APPENDIX C

Plants and Animals

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Exhibit 1

Threatened and Endangered Species Report

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THREATENED AND ENDANGERED SPECIES

This report provides detailed information on threatened, endangered and sensitive species considerations for the Desert Claim Wind Power Project. The technical documentation in this exhibit supports the summary information presented in **Section 3.4, Plants and Animals**, of the EIS. The organization of the exhibits reflects the subheadings used in the respective portions of **Section 3.4** addressing vegetation, wildlife and fish.

1. Affected Environment

1.1 Plants

Review of federal and state lists of rare plant species suggests that 21 such species could occur in the project area, based on the type of habitats present (**Table 1**). Of the 21 rare plant species, one (Ute ladies'-tresses) is a federally-listed threatened species, with a state ranking of endangered. Five are federal 'species of concern', with state rankings of threatened or sensitive. The remaining 15 are listed at the state level as either sensitive or review species. The Washington Natural Heritage Program (WNHP) database has records for two state sensitive species in or adjacent to the project area. One historic record (1959) for Piper's daisy includes the western portion of the project area, and one current record (1991) for long-sepal globemallow is located adjacent to the eastern end of the project area.

In the project area, the wet meadows provide potential habitat for the Ute ladies'-tresses orchid, federally listed as a threatened species in 1992 (USFWS 1992). The primary threats to the species are a general lack of knowledge about the species ecology and distribution, habitat loss or degradation, and invasion of exotic species (USFWS 1995). Very little is known about the historic distribution of this plant. It was previously thought to only have occurred in Nevada, Utah, and Colorado. However, since the early 1990's new populations have been discovered in Wyoming, Nebraska, Montana, Idaho, and Washington. In Washington, Ute ladies'-tresses orchid is known to occur in north-central Washington in Okanogan and Chelan Counties. Ute ladies' tresses orchids flower in late July through August and occasionally into September and October if conditions are favorable (USFWS 1992). It is believed that individual plants rarely flower in consecutive years or under unfavorable conditions, and populations of Ute ladies' tresses orchid are known to fluctuate from year to year, possibly depending on site conditions such as water availability, disturbance history, or encroachment by invasive weeds (USFWS 1995). This orchid has a close affinity with floodplain areas where the water table is near the surface during the growing season providing continuous sub-irrigation and where the vegetation is relatively open and not overly dense (USFWS 1995). Ute ladies' tresses tolerate areas with some disturbance such as flooding, grazing, or haying to reduce overstory cover from competing plants (USFWS 1995). The wet meadow habitats in the project area were searched for Ute ladies'-tresses orchid in early September 2002, but no Ute ladies'-tresses were found (Young et al 2003).

Table 1
Rare Plants Potentially Occurring in the Project Area

Species	Federal Status	State Status	General Habitat	Flowering Period
Tall agoseris *Agoseris elata*		S	Meadows, open woods, and exposed rocky ridgetops	June-August
Pasque flower *Anemone nuttalliana*		S	Prairies to mountain slopes, mostly on well-drained soil	May-August
Palouse milk-vetch *Astragalus arrectus*		S	Grassy hillsides, sagebrush flats, river bluffs, and openings in open ponderosa pine and Douglas fir forests	April-July
Columbia milk-vetch *Astragalus columbianus*	SOC	LT	Sagebrush-steppe	March-June
Pauper milk-vetch *Astragalus misellus* var. *pauper*		S	Open ridgetops and slopes	April-mid June
Bristle-flowered collomia *Collomia macrocalyx*		S	Dry, open habitats	late May- early June
Golden corydalis *Corydalis aurea*		R1	Varied habitats, moist to dry and well drained soil	May-July
Beaked cryptantha *Cryptantha rostellata*		S	Very dry microsites within sagebrush steppe	late April –mid June
Shining flatsedge *Cyperus bipartitus*		S	Streambanks and other wet, low places in valleys and lowlands	August-September
Wenatchee larkspur *Delphinium viridescens*	SOC	T	Moist meadows, moist microsites in open coniferous forest, springs, seeps, and riparian areas	July
Piper's daisy *Erigeron piperianus*		S	Dry, open places, often with sagebrush	May-June
Longsepal globemallow *Iliamna longisepala*		S	Sagebrush-steppe and open ponderosa pine and Douglas fir forest	June-August
Hoover's desert-parsley *Lomatium tuberosum*	SOC	T	Loose talus and drainage channels of open ridgetops within sagebrush-steppe	March-early April
Suksdorf's monkey-flower *Mimulus suksdorfii*		S	Open, moist to rather dry places within sagebrush-steppe	mid April-July
Coyote tobacco *Nicotiana attenuata*		S	Dry, sandy bottom lands, dry rocky washes, and other dry open places	June-September
Hedgehog cactus *Pediocactus simpsonii* var. *robustior*		R1	Desert valleys and low mountains	May-July
Fuzzytongue penstemon *Penstemon eriantherus* var.*whitedii*		R1	Dry open places	May-July
Least phacelia *Phacelia minutissima*	SOC	S	Moist to fairly dry open places	July

Species	Federal Status	State Status	General Habitat	Flowering Period
Sticky goldenweed *Pyrrocoma hirta* var. *sonchifolia*		R1	Meadows and open or sparsely wooded slopes	July-August
Ute ladies'-tresses *Spiranthes diluvialis*	LT	E	Broad low-elevation intermontane valley plains, with deltaic meandered wetland complexes; restricted to calcareous, temporarily inundated wet meadow zones and segments of channels and swales where there is stable subsurface moisture and relatively low vegetation cover.	Mid July – early September
Hoover's tauschia **Tauschia hooveri**	SOC	T	Basalt lithosols within sagebrush-steppe	March-mid April

Federal Status
LT = Listed Threatened: Likely to become endangered.
SOC = Species of Concern: A taxon whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

State Status
E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.
T = Threatened: Any taxon likely to become endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.
S = Sensitive: Any taxon that is vulnerable or declining and could become endangered or threatened in the state without active management or removal of threats.

R1 = Review Group 1: Of potential concern but needs more field work to assign another rank.

Surveys for the other rare plant species were focused on areas of likely disturbance from the proposed project. The field surveys did not locate any federal species of concern or state listed plant species that might occur in the project area (Young et al, 2003).

1.2 Wildlife and Fish

A list of federal special-status wildlife and fish species (endangered, threatened, proposed, and candidate species) was solicited from the U.S. Fish and Wildlife Service (USFWS), and the Washington Department of Fish and Wildlife (WDFW) Species of Concern list was queried for state special-status species potentially occurring in the study area (WDFW 2000). The USFWS species list indicates that gray wolf (*Canis lupus*), endangered; bald eagle (*Haliaeetus leucocephalus*), threatened; bull trout (*Salvelinus confleuntus*), threatened; northern spotted owl, (*Strix occidentalis caurina*), threatened; Ute ladies'-tresses orchid (*Spiranthes diluvialis*), threatened; western sage grouse (*Centrocercus urophasianus phaios*), candidate; and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), candidate; may be present near and therefore may be affected by the proposed project. Ute's ladies tresses orchid, a wetland plant, is addressed under the Vegetation section. Middle Columbia River steelhead *(Oncorhynchus mykiss)*, an anadromous fish, is listed by NOAA Fisheries as a federal threatened species and may occur in Reecer Creek and throughout the Yakima River. In addition, 30 state special status

species may occur near the proposed project based on known species range (**Table 2**). Of these, four species, golden eagle, northern goshawk, sage thrasher, and loggerhead shrike were documented in the study area in low numbers (see Young et al. 2003a).

The USFWS indicated that no designated critical habitat for listed species was present near the project. The Endangered Species Act defines critical habitat for threatened or endangered species as specific area(s) within the geographical range of a species where physical or biological features are found that are essential to the conservation of the species and which may require special management consideration or protection. Critical habitat is specific geographic area(s) designated by the USFWS for a particular species. Under the ESA, it is unlawful to adversely modify designated critical habitat. According to the USFWS, there is no critical habitat as defined by the ESA for threatened or endangered species that may be affected by the project. Therefore, construction, maintenance, and operation of the proposed wind power project would not adversely modify critical habitat for endangered or threatened species.

1.2.1 Gray Wolf

Gray wolf is an endangered species throughout the lower 48 states, except in Minnesota where it is listed as threatened, and in Idaho and Wyoming where it is listed as non-essential, experimental. Historically, gray wolves occurred throughout North America from the arctic to northern Mexico and the southern U.S. and inhabited a wide range of habitats including coniferous forests, grasslands, arctic tundra, and deserts. Large wilderness tracts with little human disturbance are believed to be essential in maintaining healthy wolf populations. Today, gray wolves are fairly abundant in Canada and Alaska, and there are also native populations in northern Minnesota, Michigan, Wisconsin, and northern Montana (USFWS 2000). Due to the reintroduction efforts of the USFWS, gray wolves also occur in Idaho, Wyoming, and southern Montana. There are no known wolf packs in Washington (WDFW 1999). Occasionally, individual wolves are reported in the state that are believed to be lone wolves dispersing from Canada or released wolf-dog hybrids (WDFW 1999). There are several historical records of wolves, the latest of which occurred in 1993, in the mountains west and north of the project area in the PHS database (WDFW PHS 2002). Due to the successful wolf reintroduction effort in central Idaho, wolves may eventually disperse in to eastern Washington. Habitat throughout the northern Cascade Range and in extreme northeastern Washington is considered suitable for wolves (WCFWRU 1999). Wolves are not expected to occur in the project area due to the heavy human influence, lack of large tracts of suitable habitat, and uncertain population status in Washington.

1.2.2 Bald Eagle

In 1978, the USFWS listed bald eagle throughout the lower 48 States as endangered except in Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was listed as threatened (USFWS 1978). In 1995, bald eagle was reclassified from endangered to threatened in all of the lower 48 states (USFWS 1995). In July 1999, the USFWS proposed de-listing bald eagle (USFWS 1999), however to date, bald eagle has not been removed from the list of threatened species. Between the late 1970s and mid-1990s, the species had been doubling its breeding population in the U.S. every 6-7 years (USFWS 1995). In 1963, a National Audubon Society survey reported only 417 active nests in the lower 48 states, with an average of 0.59 young produced per active nest. In 1994, about 4,450 occupied breeding areas were reported with an estimated average young per occupied territory (for 4,110 territories) of 1.17 (USFWS 1995).

TABLE 2
State and Federal Special-Status Wildlife and Fish Species of Known or Potential Occurrence in the Study Area

Common Name and Scientific Name	Federal Status	WDFW Status	Occurrence in Study Area	Occurrence Documentation
Mammals				
Gray Wolf *(Canis lupus)*	E	E	**Not documented.** Historical records from Wenatchee NF; unlikely to occur due to lack of suitable habitat, current known range, and high human use of project area.	WDFW 1999; WDFW PHS 2002
Wolverine *(Gulo gulo)*	SoC	C	**Not documented.** Unlikely due to lack of suitable habitat; recorded in mountain habitats north and west of project.	WDFW PHS 2002; WCFWRU 1999
Fisher *(Martes pennanti)*	SoC	E	**Not documented.** Unlikely due to lack of suitable habitat; recorded in mountain habitats north and west of project.	WDFW PHS 2002; WCFWRU 1999
Western Gray Squirrel *(Sciurus griseus)*	Soc	T	**Not documented.** Unlikely due to lack of suitable habitat; WDFW PHS records from foothills north and west of project.	WDFW PHS 2002; WCFWRU 1999
Black-tailed jackrabbit *(Lepus californicus)*	N/A	C	**Not documented.** Possible occurrence based on suitable grassland/shrub habitats; documented in southeast Kittitas County.	WCFWRU 1999; TNC 1999
White-tailed jackrabbit *(Lepus townsendi)*	N/A	C	**Not documented.** Possible occurrence based on suitable grassland/shrub habitats; one record from northwest Kittitas county	WCFWRU 1999; TNC 1999
Merriam's shrew *(Sorex merriami)*	N/A	C	**Not documented.** Possible occurrence based on suitable sagebrush shrub and mesic grass/shrub habitats; documented in southeast Kittitas county.	WCFWRU 1999; TNC 1999
Townsend's big-eared bat *(Coryhorhinus townsendii)*	SoC	C	**Not documented.** Unlikely to occur due to lack of suitable habitat in project area.	TNC 1999
Birds				
Peregrine falcon *(Falco peregrinus)*	SoC	E	**Not documented.** Unlikely breeder due to lack of suitable nest habitat (cliffs); possible rare migrant; no observations on site.	Smith et al., 1997, Young et al., 2003a
Bald eagle *(Haliaaetus leucocephalus)*	T	T	**Documented on site.** Annual winter resident from approximately mid-February to early-April; multiple observations on site and nearby; Yakima River riparian corridor important winter habitat.	Young et al 2003a; WDFW PHS 2002
Ferruginous hawk *(Buteo regalis)*	SoC	T	**Not Documented.** Possible resident but unlikely due to marginal habitat suitability; no observations on site; records from southeast Kittitas County.	Young et al. 2003a; Smith et al 1997

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State and Federal Special-Status Wildlife and Fish Species of Known or Potential Occurrence in the Study Area

Common Name and Scientific Name	Federal Status	WDFW Status	Occurrence in Study Area	Occurrence Documentation
Northern goshawk *(Accipiter gentilis)*	N/A	C	**Documented on site.** Likely rare migrant; one incidental observation on site during spring migration season; no suitable nesting habitat (coniferous and aspen woodlands) on site; records from Wenatchee NF to north.	Young et al. 2003a; Smith et al 1997; WDFW PHS 2002
Golden eagle *(Aquila chrysaetos)*	N/A	C	**Documented on site.** One winter observation from the site; no nest sites found; likely a rare but regular transient; records from other parts of Kittitas County.	Young et al. 2003a; Smith et al 1997; WDFW PHS 2002
Merlin *(Falco columbarius)*	N/A	C	**Not Documented.** Unlikely but possible rare migrant through area; no observations on site; no suitable nesting habitat on site.	Young et al. 2003a; Smith et al 1997
Spotted owl (*Strix occidentalis*)	T	E	**Not Documented.** Unlikely due to lack of suitable habitat; occurrence would be accidental; no observations on site; records from forests north and west of project area.	Young et al. 2003a; Smith et al 1997; WDFW PHS 2002
Flammulated owl (*Otus flammeolus*)	N/A	C	**Not Documented.** Unlikely due to lack of suitable habitat; no observations on site; recorded in forests north and west of project area.	Young et al. 2003a; Smith et al 1997
Western yellow-billed cuckoo (*Coccyzus americanus)*	C	C	**Not Documented.** Unlikely due to lack of suitable habitat; no observations on site; thought to be extirpated as a breeder in Washington	Young et al. 2003a; Smith et al 1997
Western sage grouse *(Centrocercus urophasianus)*	C	T	**Historical.** Unlikely due to lack of suitable habitat; no observations on site; recorded in southeast Kittitas County.	Young et al. 2003a; Smith et al 1997; Hays et al. 1998a
Sharp-tailed grouse *(Tympanuchus phasianellus)*	N/A	T	**Historical.** Unlikely due to lack of suitable habitat (grasslands, native prairie); no observations on site; historical records from Kittitas County.	Hays et al. 1998b; Young et al. 2003a; Smith et al 1997
Vaux's swift *(Chaetura vauxi)*	N/A	C	**Not documented.** No suitable nesting habitat; unlikely rare migrant; no observations on site.	Young et al. 2003a; Smith et al 1997
White-headed woodpecker (*Picoides albolarvatus*)	N/A	C	**Not documented.** No suitable habitat; unlikely rare transient or migrant; no observations on site; records from forests north and west of project.	Young et al. 2003a; Smith et al 1997
Lewis woodpecker *(Melanerpes lewis)*	N/A	C	**Not documented.** No suitable habitat; unlikely rare transient or migrant; no observations on site; records from forests north and west of project.	Young et al. 2003a; Smith et al 1997;

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Common Name and Scientific Name	Federal Status	WDFW Status	Occurrence in Study Area	Occurrence Documentation
Pileated woodpecker (*Dryocopus pileatus*)	N/A	C	**Not documented.** No suitable habitat; unlikely rare transient or migrant; no observations on site; records from forests north and west of project.	Young et al. 2003a; Smith et al 1997
Black-backed woodpecker (*Picoides arcticus*)	N/A	C	**Not documented.** No suitable habitat; unlikely rare transient or migrant; no observations on site; records from forests north and west of project.	Young et al. 2003a; Smith et al 1997
Sage thrasher *(Oreoscoptes montanus)*	N/A	C	**Documented on site.** Observed during spring and summer surveys on site; suitable sagebrush cover for nesting.	Young et al. 2003a; Smith et al 1997
Loggerhead shrike *(Lanius ludovicianus)*	SoC	C	**Documented on site.** Observed incidentally during avian surveys on site; suitable sagebrush and shrub cover for nesting.	Young et al. 2003a; Smith et al 1997
Sage sparrow *(Amphispiza belli)*	N/A	C	**Not documented.** Unlikely due to lack of suitable habitat (mature old growth sagebrush); no observations on site; records from southeast Kittitas County.	Young et al. 2003a; Smith et al 1997
Reptiles				
Sagebrush lizard *(Sceloporus graciosus)*	N/A	C	**Not documented.** Possible due to potentially suitable habitat (sagebrush, shrub steppe); recorded in extreme southeast Kittitas County	Nussbaum et al. 1983; WCFWRU 1999
Striped whipsnake *(Masticophis taeniatus)*	N/A	C	**Not documented.** Possible due to suitable habitat (grasslands, sagebrush, dry rocky canyons); records from southeast Kittitas County.	Nussbaum et al. 1983; WCFWRU 1999
Sharptail Snake *(Contia tenuis)*	N/A	C	**Not documented.** Possible due to potentially suitable habitat (mixed forest; riparian); recorded in Kittitas County	Nussbaum et al. 1983; WCFWRU 1999
Amphibians				
Columbia spotted frog *(Rana luteiventris)*	N/A	C	**Not documented.** Possible in suitable habitat (ponds, wetlands with open water, slow moving streams); records from Kittitas County.	Nussbaum et al. 1983; WCFWRU 1999
Western toad *(Bufo boreas)*	SoC	C	**Not documented.** Possible in suitable habitat (ponds, wetlands with open water, slow moving streams); records from Kittitas County.	Nussbaum et al. 1983; WCFWRU 1999

TABLE 2
State and Federal Special-Status Wildlife and Fish Species of Known or Potential Occurrence in the Study Area

Common Name and Scientific Name	Federal Status	WDFW Status	Occurrence in Study Area	Occurrence Documentation
Fish				
Middle Columbia River steelhead *(Oncorhynchus mykiss)*	T	C	**Not documented but possible.** Possible because of cross-basin water diversion from First Creek; also possible in the mainstem Yakima River and larger perennial tributaries.	Chapman et al. 1994; WDFW PHS 2002; B. Renfrow, WDFW, pers. comm.
Chinook salmon (*Oncorhynchus tshawytscha*)	T	C	**Not documented.** Unlikely due to lack of habitat (rivers, perennial streams); possible in the mainstem Yakima River and larger perennial tributaries.	Chapman et al. 1994; WDFW PHS 2002
Bull trout *(Salvelinus confluentus)*	T	C	**Not documented.** Unlikely due to lack of habitat (near pristine stream habitat with cold water and loose clean gravel); generally in mountainous areas; records from Yakima River.	WDFW 2000b; WDFW PHS 2002
Mountain sucker (C*atostomus platyrhynchus*)	N/A	C	**Not documented.** Unlikely due to lack of habitat (perrenial mountain streams); generally in mountainous areas.	WDFW PHS 2002

Codes:
E = Endangered.
T = Threatened.
C = Candidates.
SoC = Species of concern
N/A = not applicable; no status

Historically, bald eagles occurred over most of North America in a variety of habitats. In Washington, bald eagles occur year round and are common west of the Cascades Mountains but also occur along major rivers in eastern Washington (Smith et al. 1997). The bald eagle population in Washington has been increasing since the early 1980's. Between 1980 and 1998, the state population increased at an annual rate of 10% from approximately 105 occupied territories to 666 occupied territories (Watson et al. 2002). The distribution of breeding bald eagles also increased as areas unoccupied in 1980 (e.g., northeast and southeast regions of the state) experienced an influx of nesting pairs. In winter, Washington experiences a significant influx of bald eagles from Canada, Alaska, Montana, and California, and the population may increase to three to six times the breeding population (Stinson et al. 2001). Based on winter surveys conducted from 1982-1989, the winter bald eagle population increased from approximately 1,200 to 2,800 individuals. It is estimated that the current winter population of bald eagles in Washington may exceed 4,500 individuals (Stinson et al. 2001).

