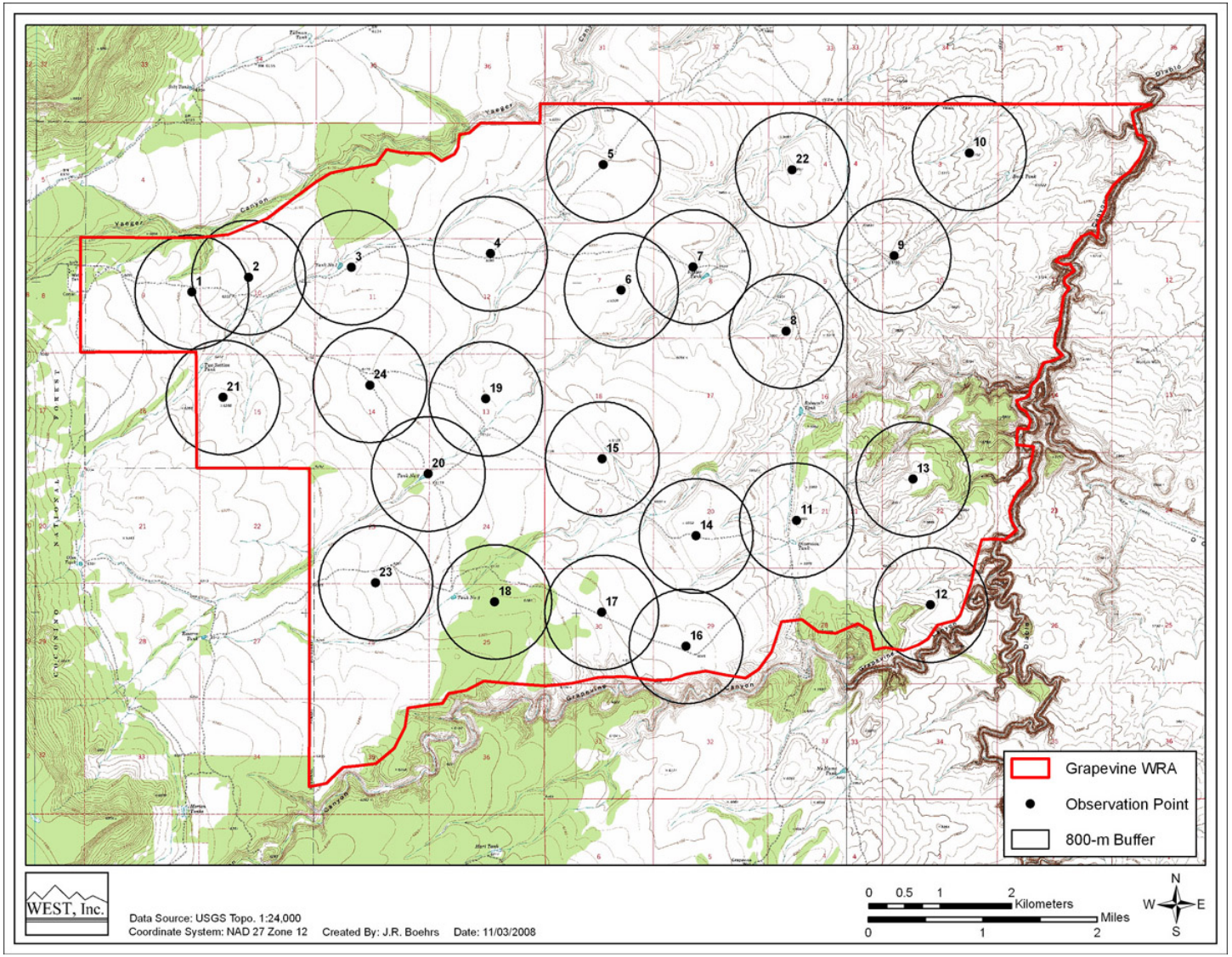


Figure 2. Fixed-point bird use survey plots at the GWRA.

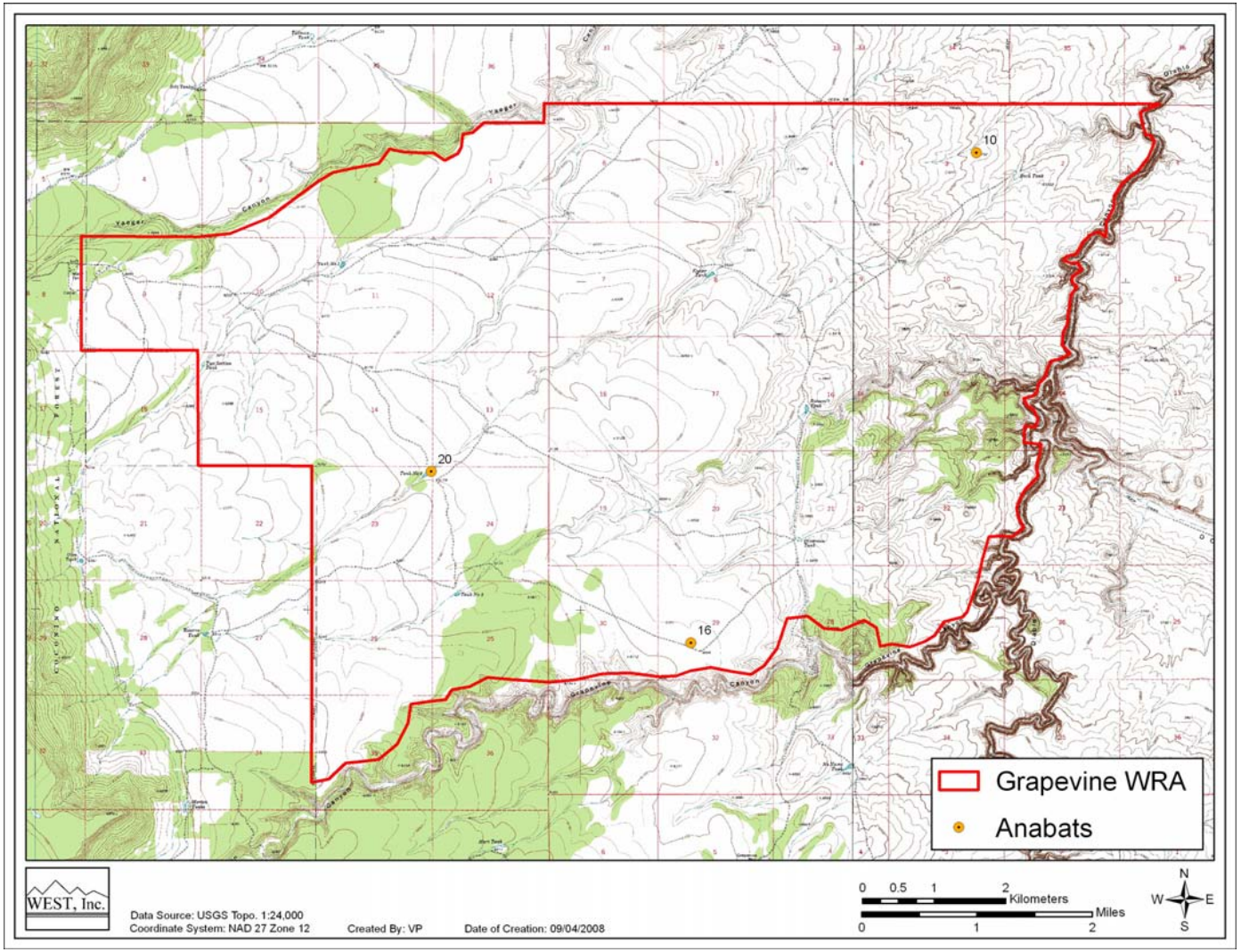


Figure 3. Anabat locations at the GWRA. Four Anabat II detectors were deployed with two stations located at Point 16: one was elevated at the top of the met tower (16 High) and the second was located at ground level (16 Low)