Bald eagles are winter residents in the Kittitas Valley but are not known to breed in the area (Smith et al. 1997). The WDFW PHS (2002) database identifies the Yakima River riparian corridor from Yakima Canyon to Swauk Creek as important wintering habitat for 25-30 bald eagles, and upstream from Swauk Creek as important winter habitat for 10-15 eagles. The PHS database identifies the Teanaway River

riparian corridor to the west as wintering habitat for bald eagles but does not provide an estimate of the number of bald eagles using this area. Christmas bird counts for the Ellensburg count circle (latitude 47°, longitude 120.6^{o}; approximately northwest Ellensburg town limits) indicates an increasing trend in bald eagles counted from approximately 0-2 in the late 1970s to approximately 13-15 in 2000-2001.

During the baseline studies of the project area, two roadside survey routes were established along public roads near the study area (see Young et al. 2003a) and surveyed a total of 18 times between March 1 and April 12, 2002 and December 12, 2002 and April 12, 2003. During the surveys, a total of 39 bald eagles were observed (duplicate observations possible). The maximum number of bald eagles observed during one survey day was 18 (March 1, 2002). On average, 2.4 bald eagles were observed per survey day (2 routes), for an average of 0.11 bald eagles per survey per mile of route. Approximately, 54 percent of the observations were adults, 5 percent were subadults (1-3 years of age), 36 percent were juveniles (<1 year old), and 5 percent were of unknown age (unidentified due to poor visibility).

From the baseline study, the primary period of bald eagle occupation in the project area appears to be between approximately mid-February and early-April. No regular night roost sites were found in or near the study area and based on observations made, it appears as if bald eagles opportunistically roost in suitable trees near foraging areas. Many of the bald eagle observations were associated with cattle grounds and calving operations where they were observed foraging on carrion (dead cows) or calving byproducts (afterbirth).

1.2.3 Bull Trout

Bull trout was listed as threatened for the Klamath River and Columbia River distinct population segments in June 1998 due to a variety of concerns such as habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species (USFWS 1998). Bull trout historically occurred in major river drainages throughout the Pacific Northwest. It is estimated that bull trout presently occur in 45% of the historical range (Quigley and Arbelbide 1997). Bull trout exhibit resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in a tributary or stream in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from 1 to 4 years before migrating to either a lake (adfluvial), large river (fluvial) or, in certain coastal areas, to saltwater (anadromous), where maturity is reached (Fraley and Shepard 1989; Goetz 1989). Habitat components that influence bull trout distribution and abundance include cold water temperatures; instream cover such as large woody debris, undercut banks, boulders, and pools; clean loose substrate gravel for spawning and rearing; and unobstructed migratory corridors (Fraley and Shepard 1989; Goetz 1989; Rieman and McIntyre 1993; Watson and Hillman 1997). The nearest known bull trout inhabited streams to the project area are the Yakima and Teanaway Rivers (WDFW PHS 2002). No bull trout are known to occur in Reecer and Wilson Creeks or tributaries in and near the project area (WDFW PHS 2002).

1.2.4 Northern Spotted Owl

Northern spotted owl was listed as a threatened species in June 1990 due to habitat loss, degradation and fragmentation due primarily to old growth timber harvest (USFWS 1990). Spotted owls historically occurred throughout the Pacific Northwest from central California north into southern British Columbia. In Washington, spotted owls occur in low and moderate elevation coniferous forests of the Cascade Mountain range and the Olympic peninsula (Smith et al. 1997). Spotted owls are territorial and may occupy territories up to 22 square miles (58 km^2) in size (Gutierrez et al. 1995). Spotted owl habitat

consists of four components: nesting, roosting, foraging, and dispersal (AFWO 2001). Nesting and roosting habitat consists of dense mature coniferous forest (spruce/cedar/hemlock or Douglas-fir) with multiple canopy layers and an abundance of large trees. They nest almost exclusively in mature coniferous forest tracts greater than 1,200 acres in size with dense canopy cover (Gutierrez et al. 1995). Spotted owls will forage within nesting habitat but, depending on the characteristics of their home range, they will also utilize more open and fragmented forests for foraging (AFWO 2001). Dispersal habitat consists of forest stands with adequate tree size and canopy cover to provide protection from other predators (e.g., great horned owl) while the owl travels. Dispersal habitat may not provide good characteristics for nesting, roosting, or foraging. The WDFW PHS database maintains records of spotted owl site centers and management circles for the state of Washington. A management circle is the area encompassed by a 1.8-mile radius circle around the site center (spotted owl location), which effectively plots a spotted owl territory. Site centers are ranked based on the observation of the spotted owl(s) within the circle, (e.g., a single owl, two or more owls detected, established pair, and documented reproduction). There are spotted owl management circles throughout the Wenatchee National Forest north of the Project. At the closest point, the northernmost portion of the project is located approximately 0.75 mile (1.2 km) south of a spotted owl management circle or 2.5 mile (4.0 km) south of a site center. Other spotted owl site centers and management circles are located further north and west of the project. No spotted owls were observed during field surveys of the project area and they are not expected to occur in the vicinity of the project due to lack of suitable habitat.

1.2.5 Western Sage Grouse

The USFWS was petitioned to list western sage grouse under the Endangered Species Act in 2000 and 2003. In 2001, they found that the action may be warranted but was precluded by higher priority actions (USFWS 2001a). In 2003, they found that the petition did not present substantial information indicating that listing of the species was warranted (USFWS 2003). Western sage grouse is included on the list of candidate species. Western sage grouse is a subspecies of sage grouse that historically occurred from southern British Columbia south through central Washington. In Washington, sage grouse occurred in most counties east of the Cascades but today only occur in two locations: (1) Douglas County and northern Grant County; and (2) southeastern Kittitas County and northern Yakima County (Smith et al. 1997). There are other recent records from Lincoln and Benton Counties but no confirmed breeding in these locations (Hays et al. 1998a, LaFramboise and LaFramboise 1999). Sage grouse are found in areas with extensive tracts of native sagebrush steppe habitat with medium to high sagebrush canopy cover and healthy bunchgrass stands (Hays et al. 1998). The project is located in a transition zone to the foothills of the Cascade Mountains and the primary habitats are shrub-steppe and grassland with scattered areas of lithosol, conifer, agriculture, pasture, and riparian habitats. According to the Washington State Gap Analysis Project (GAP)[1], the project area falls outside mapped and modeled habitat for sage grouse in Washington (Smith et al. 1997; WCFWRU 1999). No sage grouse were observed during field surveys in the project area and they are not expected to occur in the vicinity of the project.

1.2.6 Western Yellow-Billed Cuckoo

The USFWS was petitioned to list yellow-billed cuckoo as an endangered species in 2000 but found that while the action may be warranted, it was precluded by higher priority actions (USFWS 2001b). Yellow-billed cuckoos are found from southern Canada south into central Mexico. It is commonly thought that

[1] The Washington State Gap Analysis Project is based on a two primary data sources: vegetation types (actual vegetation, vegetation zone, and ecoregion) and species distribution. The two data sources are combined to map the predicted distribution of vertebrate species. More information about the Washington Gap Analysis Project can be found on the WDFW web page: www.wa.gov/wdfw/wlm/gap/dataprod.htm

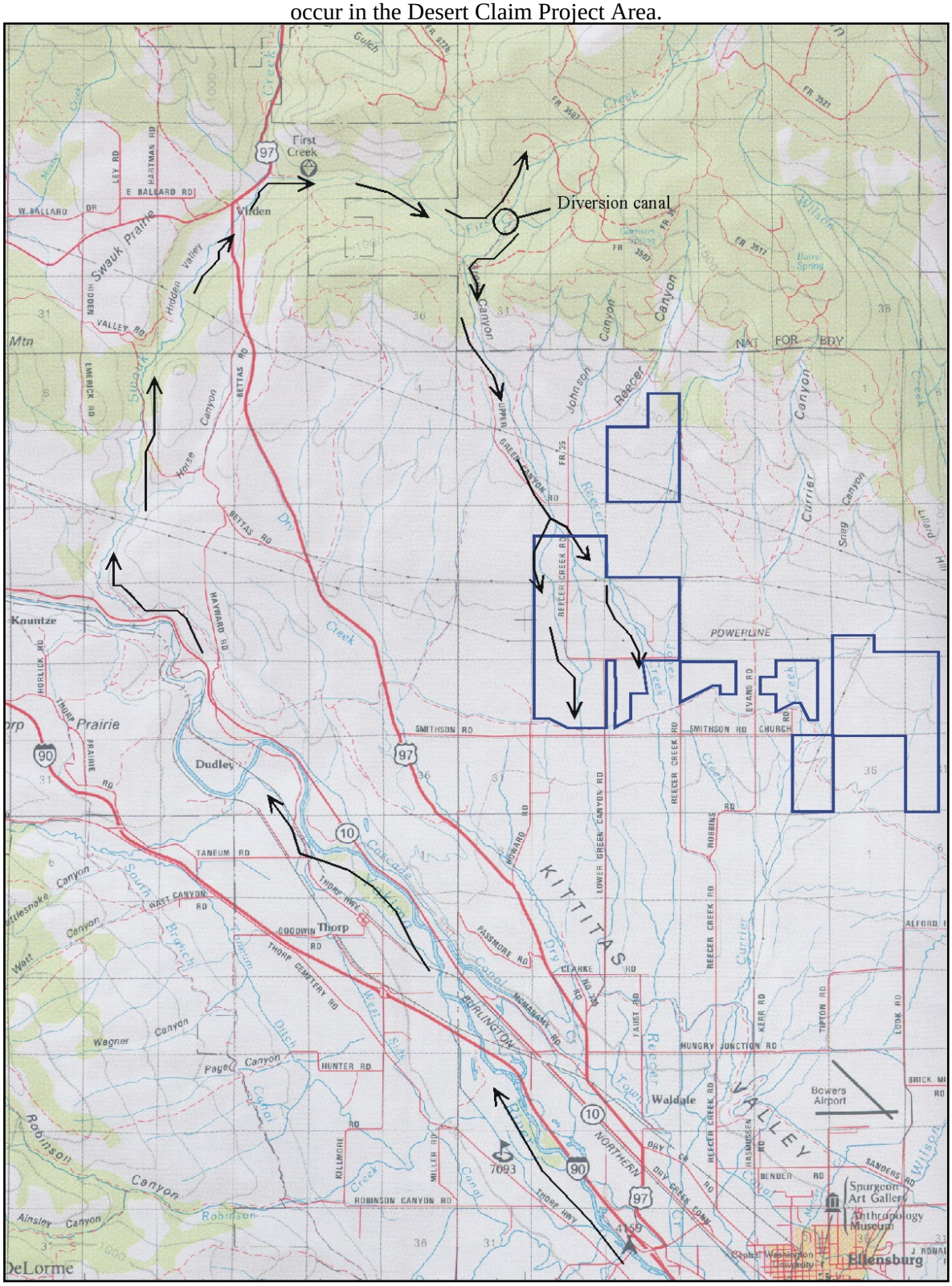
there are two subspecies, eastern and western, separated approximately by the Rocky Mountains. Western yellow-billed cuckoo is considered a Distinct Population Segment (DPS) under USFWS policy (USFWS 2001b). Yellow-billed cuckoos are migratory, occupying the breeding grounds from May through September and wintering as far south as South America. Western yellow-billed cuckoos are insectivorous and breed primarily in large cottonwood and willow riparian areas along large rivers (USFWS 2001b). According to the Washington breeding bird atlas, yellow-billed cuckoo is believed to have been extirpated as a breeder in Washington (Smith et al. 1997). The project is located in a transition zone to the foothills of the Cascade Mountains and the primary habitats are shrub-steppe and grassland with scattered areas of lithosol, conifer, agriculture, pasture, and riparian habitats. The riparian habitat in the project area is mainly associated with Reecer Creek and some smaller tributaries as well as some irrigation ditches. The riparian areas are dominated by cottonwood, willow and hawthorn with a herbaceous understory (see Vegetation section). While these areas may technically be suitable for yellow-billed cuckoos, they are patchy in nature (i.e., no extensive tracts) and, based on current knowledge of western yellow-billed cuckoos in Washington, they are not expected to occur in the project area. Habitat suitable for their occurrence would not be affected by the project and no cuckoos were observed during field surveys in the project area.

1.2.7 Middle Columbia River Steelhead

The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) has listed several populations of steelhead [(designated Evolutionary Significant Units (ESU)] throughout the western U.S. including the Middle Columbia River population of this species as threatened (NOAA 2004). The Middle Columbia River population includes those individuals that use the Yakima River. In general, steelhead are the anadromous form of rainbow trout that spend a portion of their life in the ocean and spawn in freshwater streams. Steelhead are commonly named after the season in which their spawning runs occur. For example, the steelhead that use the Yakima River spawn in the summer and are referred to as summer steelhead. These fish usually spend 2 years in the ocean and enter freshwater rivers up to 1 year before spawning, and may spawn more than once. Individual steelhead from the Middle Columbia River ESU are known to utilize the Yakima River and also Reecer Creek south (downstream) of the project (WDFW PHS 2002). However, due to water diversions (irrigation channels) and the intermittent nature of many of the streams in the project area, it is not believed that steelhead using the lower reaches of Reecer Creek would occur within the project area.

According to WDFW, a radio-tagged steelhead recently spawned in First Creek in the foothills of the Wenatchee Mountains north of the project area (B. Renfrow, WDFW, pers. comm.). First Creek is a tributary of Swauk Creek, which is approximately 5 miles west of the project area. Water in First Creek is diverted with an unscreened diversion facility into a ditch that winds over a low pass into Green Canyon and intercepts a few other small streams (Figure 1). Fish in First Creek can be transferred via the ditch to the canal in Green Canyon and other small tributaries, and eventually into the Reecer Creek subbasin. Because a radio-tagged steelhead spawned in First Creek, it is possible for juvenile steelhead to occur in the ditch and move down to the Reecer Creek drainage above the North Branch Canal and through the Desert Claim project area (B. Renfrow, WDFW, pers. comm.). Streams and interconnected channels in the Reecer Creek subbasin could therefore be rearing habitat for juvenile steelhead. Figure 1 illustrates how juvenile steelhead might find their way into the Desert Claim project area.

Figure 1. Schematic of interconnected streams and waterways showing route by which steelhead could occur in the Desert Claim Project Area.



2. Environmental Impacts of the Proposed Action

2.1 Plants

Due to the absence of known populations within the project area, no project-related impacts are anticipated to rare plant species. These include federally listed endangered, threatened, proposed, or candidate plant species and Washington State endangered, threatened, sensitive, or review plant species.

2.2 Wildlife and Fish

For most of the federal and state listed species identified, the project would have no effect. Resource information indicated that gray wolf, bull trout, northern spotted owl, western sage grouse, and western yellow-billed cuckoo are not likely to occur in the project area and that essential habitat for these species is lacking within the project area. Bull trout may occur downstream of the project in the Yakima River, however, the project should have minimal affect on streams and water resources and should have no effect on the Yakima River, more than 8 miles downstream. For the majority of the state listed species, available information also indicates that they are unlikely to occur in the project area (see **Table 2**). The proposed wind power project would not affect these species and no further discussion of potential impacts is included.

Of the state or federally listed species, bald eagle and Middle Columbia River steelhead, federal and state threatened; and golden eagle, northern goshawk, loggerhead shrike, and sage thrasher, all state candidate species; were documented on or near the site. Given their potential occurrence in the project, these species might be affected by the project construction and/or operation and are discussed in more detail below.

Avian species are thought to be most at risk from wind power development due to potential collision with wind turbines and met tower. **Table 3** provides a qualitative discussion of risk factors for those sensitive species that have been documented on or near the site and are expected to occur in the project area in the future. Other sensitive avian species may migrate through the project area, but their low level of use and temporary occurrence in the area reduces their risk of being affected by the project.

2.2.1 Bald Eagle

Available information and results of the baseline studies indicate that bald eagles occur on site during the winter and early spring seasons. Direct effects to bald eagles from the project might include loss of winter habitat (temporary and long-term) and potential mortality (temporary due to construction or long-term due to operation of wind plant). Indirect effects might include disturbance and displacement related effects from construction (short-term) as well as operation (long-term) of the wind plant.

Habitat Loss

The primary bald eagle winter habitat in the area includes the Yakima River riparian corridor for roosting and foraging and adjacent upland areas for foraging. Bald eagles use the large trees within the riparian corridor and scattered tree patches in upland areas for perching and roosting. They likely forage in the river for fish and are frequently observed in upland areas where livestock operations occur scavenging/ foraging on carrion (dead cows) and calving operation byproducts (afterbirth).

The project would be constructed in steppe and grassland habitats along the flats and ridge tops in the transition zone to the mountain foothills to the north. The project would not result in the permanent

(long-term) loss of important winter roosting or perching habitat. The actual turbine pads, roads, met towers, substation, and maintenance facilities would result in the loss of approximately 78 acres of upland habitat which is not considered important bald eagle winter habitat. These areas are not heavily used by wintering bald eagles except when dead cows or dead big game animals are present, creating scavenging/ foraging opportunities. At the nearest point, construction activity would be approximately 3 miles from the Yakima River riparian corridor (southwestern most turbines), which is unlikely to cause any temporary habitat loss due to disturbance of eagles roosting along the river. Temporary loss of roosting habitat due to construction disturbance in the project area would be for the duration of the construction period (9-12 months) and would affect only a minor portion of available roosting habitat (scattered patches of trees).

Mortality

The possibility of short-term (due to construction activity) mortality effects from the project is considered negligible and very unlikely to occur. Bald eagles in the area during the construction period are unlikely to occur within the construction zones due to noise and high human and equipment presence, and therefore are unlikely to be at risk of construction related mortality. In addition, the majority of construction is likely to take place during late spring, summer and fall months when bald eagles do not occur in the area.

Once the wind project is operational, bald eagles in the area might be at risk of collision with turbines or met towers. Based on the baseline studies and available information about bald eagle use of the valley, potential bald eagle mortality due to operation of the wind plant would be limited to the winter and early spring seasons - approximately late December to mid-April. Bald eagles would not be at risk of collision during summer or fall because they are not known to occur in the area during those seasons. Many avian species, including several raptor species, are documented casualties due to collision with wind turbines (see Erickson et al. 2001). Raptor mortality has been documented at many wind plants, although raptor mortality at the newer generation wind plants is estimated to be 3-7 times less than the wind plant at Altamont Pass, California, which has many older generation wind turbines (Young et al. 2003b). Golden eagles appear to be more susceptible to collision mortality than other raptors, but there have been no documented bald eagle fatalities at wind plants (Erickson et al. 2001).

Estimates of bird mortality from wind projects may be based on bird use of a site and the propensity for that species to fly within the rotor swept area or zone of risk. For the proposed project, there were 13 observations of bald eagles made during standardized point counts across the project area. Of those observations, 9 of the eagles were observed flying, and approximately 78% of the flying eagles were within the zone of risk, defined as the area between 25 and 125 m above ground level based on common wind turbine and tower heights. While the sample size is relatively small, it does show that wintering bald eagles have some exposure to turbines by flying within the rotor swept area.