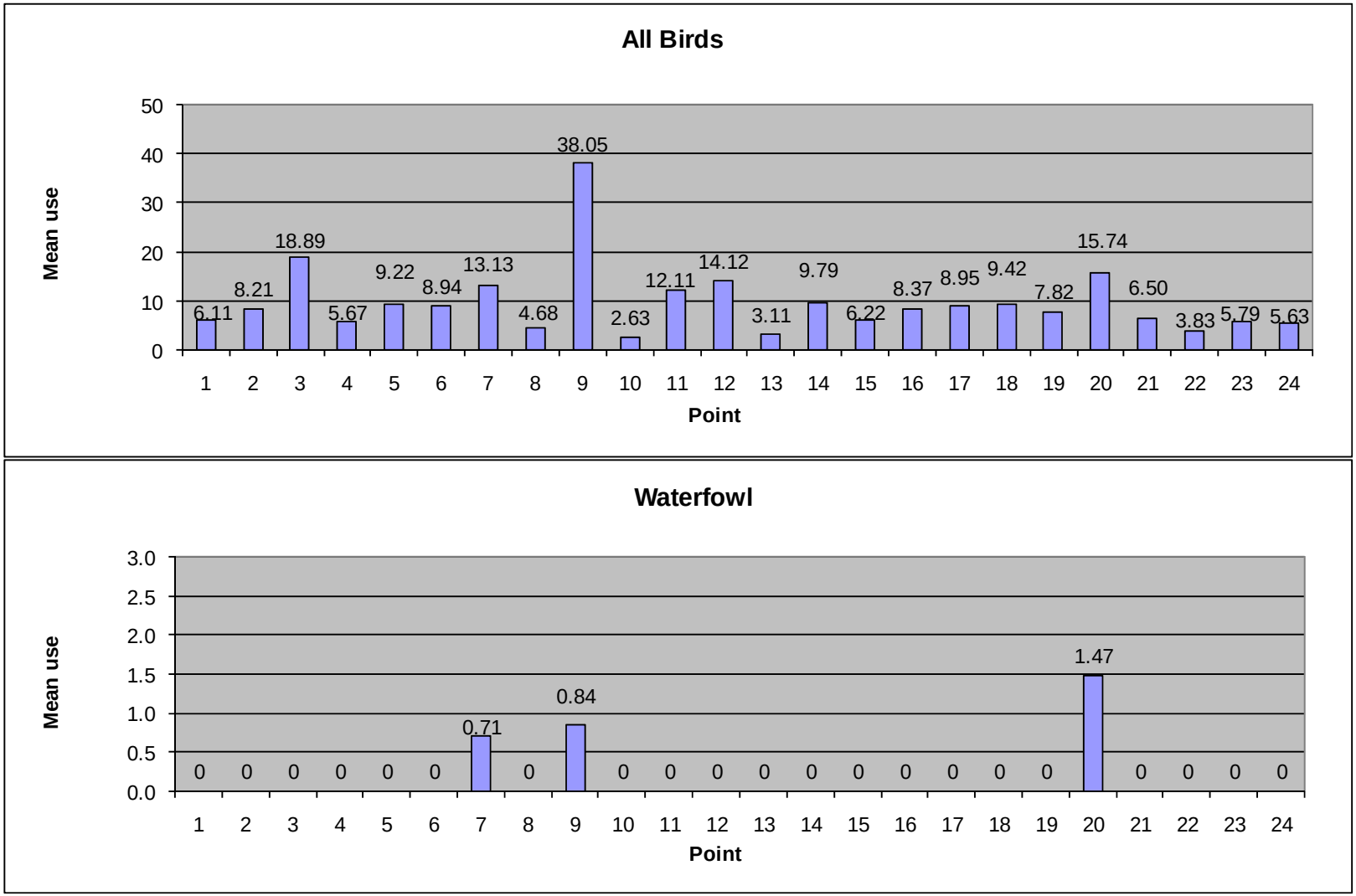


Figure 4. Mean use (birds/20-min survey) at each fixed-point for the GWRA, June 22, 2007 - May 29, 2008, for all birds and major bird types.

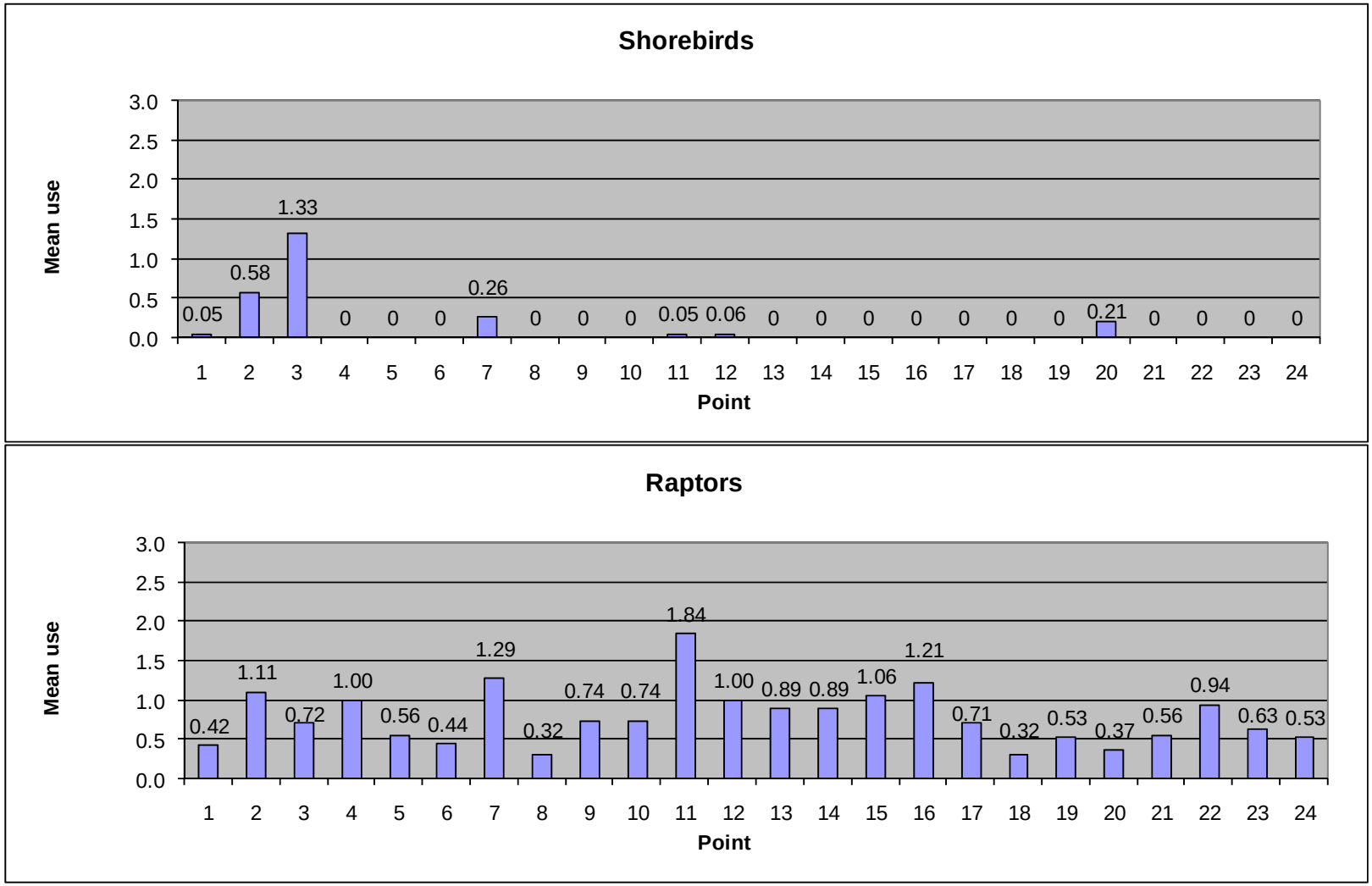


Figure 4 (*continued*). Mean use (birds/20-min survey) at each fixed-point for the GWRA, June 22, 2007 - May 29, 2008, for all birds and major bird types.

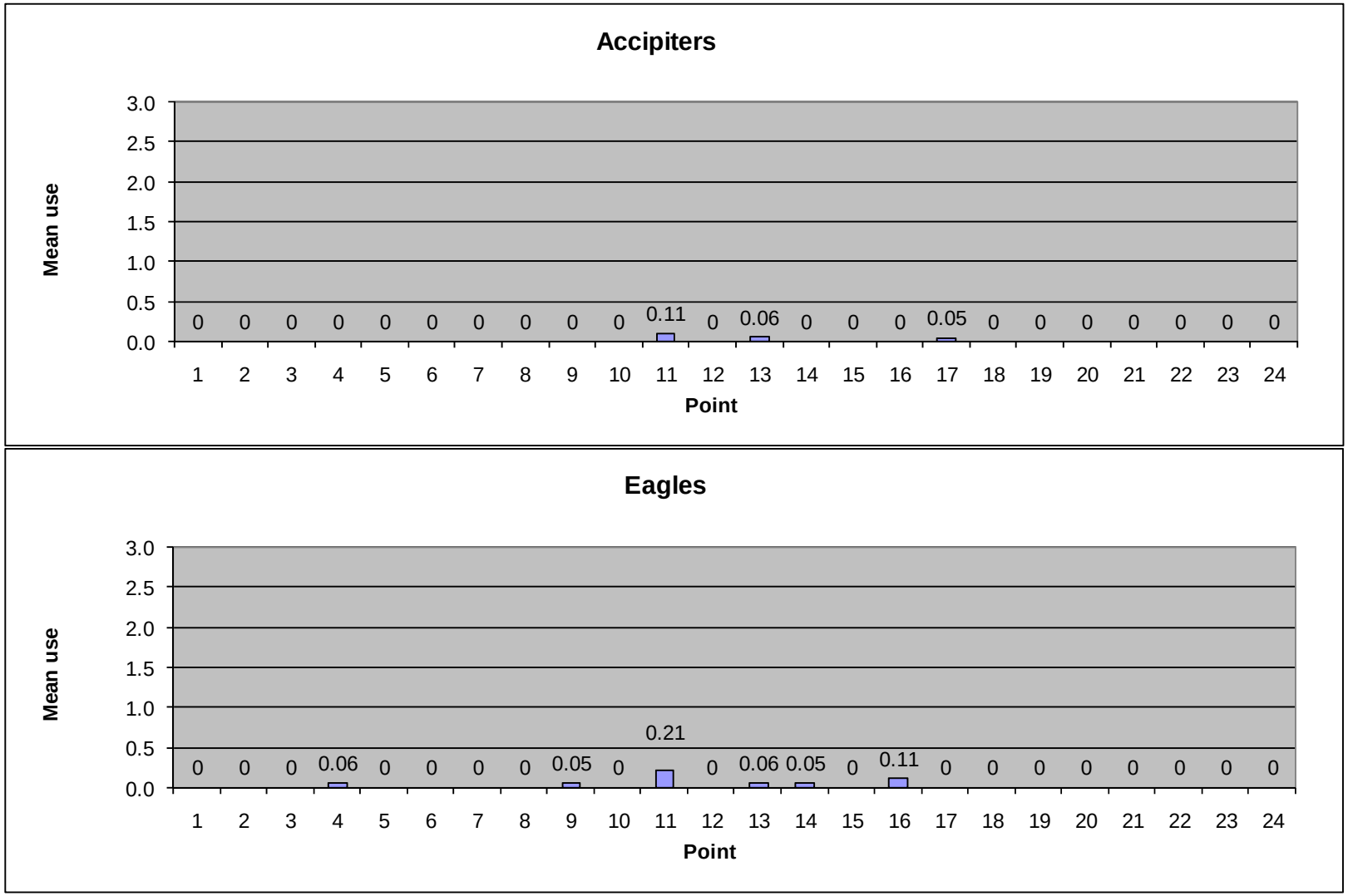


Figure 4 (*continued*). Mean use (birds/20-min survey) at each fixed-point for the GWRA, June 22, 2007 - May 29, 2008, for all birds and major bird types.

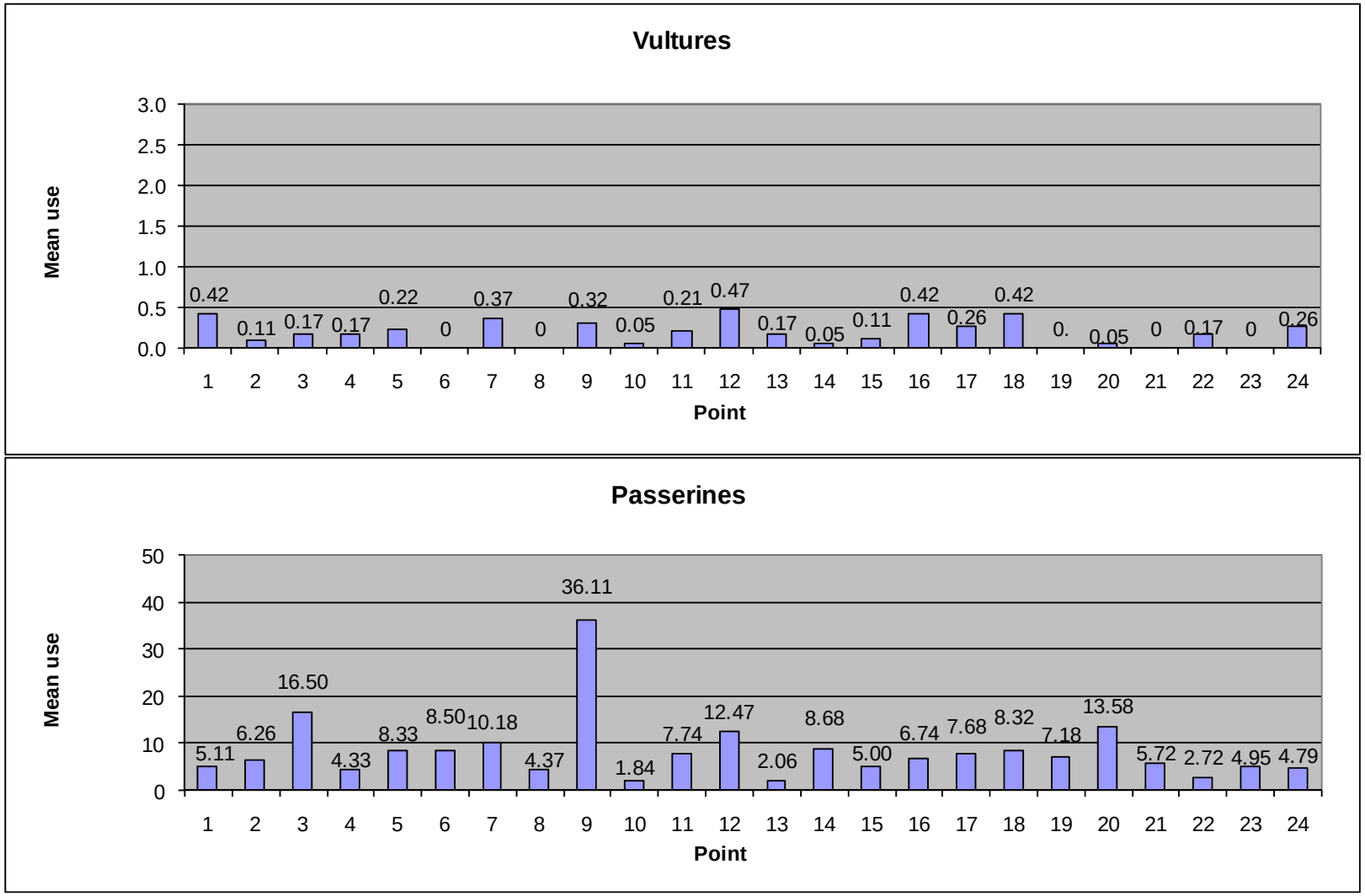


Figure 4 (*continued*). Mean use (birds/20-min survey) at each fixed-point for the GWRA, June 22, 2007 - May 29, 2008, for all birds and major bird types.

Figure 5. Raptor nests and locations at the GWRA.

Figure 6. Raptor nest survey effort and nests at the GWRA.

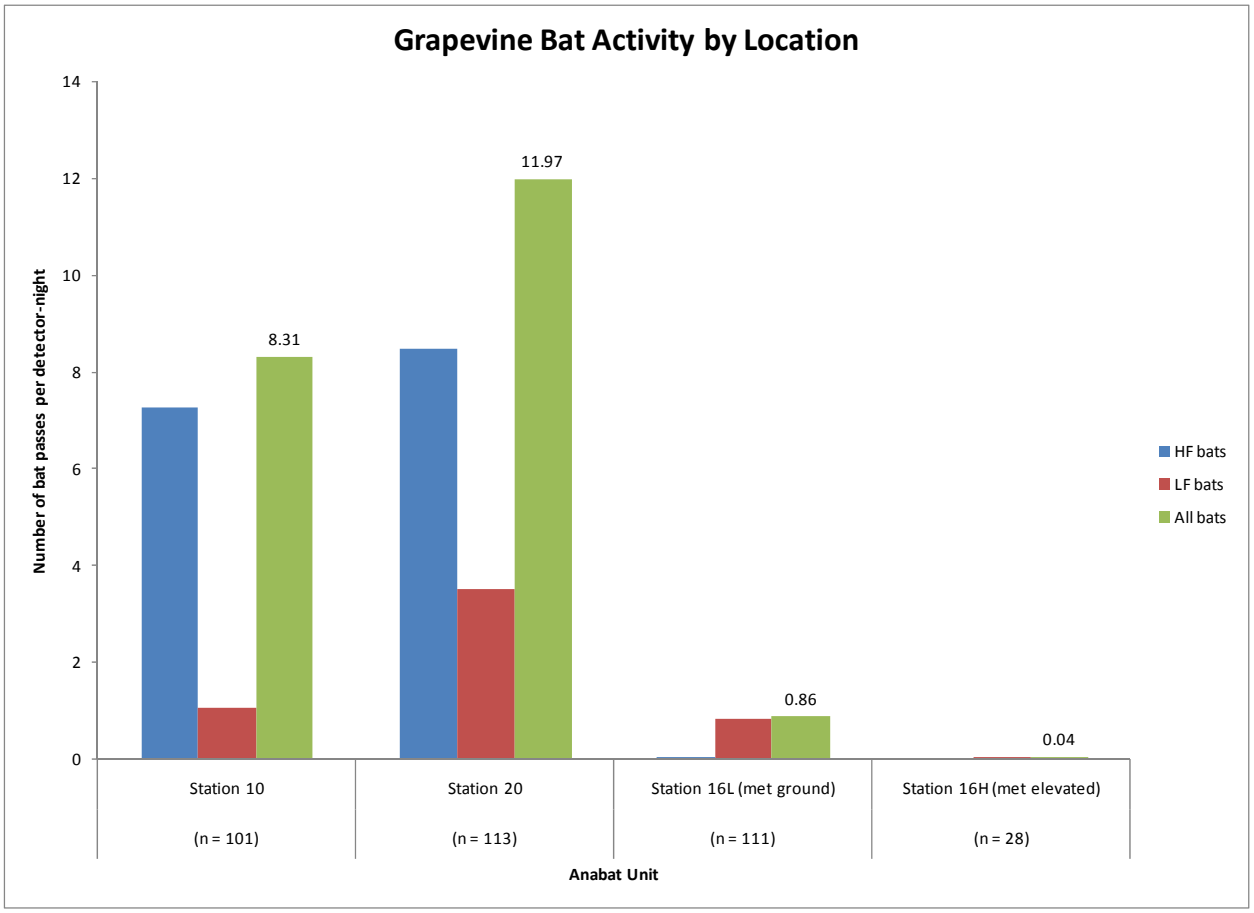


Figure 7a. Bat activity recorded at Anabat stations at the GWRA, 2007. HF = high frequency bat passes; LF = low-frequency bat passes.