Table 3
Collision Risk Factors for Special Status Avian Species Potentially Occurring in the Study Area

Species	Risk Factors: Behavioral and Environmental Factors	Risk Factors: Abundance and Distribution Factors Based on Field Studies and Existing Information	Generalized Level of Risk (Impact Level)
Bald eagle	Feeds on carrion, fish, waterfowl in winter; wintering habitat along Yakima River and cattle yards in Kittitas Valley; flight heights include the rotor swept area.	Many individuals observed in study area in winter; no fatalities observed at other wind plants	Level of risk is believed low due to winter foraging behavior and low use of actual wind plant area
Northern goshawk	Forest-dwelling species, migrant or transient through non-forested areas; would most likely be found in forest patches and/or tree habitat on site; flight heights include rotor swept area	One observation in study area; rare migrant or transient; no fatalities known from other wind plants	Level of risk is believed very low
Golden eagle	Grassland and shrub-steppe species, nesting in trees or cliffs, hunts small/medium mammals, birds, reptiles; flight heights include rotor swept area	One observed in study area in winter; possible migrant or transient in fall and winter; fatalities at wind plants in California (primarily Altamont) and Wyoming; common at Foote Creek Rim (WY), 1 fatality observed in 2 years	Level of risk considered low due to rare occurrence
Loggerhead shrike	Nests in sagebrush shrubland or areas with scattered trees and shrubs in open habitats; migrates to winter range in southern U.S.; flight typically below rotor height; migration flights may include rotor swept area	Observed in study area in low numbers; possibly a breeding resident and/or migrant through study area; one fatality known from Tehachapi Pass wind plant	Level of risk is believed low due to low numbers; risk may be greater during migration periods
Sage thrasher	Nests in sagebrush steppe of relatively good quality; migrates to winter range in southern U.S.; flight typically below rotor height; migration flights may include rotor swept area	Observed in study area in low numbers; possibly a breeding resident and/or migrant through study area; 1 fatality documented at Foote Creek Rim wind plant (WY) during 2-year study	Level of risk is believed low due to low numbers; risk may be greater during migration periods

The number of potential bald eagle fatalities due to the project is difficult to predict. Based on the results of the baseline studies and monitoring studies at other existing wind plants, it was predicted that between 3 and 4 raptors might be killed at the proposed wind plant each year (see Young et al. 2003a). Based on the use estimates from the study, bald eagle was the third most common raptor on the site during the winter, comprising approximately 12% of all winter raptor use, and the sixth most common raptor in the spring, comprising 3% of all spring raptor use (Young et al. 2003a). Over all seasons combined (one year), bald eagles comprised approximately 4% of all raptor use of the site. If the risk of collision with a turbine for raptors is proportional to their use of a site, then we would expect that 4% of the annual raptor mortality would be bald eagles. If 4 raptors were killed by the wind plant each year, then we would expect 0.16 bald eagle death per year or 1 dead bald eagle every 6.25 years. This is at best a conservative estimate, which does not take into account changes in bald eagle use over time (e.g., increasing bald eagle population), the behavior of bald eagles (e.g., passive foraging/scavenging), seasonal variation in wind power production (e.g., turbines turning less in winter), and mode of use of the project area (e.g., attracted to the site for foraging or simply passing through), all of which could influence annual mortality of a species. In any event, the death of one bald eagle every 6 years due to the project, while an adverse effect (take) under the Endangered Species Act, would not affect the wintering population of bald eagles in Kittitas Valley. This level of mortality would not have a measurable effect on the bald eagle population.

Disturbance/Displacement

Construction of the project might create short-term (life of construction) disturbances and operation of the wind plant (operating turbines) might create long-term disturbances that could affect bald eagles in the area. These effects are believed to be negligible for a number of reasons. Based on the available information, bald eagles only occur in the area during the winter and early spring. Most of the construction activity is likely to take place during the late spring, summer and fall when weather conditions are more favorable, minimizing the potential for construction related disturbances. In addition, bald eagle use of the project site is minimal compared to surrounding areas such as the Yakima River riparian corridor and area cattle yards, which is likely based on the availability of prey or carrion. Bald eagles are not expected to frequently occur within the project area and operation of the wind plant should have minimal disturbance effect on bald eagles.

Wintering bald eagles will sometimes utilize night roosts located in secluded, sheltered, upland areas away from human disturbances, and which may be considerable distances from foraging areas. There is the possibility that winter roosts may occur in forested areas north of the project and bald eagles could travel across the project area from areas closer to the Yakima River. Should a roost occur north of the project and bald eagles travel back and forth across the site, both construction and operational disturbances from the wind plant might displace or alter eagle movement patterns. No evidence that winter roosts occur north of the project was observed during the winter roadside surveys for bald eagles. Due to the concentration of eagle observations south of the project (see Young et al 2003a), it is more likely that eagles roost in the riparian areas and move from the river to upland foraging areas (e.g., winter cattle yards).

2.2.2 Golden Eagle

Golden eagles appear to be rare winter residents or migrants in the project area. During the baseline studies, only one golden eagle was observed in the study area in the winter. Golden eagles have been documented throughout Kittitas County and they are expected to breed in the county (Smith et al. 1997), however, no golden eagle nests were found during the raptor nest survey for the baseline study (see Young et al. 2003a). Based on the available information, they are expected to occur in the study area in low numbers and possibly on a regular basis. Due to the low use of the area, construction activities are

not expected to affect golden eagles. There would be little potential for direct or indirect effects from construction of the wind plant (mortality, disturbance or displacement effects) on golden eagles.

Once the wind project is operational, golden eagles in the area might be at risk of collision with turbines or met towers. Based on studies at the Altamont Pass wind plant in California, golden eagles appear to be more susceptible to collision with turbines than many other raptor species; however, many of the turbines at Altamont are older turbines that may cause greater impacts to avian species. Raptor mortality at newer generation wind plants is estimated to be 3-7 times less than the wind plant at Altamont Pass in California (Young et al. 2003b). A single golden eagle fatality was reported from the Foote Creek Rim wind plant in Wyoming, based on a 2-year study of 105 turbines (Young et al. 2003c). Golden eagle use of Foote Creek Rim is high and comparable to use at Altamont, suggesting that the newer generation turbines, which are often much larger, present less risk of collision to golden eagles. In any event, given the current use of golden eagles of the proposed wind project site, mortality for this species due to the project is expected to be nearly zero. Should the golden eagle population of Kittitas County increase over time, potential collision impacts to golden eagles would be expected to increase.

2.2.3 Northern Goshawk

As with golden eagles, northern goshawks appear to be a rare migrant or transient through the project area. A single northern goshawk was observed incidentally during a bald eagle survey in the study area is the spring of 2001. Currently there is no breeding habitat, coniferous or aspen forest, for goshawks in the project area. There is however, ample breeding habitat in the Wenatchee National Forest to the north and they have routinely been documented in areas to the north and west of the project (WDFW PHS 2002). It is possible that a few northern goshawks regularly move through the project area, despite the lack of extensive forest habitats, as they migrate to and from the breeding areas. They are expected to occur in the project area only in very low numbers. Construction activities are not expected to affect northern goshawks. There is little potential for direct or indirect impacts (mortality, disturbance or displacement) on goshawks from construction of the wind plant.

Once the wind project is operational, goshawks moving through the area might be at risk of collision with turbines or met towers. Based on studies at other wind plants, no northern goshawk fatalities have been documented (Erickson et al. 2001). Given the very low use of the proposed wind project site by goshawks, mortality for this species is expected to be nearly zero. No northern goshawk fatalities are expected from the project.

2.2.4 Loggerhead Shrike and Sage Thrasher

These species are possible breeding residents in the study area. While they were observed in low numbers, they were observed during the spring and summer and there is potential breeding habitat for them scattered through the project area. They are expected to migrate to more southerly climates in the fall and winter in the southern U.S. and Mexico. Sage thrashers nest in big sagebrush stands and loggerhead shrikes nest in sagebrush or dense woody shrub vegetation in open habitats. Direct effects to these species from the project might include loss of breeding habitat (temporary and long-term) and potential mortality (temporary due to construction or long-term due to operation of wind plant). Indirect effects from the project might include disturbance and displacement related effects from construction (short-term) as well as operation (long-term) of the wind plant.

The project would be constructed in steppe and grassland habitats along the flats and ridge tops in the transition zone to the mountain foothills to the north. The actual project facilities would result in the loss

of approximately 38 acres of shrub steppe vegetation type, which is considered breeding (nesting, foraging, loafing) habitat for sage thrashers and loggerhead shrikes. The other vegetation types impacted by the project are not as important to these species, but they may periodically move through or forage throughout the project area. The possibility of short-term (due to construction activity) mortality effects from the project is considered unlikely to occur and would most likely be due to destruction of a nest in shrub vegetation directly impacted by construction activity. The majority of construction is likely to take place during late spring, summer and fall months, when these species would potentially occupy the area.

Once the wind project is operational, loggerhead shrikes and sage thrashers in the area might be at risk of collision with turbines or met towers. Many avian species, including both sage thrasher and loggerhead shrike, are documented casualties due to collision with wind turbines (see Erickson et al. 2001) indicating their susceptibility to collision mortality. A single loggerhead shrike casualty was documented at the Tehachapi Pass Wind Plant in California (Erickson et al., 2001) and a single sage thrasher casualty was found at the Foote Creek Rim Wind Plant in Wyoming (Young et al. 2003b). However, due to the low level of use of the project area by these species (see Young et al 2003a), mortality impacts to these species are not expected to be substantial. In addition, based on the vegetation type distribution, sage thrashers and loggerhead shrikes are not expected to commonly occur over the whole project area, limiting risk to those turbines in areas where suitable habitat occurs.

2.2.5 Middle Columbia River Steelhead

Based on recent information from the WDFW, juvenile steelhead may occur in the diversion canal from First Creek, and from there may enter Green Canyon, Reecer Creek and other interconnected waterways in the project area (Figure 1). In 2003, a radio-tagged steelhead moved up Swauk Creek into First Creek and spawned (B. Renfrow, WDFW, pers. comm.). It is conceivable that juvenile steelhead could then move down First Creek, encounter the unscreened diversion facility that transfers water into Green Canyon and move into this drainage. This water eventually flows into the Desert Claim project area and, due to interconnected canals, some of it flows into the Reecer Creek drainage. Due to this situation, it is possible that juvenile steelhead may occur in the Desert Claim project area. Stream habitat in the project area could therefore act as rearing habitat for juvenile steelhead.

Operation and maintenance activities in the wind plant are not expected to affect any of the waterways or creeks and therefore should not affect juvenile steelhead in the project area. Construction activities may affect juvenile steelhead if they affect any of the streams or waterways in which steelhead could occur. Construction could adversely affect these waterways through sediment-laden runoff entering the water or through direct effects from construction occurring in the channel (e.g. a road crossing) or channel changes to accommodate the wind plant layout. Based on the wind plant layout, turbine access roads would cross Reecer Creek in 2 locations and there would also be 11 road crossings of other interconnected waterways from the Green Canyon channel or tributaries to Reecer Creek in which steelhead could occur. In addition there would be at least two locations where underground collector/communications lines would cross channels independent of access roads. Construction at these stream crossings may directly affect juvenile steelhead though mortality or indirectly through reduced habitat conditions from water quality degradation (sediment, fuel/oils contamination) or blockage if the crossing does not allow fish passage. These impacts, should they occur, would be considered adverse. Steelhead potentially affected would be rearing juveniles. Provided Best Management Practices (BMPs) for construction, appropriate and adequate site management practices, and erosion control measures are employed, impacts to streams and waterways should be minimized or avoided; however, the in-stream construction required to place culverts and road fill would result in some sedimentation from disturbance of stream bottoms, stream banks, and the placement of fill material. Also, provided the crossings are designed to allow continual

water flow and fish passage during low water conditions, impacts to fish movement would be minimized. The use of oversized culverts buried below the normal water line would allow a natural stream bottom to form inside the culvert, further minimizing habitat effects.

3.Impacts of the No Action Alternative

Under the no action alternative the proposed Desert Claim Wind Power Project and all associated features including the turbines, met towers, access roads, utilities, and substations would not be constructed. There would be no impacts from the wind power facility on state or federal species since it would not be constructed. The project area and Kittitas Valley do not contain habitat for a large number or variety of federally or state listed species. The listed species of most abundance is bald eagle. Alternate land uses or power production through other technologies, such as natural gas or coal-fired plants, could have significant impacts on bald eagles, steelhead or listed species in other areas. Other development of the area, which might not occur if the wind plant were constructed, such as residential homes, could have significant impacts in the form of habitat loss, degradation of streams, and displacement of bald eagles by altering land use. For example, pressure to develop additional rural residences could reduce or eliminate existing land uses such as cattle production or roosting areas along the Yakima River, thus reducing the amount of important winter habitat for bald eagles. Wintering bald eagles in the Kittitas Valley have been increasing in number and will likely continue to increase as bald eagles continue to recover as a species. If the area does not provide adequate winter roosting areas or foraging opportunities, wintering bald eagles may be forced to winter elsewhere.

4. Cumulative Effects

The project area and Kittitas Valley do not contain habitat for a large number or variety of federally or state listed species. The listed species of greatest abundance is bald eagle. Juvenile Middle Columbia River steelhead could also occur in Reecer Creek and some of the irrigation water canals in the project area. Because of the low potential occurrence of most listed species potentially occurring in the project area, development of the project is not expected to contribute to cumulative effects on these species. Potential impacts on bald eagles and steelhead are treated in more detail below.

Bald Eagle

Currently, there are two other wind plants proposed for Kittitas County in addition to the Desert Claim project. These projects are the Kittitas Valley wind project, located approximately 3 miles west of Desert Claim, and the Wild Horse wind project, located approximately 12 miles southeast of Desert Claim. If all three projects were constructed there would be a total of between 350 and 370 turbines in the county. Baseline avian studies similar to the Desert Claim study also occurred at the Kittitas Valley and Wild Horse sites (Erickson et al. 2003a and 2003b). Results of a cumulative effects analysis based on the three data sets are presented in a technical report prepared to support the Environmental Impact Statements for all three projects (Young and Erickson 2003). Use of the Wild Horse site by bald eagles is extremely low and it is not expected to individually have an effect on wintering bald eagles in the area (Erickson et al 2003b). Only one bald eagle was observed at this site during winter point count surveys and the Wild Horse site does not have the same land use characteristics (e.g., nearby large riparian corridor and winter cattle grounds and calving operations) that occur near the Kittitas Valley and Desert Claim site and which are attractants to bald eagles. Cumulative effects on bald eagles arising from the projects would primarily be due to the Kittitas Valley and Desert Claim projects. Further discussion of cumulative effects is based primarily on these two projects.

As with a single project, the cumulative effects of three wind projects would have similar potential

impacts including loss of winter habitat, mortality, and disturbance/displacement effects. For bald eagle, the primary impact of most concern is the potential for fatalities due to collisions with turbines or met towers. Winter habitat loss or disturbance/displacement effects for each project would be minimal and not result in significant effects cumulatively. The Kittitas Valley wind project, located approximately 3 miles west of Desert Claim, occurs in much the same vegetation types as Desert Claim but is slightly closer to the Yakima River. Neither project would contribute to the loss of important bald eagle roosting habitat (Yakima River riparian corridor) or foraging areas (cattle lots and calving operations). Additionally, neither project should result in substantial disturbance or displacement effects, primarily because of the seasonal occupancy of bald eagles in the area and the lack of impacts to important winter bald eagle habitat (i.e., the construction would be taking place in areas not frequently occupied by bald eagles).

When standardized by survey miles conducted, slightly more bald eagles were observed during winter roadside surveys in and around the Kittitas Valley site, likely due to its closer proximity to the river (Erickson et al. 2003a). Winter and spring use of the Kittitas Valley and Desert Claim sites by bald eagles was similar. For the winter season, bald eagle was the third most common raptor for the Kittitas Valley and Desert Claim area, and for the spring season, the sixth most common raptor observed. Potential mortality for bald eagles due to the proposed projects is difficult to predict. Given the very low bald eagle use at the Wild Horse project, no bald eagle mortality is expected at that site. No bald eagle fatalities have been reported from other wind plants so the level of susceptibility to collision with turbines is unknown. Based on the low use of the Kittitas Valley and Desert Claim project areas, annual bald eagle mortality is expected to be nearly zero. However, due to the nearby vicinity of important roosting (riparian) and foraging areas (cattle lots), bald eagles might regularly move through the wind plants, increasing their exposure. A conservative estimate would be that, assuming risk of collision is proportional to use, on average one bald eagle would be killed every 6 years at either Kittitas Valley or Desert Claim (see Section 2.2.1 above). If both wind projects are constructed, to approximately double the number of turbines in the area, the overall risk to bald eagle might increase to one bald eagle fatality every 3 years. Given the very low bald eagle use at the Wild Horse site, this level of potential mortality would not increase measurably if that project were also constructed. Mortality over the long term is difficult to predict and likely would vary depending on the population levels of bald eagles near the projects and changes in land use (e.g., reduction in cattle operations). This low level of mortality would not have a measurable effect on the increasing winter population in the Kittitas Valley or in the State of Washington.

Other projects or actions in addition to wind development that are occurring in the Kittitas Valley and which may impact bald eagles would include population growth, particularly in Ellensburg and the Kittitas Valley; new housing developments and subdivisions; increased infrastructure to accommodate population growth; increased utilities/pipelines due to increased development; increased gravel/materials mining to accommodate development and roads; logging of nearby forests; and future agriculture practices including livestock grazing.

The proposed project is not expected to contribute to population growth and associated development activities such as new housing, but is designed to accommodate future power needs associated with population growth and development. The Ellensburg area and Kittitas County are undergoing substantial population growth, and scattered rural residential home sites and subdivisions are common in the foothills and area surrounding Ellensburg, including areas immediately north of the project. These developments have the effect of reducing open space, rangeland, and forests and activities associated with those landscapes such as livestock production or logging. Further development may contribute cumulative effects to bald eagles by creating additional disturbances, reducing foraging and secluded sheltering

opportunities, and creating collision hazards. To a large degree, livestock production has benefited bald eagles by providing sources of carrion and forage. Reduction of livestock operations in the Kittitas Valley due to city expansion, development, and housing will reduce these resources for bald eagles.

Other cumulative effects associated with increased development, such as increased infrastructure and increased human presence and disturbance, may also affect bald eagles simply by using more space that could be utilized by bald eagles and creating more disturbances. Bald eagles are large avian predators capable of wide ranging movements. While bald eagles can become accustomed to human activity, they are generally sensitive to human encroachment. Future developments and associated human actions would be expected to affect wintering bald eagles, especially as they allow more human use of eagle occupied areas. Additional use of open and secluded spaces by humans would be expected to cause some habitat degradation or reduce use by bald eagles as they avoid humans. Also, more human activity in the area will lead to more disturbance, displacement, and contribute to other environmental impacts, for example, water quality degradation. The impacts would depend, in part, on where human activities occur, particularly in relation to the Yakima River and winter foraging areas. For example, the more activity that occurs in riparian areas along the Yakima River and results in the loss of riparian vegetation, the greater the potential for impacts to bald eagle roosting habitat.

The magnitude of all cumulative effects on bald eagles is difficult to measure. While cumulative effects to bald eagles are likely occurring from increased development and human population growth of the area, the bald eagle population itself in Kittitas valley, the State of Washington and North America is also increasing. The number of wintering bald eagles in Kittitas Valley is expected to increase despite potential cumulative effects as the species is well on the way to recovery (USFWS 1999, Watson et al. 2002). It is possible that cumulative effects to wintering bald eagles in the Kittitas Valley are presently occurring, but without knowing a baseline with which the population may increase in the absence of any effects, it is difficult to determine if the cumulative effects are adverse. Finally, the presence of the wind plant itself might preclude some additional development such as houses and subdivisions and other cumulative effects, and preserve some of the historic land uses (livestock production), thus indirectly preserve some important winter habitat for bald eagles.

Steelhead

According to available information, some individuals of the Middle Columbia River ESU of steelhead use the Yakima River and tributaries and spawn in Swauk Creek and tributaries. These individuals may occur periodically, or in the case of juveniles, year round in the Desert Claim and Kittitas Valley wind project areas. There is no information that steelhead would occur within the Wild Horse project. Operation and maintenance activities of wind plants are not expected to adversely affect the waterways or creeks within the wind plants in which steelhead could occur. Adverse effects are more likely to occur from the construction activity, which causes land disturbance and can result in adverse effects to waterways from run off (sedimentation) or construction within streams. Provided appropriate BMPs and erosion control measures are employed during construction, these impacts can be greatly reduced or eliminated. Adverse impacts are more like to arise from in-stream construction from road crossings or channel changes to accommodate the wind plant layout.

According to the Kittitas Valley wind plant EIS, the project would not affect Swauk Creek or the Yakima River and should therefore not affect steelhead. The Desert Claim project may affect steelhead through adverse effects to Reecer Creek and interconnected waterways from road crossings. As such, the cumulative effects from the three wind plants to steelhead would not be greater than those from the Desert Claim project (see Section 2, Environmental Impacts above).

The overall magnitude of cumulative effects on steelhead is difficult to measure due to the life history strategy of this species. Being anadromous and spending a fair amount of the life cycle in the ocean, effects on the species could arise from far reaching activities in the Pacific Ocean all along the Columbia River to the spawning habitat in upper Kittitas Valley. Other projects or actions in addition to wind development that are occurring in the Kittitas Valley and that may impact steelhead would include actions that may affect occupied stream course (e.g., Yakima River, Swauk Creek drainages) such as new housing developments and subdivisions; increased infrastructure to accommodate population growth; increased utilities/pipelines due to increased development; increased gravel/materials mining to accommodate development and roads; logging of nearby forests; and future agriculture practices including livestock grazing. To a certain degree, as these activities occur in nearby upland areas away from streams they would have no effect on spawning steelhead but the overall impact from increased development often results in lower stream quality in an area. These activities may adversely affect steelhead if they result in degradation of streams and stream habitats. For example, and similar to bald eagle, the more activity that occurs in riparian areas along the Yakima River and results in the loss of riparian vegetation, the greater the potential for adverse effects to the river and therefore steelhead habitat.

While adverse effects may arise from the Desert Claim project, and other the cumulative effects are likely occurring from increased development and human population growth of the area, the overall cumulative effects to the Middle Columbia River steelhead ESU are not expected to increase significantly due to the construction of the Desert Claim project. Finally, the presence of the wind plant itself might preclude some additional development such as houses and subdivisions and other cumulative effects, and preserve some of the historic land uses (livestock production), thus indirectly helping to preserve some important juvenile rearing habitat for steelhead.

5. Mitigation Measures

The following measures would be incorporated into the Project construction to minimize potential short-term (construction) effects on bald eagles and steelhead from the project:

- minimize construction activity that occurs during the winter;
- best management practices should be employed to reduce peripheral impacts to adjacent native vegetation and habitats and to minimize the construction footprint;
- the construction footprint at all stream or water channel crossing should be strictly minimized to avoid peripheral impacts to stream habitat;
- a site management plan should be developed to, at a minimum, provide adequate on-site waste disposal, fire prevention and management, and establish erosion control procedures;
- construction equipment refueling stations should be a minimum of 100 feet from any drainage, stream, irrigation channel, or riparian area;
- adhere to the NPDES permit stipulations, including erosion control measures;
- all stream and channel crossings should be designed to allow continual waterflow under all (low) conditions and insure fish passage;
- reclaim disturbed areas as soon as practical following construction.

The following measures would be employed to minimize potential long-term (operational) effects from the Project:

- establish and enforce reasonable driving speed limits within the wind plant to minimize the potential for road killed wildlife or livestock that may attract foraging bald eagles;
- provide adequate on-site waste disposal;
- remove and disposed of all carcasses of livestock, big game, and other wildlife from within the

wind plant that may attract foraging bald eagles;

- ensure that livestock calving areas of participating landowners remain outside the wind plant;
- install bird flight diverters on all guy wires associated with met towers;
- bury all power and communication lines on-site underground where feasible;
- install raptor perch guards on all power poles constructed for the wind plant;
- any permanent on-site equipment fueling or maintenance stations should be established greater than 200 feet from any drainage, creek, irrigation channel, or riparian area .

6. Significant Unavoidable Adverse Impacts

There are no significant unavoidable adverse impacts that would occur to state or federally listed threatened, endangered, proposed or candidate species from implementation of the project.

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Exhibit 2

Baseline Avian Studies Report

BASELINE AVIAN STUDIES FOR THE PROPOSED DESERT CLAIM WIND POWER PROJECT KITTITAS COUNTY, WASHINGTON

FINAL REPORT

July 2003

Prepared For:

Desert Claim Wind Power, LLC

Ellensburg, Washington

Prepared By:

Western EcoSystems Technology, Inc.

Cheyenne, Wyoming

BASELINE AVIAN STUDIES FOR THE PROPOSED DESERT CLAIM WIND POWER PROJECT, KITTITAS COUNTY, WASHINGTON

FINAL REPORT

March 2002 - March 2003

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EXECUTIVE SUMMARY

Desert Claim Wind Power LLC, wholly owned and managed by enXco, Inc., is evaluating the feasibility of wind power development in Kittitas County, Washington. The proposed site, *Desert Claim*, is located in the transition from the rangelands of the valley floor to the foothills of the Wenatchee Mountains approximately 8 miles north of Ellensburg, Washington. The site is relatively level and open and slopes gradually from the south as it approaches the foothills. The proposed development would have a generation capacity of at least 180 MW and be a maximum of 120 turbines depending on turbine model, electricity markets, transmission constraints, and results of site surveys.

Desert Claim Wind Power and enXco have committed to characterizing the avian use and resources at the Desert Claim site to estimate the level of potential impacts the project could have on these resources. Subsequently, enXco contracted Western EcoSystems Technology, Inc. to develop a study protocol and conduct a twelve-month baseline study of avian use and other biological resources of the project area.

Studies conducted for the project included fixed-point surveys that targeted raptors and large birds, roadside surveys for bald eagles, raptor nest surveys, vegetation mapping, rare plant surveys, and general wildlife observations. The principal objectives of the baseline studies were to: (1) quantitatively describe the temporal and spatial use by birds of the study area; and (2) provide baseline information on avian species and their habitat sufficient to use in evaluating the probable impact of the development. Methodology of the surveys for each study component is provided below in the text of the report.

From the avian fixed-point surveys, use estimates of the study area by species and groups were calculated as the number of detections per survey (30 minutes) standardized to a fixed plot size (800 m radius). Two measures of species diversity in the study area were also calculated. Frequency of occurrence was calculated as the percent of surveys where a particular species was observed, and species composition was the mean use for a species divided by the total use for all species and multiplied by 100 to provide percent composition. An exposure index was calculated by species and group which is a relative measure of the risk of each species coming in contact with a turbine based on use of the study area by a species, the proportion of observations of that species flying, and the proportion of observations of that species flying within the rotor swept area.

Between March 22, 2002 and March 13, 2003, a total of 162 30-minute point count surveys were conducted. Passerines comprised 48% of all groups observed and 72% of the total number of birds observed. Raptors comprised approximately 23% of all groups but only 5% of all birds observed. Waterfowl comprised only 3% of all groups but 13% of all birds observed, corvids (magpies, crows, and ravens) comprised approximately 14% of all groups and 5% of all birds observed, and other birds (upland gamebirds, shorebirds, doves, and other non-passerine species) comprised approximately 12% of all groups and 5% of all birds observed.

Use varied across seasons. For spring, based on use, the four most abundant species in the study area were American robin (4.58 detections/30-minute survey), western meadowlark (2.66

detections/survey), European starling (2.13 detections), and Brewer's blackbird (1.36). Together these species comprised approximately 52% of the total bird use during the spring. During the summer, the four most abundant species were European starling (2.37 detections/survey), Brewer's blackbird (2.22), western meadowlark (1.02), and American goldfinch (0.56). These species comprised approximately 49% of the total bird use during the summer. In the fall, the four most abundant species were European starling (5.81 detections/survey), American robin (3.76), California quail (0.93), and Western meadowlark (0.87), which comprised more than 62% of the total bird use. In the winter, the four most abundant species were European starling (13.45), mallard (6.74), American robin (3.73), and unidentified finch (1.82). These species comprised more than 72% of the total bird use for the winter. Overall seasons, European starling was the most common bird observed with 6.46 detections per survey, followed by American robin (3.21), mallard (2.40), and western meadowlark (1.13). These four species comprised more than 57% of all bird use of the site for the year.

Only two species, western meadowlark (38.9% of surveys) and black-billed magpie (30.3%) were observed in more than or roughly one-third (33%) of the surveys. Five other species, red-tailed hawk (29.5%), common raven (25.2%), American robin (22.7%), killdeer (21.8%) and vesper sparrow (20.4%) were observed in approximately one-quarter (25%) of the surveys. Together, these seven species made up approximately 30% of all bird use (29.2%). In contrast, European starling alone made up 28.2% of all bird use at the site but was only observed in 16% of the surveys. The high bird use for starling was due to the majority of observations being large flocks. Eight other species, European starling (16.0%), horned lark (14.68%), Brewer's blackbird (14.1%), rough legged hawk (13.5%), American kestrel (12.5%), northern harrier (11.4%), American goldfinch (10.5%), and California quail (10.1%) were observed in more than 10% of the surveys. The majority of species were observed in less than 5% of the surveys.

Two aerial surveys for raptor nests were conducted (May 2-5 and June 5, 2002) within the raptor nest study area (the study area plus two-mile radius buffer). The total area searched was approximately 52 square miles (134 km^2). A total of 29 raptor or large stick nests were located, 18 of which were classified as active raptor nests during the first survey. Nest density for buteos [red-tailed hawk and unidentified buteo] was 0.28 nest/mi^2 (0.11 nest/km^2). Nest density for all raptors located (buteos and owls) was approximately 0.34 nest/mi^2 (0.13 nest/km^2).

Two roadside bald eagle survey routes (Reecer Creek and Wilson Creek) were established along public roads near the study area. These routes were surveyed a total of six times between March 1 and April 12, 2002 and twelve times between December 12, 2002 and April 12, 2003. A total of 39 bald eagles were observed during the surveys. The maximum number of bald eagles observed during any one survey was 18 (March 1, 2002). On average, 2.4 bald eagles were observed per survey day (2 routes). Approximately 54 percent of the observations were adults, 5 percent were subadults (1-3 years of age), 36 percent were juveniles (<1 year old), and 5 percent were unknown (unidentified due to poor visibility). Most of the bald eagles observed during the winter surveys occurred approximately 1-3 miles south and east of the study area. Based on the surveys, the primary period of bald eagle occupation in the study area appears to be between approximately mid-February and early-April. No regular night roost sites were identified in or near the study area. Many of the eagle observations were associated with cattle grounds and calving operations south of the project.

The vegetation in the study area was mapped and classified into ten types (shrub-steppe, grassland, lithosol, agriculture, wet meadow, riparian shrub, riparian tree, pine forest, open water, developed). The primary vegetation type was shrub-steppe which made up approximately 53.4 percent of the study area (approximately 2,794 acres). The grassland type made up approximately 30.2 percent of the study area (approximately 1,578 acres) and lithosol made up approximately 3.8 percent (approximately 199 acres). Agriculture made up approximately 4.8 percent of the study area (252 acres). The remaining types were minor components of the study area comprising approximately 7.8 percent cumulatively. The shrub-steppe and grassland types were typically used for livestock production and showed signs of grazing with few large perennial bunchgrasses and areas of the invasive annual cheatgrass. No rare plants listed either federally or by Washington State were found in the project area.

Eight species of mammals (mule deer, elk, porcupine, raccoon, long-tailed weasel, yellow-bellied marmot, least chipmunk, and coyote) and one species of reptile (short-horned lizard) were recorded in the study area. Mule deer was the only regularly observed big game species on site. The number of mule deer observations increased in the winter. Bald eagle was the only federally listed species observed in the study area. Four Washington State candidate species, golden eagle, sage thrasher, loggerhead shrike, and northern goshawk, were also recorded during the study.

Overall the results of the study were similar to other wind plants studied in the Washington - Oregon region. The diversity of species observed during the study was slightly higher than other sites studied; however, the majority of avian use on the site was from several common passerine species. Raptor use on the site was above average. Spatial use by raptors of the site was generally scattered but there were a few topographic features that appeared to concentrate buteo use. Bald eagle use of the site was confined to the winter months and appeared to be primarily eagles passing through the area to suitable foraging areas nearby. Waterfowl use of the site was also heaviest in the winter months. Raptor nest density was typical of other sites studied. Estimated impacts from the project are not expected to exceed what has been reported from other newer generation wind plants that have been studied. Additional discussion topics and potential mitigation and monitoring measures are addressed in the text below.

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1.0 INTRODUCTION

Desert Claim Wind Power LLC, wholly owned and managed by enXco, Inc., is evaluating the feasibility of wind power development in Kittitas County, Washington. The proposed site, *Desert Claim*, is located in the transition from the rangelands of the valley floor to the foothills of the Wenatchee Mountains approximately 8 miles north of Ellensburg, Washington (Figure 1). The site is relatively level and open and slopes gradually from the south as it approaches the foothills. The proposed development would have a generation capacity of at least 180 MW and be a maximum of 120 turbines depending on turbine model selected, electricity markets, transmission constraints, and results of site surveys.

Desert Claim Wind Power and enXco have committed to characterizing the avian use and resources at the Desert Claim site to estimate the level of potential impacts the project could have on these resources. Subsequently, enXco contracted Western EcoSystems Technology, Inc. (WEST) to develop a study protocol and conduct a twelve-month baseline study of avian use of the project area.

The principal goal of the baseline study was to collect sufficient information on avian species in the proposed development useful in evaluating the potential impacts of wind power development in the area. The principal objectives of the studies were to: (1) quantitatively and qualitatively, depending on the species or resource, describe the temporal and spatial use by birds and other wildlife of the study area; (2) describe the vegetation types present on the site; (3) list the occurrence and potential use of the site by special status species of plants and wildlife; (4) describe and estimate the winter bald eagle use of the area; and (5) provide baseline information on these resources that could be used in evaluating the probable impact of wind power development in the area.

Key questions addressed by the study included:

- What species of birds and other wildlife use the study area during different seasons?
- What vegetation types are present in the study area and what are the dominant plant species in each type?
- Where in the study area (spatial use) do species occur and what habitats do they use?
- What is the seasonal and daily (temporal) use of the study area for given species or groups of species?
- Are there key habitat features (biotic and/or abiotic) which increase the probability of species use of an area?
- How do indices of use of the study area by birds compare to other wind plants that have been studied in the region (primarily Oregon and Washington)?
- Based on avian use, habitat, and other factors at the site and by comparing with avian use, habitat, and mortality at existing wind plants, what are the expected impacts from the proposed project.

The study protocol follows similar avian studies conducted at numerous wind plants and proposed wind plants across the west and mid-west including the Vansycle and Stateline Wind Plant in Oregon and Washington (Erickson *et al*. 2000), the Buffalo Ridge Wind Plant in southwest Minnesota (Johnson *et al*. 2000a), the Foote Creek Rim Wind Plant in Wyoming (Johnson *et al*. 2000b), the Nine Canyon Wind Project, Washington (Erickson *et al*. 2001), and the Klondike Wind Project, Oregon (Johnson *et al*. 2002), and other proposed wind plants in Oregon and Washington (e.g., Combine Hills Turbine Ranch, Oregon; the Maiden Wind Farm, Washington; Zintel Canyon, Washington).

Both the Washington Department of Fish and Wildlife (WDFW) and the U.S. Fish and Wildlife Service (USFWS) were integral in the preparation of the study plan and agreed to the final protocol. Each agency was provided a copy of the draft study protocol for review and comment prior to study implementation and two meetings were held with agency representatives in Ellensburg, Washington to discuss the studies and issues or concern. While the primary concern and study objectives centered around avian resources, information was also recorded on other wildlife groups and biological resources (e.g., vegetation) due in part to concerns raised by the agencies. To the extent practical, the field studies were modified to address agency concerns. For example, potential impacts to big games species and shrub steppe habitat were of concern to the agencies. To help address these issues, the fixed-point survey (see below) methods were modified to include recording observations of big game species and background information on shrub steppe conditions was gathered on which to base a functional assessment if needed.

The following report contains the results of the avian baseline study for the one-year period from March 2002 to March 2003. This baseline study provides data for describing the temporal and spatial use by birds and other biological resources of the study area and for evaluating the probable impact of wind power development in the study area. Results from the baseline avian study may be used in the overall environmental impact assessment for the project.

2.0 STUDY AREA

The Desert Claim project area lies in the northern portion of Kittitas Valley south of Table Mountain of the Wenatchee National Forest (Figure 1). The proposed development area is approximately 8 square miles of private land with some interspersed land administered by the Washington Department of Natural Resources. The site is approximately 8 miles north of Ellensburg, Washington (Figure 1). At its nearest point, the Yakima River is located approximately 3 miles southwest of the project. The project area ranges in elevation from approximately 2000 to 3100 feet

Dominant vegetation of the Desert Claim project area is a mix of steppe types (shrub and grassland steppe) or a variety of less extensive types such as agriculture, wet meadow, and riparian types. Roughly speaking the eastern half of the project area is shrub steppe and the western half is grassland and agriculture (hay meadows). The northern most section of the project is foothills shrub with scattered conifer forest. The steppe types are primarily shrub and grass dominated areas with predominantly native sagebrush (*Artemisia spp*.), rabbitbrush

(*Chrysothamnus spp.*), bunchgrasses [e.g., Sandberg's bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegnaria spicatum*)] and exotic annuals such as the introduced cheatgrass (*Bromus tectorum*)]. Bands of riparian habitat are present along Reecer Creek, Wilson Creek, and other small streams that roughly run north-south through or near the project area. Stands of deciduous trees and wet meadows of various sizes exist along the creeks as well as near water bodies, houses, and other developments.

The study area includes the proposed wind power development area and an adjacent buffer of variable width depending on the study component. The primary study area includes the proposed development area or the location of the wind turbines and associated facilities such as met towers, substations, new roads, operations and maintenance facility, and underground overhead powerlines, and equipment storage or lay-down areas, parking areas, and the area within a buffer of approximately 1 mile (1.6 km) from all project facilities. At the time of the study set-up, WEST obtained a list of participating landowners which was used to define the boundaries of the primary study area. As the project area changed and new landowners were included, the primary study area was adjusted to incorporate the new areas.

All avian use surveys, general wildlife observations, and vegetation surveys occurred within the primary study area. The raptor nest study area included the primary study area and the surrounding area within two miles. The helicopter surveys for raptor and other large bird nests occurred within this area. The bald eagle survey routes utilized public roads that were near the project area and allowed observation of an area larger than the primary study area.

3.0 METHODS

The baseline avian studies consisted of five primary components:

1) fixed-point surveys - point count surveys for all birds but which target raptors, other large birds, and big game species;
2) raptor nest survey - aerial and ground surveys to locate raptor nests on and within two miles of the site;
3) bald eagle surveys - winter roadside surveys for bald eagles around the study area;
4) vegetation mapping and rare plant survey; and
5) general wildlife observations.

3.1 Fixed-point Survey

The primary objective of the fixed-point surveys was to estimate the spatial and temporal use of the site by birds and in particular raptors and other large birds. Point counts (variable circular plots) were conducted on the development area using methods described by Reynolds et al. (1980) and Bibby et al. (1993). The points were selected to survey as much of the project area as possible while also providing relatively even coverage without overlap of surveyed area. The emphasis of these surveys was locating and counting raptors and other large birds (waterfowl, shorebirds, waterbirds, corvids, and upland gamebirds), however, all birds seen during the point counts were recorded.

3.1.1 Survey Plots

Initially four survey plots (points A, B, C, D) were established over the study area (Figure 2). As new property was added to the project, two additional fixed-point survey plots were established (points E and F). The observation points were established to provide good coverage of the habitats and topographic features of the area and so that 800 m radius buffers around each point did not overlap (see Figure 2). Each survey plot was a variable circular plot centered on an observation point marked in the field. The survey effort concentrated within an approximate 800 m (0.5 mi) radius circle centered on the observation point. Observations of birds beyond the 800 m radius were recorded, but were not included in the analysis so that results were standardized between survey plots at the site as well as with other similar wind project studies.

Survey periods at each point were 30 minutes long. All birds observed during the survey were recorded. All raptors and other large birds observed were assigned a unique observation number and plotted on a map of the survey plot (see Appendix A). The date; start and end time of the observation 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, height above ground, activity (behavior), and habitat(s) were recorded for each bird observed. Flight or movement paths were mapped for all raptors and large birds and given the corresponding unique observation number.

Four instantaneous counts were made during each 30-minute observation period. The first instantaneous count was made at the beginning of the observation period and the remaining counts occurred at 10-minute intervals. An instantaneous count consists of a summary of all birds present in and near the plot at a particular time. During the instantaneous count, the observer scanned the full survey plot recording all birds seen at that moment. For each raptor/large bird seen during an instantaneous count, the approximate height above ground and distance to the observer were recorded.