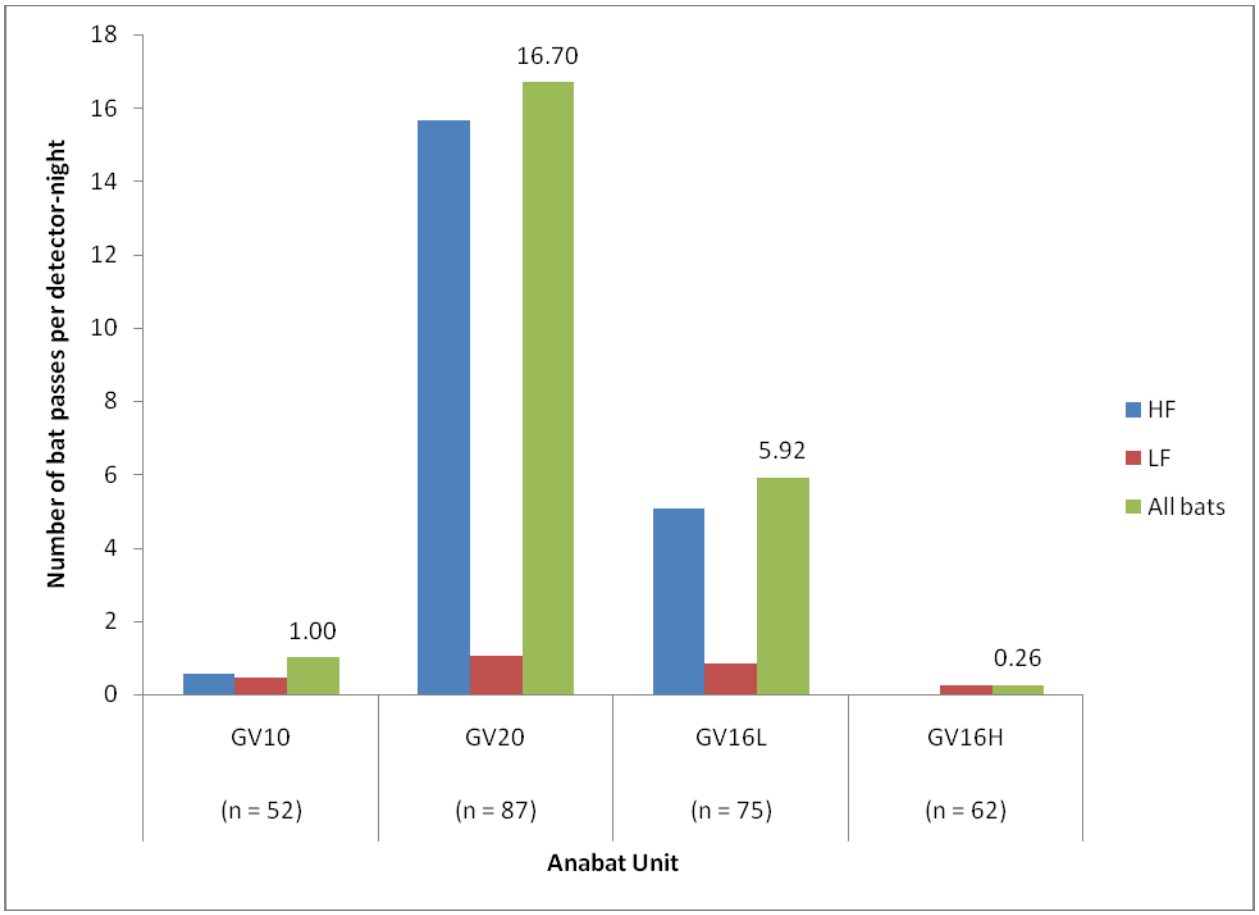


Figure 7b. Bat activity recorded at Anabat stations at the GWRA, 2008. HF = high frequency bat passes; LF = low-frequency bat passes.

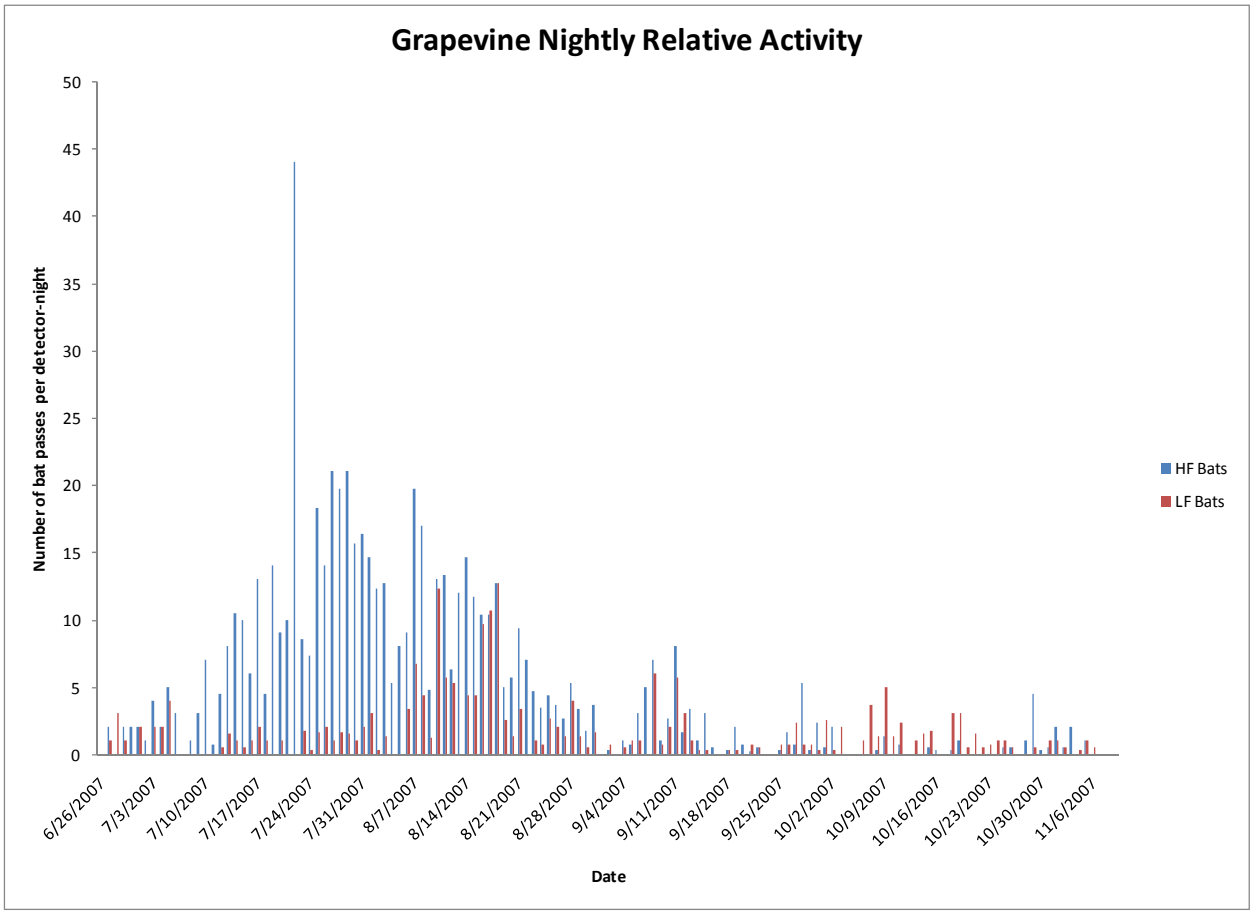


Figure 8a. Nightly bat activity at GWRA as recorded by Anabat detector, 2007. HF = high frequency bat passes; LF = low-frequency bat passes.

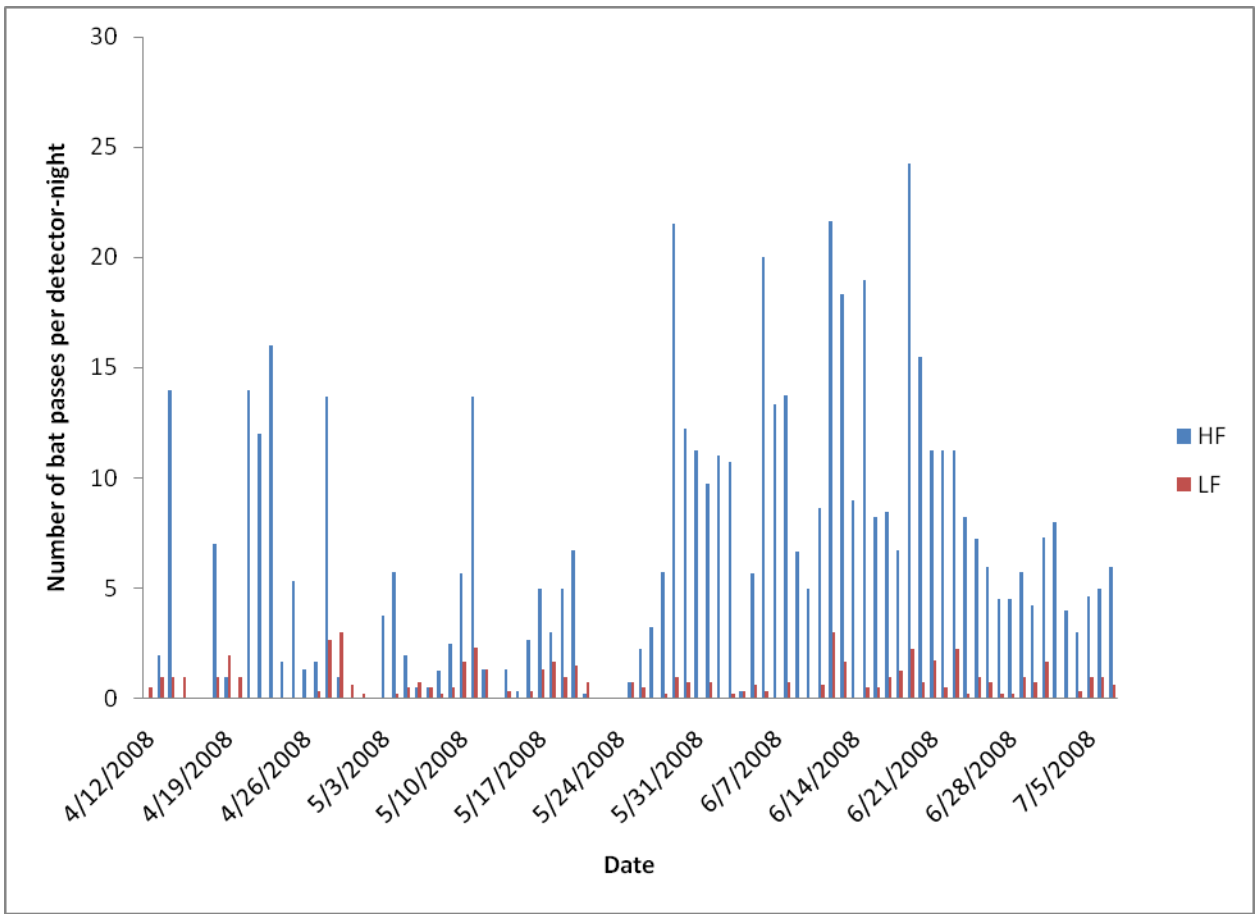


Figure 8b. Nightly bat activity at GWRA as recorded by Anabat detectors, 2008. HF = high frequency bat passes; LF = low-frequency bat passes.

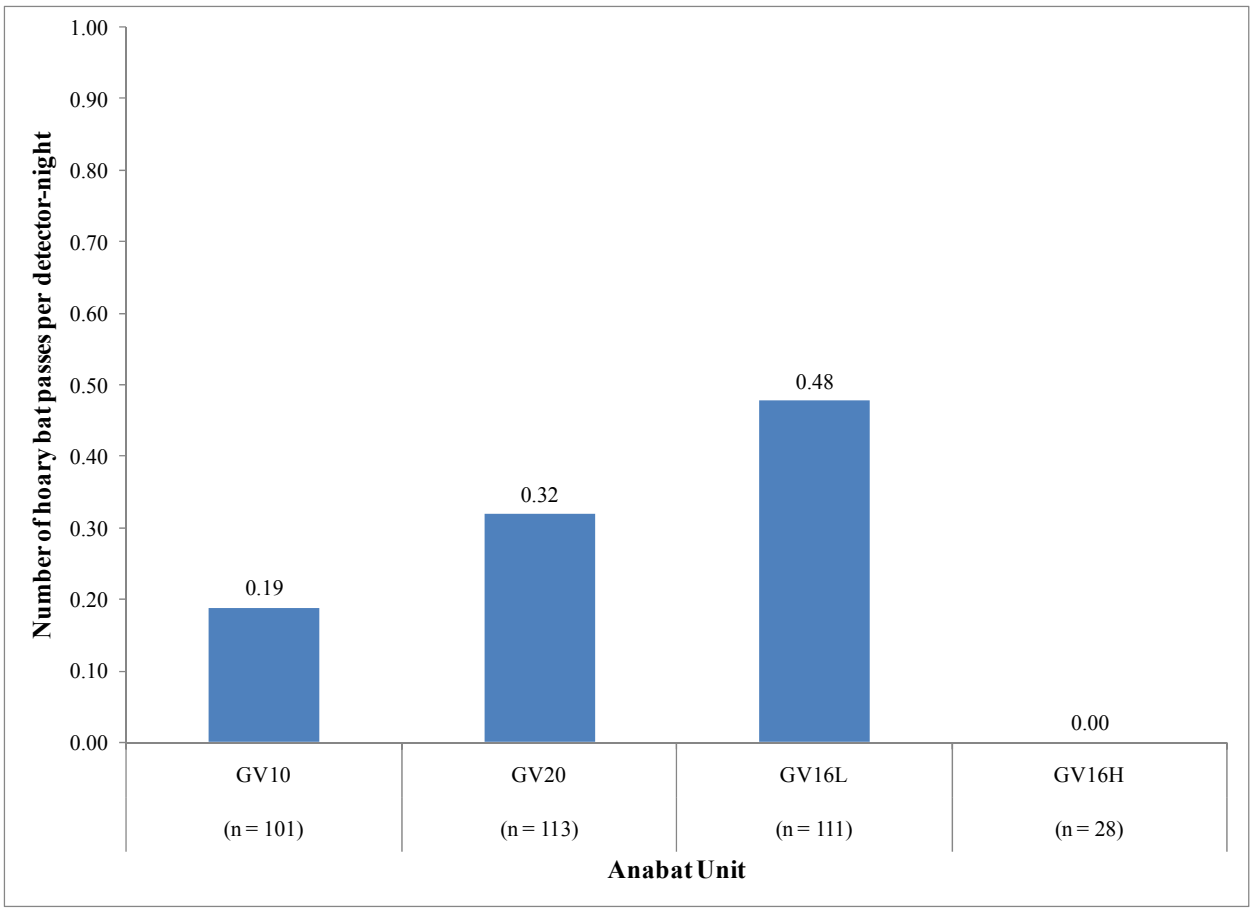


Figure 9a. Hoary bat activity by location as recorded by Anabat detectors at the GWRA, 2007.

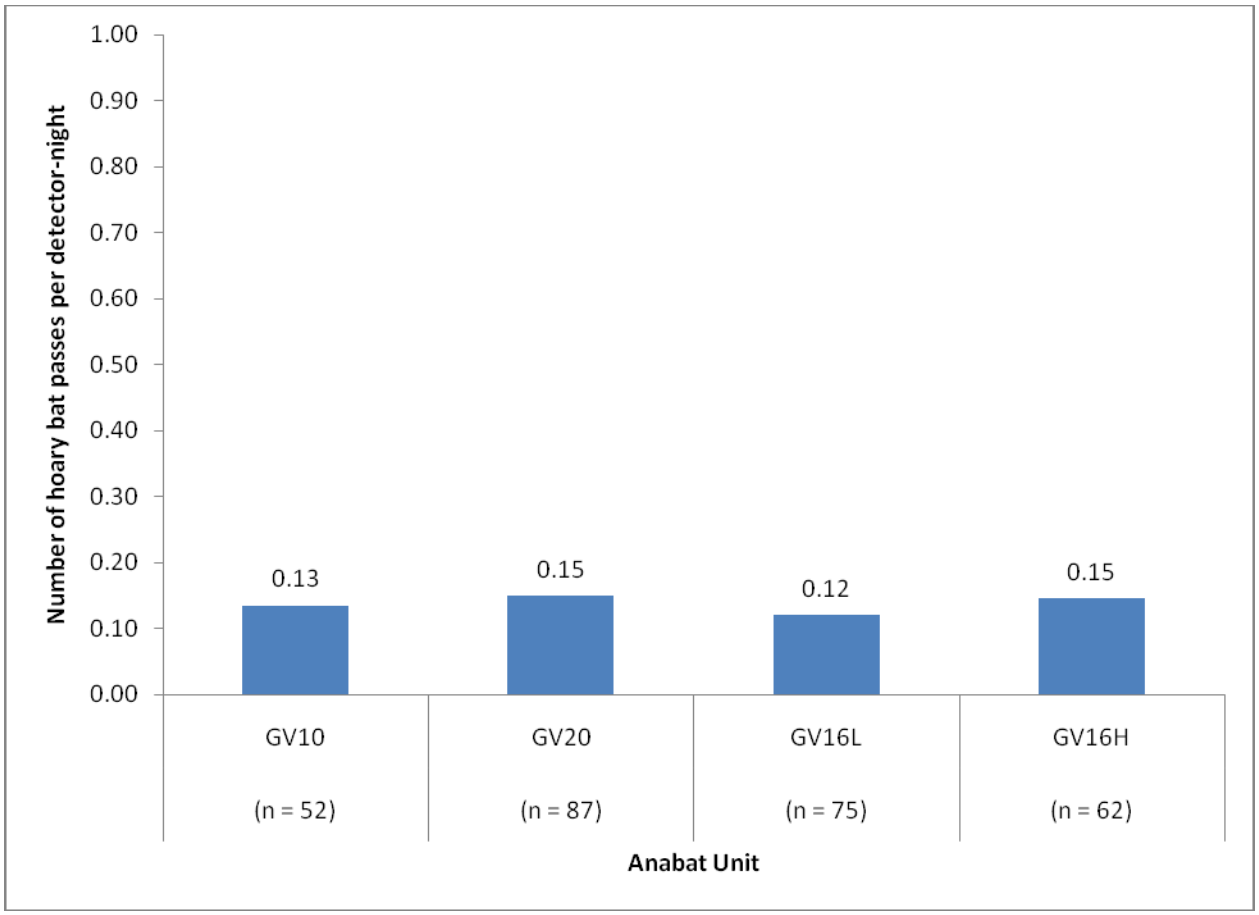


Figure 9b. Hoary bat activity by location as recorded by Anabat detectors at the GWRA, 2008.