The behavior of each raptor/large bird observed and the habitat in or over which the bird occurred were recorded. Behavior categories include perched, soaring, flapping, flushed, circle soaring, hunting, gliding, and other (noted in comments). Habitats were recorded as shrub-steppe, grassland, deciduous shrub/tree, conifer forest, rock/rock outcrop, riparian, agriculture, and other (noted in comments). The initial flight patterns and habitats (first observation) were uniquely identified on the data sheet and subsequent patterns and habitats (if any) also recorded. The flight direction of observed birds was recorded on the data sheet map (Appendix A). Approximate flight height at first observation was recorded to the nearest meter or 5-meter increment and the approximate lowest and highest flight heights observed were also recorded. Any comments or unusual observations were noted in the comments section.

Raptors, other large birds, any species of concern, and species not previously seen on site that were observed between point counts were coded as in-transit observations and also recorded on field maps with unique observation numbers. Mapped information such as point of first observation and flight paths were digitized for describing spatial use of the site.

3.1.2 Observation Schedule

Sampling intensity was designed to document avian use and behavior by habitat and season within the project area. Surveys took place for one full year. Efforts were made to survey all plots on an approximately weekly basis with at least one observer on site one day per week. Surveys were conducted during daylight hours and survey periods were varied to approximately cover all daylight hours during a season. Seasons were defined as spring: March 15 - May 31; summer: June 1- August 14; fall: August 15-October 31; and winter: November 1-March 14. To the extent practicable, all stations were surveyed about the same number of times each season; however, the schedule varied in response to adverse weather conditions (e.g., rain, snow, fog), which caused delays and/or missed surveys.

3.1.3 Big Game Observations

Observations of big game species seen while conducting fixed-point surveys were also recorded. Preliminary project investigations indicated the project area is winter range for mule deer (*Odocoileus hemionus*), and an elk (*Cervis elaphus*) migration corridor is located to the north of the project. Observations of any big game species were plotted on the data sheet maps and the number of individuals in each group recorded. The objective of recording this data was to provide baseline information about big game in the project area and estimate seasonal variation in use by these species.

3.2 Raptor Nest Survey

The objective of the raptor nest survey was to gather information on species nesting in the area including nest locations, nesting season (timing), and nest success as well as locate nests which may be subject to disturbance and/or displacement effects from wind plant construction and operation. The nest survey area included the proposed development area and the area within an approximate 2-mile buffer of the site excluding extensive tracts of dense coniferous forest (Figure 3).

The focal species for the nest survey was ferruginous hawk (*Buteo regalis*) a state threatened species. Richardson (1996) reports that ferruginous hawks in Washington initiate their nesting activity in late-March and early-April. The initial nest survey was conducted via helicopter from May 2-5, 2002 when ferruginous hawks in the study area would be actively incubating eggs or brooding/attending young (Richardson 1996). GPS coordinates were recorded for all nests located of all raptor or other large bird species and mapped on a GIS ArcView™ project utilizing USGS topographic maps (1:24000 scale) as the base. A follow up survey was conducted on June 5, 2002 to visit located nests and look for evidence of nest success (e.g., fledged young nearby, full grown chicks in the nest) and to gather data on later nesting species [e.g., Swainson's hawk (*Buteo swainsoni*)].

Locations of all nests were recorded, including inactive nests as they could be occupied during other years. Survey methods involved flying over the area while searching for suitable nesting areas and substrate (e.g., trees, rock outcrops, cliffs, and other structures, such as power poles). Once suitable nesting areas were found they were searched thoroughly from the air and all nests found, whether active or inactive, were given a unique identification number and their locations

recorded in Universal Transverse Mercator (UTM) coordinates. The surveys were conducted by a biologist experienced in raptor nest surveys. In additional to the helicopter survey, public roads within the raptor nest survey area were driven to search for nest sites that were visible from the ground.

3.3 Bald Eagle Surveys

Information from the WDFW PHS database indicated that the Kittitas Valley and Yakima River riparian corridor is important habitat for wintering bald eagles (*Haliaeetus leucocephalus*) and, therefore, a potential concern for the proposed project. The objective of the bald eagle surveys was to determine the abundance and location of wintering bald eagles near the proposed development area. Surveys were conducted which were designed to locate bald eagles, concentration areas, and/or potential roost sites near the project.

Two survey routes were established along Reecer Creek Road and Wilson Creek Road near the project site (Figure 2). These routes were surveyed periodically from early March 2002 to mid April 2002 and again from late December 2002 to mid April 2003. A survey consisted of driving slowly (20 mph) the predetermined route while visually scanning all areas visible from the road. Periodic stops were made in safe locations to scan areas of large trees with binoculars or spotting scope to look for perched eagles. Depending on the traffic and safe pull-off availability, when an eagle or species of interest was spotted, the observer stopped the vehicle to record the appropriate data and location. UTM coordinates for the observer location (along the road) were recorded and later corrected for approximate distance and direction to the eagle. Surveys were conducted primarily in the morning hours to look for perched eagle but a few evening surveys were also conducted. Other special status wildlife and species of interest observed during the surveys were also recorded.

3.4 General Wildlife Observations

The objective of recording general wildlife observations on the site was to document wildlife other than avian species that may be affected by the proposed development. General wildlife observations were made year round while observers were on site conducting other surveys. Raptors, unusual or unique avian sightings, sensitive species, mammals, reptiles, and amphibians sighted while field observers were on or near the site or traveling between plots were recorded on data sheets for incidental observations. The data recorded were similar to those recorded during the plot studies. The observation number, date, time, species, number, sex/age class, height above ground (for birds), and habitat were recorded. Observations of uncommon species and species of concern were mapped on a project map by observation number.

3.5 Vegetation Surveys

The objective of the vegetation surveys was to characterize the dominant vegetation and vegetation communities of the study area that may be impacted by the proposed project.

Information from the surveys may be used in the overall environmental impact assessment, to describe habitats used by wildlife species observed, assess habitat suitability for special status species of wildlife, determine the need for more detailed vegetation impact analyses, and determine areas where rare plant surveys would be needed.

3.5.1 Vegetation Mapping

Vegetation in the study area was mapped according to "vegetation types". For vegetation mapping, the "study area" included the 5,200 acres where Desert Claim has landowner permission to develop the project (Figure 1). "Vegetation types" are considered to be generally recognizable assemblages of plant species that occur in a pattern across the landscape. Vegetation types were determined based on visual assessment of dominant plant species. Commercially available black and white digital aerial photography dated 2000 with a minimum pixel size of 1 meter was used for mapping. The vegetation types were mapped during September 2002 and late April to early May 2003. Initially, the roads in and around the project site were driven in order to correlate vegetation types with the signature (color, shading, texture) on the aerial photos. Each vegetation type was then mapped based on either visual observation of the habitat from a road or high point, or by walking the boundaries of the habitat. Due to the scale of the aerial photos used, fine-scale intermingling in transition areas and small inclusions of one vegetation type within another are not shown. The mapped boundaries of each habitat type were digitized using ArcView™. Observations of dominant species, general condition, and land uses were recorded for each vegetation type

In addition to the vegetation map that was developed for the study area, a literature review was conducted to gain an understanding of previous work on soils and vegetation in similar habitats. Daubenmire (1970), in particular, is noteworthy for characterization of the vegetative communities of eastern Washington.

3.5.1 Rare Plant Survey

The objective of the rare plant survey was to identify listed, sensitive, or otherwise rare plants that occur in the development area that may be impacted by construction or operation of the wind plant. The rare plant survey considered both federal and state listed plant species. At the federal level, listed species included those listed as threatened or endangered that potentially occur in the study area, as well as species that have been formally proposed or are candidate species for federal listing, or "species of concern". The "species of concern" status is an unofficial status for species that appear to be in jeopardy, but information is insufficient to support listing. At the state level, listed species included those identified as endangered, threatened, sensitive, review, or extirpated by the Washington Natural Heritage Program (WNHP) that potentially occur in the study area. State-listed species that potentially occur in the study area were determined based on the WNHP database, which maintains the most complete database available for state-listed species. The WNHP was also contacted to obtain records for any known rare plant populations in the study area or general project vicinity.

To supplement the information provided by the above agencies, a number of other sources were consulted for additional information regarding rare plant species potentially found in the study area, including critical information such as habitat preferences, morphological characteristics,

phenologic development timelines, and species ranges. Sources included: taxonomic keys and species guides (WNHP 2003; USFWS 2001; Cronquist et al. 1977; Hitchcock and Cronquist 1973) and online databases of common and rare plant species (Ilanga Inc. 2003; USDA 2003).

It should be noted that the Endangered Species Act of 1973 (16 USC 1531, *et seq.*, as amended), does not give plant species legal protection on non-federal lands unless a State law or regulation is being violated (ESA Section 9(a)(2)(B)). Rare plant species are not legally protected in Washington State (Swope Moody, WNHP, pers. comm.). Despite the lack of legal protection, every effort was made to locate rare plant species that could be impacted by the project and, if present, identify mitigation measures to avoid or minimize impacts to these resources.

Using data collected during the pre-field review and the habitat map of the study area, pedestrian field surveys were performed on September 5 and 6, 2002 and April 28 and May 15, 2003 to locate rare plant species within the study area. The surveys were timed to locate as many target species as possible. Methods for surveying for rare plants followed guidelines and recommendations of the WDFW and the Washington Natural Heritage Program. The areas surveyed included those areas of native habitat within the study area in which one or more of the rare plant species could occur. Surveys were not conducted on gravel or paved roads or other developed areas (e.g., farms, equipment storage areas, gravel pits) or in agricultural areas (i.e., hay fields). The surveys were accomplished by performing meandering pedestrian transects back and forth across the survey area. The intensity of the pattern, and the speed at which the surveyor walked, was variable, and depended on the structural complexity of the habitat, the visibility of the target species, and the probability of species occurrence in a given area. Care was taken to thoroughly search all unique features and habitats encountered with high probability of occurrence of rare species.

During the surveys a list of vascular plants encountered was made (Appendix B). Informal collections of unknown species were taken for later identification. *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) was the primary authority used for vascular plant species identification. Updated taxonomy referenced in the NRCS PLANTS database or Washington Flora Project database is used where applicable (USDA 2003; Ilanga Inc. 2003). Notes were also taken regarding general plant associations, land use patterns, unusual habitats, and wildlife use. Photographs of the habitat types and representative individual plants were taken using a digital camera.

3.6 Data Compilation and Report Preparation

3.6.1 Data Compilation and Storage

A database was created to store, retrieve and organize field observations. Data from field forms were keyed into electronic data files using a pre-defined format that made subsequent data analysis straightforward. All field data forms, field notebooks, and electronic data files have been retained for future reference.

3.6.2 Quality Assurance/Quality Control

QA/QC measures were implemented at various stages of the study, including in the field, during data entry, during data analysis, and report writing. Each observer was responsible for inspecting his or her data forms for completeness, accuracy, and legibility. The study team leader periodically reviewed data forms to ensure completeness and legibility. Problems detected were corrected and changes made to the data forms were initialed and dated by the person making the change.

The electronic database was compared to the original data sheets by randomly choosing electronic records and verifying these with the field data sheet. Any errors detected were corrected by referencing the raw data forms and/or consulting the observer(s) who collected the data. Any irregular codes detected, or any data suspected as questionable, were discussed with the observer and study team leader. Any errors or suspect data identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

3.7 Statistical Analysis and Products

Statistics/data generated for the study include the following:

- Species lists and observations by season;
- Relative use by species, species group, season, and observation point (habitat);
- Mean frequency of occurrence and species composition;
- Mapped summary of raptor observations and flight paths by species or group;
- Mean flight characteristics by species and species group;
- Exposure indices by species and species group;
- Other wildlife and sensitive species lists and locations mapping;
- Vegetation type mapping and rare plant mapping (if applicable);
- Raptor nest location by species mapping;
- Table of raptor nests and success by species;
- Comparisons of avian use and raptor nest density between the proposed project and other new or existing wind plants.

The number of raptors and other species seen during each point count survey was standardized to a unit area and unit time searched. Avian use by species was calculated as the mean number of observations per 30-minute survey within 800 m of the survey point. Standardizing the data to a unit area and unit time allows comparison of avian use within the site between survey plots (habitat) and seasons and from the site to other wind plants that have been studied with similar methods.

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 and multiplied by 100 to provide percent composition. Frequency of occurrence and percent composition provide relative estimates of the avian diversity of the study area. For example, a particular species may have high use estimates

of 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 the project.

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

$$R = A * P_f * P_t$$

Where A = mean relative use for species *i* (observations within 800 m of observer) averaged across all surveys, P_f = 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 = proportion of all flight height observations of species *i* within the rotor-swept area. This index does not account for differences in behavior other than flight characteristics (i.e., flight heights and percent of birds observed flying).

Data were plotted (means and 90% confidence intervals) to illustrate differences in raptor and other bird use between survey period (seasons) and stations (habitat). Because of the relative close proximity of points to each other, the variability of estimates of avian use were based on survey to survey variability (i.e., temporal variability). Maps of bird use (perches and flight paths) by observation point were developed to identify, to the extent possible, habitats or other topographic features that appeared related to bird use.

4.0 RESULTS

4.1 Fixed-point Raptor and Large Bird Surveys

Surveys were conducted at fixed-point count stations located within the study area (Figure 2) approximately once each week between March 22, 2002 and March 13, 2003. Varying weather conditions caused some surveys to be missed and the number of fixed-point stations increased from 4 to 6 in the fall of 2002 when new area was added to the project. Over the whole study period, a total of 162 30-minute point count surveys were conducted.

A total of 68 avian species and an additional 6 unidentified bird types (best possible identification, e.g., unidentified buteo) were observed during the fixed-point surveys (Table 1). 3,992 total observations in 816 different groups[1] were recorded during the fixed-point surveys (Table 1). These are raw counts of observations, that are not standardized by the number of hours of observation, but do provide an overall list of what was observed. These counts likely contain duplicate sightings of the same birds.

Passerines were the most numerous group; European starling (*Sturnis vulgaris*), American robin (*Turdus migratorius*), western meadowlark (*Sturnella neglecta*), and American goldfinch (*Carduelis tristis*) were the most numerous passerines observed. Passerines comprised 48% of

[1] Group is defined as an observation of a species of bird regardless of number seen together. For example, a flock of 8 American robins flying together is considered a group as well as an individual robin observed by itself.

all groups observed and 72% of the total number of birds observed. Raptors comprised approximately 23% of all groups but only 5% of all birds observed. In contrast, waterfowl comprised only 3% of all groups but 13% of all birds observed. Corvids (magpies, crows, and ravens) comprised approximately 14% of all groups and 5% of all birds observed. Other birds (upland gamebirds, shorebirds, doves, and other non-passerine species) comprised approximately 12% of all groups and 5% of all birds observed (Table 1).

4.1.1 Avian Use

To standardize the data for comparison between points, seasons, and other studies; avian use, frequency of occurrence, and species composition were calculated from observations within 800 m of the survey point. Avian use by species was calculated as the mean number of observations per 30-minute survey (Table 2). Because individual birds were not marked, counts do not distinguish between individuals; rather, they provide an estimate of avian use of the study area. For example, if one red-tailed hawk (*Buteo jamaicensis*) was observed during five surveys, it is unknown if this was the same bird seen five times or five different birds seen once. But this does provide an index of how often or frequent red-tailed hawks occur in the study area, and therefore are at risk of being affected by the proposed project. References to abundance are use estimates and not absolute density or numbers of individuals.

Use varied across seasons (Table 2). For **spring**, based on use, the four most abundant species in the study area were American robin (4.58 detections/30-minute survey), western meadowlark (2.66 detections/survey), European starling (2.13 detections/survey), and Brewer's blackbird (*Euphagus cyanocephalus*) (1.36 detections/survey). Together these species comprised approximately 52% of the total bird use during the spring (Table 3). During the **summer**, the four most abundant species were European starling (2.37 detections/survey), Brewer's blackbird (2.22), western meadowlark (1.02), and American goldfinch (0.56). These species comprised approximately 49% of the total bird use during the summer (Table 3). In the **fall**, the four most abundant species were European starling (5.81 detections/survey), American robin (3.76), California quail (*Callipepla californica*) (0.93), and Western meadowlark (0.87), which comprised more than 62% of the total bird use (Table 3). In the **winter**, the four most abundant species were European starling (13.45), mallard (*Anas platyrhynchos*) (6.74), American robin (3.73), and unidentified finch (1.82). These species comprised more than 72% of the total bird use for the winter (Table 2). Over all seasons, European starling was the most common bird observed with 6.46 detections per survey, followed by American robin (3.21), mallard (2.40), and western meadowlark (1.13) (Table 2). These four species comprised more than 57% of all bird use of the site for the year (Table 3)

Averaged over all seasons and based on use, passerines were the most abundant group observed followed by waterfowl/waterbirds, raptors, and corvids (Table 2). Passerines as a group had the highest use in all four seasons. Waterfowl had the second highest use in the winter, however, raptors had the second highest use estimates in the spring, summer, and fall. The high winter waterfowl use was due primarily to large flocks of mallards that frequented the study area during the winter season (see Table 1). Mean use for passerines and raptors, the two most abundant groups most of the year based on use, was plotted by survey period. Passerine use was relatively constant across the seasons but a spike caused by large flocks of starlings observed in the winter

caused a slight overall increase for the winter season (Figure 5). Raptor use fluctuated throughout the study period with the highest use occurring in early spring (Figure 5). Raptor use did not drop in winter due mainly to an increase in rough-legged hawk observations. Mean use for these two groups was also plotted by survey station (Figure 6). Passerine use was highest at survey plots B and E which had a mix of vegetation types (see Figures 2 and 4). Plot B encompassed grassland, shrub-steppe, agriculture, and riparian habitats. Plot E was on a ridge in shrub-steppe overlooking riparian, grassland, and some developed area. Similarly, plot C also had higher use and encompassed a variety of habitats. Raptor use across the study area was similar to passerine use in that plots with a diversity of vegetation had the higher use estimates (Figure 6), however, these plots were also the most topographically diverse. Plots C and E were located on a roughly north-south ridge line that may have influenced raptor use (see below Spatial Use).

4.1.2 Species Composition and Frequency of Occurrence

Species composition is represented by the mean use for a species divided by the total use for all species and multiplied by 100 to provide percent composition (Table 3). Frequency of occurrence was calculated as the percent of surveys where a particular species was observed (Table 4). Frequency of occurrence and percent composition provide relative estimates of the avian diversity of the study area. For example, only two species, western meadowlark (38.9% of surveys) and black-billed magpie (30.3%) were observed in more than or roughly one-third (33%) of the surveys. Five other species, red-tailed hawk (*Buteo jamaicensis*) (29.5%), common raven (*Corvus corax*) (25.2%), American robin (22.7%), killdeer (*Charadrius vociferus*) (21.8%) and vesper sparrow (*Pooecetes gramineus*) (20.4%) were observed in approximately one-quarter (25%) of the surveys. Together, these seven species made up approximately 30% of all bird use (29.2%). In contrast, European starling alone made up 28.2% of all bird use at the site but was only observed in 16% of the surveys. The higher bird use for starling was due to the majority of observations being large flocks (see Table 1). Eight other species, European starling (16.0%), horned lark (*Eremophila alpestris*) (14.68%), Brewer's blackbird (14.1%), rough legged hawk (*Buteo lagopus*) (13.5%), American kestrel (*Falco sparverius*) (12.5%), northern harrier (*Circus cyaneus*) (11.4%), American goldfinch (10.5%), and California quail (10.1%) were observed in more than 10% of the surveys. The majority of species were observed in less than 5% of the surveys (Table 4).

As a group, and due primarily to the abundance of several common species, passerines comprised more than 73% of the avian use on site (Table 3) and were observed in more than 79% of all surveys (Table 4). Raptors as a group comprised approximately 5% of the avian use of the site (Table 3) and were observed in approximately 58% of the surveys (Table 4

Frequency of occurrence for passerines and raptors was plotted by survey period (Figure 5). Passerine occurrence was variable but highest in the spring and summer when passerines were recorded in 100% of the surveys (Figure 5). Raptor occurrence was also fairly variable but had a decreasing trend from spring through summer to fall and then increasing in winter (Figure 5). Frequency of occurrence for these two groups was also plotted by survey station (Figure 6). Passerine occurrence was somewhat even across the study area except for plot F, the northern most station, where they were observed less frequently (Figure 6). Raptor occurrence was more

variable and was similar to raptor use in that plots C and E had the highest frequency of occurrence (Figure 6).