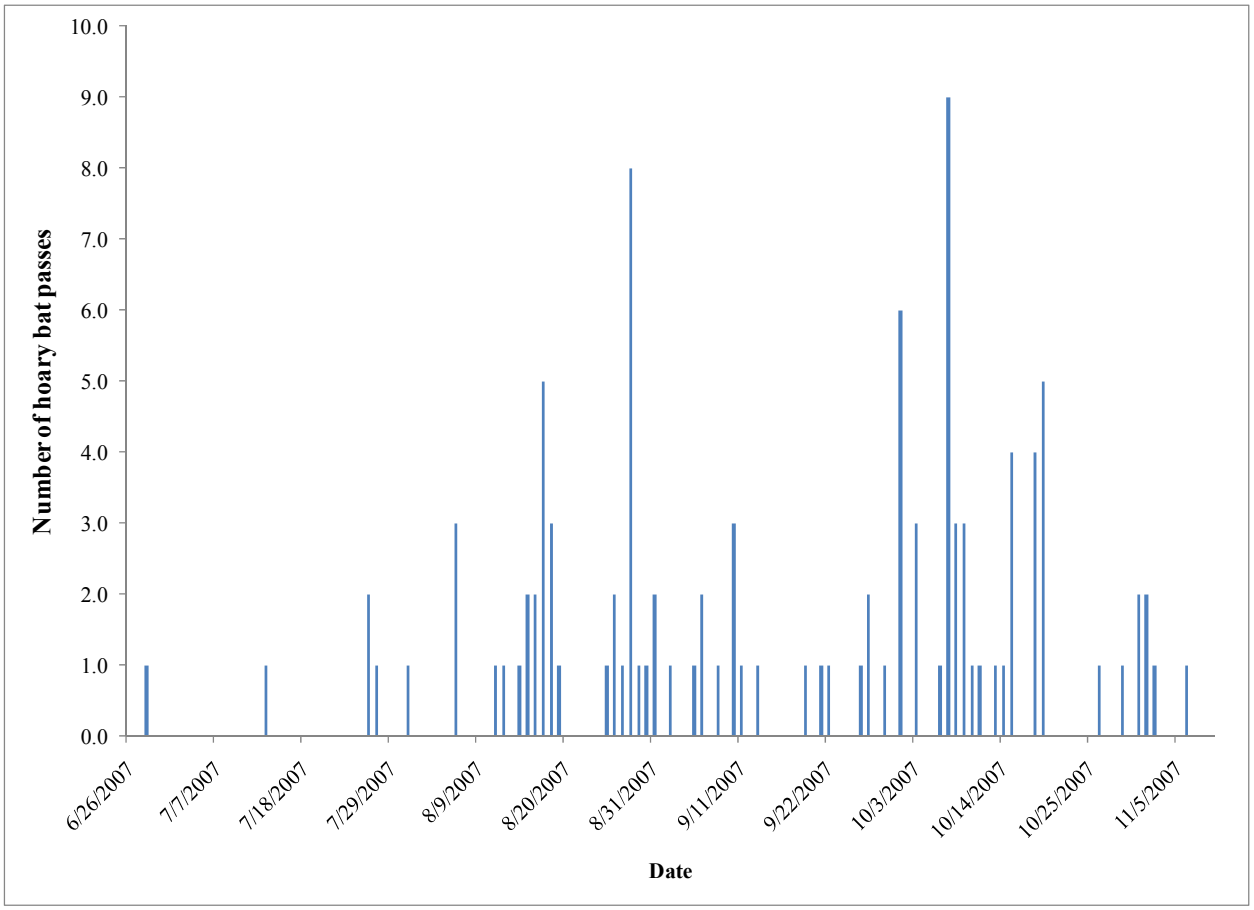


Figure 10a. Nightly hoary bat activity as recorded by Anabat detectors at the GWRA, 2007.

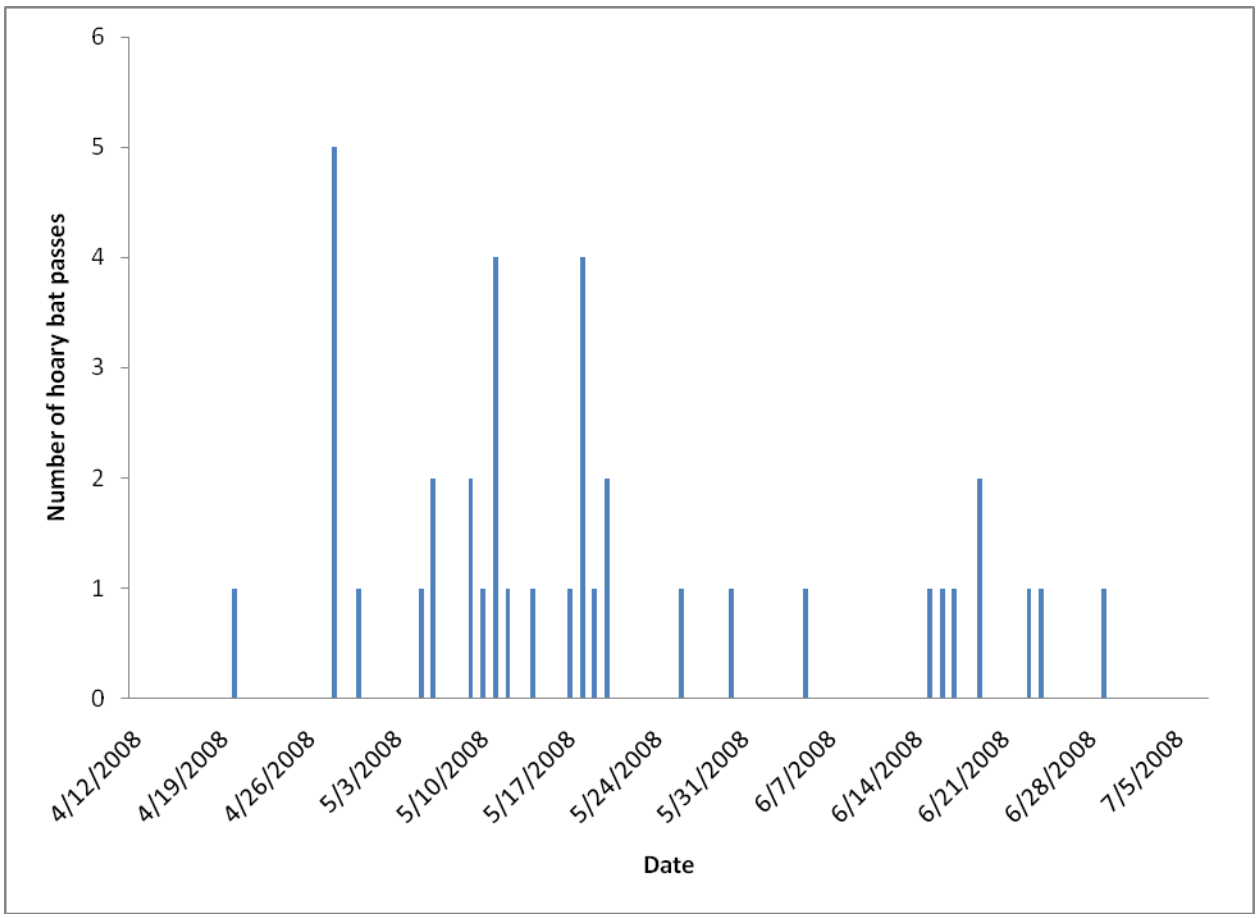


Figure 10b. Nightly hoary bat activity as recorded by Anabat detectors at the GWRA, 2008.

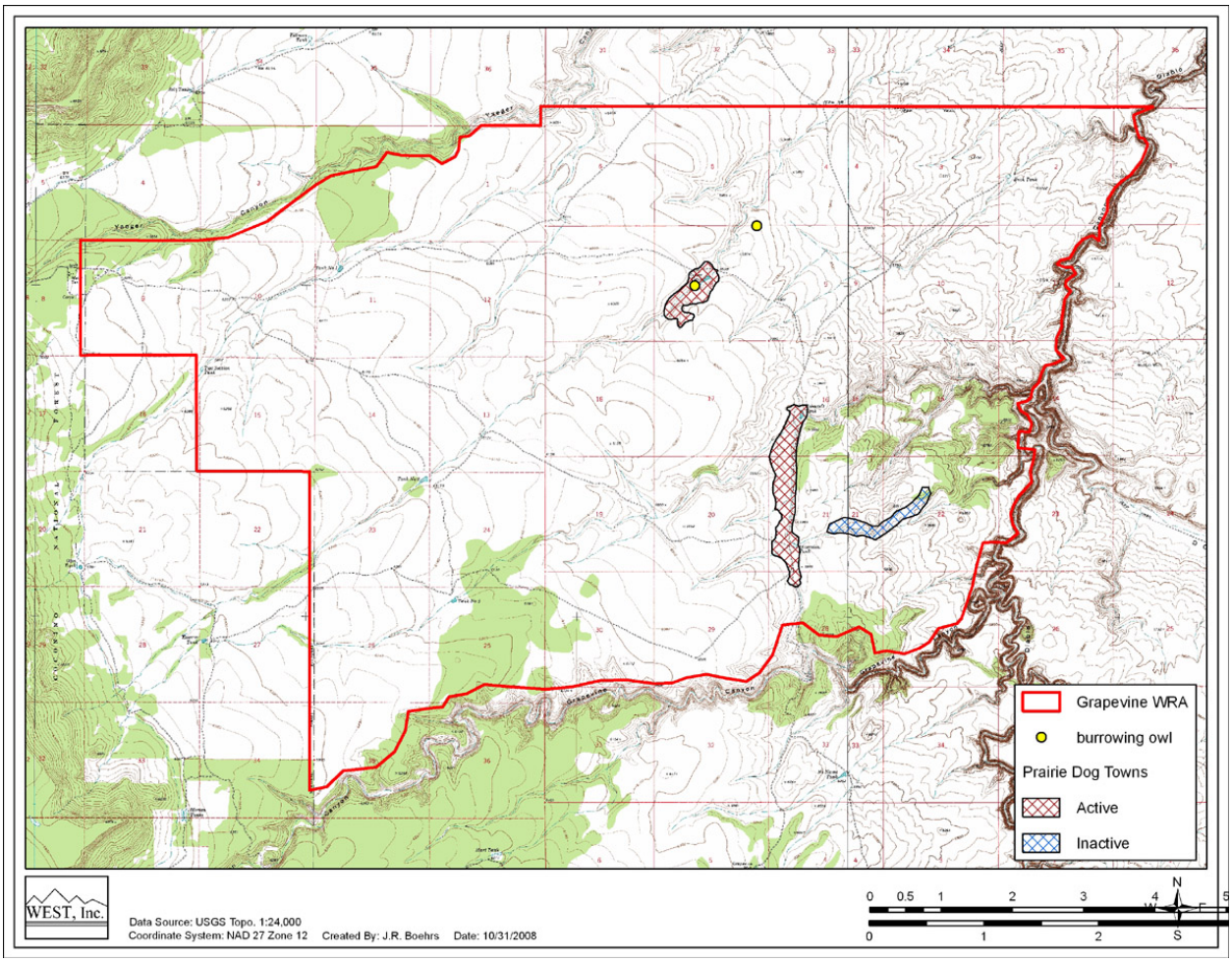


Figure 11. Sensitive species locations at the GWRA.

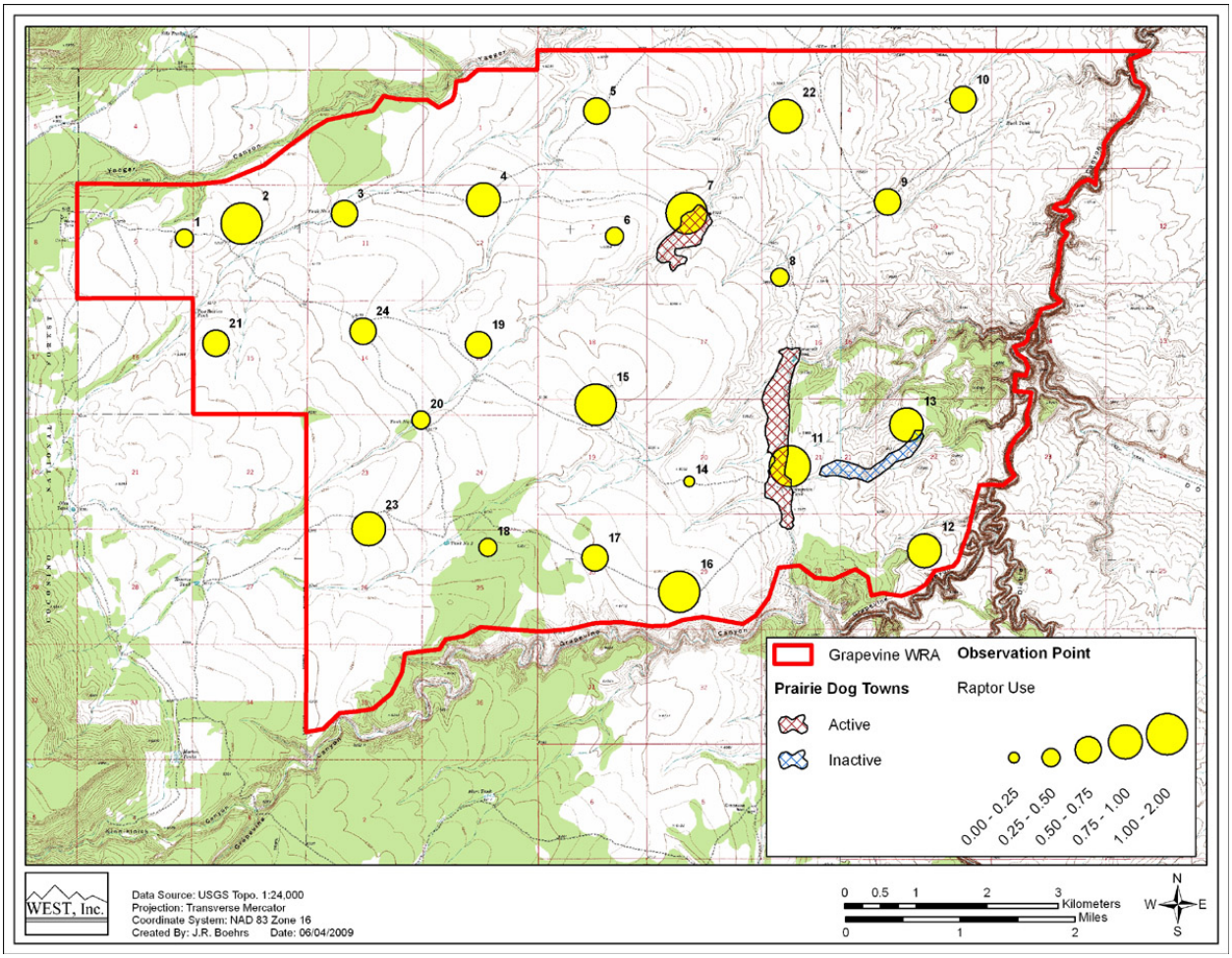


Figure 11. Raptor use in relation to prairie dog towns at the GWRA.

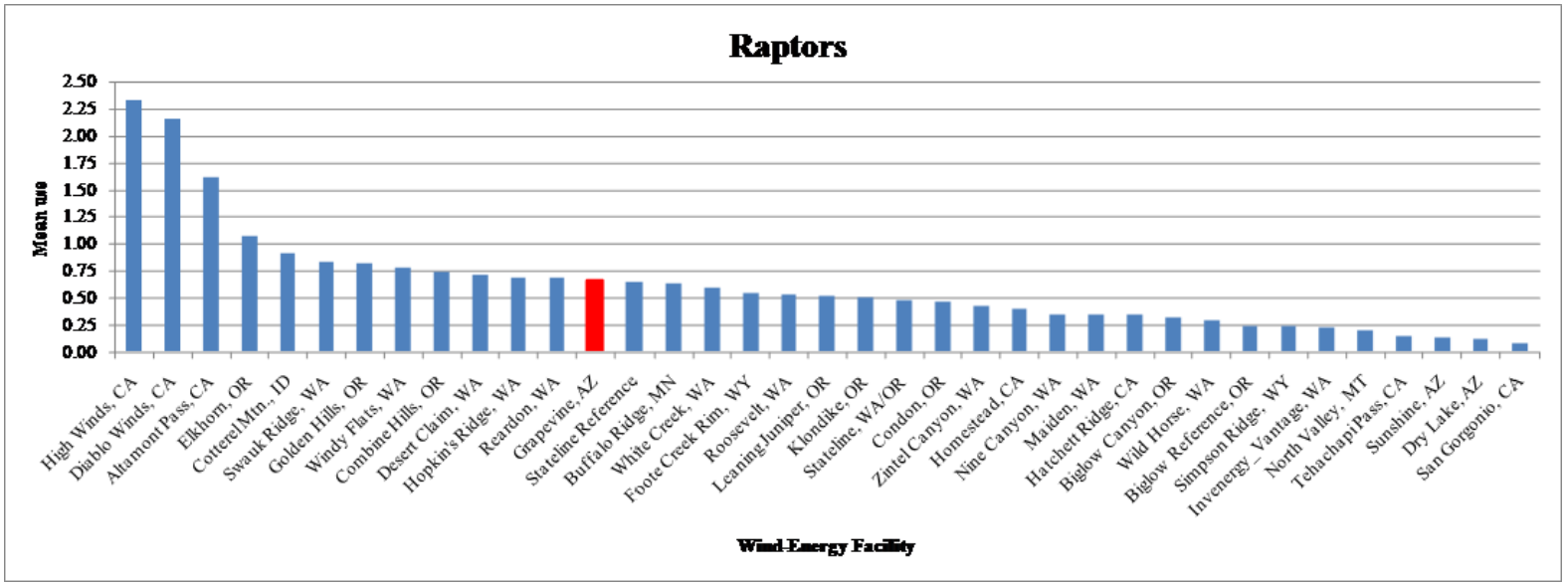
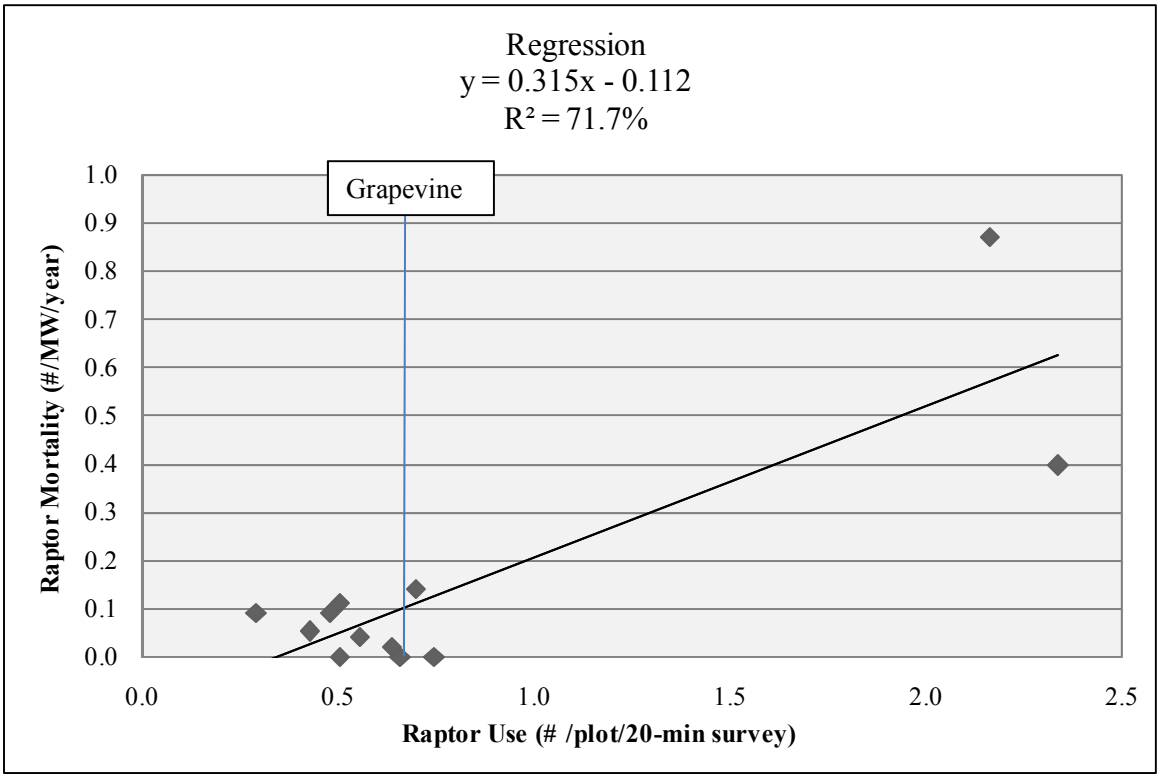


Figure 13. Comparison of overall raptor use between the GWRA and other US wind-energy facilities.