An additional index of species diversity is the mean number of species observed per survey. In general, the mean number of species per survey peaked in spring and decrease through the year to a low in winter (Figure 7).

4.1.3 Flight Height Characteristics

The proportion of observations of a bird species flying within the rotor swept area provides a rough estimate of the propensity of that species to fly within the area occupied by the turbine rotors (Table 5). The turbines and tower heights identified for the project would have a maximum height with the blade pointed up of approximately 120 m. Using the estimated range of tower heights and rotor diameters, the "zone of risk" included the area from approximately 25 m above ground level (AGL) to 125 m AGL. This range was a conservative estimate that included a small buffer of approximately 5 m on the upper and lower limits. Most of the passerines observed, with the exception of finches and swallows, were regularly observed flying less than 25 meters above the ground (Table 5). The larger birds tend to fly higher, and frequently flew greater than 25 meters high, which is within the primary zone of risk for turbine blades for most newer generation turbines. As a group, 93% of waterfowl observed flying were observed in the zone of risk. Flying eagles were observed in the zone of risk 80% of the time and flying buteos approximately 66% of the time. Flying passerines were observed within the zone of risk approximately 53% of the time (Table 6).

4.1.4 Exposure index

The exposure index is a relative measure of the risk of each species observed on-site during the fixed-point surveys coming in contact with a turbine, based on the use (measure of abundance) of the site by the species and the flight characteristics observed for that species. European starling, mallard, and American robin had the highest exposure indices (Table 7). These three species were commonly observed on site and often observed flying in large flocks. Of the raptors, red-tailed hawk had the highest exposure index. Most of the other raptors were seen less frequently (i.e., use was lower) which reduced their exposure index. Common raven also had a relatively high exposure index due to its propensity to fly in the zone of risk.

4.1.5 Spatial Use

The objective of mapping observed bird locations was to look for areas of concentrated use by raptors. Point of first observation, approximate flight paths, and perch locations were mapped for each raptor observed in the project area (Figures 8-10). Red-tailed hawks were the most common raptor observed. Most red-tailed observations were in the mid and eastern portions of the project area (Figure 8). Other raptors such as accipiters, falcons, and harriers appeared more random and were relatively evenly distributed across the study area (Figures 9-10). For most raptors there did not appear to be a strong association of use with topographic features of the site. For red-tailed hawks and rough-legged hawks there were a few locations that appeared to be correlated with use. In particular the ridgeline located within survey points C and E appeared to concentrate use by buteos (see Figure 8). Another area that also appeared to have more concentrated use by buteos was the hillside within survey plot B. There was a concentration of

observations in this area although they were spread out over a broader area. This area is also just outside the proposed development area.

4.1.6 Big Game Observations

Only one species of big game, mule deer, was commonly observed in the project area (Table 8). Some individuals were observed in all seasons, however, there was an increase in the number observed in the winter. Mule deer were fairly evenly distributed over the study area (Figure 11). Based on available information, there is also the potential for elk to occur on the site, however, only one group was observed incidentally near the site in March 2003. No elk were observed within the study area.

4.2 Raptor Nest Survey

Two aerial surveys for raptor nests were completed within the raptor nest study area (the study area plus two-mile radius buffer). The total area searched was approximately 52 square miles (134 km^2) (Figure 3). A total of 29 raptor or large stick nests were located. Eighteen active raptor nests were located during the first survey (Table 10). The most common nesting raptor in the study area was red-tailed hawk with 12 active nests. There were also three unknown buteo nests which were active. Generally these were nests with young or eggs present, but where no adult was observed at the nest or near by to provide species identification. It is likely that most of these were also red-tailed hawks. Nest density for buteos [red-tailed hawk and unidentified buteo] was 0.28 nest/mi^2 (0.11 nest/km^2). Nest density for all raptors located (buteos and owls) was approximately 0.34 nest/mi^2 (0.13 nest/km^2).

The second nest survey was intended to gather as much information as possible about nest success from the active nests located during the first survey and search for new nests to the extent practical. Based on the second survey, both red-tailed hawk and great horned owl were confirmed producing or fledging chicks in the study area (Table 10). The calculated nest success rates (Table 10) are based on relatively small sample sizes but they provide an estimate of approximate nest success (i.e., percent of nests that are successful by species), and a record of successful breeding by two raptor species in the study area.

In general, the raptor nest survey area contained marginal habitat in terms of nest site availability. There were no large riparian corridors in the survey area and no noticeable cliffs. There are several powerline corridors which had several nests present (see Figure 3) but most nests were in isolated patches of trees or along the Wilson Creek riparian area. The aerial survey method enables/facilitates locating nests that are easily seen from the air and generally focuses on locating suitable raptor nest structures. Ground nesting species are generally missed with this type of survey due to the difficulty of locating nests on the ground from the air. It is likely that some ground nesting species such as northern harriers and possibly short-eared owls nest within the survey area. No ground nesting raptors were located during other activities in the study area such as the vegetation surveys or while walking to point count locations.

4.3 Bald Eagle Surveys

The WDFW estimates that between 35-50 bald eagles winter in the Kittitas Valley along the Yakima River riparian corridor (WDFW PHS 2002). Two roadside bald eagle survey routes were established along public roads near the study area (see Figure 2), and labeled Reecer Creek and Wilson Creek. These routes were surveyed a total of six times between March 1, 2002 and April 12, 2002 and twelve times between December 12, 2002 and April 12, 2003 (Table 10).

A total of 39 bald eagles were observed during the surveys (Table 10). The maximum number of bald eagles observed during any one survey was 18 (March 1, 2002). On average, 2.4 bald eagles were observed per survey day (2 routes). Approximately 54 percent of the observations were adults, 5 percent were subadults (1-3 years of age), 36 percent were juveniles (<1 year old), and 5 percent were unknown (unidentified due to poor visibility). Most of the bald eagles observed during the winter surveys occurred approximately 1-3 miles south and east of the study area (Figure 12). In addition to the survey observations, a fair number of bald eagles were observed incidentally in the project vicinity outside the scheduled bald eagle surveys or while observers were traveling to the site (see Table 11).

Based on the surveys, the primary period of bald eagle occupation in the study area appears to be between approximately mid-February and early-April. No regular night roost sites were identified in or near the study area and it appears as if bald eagles may opportunistically roost in suitable trees near foraging areas. Many of the eagle observations were associated with cattle grounds and calving operations where they were observed foraging on carrion (dead cows) or calving byproducts.

4.4 General Wildlife and In-Transit Observations

4.4.1 Avian species

Avian species of interest were recorded when seen during periods when observers were traveling to survey points, in-transit between survey points, traveling to the site, or on-site for other purposes (Table 11). Many incidental observations occurred near the site but were not on property contained within the proposed development. While general wildlife or incidental observations are not standardized in any fashion, they are a record of species of interest on or near the project area and a record of some species on-site not observed during standard surveys.

Several raptor species were observed on-site or near by outside of the scheduled surveys (fixed-point or bald eagle surveys), including bald eagle, red-tailed hawk, rough-legged hawk, American kestrel, prairie falcon (*Falco mexicanus*), northern harrier, Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), northern goshawk (*Accipiter gentilis*), turkey vulture (*Cathartes* aura), and barn owl (*Tyto alba*). Several species of waterfowl were seen incidentally and not during surveys including common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), ring-necked duck (*Aytha collaris*), and northern shoveler (*Anas clypeata*). Other avian species of interest observed incidentally included spotted sandpiper

(*Actitis macularia*), loggerhead shrike (*Lanius ludovicianus*), and long-billed curlew (*Numenius americanus*).

4.4.2 Threatened, Endangered, Candidate Species
Bald eagle, a federally and state threatened species, was observed in the study area during the winter (see Section 4.3 above). No other federally listed species were observed in the study area.

Four state candidate species, golden eagle (*Aquila chrysaetos*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike, and northern goshawk, were also recorded on the site. A single golden eagle and numerous sage thrashers were observed during the point count surveys. The northern goshawk and loggerhead shrike were observed during bald eagle roadside surveys.

4.4.3 Non avian species
Eight species of mammals, mule deer, elk, porcupine (*Erethizon dorsatum*), yellow-bellied marmot (*Marmota flaviventris*), least chipmunk (*Eutamius minimus*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), coyote (*Canis latrans*); and one species of reptile, short-horned lizard (*Phrynosoma douglassi*) were observed in the study area during the study period. Mule deer were fairly common on-site (see section 4.1.6 above) but a few individuals of the other species were observed (Table 11).

4.5 Vegetation Surveys

4.5.1 Vegetation Mapping
The vegetation in the study area was mapped and classified into ten types (Figure 4, Table 12). Within the study area, the primary vegetation type is shrub-steppe. This type comprises 53.4 percent of the study area and is primarily found in the eastern and northern parcels. The shrub-steppe type consists of upland areas dominated by shrubs, primarily bitterbrush (*Purshia tridentata*), rigid sagebrush (*Artemesia rigida*), and big sagebrush (*A. tridentata*) with an understory of mixed grasses and forbs. Rigid sagebrush is found on the ridge-tops and exposed areas. Bitterbrush is also common in these areas, but dominates in the drainages and swales where it is generally denser and larger (up to approximately 6 feet tall). Areas of dense shrub steppe in the northern parcel dominated by mature bitterbrush were mapped separately (Figure 4). Interspersed within the shrub steppe are lithosol habitats (areas of exposed shallow, rocky soils) dominated by Sandberg's bluegrass and scattered rigid sagebrush. These inclusions were too small and numerous to be delineated separately from the shrub steppe at the scale of aerial photography used. The lithosol, however, was primarily found on exposed sites. Cattle graze in most of the shrub steppe areas and cattle trails were common; however, the shrubs did not appear stressed or in otherwise poor condition due to cattle grazing. Grass species and grass cover were less common than would be expected though, presumably due to past livestock grazing. Livestock grazing has been observed to result in a decline in large perennial grasses and an increase in annual cheatgrass in shrub steppe habitat (Daubenmire 1970). A few weedy species, including cheatgrass and knapweed (*Centaurea* sp.), were observed in the shrub-steppe type, but native species dominate.

Grasslands make up 34 percent of the study area, primarily in the western portion of the study area. The grasslands are areas dominated by grasses and a variety of forbs. Common species include bluebunch wheatgrass, Sandberg's bluegrass, cheatgrass, bulbous bluegrass (*Poa bulbosa*), and forbs such as lupines (*Lupinus spp*), balsamroots (*Balsamorhiza hookeri* and *B. sagittata*), Hood's phlox (*Phlox hoodii*), and various lomatiums (*Lomatium nudicaule, L. canbyi,* and *L. dissectum*). Soils range from shallow and rocky to moderately deep. The shallow-soiled lithosols are common and are interspersed throughout the grasslands. Sandberg's bluegrass dominates the lithosols. The grassland vegetation types are primarily used for cattle grazing.

For this project, areas classified as "agricultural" were those areas used for irrigated hay meadows that appear to be routinely cut for hay production. While other lands, primarily shrub steppe and grasslands, are used for agricultural purposes (e.g., cattle production), these areas are not considered under the "agricultural" category because they consist primarily of native vegetation. Agricultural areas make up 4.8 percent of the study area primarily in the western half (Figure 4).

Wet meadows are found scattered throughout the study area in drainages and swales, and along the North Branch Canal and around stock ponds. Wet meadows make up approximately 2.9 percent of the study area. These areas dominated by hydrophytic vegetation, including various sedges (*Carex spp.*), grasses, and rushes (*Juncus spp.*) and other herbaceous species such as smartweed (*Polygonum lapathifolium*), monkeyflower (*Mimulus guttatus*), and speedwell (*Veronica* sp.). These areas appear to be saturated or inundated most of the year, either from leakage from the canal or stockponds, surface water flow, or high groundwater. Evidence of occasional cattle use was observed, such as hoof prints in the soft ground, however, these areas did not appear adversely affected by cattle. Weeds were observed in some of the individual wet meadows, primarily chicory (*Cichorium intybus*). Wetland delineations, in accordance with the U.S. Army Corps of Engineers methods, were not conducted in these areas for this study.

The riparian shrub type consists of riparian areas adjacent to perennial or intermittent streams where shrubs are common, but often scattered. This type makes up approximately 2.1 percent of the study area. Common shrub species include black hawthorn (*Crataegus douglasii*) and coyote willow (*Salix exigua*). Various herbaceous species are also present including grasses such as blue grass (*Poa pretensis*), rushes, and forbs such as curly dock (*Rumex crispus*). Weedy species, including chicory and knapweed, were also observed.

The riparian forest type is similar to the riparian shrub type, but the overstory consists of a mix of trees and tall shrubs. The dominant tree and shrub species include cottonwoods (*Populus balsamifera* spp. *trichocarpa*) and various willows (*Salix* spp.). In some locations, the trees and shrub understory are very dense, limiting herbaceous growth. This type makes up approximately 1.4 percent of the study area. Animal trails were noted through some of these areas, and these areas probably receive use by livestock and wildlife for shade and water. As with the wet meadows, standard wetland delineations were not conducted in the riparian types for this study.

A small amount of pine forest occurs in the upper elevations of the northern most parcel, making up approximately 0.6 percent of the study area. The dominant species in these forests is Ponderosa pine (*Pinus ponderosa*).

Small areas of open water are scattered throughout the study area; open water comprises approximately 0.5 percent of the study area. This type includes natural ponds, stock ponds, and a portion of the North Branch Canal within the study area.

Developed areas make up 0.3 percent of the study area. These are areas where human activity has removed or altered natural vegetation, such as residential homes, farm buildings, and yards.

The above descriptions characterize the vegetation types observed and mapped within the 5,200-acre study area during 2002 and 2003. Daubenmire (1970) provides a description of generalized vegetation zones and associations of the eastern Washington shrub steppe based on climate, vegetation structure, and floristics. These vegetation zones and associations represent climax communities, which typically develop over time in the absence of anthropogenic disturbance. The study area is within Daubenmire's *Artemisia tridentata – Agropyron* zone. In an undisturbed condition, this zone is distinguished by big sagebrush (*Artemisia tridentata*) as the principal shrub and bluebunch wheatgrass (*Agropyron [Pseudoroegeneria] spicata*) as the principal grass. The soils in this zone are mostly loams or stony loams. Grazing by cattle and horses in this zone tends to result in a decline in large perennial grasses and an increase in annual cheatgrass. Big sagebrush cover can vary from 5 to 26 percent, and does not seem to be correlated to grazing (Daubenmire 1970).

In addition to big sagebrush, a number of other shrub species may be present in the *Artemisia tridentata – Agropyron* zone in small numbers; these include rabbitbrushes (*Chrysothamnus* spp. and *Ericameria* spp.), threetip sagebrush (*Artemisia tripartita*), and spiny hopsage (*Grayia spinosa*). Bluebunch wheatgrass is supplemented by variable amounts of needle-and-thread grass (*Hesperostipa comata*), Thurber's needlegrass (*Achnatherum thurberianum*), Cusick's bluegrass (*Poa cusickii*), and bottlebrush (*Elymus elymoides*). A low layer of plants consisting of Sandberg's bluegrass, cheatgrass, and flatspine stickseed (*Lappula occidentalis*) may also be present (Daubenmire 1970).

Within the steppe region, a variety of habitats occur that have soils sufficiently unusual in physical or chemical properties to develop unique climax communities that are not necessarily associated with a particular vegetation zone. Lithosol (shallow soils) habitats are one such habitat that is found in the study area. Daubenmire (1970) recognizes a variety of lithosolic plant associations. All are typically composed of a uniform layer of Sandberg's bluegrass, over a crust of mosses and lichens, with a low shrub layer above.

Within most of the shrub-steppe region, including the study area, many of the plant communities have been modified due to numerous disturbance factors. Livestock grazing and other agricultural practices have resulted in a shift in plant community composition in the study area from the climax communities described above. Notable in the study area are a low percentage of

native grass species and grass cover in general and some non-native species and weedy species throughout much of the study area.

4.5.2 Rare Plant Survey

Review of federal and state lists of rare plant species suggest that twenty-one species could occur in the study area based on the type of habitats found there (Table 13). Eighteen of the species are typically found in shrub steppe or grassland habitats and three occur in riparian or wet meadow habitats. Of the twenty-one rare plant species, one (Ute ladies'-tresses) is a federally-listed threatened species, with a state ranking of endangered. Five are federal 'species of concern', with state rankings of threatened or sensitive. The remaining fifteen are listed at the state level as either sensitive or review species. The WNHP database has records for two state sensitive species in or adjacent to the study area. One historic record (1959) for Piper's daisy includes the western portion of the study area, and one current record (1991) for long-sepal globemallow is located adjacent to the eastern end of the study area.

In the study area, the wet meadows provide potential habitat for the federally-listed Ute ladies'-tresses orchid, which flowers in late summer (late July through early September). The wet meadow habitats in the study area were searched for Ute ladies'-tresses orchid in early September 2002. No Ute ladies'-tresses were found.

Surveys for species that occur in shrub steppe and grassland habitats were focused on areas of likely disturbance from the proposed project. The field surveys did not locate any federal species of concern or state listed plant species that might occur in the study area.

5.0 SUMMARY AND DISCUSSION

5.1 Avian Use and Species Diversity

Avian use varied by season, however, over all seasons, the four most common species based on the fixed-point surveys were European starling (6.46 observations per survey), American robin (3.21), mallard (2.40), and western meadowlark (1.13). Together these four species made up more than one-half (57%) of all birds observed during the fixed-point surveys. The high use estimate by mallard was due primarily to large flocks observed in the winter. European starlings were also frequently observed in large flocks but were only observed in about 16% of the surveys. In contrast, western meadowlarks were observed in more than 38% of the surveys but in smaller group sizes. For avian species groups, passerines were by far the most common group with approximately 16.77 observations per survey on average, followed by waterfowl (2.60), raptors (1.15) and corvids (1.10). While the species vary, these statistics reflect common results from other wind plants and proposed wind plants that have been studied, where passerines account for most of the avian use of a site and raptors and other species groups are a distant second.

Over all seasons, the most abundant raptors observed were red-tailed hawk, rough-legged hawk, American kestrel, and northern harrier, although rough-legged hawks were observed primarily in

the winter and early spring. On average approximately one red-tailed hawk was observed every 3 surveys, one rough-legged hawk every 5 surveys, one kestrel every 6 surveys, and one northern harrier every 7 surveys. Raptor use varied by season but was highest in the spring (1.67) and fall (1.16) and dropped in the summer (0.82) and winter (0.96), which is typical of many other wind sites studied and probably due to migrants moving through the area in spring and fall.

Frequency of occurrence provides a relative estimate of the avian diversity of the study area. Species diversity was slightly higher than other wind areas studied in Washington and Oregon with the majority of use scattered among several species as opposed to only one or two. Only one species, western meadowlark (38.89%), was observed in more than one-third (33%) of the surveys. There were several species observed in approximately one-quarter (25%) of the surveys including, black-billed magpie, red-tailed hawk, common raven, American robin, killdeer, and vesper sparrow; and eight others, European starling, horned lark, Brewer's blackbird, rough-legged hawk, American kestrel, northern harrier, American goldfinch, and California quail, observed in more than 10% of the surveys (see Table 4 for percents). The relatively moderate species diversity for the area is likely the result of the mix of vegetation types present (see Figure 4). The survey points were established in a fashion that allowed observation in all habitats present. All of these species are common open-land species typical of habitats in the study area.

5.2 Risk of Turbine Collision

5.2.1 Exposure Index

The species with the highest exposure indices for the site were European starling, mallard, and American robin. European starling was the most abundant species observed, due to numerous large flocks and was observed flying in the zone of risk about two-thirds of the time. Mallards were also observed in numerous large flocks (which related to high use) as well as most flight observations being in the zone of risk. American robins, while observed flying in the zone of risk less than half the time, were one of the most common species on site. Mortality studies at other wind plants have found starlings, mallards, and robins but not in high numbers (see Erickson *et al.* 2001). European starling, a non-native species, is not protected and there is little or no concern over potential fatalities of this species. There has been some waterfowl mortality reported at wind plants, however, it does not appear to be substantial (see Section 5.2.4).