Data from the following sources:

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



Overall Raptor Use 0.67
Predicted Fatality Rate 0.10/MW/year
90.0% Prediction Interval (0, 0.35/MW/year)

Figure 14. Regression analysis comparing raptor use estimations versus estimated raptor mortality.

Data from the following sources:

Study and Location	Raptor Use	Source	Raptor Mortality	Source
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003c	0.00	Young et al. 2005
Diablo Winds, CA	2.161	WEST 2006a	0.87	WEST 2006a
Foote Creek Rim, WY	0.55	Erickson et al. 2002b	0.04	Erickson et al. 2002b
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Hopkins Ridge	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Klondike, OR	0.50	Johnson et al. 2002	0.00	Johnson et al. 2003
Stateline, WA/OR	0.48	Erickson et al. 2002b	0.09	Erickson et al. 2002b
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2002b
Wild Horse, WA	0.29	Erickson et al. 2003b	0.09	Erickson et al. 2008
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b

APPENDIX D.4

U.S. FISH AND WILDLIFE SERVICE

Department of Energy
Western Area Power Administration
P.O. Box 281213
Lakewood, CO 80228-8213

Ms. Shaula Hedwall
U.S. Fish & Wildlife Service
323 North Leroux, Suite 201
Flagstaff, AZ 86001

Subject: Request for concurrence with Western Area Power Administration's determination on the Mexican Spotted Owl for the Grapevine Canyon Wind Project.

Dear Ms. Hedwall:

The U.S. Department of Energy, Western Area Power Administration's Desert Southwest Regional Office (Western) has received an interconnection request for its 345-kilovot (kV) transmission system from Foresight Flying M LLC (Foresight) for the proposed Grapevine Canyon Wind Project in Coconino County, Arizona. The Grapevine Canyon Wind Project would include: 1) a wind energy generating facility up to 500 megawatts; 2) a 345-kV electrical transmission tie-line; and 3) a 345-kV electrical interconnection switchyard that would be owned and operated by Western.

The wind energy generating facility would be located on private land and trust land administered by the Arizona State Land Department. The electrical transmission tie-line would be located on private and State trust lands, as well as Federal lands administered by the Forest Service. The interconnection switchyard would be located entirely on National Forest System lands. The project is located about 28 miles south and east of Flagstaff, Arizona in Coconino County. The enclosed Biological Assessment covers actions proposed to be constructed, owned, operated, and maintained by Western and Foresight.

Western has determined that its proposed action, constructing a new switchyard and the installation of new inset structures, will not have an effect on the Mexican spotted owl. Western believes that Foresight's proposed transmission line may affect but is not likely to adversely affect the Mexican spotted owl due the low potential for Mexican spotted owl collisions with the transmission line and any overhead collection lines. Western does not believe that the proposed Wind Park, including the proposed extension tie-line, will affect the Mexican spotted owl. Western believes that there is some possibility that Mexican spotted owls may come into the Swithyard during unusual weather conditions or to search for prey. Western believes that the Switchyard may affect but is not likely to adversely affect the Mexican spotted owl during such events. Western has suggested and the Forest Service has determined that the granting of right-of-way on Forest Service managed lands is not likely to adversely affect the Mexican spotted owl.

If you have any questions or comments regarding this determination please feel free to contact Ms. Misti Schriner at (720) 962-7239 or Mr. Dave Swanson at (720) 962-7213.

Respectfully,

Misti K. Schriner
Biologist

Enclosure

cc:
Amy LeGere
Vice President of Development
2225 N. Gemini, Suite 7
Flagstaff, AZ 86001

David Tidhar
Research Biologist / Project Manager
WEST, Inc.
26 North Main St.
Waterbury VT 05676

United States Department of the Interior

U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:
AESO/SE
22410-2010-I-0346
22410-2010-CPA-0137

March 15, 2012

Ms. Misti K. Schriner
Department of Energy
Western Area Power Administration
Post Office Box 281213
Lakewood, Colorado 80228-8213

RE: Grapevine Canyon Wind Project

Dear Ms. Schriner:

Thank you for your February 8, 2012, request for informal consultation with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). The Western Area Power Administration (Western) has requested informal consultation for potential effects resulting from constructing and implementing the Grapevine Canyon Wind Project, Coconino County, Arizona. We received your request for consultation and the biological assessment (BA) for the project on February 14, 2012. In addition, we have discussed the project with Western staff, Foresight Renewables, and WEST, Inc. The WAPA requests our concurrence that the proposed action "may affect, but is not likely to adversely affect" the threatened Mexican spotted owl (*Strix occidentalis lucida*). We concur with your determination and provide our rationale below.

PROPOSED ACTION

A complete description of the proposed action is found in your February 8, 2012, BA, and is included herein by reference.

Western received an interconnection request for its 345-kilovolt (kV) transmission system from Foresight Flying M LLC (Foresight) for the proposed Grapevine Canyon Wind Project. The project would include: 1) a wind energy generating facility up to 500 megawatts; 2) a 345-kV electrical transmission tie-line; and, 3) a 345-kV electrical interconnection switchyard that would be owned and operated by Western. The project area is located approximately 28 miles south and east of Flagstaff, Arizona. The wind generating facility would be located on private and state trust land administered by the Arizona State Land Department. The electrical transmission tie-line would be located on private and State trust lands, as well as Forest Service-administered lands on the Coconino National Forest. The interconnection switchyard would be located

entirely on National Forest System (NFS) lands.

The proposed Federal actions evaluated in this BA by each of the involved Federal agencies are specific and limited and are based on the purpose and need for agency action. Proposed actions are as follows:

- Western: To approve Foresight's interconnection to Western's transmission system, on the Glen Canyon-Pinnacle Peak 345-kV transmission lines, an action which also requires a new Western switchyard on NFS lands. The switchyard would be constructed, owned and operated by Western. The proposed 345-kV interconnection switchyard would be constructed on an approximately 15-acre parcel, located about three-quarter mile north of Forest Service Road 125 and generally within the existing rights-of-way of Western's two 345-kV transmission lines. The switchyard is expected to be approximately 650-feet wide by 1,000-feet long. The switchyard for this project would contain power circuit breakers, disconnect switches, steel busses, steel poles, cables, metering equipment, communication equipment, AC/DC batteries, and other equipment. The switchyard would be lighted at night.

- Forest Service: To approve Foresight's special use permit authorizing a 200-feet wide right-of way to accommodate the construction, operation, and maintenance of a portion of a new 345-kV electrical transmission tie-line corridor across approximately 8.5 miles of NFS lands, as well as an approximately 15-acre parcel to operate and maintain a new Western switchyard.

In addition, Foresight is developing an Avian and Bat Protection Plan (ABPP) in cooperation with the FWS and Arizona Game and Fish Department (AGFD) to minimize effects to birds (including migratory birds, golden, and bald eagles) and bats that could occur within the project area. These actions are not part of section 7 consultation under the Act, and as such are not discussed in detail in this letter, but will be addressed in a separate process.

DETERMINATION OF EFFECTS

We concur with your determination that the proposed action may affect, but will not likely adversely affect, the Mexican spotted owl. We base our concurrence on the following:

- Habitat types within the action area consist of grassland (63.2%), pinyon-juniper woodland (34.4%), and ponderosa pine (2.4%). Construction activity associated with the transmission line, switchyard, and wind park (including the extension tie-line) would not affect any key habitat components of Mexican spotted owl habitat or primary constituent elements of critical habitat.

- Construction activity associated with the transmission line, switchyard, and wind park (including the extension tie-line) will not result in any disturbance to nesting or roosting owls as the project is not located within 0.25 mile of any designated protected activity centers (PACs).

- The proposed transmission line would be located within potential foraging habitat for Mexican spotted owls. To minimize the likelihood of bird collisions with the transmission line, Avian Power Line Interaction Committee (APLIC) suggested practices will be included in the proposed action.

In keeping with our trust responsibility to American Indian Tribes, for proposed actions that may affect Indian lands, Tribal trust resources, or Tribal rights, we encourage you to invite the affected Tribes and Bureau of Indian Affairs to participate in the project and, by copy of this letter, are notifying the Hopi Tribe and Navajo Nation.

Thank you for your continued coordination. No further section 7 consultation is required for this project at this time. Should project plans change, or if information on the distribution or abundance of listed species or critical habitat becomes available, this determination may need to be reconsidered.

In all future correspondence on this project, please refer to consultation number 22410-2010-I-0346. Should you require further assistance or if you have any questions, please contact Shaula Hedwall (x103) or Brenda Smith (x101) of our Flagstaff Suboffice at (928) 226-0614.

Sincerely,

Brenda N Smith

for Steven L. Spangle
Field Supervisor

cc (electronic):
Alternative Energy Coordinator, FWS, Albuquerque, NM (Attn: Laila Lienesch)
Program Coordinator, Conservation Planning Assistance, FWS, Albuquerque (Attn: Chris O'Meilia)
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Flagstaff, AZ
Forest Supervisor, Coconino National Forest, Flagstaff, AZ (Attn: Cecelia Overby)
Vice President of Development, Foresight Renewables, Flagstaff, AZ (Attn: Amy LeGere)
Research Biologist/Project Manager, WEST, Inc., Waterbury, VT (Attn: David Tidhar)

cc (hard copy):
Environmental Specialist, Environmental Services, Western Regional Office, Bureau of Indian Affairs, Phoenix, AZ
Director, Hopi Cultural Preservation Office, Kykotsmovi, AZ
Director, Historic Preservation Department, Navajo Nation, Window Rock, AZ