5.2.2 Raptors

Compared to other wind plants that have been studied, raptor use for the site is above average with slightly more than one raptor (1.15) observed each survey. The majority of the raptor sightings were red-tailed hawks during the spring, summer, and fall and rough-legged hawks during the winter. For comparison, raptor use at several existing or proposed wind plants studied with the same methods[2] was generally lower. For example, raptor use (per 30-minute survey) at the Vansycle Wind Plant (OR) was approximately 0.55 raptors; Condon Wind Plant (OR) was approximately 0.49 raptors; at the Stateline Wind Plant (WA/OR) approximately 0.90; at the

[2] Fixed-point surveys were conducted following the same methods at all wind plants but some had variable survey duration. The calculated use at these wind plants was standardized to 30-minute duration surveys under the assumption that raptor observations were uniform across time for each survey period.

Klondike Wind Plant (OR) approximately 0.70; at the Buffalo Ridge Wind Plant (MN) approximately 0.74; and at the Foote Creek Rim Wind Plant (WY) raptor use was approximately 1.10 raptors. Raptor use at two sites in nearby Benton County, Washington, was also slightly lower: the Maiden wind site was approximately 0.56 and the Nine Canyon wind plant was approximately 0.40 raptors per survey. Raptor use at the proposed nearby Kittitas Valley wind project site, was 1.01, however this was for only 20-minute surveys.

Raptor mortality at other newer generation wind plants is very low. The estimate of raptor mortality at the Foote Creek Rim Wind Plant (WY) is approximately 0.03 raptors per turbine per year based on a three-year study of 69 turbines (Young *et al*. 2003). No raptor mortality was observed at the Vansycle Wind Plant (Erickson *et al*. 2000) or the Klondike Wind Plant (Johnson *et al.* 2003) during the first years of study; and 0.001 raptors per turbine per year were found at the Buffalo Ridge Wind Plant (MN) during a four-year study (Erickson *et al*. 2001). Raptor mortality at the Stateline wind project (WA/OR) is one of the highest observed and is approximately 0.05 raptors per turbine per year based on an 18 month study (Erickson et al. 2003).

Considering these mortality results as well as raptor use estimates at these wind plants, it is estimated that potential raptor mortality at the proposed project would be approximately that of the Foote Creek Rim wind plant, or approximately 0.03 raptors per turbine per year. The Foote Creek Rim wind plant is the most similar to the Desert Claim site in terms of raptor use and it also has some similar topographic features. The Foote Creek Rim wind plant is located on a mesa with steep sloping sides. The eastern portion of the Desert Claim site also contains a steep slope feature that may influence raptor use (see Figure 2). Using the Foote Creek Rim raptor mortality rate, a range of approximately 3 to 4 raptor fatalities could occur per year at the Desert Claim wind project if 120 turbines are constructed.

5.2.3 Passerines

Passerines have been the most abundant avian fatality at other wind plants studied (see Johnson *et al.* 2000, Young *et al.* 2003, Erickson *et al.* 2000), often comprising more than 80% of the avian fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines make up the vast majority of the avian observations on-site, it is expected passerines would make up the largest proportion of fatalities. Common species such as European starling, western meadowlarks, and American robin (all confirmed casualties at other wind plants) would be most at risk. Nocturnal migrating species may also be affected, but would not be expected in large numbers based on data collected at other wind plants [i.e., no large mortality events documented at wind plants (Erickson *et al.* 2001)].

Based on post-construction mortality monitoring at other newer generation wind plants, passerine mortality has been somewhat variable. Projected impacts for the proposed project are primarily based on data collected at the Vansycle Wind Plant (Erickson *et al*. 2000), the Foote Creek Rim Wind Plant (Young *et al*. 2003), the Buffalo Ridge Wind Plant (Johnson *et al.* 2000); and the more recently studied Klondike (Johnson *et al.* 2003) and Stateline (Erickson et al. 2003) Wind Plants where fatality estimates have been made for all birds, including passerines, and adjusted for scavenging and searcher efficiency.

An extensive post-construction study of two wind plants on Buffalo Ridge (MN) with 350 total turbines was conducted from 1996 through 1999. Total annual mortality was estimated to average approximately 2.8 birds per turbine (Johnson *et al*. 2000). Based on a three year study at Foote Creek Rim (WY), the total annual mortality associated with 69 turbines was estimated to be approximately 1.5 birds per turbine per year (Young *et al.* 2003). At the Vansycle Wind Project, only 12 avian fatalities were located during the first year of operation of 38 turbines. Total estimated mortality was 24 birds per year or approximately 0.6 bird per turbine per year (Erickson *et al*. 2000). Estimates from the Klondike Wind Plant were 1.42 birds per turbine per year for all birds (Johnson *et al.* 2003) based on one year of study, and estimates for the Stateline Wind Plant for all birds was 1.7 birds per turbine per year based on the first 18 months of study (Erickson et al. 2003).

Actual levels of mortality that would result from the proposed project are unknown and could be higher or lower depending on patterns of movements through the area. The per turbine mortality rate for all birds for the proposed project is expected to be in the mid range or approximately 1.2 to 1.8 birds per turbine per year. If these estimates are applied to the proposed project, the range of potential bird mortality would be expected to fall between approximately 140 and 220 birds per year if 120 turbines are constructed. Because of the high use and diversity estimates by passerines in the study area, passerine fatalities are expected to comprise the majority of the avian mortality for the project.

Carcass search studies at Foote Creek Rim (WY) have found passerine casualties associated with guyed met towers. Based on searches of five permanent guyed met towers at Foote Creek Rim over a three-year period, it was estimated that these towers resulted in approximately 8.0 avian casualties per tower per year, the vast majority of which were passerines (Young *et al*. 2003). During searches of a free-standing met tower at the Klondike Wind Plant (OR), no avian fatalities were found after one-year of study (Johnson *et al.* 2003). As currently planned, the proposed project would have 4 permanent guyed met towers. Based on the result of the Foote Creek Rim study, these 4 towers could result in up to approximately 30 avian fatalities per year.

5.2.4 Waterfowl

Some waterfowl mortality has been documented at other wind plants. The Klondike wind plant in Oregon had relatively high use by Canada goose and two fatalities were found in the first year of monitoring (Johnson et al. 2003). The Buffalo Ridge wind plant in Minnesota also had relatively high waterfowl use with few mortalities (Johnson et al. 2000a). The most common waterfowl species observed in the project area was mallard although Canada goose and northern pintail were also seen in the winter and a variety of other species were seen incidentally in the study area (see Table 11). While mallards were seen year round, the majority of waterfowl use was during the winter season. Some waterfowl mortality could be expected, however, it would likely be with the most common species, mallard, and is not expected to be substantial. Based on the wind monitoring data from the site, the winter months are the least windy and therefore the turbines would be operating less than in the spring, summer, and fall. For example, on average during the months of December, January, and February, the percent of hours when turbines would be operating at 100% capacity is approximately 14.9%. In contrast, during the months of

June, July, and August the percent of hours of 100% operation would be approximately 45.5%, on average.

5.2.5 Other Groups/Species

Other avian groups (e.g., upland game birds, doves, shorebirds) occur in relatively low numbers within the study area and mortality would be expected to be low. Although common snipe occurred in low numbers as compared to other species, they appear to be abundant on site when compared to other wind sites. This species was often observed flying in the zone of risk yet it is unknown if this species is vulnerable to turbine collision. Other species only observed during migration may be at risk; however, mortality would be expected to be low given the low use estimates by other species.

5.3 Raptor Nesting

The total study area surveyed for raptor nests was approximately 52 square miles (134 km^2). Nest density for buteos (red-tailed hawk) in this area was approximately 0.28 nest/mi^2 (0.11 nest/km^2) and for all raptors (buteos, owls) was approximately 0.34nest/km^2 (0.13 nest/km^2). This index of raptor nest density is within the range of other wind plants that have been studied in the Oregon/Washington region. For example, raptor nest density within a 2-mile buffer around the Stateline Wind Plant (WA/OR) is 0.20 nest/mi^2 (0.08 nest/km^2) (URS and WEST 2001). Nest density within a 5-mile buffer around the proposed Maiden wind farm was approximately 0.16 nest/mi^2 (0.06 nest/km^2) (Young *et al*. 2002a) and nest density around the proposed Combine Hills wind plant (Umatilla County, Oregon) is approximately 0.24 nest/mi^2 (0.09 nest/km^2) (Young *et al.* 2002b).

The good raptor nesting habitat within the project area is along the Wilson Creek riparian corridor east of the site and along the numerous powerlines running through the site. The nests within the site, and therefore in closer proximity to the proposed turbines, may be more likely affected by the project through disturbance or displacement. Once a final project layout is established, the proximity of raptor nests to turbines can be determined.

5.4 Bald Eagles

The Kittitas Valley and Yakima River riparian corridor is wintering habitat for bald eagles. This area may be occupied by as many as 35-50 bald eagles based on the WDFW Priority Habitats and Species database. Winter bald eagle surveys and the winter fixed-point surveys documented bald eagle use in and around the proposed wind project. The primary period of occupation appears to be from approximately February through early April. No large communal roost sites were located during the surveys but it appears as if bald eagle may opportunistically roost in isolated trees near suitable foraging areas and along the Yakima River. Important winter foraging opportunities appear to be carrion (dead cows) from livestock operations in the valley and possibly winter killed big game. In addition, early spring calving operations provide foraging opportunities from the calving by-products (after birth) left in the fields. Most of the winter bald eagle use was concentrated south and east of the project site in areas with a large

livestock presence; however, there were some observations in the project area. Currently the project area does not contain good winter foraging opportunities for bald eagles and they are not commonly attracted to the area.

Based on the fixed point surveys, actual winter use estimates for bald eagles were lower than other common raptors (red-tailed hawks, rough-legged hawks), however, they are still at risk of potential collision related fatalities from the wind plant. Since there appears to be little to attract bald eagles to the site, bald eagle exposure is most likely related to eagles passing through the project to adjacent foraging areas and their calculated exposure index was relatively low (see Table 7). In addition, wind speeds and duration at the site are typically lowest during the months of October through February but begin to pick up in March and April. During the early part of the bald eagle occupation period the wind turbines will not be operating as much as during the early spring. The highest wind speeds and duration at the site are during the summer and early fall periods when bald eagles are not present in the area. To date, there have been no reported bald eagle fatalities at wind plants (see Erickson et al. 2001). Potential bald eagle mortality from the project is expected to be very low but there is the possibility that it could occur.

5.5 Big Game Species

Mule deer was the only species of big game that was observed regularly on site. Mule deer were seen year round, however, there was an increase in the number of observations in the winter time. The WDFW maps the area as winter range for mule deer. Additional information from the WDFW, suggests that elk may also use the project area although apparently in very low numbers and an elk migration corridor has been identified which encroaches on the north portion of the project. Only one group of elk was observed northeast of the site during the study period.

There is little information regarding wind plant effects on big game species. The Foote Creek Rim Wind Plant (WY) appeared to have no effect on pronghorn (*Antilocapra americana*) (Johnson *et al.* 2000a). Pronghorn occurred in the area in low numbers and continued to use the wind plant area following construction of the project. It is expected that deer in the project area could potentially be disturbed by project construction and operation and maintenance. Deer that use the site occupy most vegetation types in the area. They were observed in the native grassland and riparian habitats as well as the shrub steppe areas. During the construction period, deer would likely be displaced from the project site due to the influx of humans and heavy construction equipment and associated disturbance. During standard O&M of the facility there may be temporary disturbances from vehicle and human traffic. Individual mule deer would likely seek more remote areas with less disturbance, such as the hills north of the project. Construction-related disturbance and displacement would be temporary in nature; O&M disturbance would also be temporary and for shorter periods of time. Because of the extent of suitable habitat in the region, temporary loss of habitat from project construction is considered a minor effect and once construction is complete it is expected that deer would become habituated to the wind turbines and again occupy and potentially seek un-hunted areas within the wind plant. Should the facility eventually result in a refuge for deer (and elk) due to reduced hunting pressure, seasonal use of the wind plant by big game may increase.

5.6 Vegetation Impacts

Based on a preliminary map showing proposed facility locations, the vegetation types that are expected to be impacted are primarily shrub steppe and grasslands. Most of the turbines would be located in these two habitat types. Associated linear facilities, such as roads and electric lines, are likely to cross other habitat types such as wet meadows and the riparian vegetation types. No facilitates are proposed for the pine forest vegetation type. Once a formal project layout is established, the extent of impacts to vegetation types can be determined.

Due to the absence of known populations within the study area, no project-related impacts are anticipated to any federally endangered, threatened, proposed, or candidate plant species. Likewise, no project-related impacts are predicted for any Washington State endangered, threatened, sensitive, or review plant species.

5.7 Mitigation and Monitoring

As currently proposed the wind project will be constructed in several vegetation types, including grassland, shrub steppe, and hay meadows. Based on the final wind project layout, native steppe vegetation types will be affected by the project. Mitigation and monitoring recommendations are therefore based on impacts to this vegetation type as well as potential avian resources. The following mitigation and monitoring recommendations are based primarily on measures that have been implemented at other newer generation wind plants and in particular those in the Washington and Oregon region.

5.7.1 Technical Advisory Committee

It is recommended that a Technical Advisory Committee (TAC) be formed to implement and evaluate a mitigation and monitoring program and determine the need for further studies or mitigation measures once the project is operational. The TAC should be composed of representatives from Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Kittitas County, landowners, and the project owner/developer. The role of the TAC will be to determine and coordinate appropriate mitigation measures, monitor impacts to wildlife and vegetation, and address issues that arise regarding wildlife impacts during operation of the wind plant.

5.7.2 Mitigation Measures

The primary impacts associated with the project are expected to be loss of shrub steppe habitat, fatalities of birds, and potential displacement effects on mule deer. The following are potential mitigation measures for these impacts:

- Sensitive wildlife areas such as the riparian corridors and raptor nest sites should be mapped, flagged, and/or identified to all contractors working on-site and should be designated as no disturbance zones during the construction phase.

- Measures should be taken to prevent the spread of noxious weeds such as promptly re-seeding all disturbed areas with native plant mixes and using hay bales which are certified as weed free.

- During project construction, best management practices should be employed to reduce peripheral impacts to adjacent native vegetation and habitats and to minimize the construction footprint.

- A site management plan should be developed to, at a minimum, identify sensitive wildlife areas (e.g., raptor nests), provide adequate on-site waste disposal, and establish fire management and erosion control procedures.

- Raptor nests within ½ mile of construction areas should be monitored for activity prior to construction to determine the need for construction timing restrictions around active nests.

- All power and communication lines on-site should be buried underground where feasible.

- All overhead power line poles should be equipped with anti perching devices.

- Permanent met towers on-site should be equipped with Bird Flight Diverters to minimize the potential for avian collisions with guy wires.

- Once the final turbine layout is available, consideration should be given to setting turbine locations back at least 50 meters from the rim edge of steep slopes within the E1/2 of Sections 26 and 35, T19N, R18E.

5.7.3 Monitoring

A post construction monitoring study is recommended for the project to quantify impacts to avian species and assess the need for additional mitigation measures. The post-construction monitoring plan should be developed in coordination with the TAC. The monitoring plan for the project should, at a minimum, contain the following components:

- One year of standardized fatality monitoring involving carcass searches, scavenger removal trials, and searcher efficiency trials.

- A standardized procedure for operations and maintenance personnel for reporting incidental fatalities or injured birds for the life of the project.

The protocol for the fatality monitoring study should be similar to protocols used at other newer generation wind plants in northeastern Oregon and southwestern Washington. In addition, it is also recommended that consideration be given to developing, in cooperation with other industry participants, a focused monitoring study that addresses a specific question regarding impacts

from wind plants. For example, the effects of different lighting schemes on turbines, or bird flight diverters on guy wires, on avian mortality has not been experimentally tested. If an operational monitoring study is required, a simple study design alternating treatments on turbines or met towers could address these issues in detail.

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Table 1. Avian species observed during fixed-point surveys (March 22, 2002 – March 13, 2003).

Species/Group	Spring		Summer		Fall		Winter		Total	
	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups
Waterfowl/Waterbirds	**47**	**8**	**5**	**4**	**1**	**1**	**479**	**15**	**532**	**28**
Canada goose	0	0	0	0	0	0	32	2	32	2
mallard	47	8	2	2	0	0	443	12	492	22
northern pintail	0	0	0	0	0	0	4	1	4	1
great blue heron	0	0	3	2	1	1	0	0	4	3
Shorebirds	**54**	**37**	**18**	**14**	**4**	**3**	**8**	**3**	**84**	**57**
killdeer	40	23	12	8	4	3	8	3	64	37
common snipe	14	14	6	6	0	0	0	0	20	20
Corvids	**38**	**29**	**12**	**9**	**33**	**23**	**110**	**53**	**193**	**114**
American crow	1	1	2	2	0	0	5	2	8	5
black-billed magpie	21	15	5	3	19	16	55	24	100	58
common raven	16	13	5	4	14	7	50	27	85	51
Upland Gamebirds	**4**	**3**	**9**	**6**	**31**	**5**	**50**	**7**	**94**	**21**
California quail	0	0	9	6	31	5	44	5	84	16
gray partridge	2	1	0	0	0	0	5	1	7	2
ring-necked pheasant	2	2	0	0	0	0	1	1	3	3
Doves										
mourning dove	0	0	3	2	2	2	0	0	5	4
Raptors	**57**	**55**	**30**	**29**	**39**	**36**	**67**	**65**	**193**	**185**
Accipiters	*1*	*1*	*0*	*0*	*5*	*5*	*3*	*3*	*9*	*9*
sharp-shinned hawk	0	0	0	0	3	3	0	0	3	3
Cooper's hawk	1	1	0	0	2	2	3	3	6	6
Buteos	*33*	*33*	*14*	*13*	*8*	*8*	*41*	*41*	*96*	*95*
red-tailed hawk	19	19	12	11	6	6	23	23	60	59
rough-legged hawk	14	14	0	0	2	2	18	18	34	34
unidentified buteo	0	0	2	2	0	0	0	0	2	2
Eagles	*2*	*2*	*0*	*0*	*0*	*0*	*12*	*10*	*14*	*12*
bald eagle	2	2	0	0	0	0	11	9	13	11
golden eagle	0	0	0	0	0	0	1	1	1	1
Falcons	*9*	*8*	*8*	*8*	*6*	*5*	*3*	*3*	*26*	*24*
American kestrel	9	8	7	7	6	5	1	1	23	21
prairie falcon	0	0	1	1	0	0	2	2	3	3
Other Raptors	*12*	*11*	*8*	*8*	*20*	*18*	*8*	*8*	*48*	*45*
great-horned owl	3	3	0	0	1	1	3	3	7	7
northern harrier	4	3	0	0	14	13	5	5	23	21
turkey vulture	5	5	8	8	5	4	0	0	18	17
Passerines	**500**	**112**	**320**	**122**	**497**	**73**	**1558**	**85**	**2875**	**392**
American goldfinch	0	0	17	6	26	5	84	6	127	17
American pipit	0	0	0	0	11	2	0	0	11	2
American robin	165	7	13	5	132	14	225	17	535	43
bank swallow	4	2	0	0	0	0	0	0	4	2

Table 1. Avian species observed during fixed-point surveys (March 22, 2002 – March 13, 2003).

Species/Group	Spring		Summer		Fall		Winter		Total	
	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups
barn swallow	8	3	10	2	8	1	0	0	26	6
black-capped chickadee	0	0	1	1	4	2	14	5	19	8
Brewer's blackbird	40	9	69	19	0	0	0	0	109	28
Brewer's sparrow	0	0	3	2	0	0	0	0	3	2
Bullock's oriole	4	3	4	4	0	0	0	0	8	7
cedar waxwing	2	1	12	4	13	1	0	0	27	6
chipping sparrow	1	1	0	0	0	0	0	0	1	1
dark-eyed junco	0	0	0	0	11	2	104	7	115	9
eastern kingbird	1	1	4	4	1	1	0	0	6	6
European starling	65	6	76	8	186	6	883	13	1210	33
golden-crowned kinglet	0	0	0	0	4	1	0	0	4	1
gray-crowned rosy finch	0	0	0	0	9	2	0	0	9	2
horned lark	8	3	5	3	21	10	19	9	53	25
house finch	0	0	0	0	0	0	78	2	78	2
house wren	1	1	0	0	0	0	0	0	1	1
lark sparrow	0	0	2	1	0	0	0	0	2	1
Lincoln's sparrow	0	0	0	0	1	1	0	0	1	1
mountain bluebird	2	1	5	3	5	1	1	1	13	6
Nashville Warbler	3	1	0	0	0	0	0	0	3	1
northern shrike	0	0	0	0	2	2	8	8	10	10
orange-crowned warbler	2	1	0	0	0	0	0	0	2	1
red-winged blackbird	44	6	0	0	0	0	5	3	49	9
ruby-crowned kinglet	0	0	0	0	2	1	1	1	3	2
sage thrasher	3	3	10	10	0	0	0	0	13	13
savannah sparrow	0	0	0	0	8	2	0	0	8	2
song sparrow	2	2	1	1	0	0	0	0	3	3
spotted towhee	5	2	1	1	2	1	2	1	10	5
tree swallow	0	0	7	4	0	0	0	0	7	4
unidentified empidonax	2	1	0	0	0	0	0	0	2	1
unidentified finch	0	0	7	1	0	0	120	1	127	2
unidentified passerine	0	0	0	0	0	0	3	1	3	1
unidentified swallow	0	0	3	1	1	1	0	0	4	2
varied thrush	0	0	0	0	0	0	1	1	1	1
vesper sparrow	27	15	29	17	8	3	0	0	64	35
violet-green swallow	2	1	0	0	0	0	0	0	2	1
western kingbird	4	1	7	4	0	0	0	0	11	5
western meadowlark	91	38	31	20	28	10	9	8	159	76
western tanager	1	1	3	1	0	0	0	0	4	2
white-crowned sparrow	0	0	0	0	14	4	0	0	14	4
winter wren	0	0	0	0	0	0	1	1	1	1
yellow-rumped warbler	13	2	0	0	0	0	0	0	13	2
Other	**4**	**4**	**2**	**2**	**1**	**1**	**9**	**8**	**16**	**15**
common nighthawk	0	0	1	1	0	0	0	0	1	1
downy woodpecker	1	1	0	0	0	0	0	0	1	1
northern flicker	3	3	0	0	1	1	9	8	13	12
unid'd. hummingbird	0	0	1	1	0	0	0	0	1	1
Total	**704**	**248**	**399**	**188**	**608**	**144**	**2281**	**236**	**3992**	**816**

Table 2. Estimated mean use (number of observations per 30-minute survey) for species observed within 800m of the survey point for fixed-point surveys (March 22, 2002 – March 13, 2003).

	Spring Use		Summer Use		Fall Use		Winter Use		Overall Use	
Species/Group	mean	st dev	mean	st dev	mean	st dev	mean	st dev	mean	st dev
Waterfowl/Waterbird	**1.306**	**1.853**	**0.156**	**0.297**	**0.031**	**0.088**	**7.321**	**11.61**	**2.605**	**7.047**
Canada goose	0.000	0.000	0.000	0.000	0.000	0.000	0.524	1.173	0.160	0.673
mallard	1.306	1.853	0.063	0.177	0.000	0.000	6.736	10.69	2.399	6.499
northern pintail	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.201	0.019	0.111
great blue heron	0.000	0.000	0.094	0.265	0.031	0.088	0.000	0.000	0.028	0.131
Shorebirds	**1.537**	**0.659**	**0.573**	**1.072**	**0.125**	**0.231**	**0.121**	**0.270**	**0.576**	**0.842**
killdeer	1.148	0.500	0.385	0.653	0.125	0.231	0.121	0.270	0.438	0.598
common snipe	0.389	0.546	0.188	0.438	0.000	0.000	0.000	0.000	0.139	0.366
Corvids	**1.120**	**0.617**	**0.375**	**0.443**	**1.000**	**1.150**	**1.691**	**0.829**	**1.102**	**0.905**
American crow	0.028	0.083	0.063	0.116	0.000	0.000	0.076	0.251	0.044	0.152
black-billed magpie	0.630	0.415	0.156	0.297	0.563	0.417	0.833	0.569	0.572	0.496
common raven	0.463	0.334	0.156	0.229	0.438	0.853	0.782	0.612	0.487	0.584
Upland Gamebirds	**0.111**	**0.182**	**0.281**	**0.432**	**0.969**	**1.925**	**0.797**	**1.264**	**0.549**	**1.169**
California quail	0.000	0.000	0.281	0.432	0.969	1.925	0.706	1.156	0.494	1.140
gray partridge	0.056	0.167	0.000	0.000	0.000	0.000	0.076	0.251	0.037	0.160
ring-necked pheasant	0.056	0.110	0.000	0.000	0.000	0.000	0.015	0.050	0.019	0.063
Doves										
mourning dove	0.000	0.000	0.094	0.186	0.063	0.116	0.000	0.000	0.035	0.106
Raptors/Vultures	**1.667**	**1.166**	**0.823**	**0.627**	**1.156**	**0.681**	**0.964**	**0.448**	**1.151**	**0.802**
Accipiters	*0.028*	*0.083*	*0.000*	*0.000*	*0.156*	*0.229*	*0.052*	*0.089*	*0.057*	*0.132*
sharp-shinned hawk	0.000	0.000	0.000	0.000	0.094	0.186	0.000	0.000	0.021	0.092
Cooper's hawk	0.028	0.083	0.000	0.000	0.063	0.116	0.052	0.089	0.037	0.084
Buteos	*0.954*	*1.075*	*0.385*	*0.324*	*0.240*	*0.191*	*0.609*	*0.422*	*0.563*	*0.644*
red-tailed hawk	0.565	0.422	0.385	0.324	0.188	0.177	0.333	0.217	0.370	0.315
rough-legged hawk	0.389	0.719	0.000	0.000	0.052	0.099	0.276	0.326	0.193	0.419
Eagles	*0.056*	*0.110*	*0.000*	*0.000*	*0.000*	*0.000*	*0.130*	*0.266*	*0.054*	*0.162*
bald eagle	0.056	0.110	0.000	0.000	0.000	0.000	0.115	0.223	0.049	0.140
golden eagle	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.050	0.005	0.028
Falcons										
American kestrel	0.269	0.246	0.219	0.281	0.188	0.372	0.015	0.050	0.162	0.262
prairie falcon	0.000	0.000	0.031	0.088	0.000	0.000	0.030	0.067	0.016	0.056
Other Raptors										
great-horned owl	0.093	0.141	0.000	0.000	0.031	0.088	0.048	0.083	0.045	0.096
northern harrier	0.130	0.229	0.000	0.000	0.385	0.324	0.079	0.158	0.142	0.244
turkey vulture	0.139	0.182	0.188	0.177	0.156	0.297	0.000	0.000	0.111	0.193
Passerines	**14.898**	**10.41**	**10.28**	**8.747**	**14.87**	**16.21**	**24.41**	**32.31**	**16.774**	**20.51**
American goldfinch	0.000	0.000	0.563	0.637	0.656	0.972	1.279	2.853	0.662	1.682
American pipit	0.000	0.000	0.000	0.000	0.344	0.640	0.000	0.000	0.076	0.321
American robin	4.583	8.544	0.417	0.496	3.760	3.681	3.730	5.016	3.214	5.390
bank swallow	0.148	0.294	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.155
barn swallow	0.269	0.580	0.313	0.637	0.250	0.707	0.000	0.000	0.192	0.525

Table 2. Estimated mean use (number of observations per 30-minute survey) for species observed within 800m of the survey point for fixed-point surveys (March 22, 2002 – March 13, 2003).

	Spring Use		Summer Use		Fall Use		Winter Use		Overall Use	
Species/Group	mean	st dev	mean	st dev	mean	st dev	mean	st dev	mean	st dev
black-capped chickadee	0.000	0.000	0.031	0.088	0.104	0.198	0.218	0.320	0.097	0.216
Brewer's blackbird	1.361	2.154	2.219	2.883	0.000	0.000	0.000	0.000	0.833	1.900
Brewer's sparrow	0.000	0.000	0.094	0.186	0.000	0.000	0.000	0.000	0.021	0.092
Bullock's oriole	0.148	0.444	0.135	0.199	0.000	0.000	0.000	0.000	0.067	0.241
cedar waxwing	0.074	0.222	0.375	0.423	0.406	1.149	0.000	0.000	0.192	0.587
chipping sparrow	0.028	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.042
dark-eyed junco	0.000	0.000	0.000	0.000	0.281	0.525	1.706	2.839	0.584	1.715
eastern kingbird	0.037	0.111	0.125	0.189	0.031	0.088	0.000	0.000	0.044	0.117
European starling	2.130	3.876	2.375	2.961	5.813	11.05	13.45	29.42	6.464	17.35
golden-crowned kinglet	0.000	0.000	0.000	0.000	0.125	0.354	0.000	0.000	0.028	0.167
gray-crowned rosy finch	0.000	0.000	0.000	0.000	0.281	0.795	0.000	0.000	0.063	0.375
horned lark	0.222	0.423	0.167	0.236	0.615	0.611	0.300	0.359	0.321	0.437
house finch	0.000	0.000	0.000	0.000	0.000	0.000	1.409	4.510	0.431	2.499
house wren	0.028	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.042
lark sparrow	0.000	0.000	0.063	0.177	0.000	0.000	0.000	0.000	0.014	0.083
Lincoln's sparrow	0.000	0.000	0.000	0.000	0.031	0.088	0.000	0.000	0.007	0.042
mountain bluebird	0.056	0.167	0.177	0.269	0.156	0.442	0.015	0.050	0.093	0.256
Nashville Warbler	0.083	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.125
northern shrike	0.000	0.000	0.000	0.000	0.052	0.099	0.133	0.125	0.052	0.099
orange-crowned warbler	0.056	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.083
red-winged blackbird	1.222	2.185	0.000	0.000	0.000	0.000	0.076	0.156	0.329	1.172
ruby-crowned kinglet	0.000	0.000	0.000	0.000	0.063	0.177	0.015	0.050	0.019	0.087
sage thrasher	0.083	0.125	0.344	0.297	0.000	0.000	0.000	0.000	0.097	0.201
savannah sparrow	0.000	0.000	0.000	0.000	0.250	0.707	0.000	0.000	0.056	0.333
song sparrow	0.056	0.110	0.031	0.088	0.000	0.000	0.000	0.000	0.021	0.070
spotted towhee	0.139	0.417	0.031	0.088	0.063	0.177	0.030	0.101	0.065	0.229
tree swallow	0.000	0.000	0.240	0.280	0.000	0.000	0.000	0.000	0.053	0.161
unid'd empidonax	0.056	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.083
unidentified finch	0.000	0.000	0.219	0.619	0.000	0.000	1.818	6.030	0.604	3.338
unidentified passerine	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.181	0.017	0.100
unidentified swallow	0.000	0.000	0.094	0.265	0.031	0.088	0.000	0.000	0.028	0.131
varied thrush	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.060	0.006	0.033
vesper sparrow	0.861	0.847	0.938	0.691	0.250	0.535	0.000	0.000	0.479	0.697
violet-green swallow	0.056	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.083
western kingbird	0.148	0.444	0.219	0.248	0.000	0.000	0.000	0.000	0.086	0.258
western meadowlark	2.657	1.928	1.021	0.950	0.875	1.150	0.136	0.306	1.127	1.500
western tanager	0.037	0.111	0.094	0.265	0.000	0.000	0.000	0.000	0.030	0.181
white-crowned sparrow	0.000	0.000	0.000	0.000	0.438	0.741	0.000	0.000	0.097	0.379
winter wren	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.050	0.005	0.028
yellow-rumped warbler	0.361	1.083	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.542
Other Birds	**0.111**	**0.182**	**0.063**	**0.116**	**0.031**	**0.088**	**0.152**	**0.216**	**0.095**	**0.165**
common nighthawk	0.000	0.000	0.031	0.088	0.000	0.000	0.000	0.000	0.007	0.042
downy woodpecker	0.028	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.042
northern flicker	0.083	0.177	0.000	0.000	0.031	0.088	0.152	0.216	0.074	0.160
unid'd hummingbird	0.000	0.000	0.031	0.088	0.000	0.000	0.000	0.000	0.007	0.042
Overall										

Table 3. Estimated percent composition (mean use divided by total use for all species) for each species observed within 800 m of the survey point (March 22, 2002 – March 13, 2003).

Species/Group	Spring % Comp	Summer % Comp	Fall % Comp	Winter % Comp	Overall % Comp
Waterfowl/Waterbirds	**6.29**	**1.24**	**0.17**	**20.65**	**11.38**
Canada goose	0.00	0.00	0.00	1.48	0.70
mallard	6.29	0.49	0.00	19.00	10.48
northern pintail	0.00	0.00	0.00	0.17	0.08
great blue heron	0.00	0.74	0.17	0.00	0.12
Shorebirds	**7.41**	**4.53**	**0.68**	**0.34**	**2.52**
killdeer	5.53	3.05	0.68	0.34	1.91
common snipe	1.87	1.48	0.00	0.00	0.61
Corvids	**5.40**	**2.97**	**5.48**	**4.77**	**4.82**
American crow	0.13	0.49	0.00	0.21	0.19
black-billed magpie	3.03	1.24	3.08	2.35	2.50
common raven	2.23	1.24	2.40	2.20	2.13
Upland Gamebirds	**0.54**	**2.22**	**5.31**	**2.25**	**2.40**
California quail	0.00	2.22	5.31	1.99	2.16
gray partridge	0.27	0.00	0.00	0.21	0.16
ring-necked pheasant	0.27	0.00	0.00	0.04	0.08
Doves					
mourning dove	0.00	0.74	0.34	0.00	0.15
Raptors	**8.03**	**6.51**	**6.34**	**2.72**	**5.03**
Accipiters	*0.13*	*0.00*	*0.86*	*0.15*	*0.25*
sharp-shinned hawk	0.13	0.00	0.34	0.15	0.16
Cooper's hawk	0.00	0.00	0.51	0.00	0.09
Buteos	*4.60*	*3.05*	*1.31*	*1.72*	*2.46*
red-tailed hawk	2.72	3.05	1.03	0.94	1.62
rough-legged hawk	1.87	0.00	0.29	0.78	0.84
Eagles	*0.27*	*0.00*	*0.00*	*0.37*	*0.23*
bald eagle	0.27	0.00	0.00	0.32	0.21
golden eagle	0.00	0.00	0.00	0.04	0.02
Falcons					
American kestrel	1.29	1.73	1.03	0.04	0.71
prairie falcon	0.00	0.25	0.00	0.09	0.07
Other Raptors					
great horned owl	0.45	0.00	0.17	0.14	0.20
northern harrier	0.62	0.00	2.11	0.22	0.62
turkey vulture	0.67	1.48	0.86	0.00	0.49
Passerines	**71.80**	**81.30**	**81.51**	**68.85**	**73.29**
American goldfinch	0.00	4.45	3.60	3.61	2.89
American pipit	0.00	0.00	1.88	0.00	0.33
American robin	22.09	3.29	20.61	10.52	14.04
bank swallow	0.71	0.00	0.00	0.00	0.16
barn swallow	1.29	2.47	1.37	0.00	0.84

Table 3. Estimated percent composition (mean use divided by total use for all species) for each species observed within 800 m of the survey point (March 22, 2002 – March 13, 2003).

Species/Group	Spring % Comp	Summer % Comp	Fall % Comp	Winter % Comp	Overall % Comp
black-capped chickadee	0.00	0.25	0.57	0.62	0.42
Brewer's blackbird	6.56	17.55	0.00	0.00	3.64
Brewer's sparrow	0.00	0.74	0.00	0.00	0.09
Bullock's oriole	0.71	1.07	0.00	0.00	0.29
cedar waxwing	0.36	2.97	2.23	0.00	0.84
chipping sparrow	0.13	0.00	0.00	0.00	0.03
dark-eyed junco	0.00	0.00	1.54	4.81	2.55
eastern kingbird	0.18	0.99	0.17	0.00	0.19
European starling	10.26	18.78	31.85	37.95	28.24
golden-crowned kinglet	0.00	0.00	0.68	0.00	0.12
gray-crowned rosy finch	0.00	0.00	1.54	0.00	0.27
horned lark	1.07	1.32	3.37	0.85	1.40
house finch	0.00	0.00	0.00	3.97	1.88
house wren	0.13	0.00	0.00	0.00	0.03
lark sparrow	0.00	0.49	0.00	0.00	0.06
Lincoln's sparrow	0.00	0.00	0.17	0.00	0.03
mountain bluebird	0.27	1.40	0.86	0.04	0.40
Nashville warbler	0.40	0.00	0.00	0.00	0.09
northern shrike	0.00	0.00	0.29	0.38	0.23
orange-crowned warbler	0.27	0.00	0.00	0.00	0.06
red-winged blackbird	5.89	0.00	0.00	0.21	1.44
ruby-crowned kinglet	0.00	0.00	0.34	0.04	0.08
sage thrasher	0.40	2.72	0.00	0.00	0.42
savannah sparrow	0.00	0.00	1.37	0.00	0.24
song sparrow	0.27	0.25	0.00	0.00	0.09
spotted towhee	0.67	0.25	0.34	0.09	0.28
tree swallow	0.00	1.89	0.00	0.00	0.23
unidentified empidonax	0.27	0.00	0.00	0.00	0.06
unidentified finch	0.00	1.73	0.00	5.13	2.64
unidentified passerine	0.00	0.00	0.00	0.15	0.07
unidentified swallow	0.00	0.74	0.17	0.00	0.12
varied thrush	0.00	0.00	0.00	0.05	0.02
vesper sparrow	4.15	7.41	1.37	0.00	2.09
violet-green swallow	0.27	0.00	0.00	0.00	0.06
western kingbird	0.71	1.73	0.00	0.00	0.37
western meadowlark	12.81	8.07	4.79	0.38	4.93
western tanager	0.18	0.74	0.00	0.00	0.13
white-crowned sparrow	0.00	0.00	2.40	0.00	0.42
winter wren	0.00	0.00	0.00	0.04	0.02
yellow-rumped warbler	1.74	0.00	0.00	0.00	0.39
Other Birds	**0.54**	**0.49**	**0.17**	**0.43**	**0.41**
common nighthawk	0.00	0.25	0.00	0.00	0.03
downy woodpecker	0.13	0.00	0.00	0.00	0.03
northern flicker	0.40	0.00	0.17	0.43	0.32
unidentified hummingbird	0.00	0.25	0.00	0.00	0.03

Table 4. Estimated frequency of occurrence (percent of surveys species/group is recorded) for each species observed within 800 m of the survey point (March 22, 2002 – March 13, 2003).

Species/Group	Spring Freq.	Summer Freq.	Fall Freq.	Winter Freq.	Overall Freq. Occur.
Waterfowl/Waterbirds	**19.44**	**9.38**	**3.13**	**14.55**	**12.08**
Canada goose	0.00	0.00	0.00	3.33	1.02
mallard	19.44	3.13	0.00	11.21	8.98
northern pintail	0.00	0.00	0.00	1.52	0.46
great blue heron	0.00	6.25	3.13	0.00	2.08
Shorebirds	**61.11**	**19.79**	**6.25**	**4.55**	**22.45**
killdeer	58.33	19.79	6.25	4.55	21.76
common snipe	22.22	15.63	0.00	0.00	9.03
Corvids	**58.33**	**21.88**	**50.00**	**52.42**	**46.57**
American crow	2.78	6.25	0.00	3.03	3.01
black-billed magpie	40.74	9.38	37.50	31.82	30.32
common raven	29.63	9.38	18.75	37.88	25.23
Upland Gamebirds	**8.33**	**18.75**	**15.63**	**10.91**	**13.06**
California quail	0.00	18.75	15.63	7.88	10.05
gray partridge	2.78	0.00	0.00	1.52	1.16
ring-necked pheasant	5.56	0.00	0.00	1.52	1.85
Doves					
mourning dove	0.00	6.25	6.25	0.00	2.78
Raptors	**72.22**	**47.92**	**60.42**	**53.94**	**58.61**
Accipiters	*2.78*	*0.00*	*12.50*	*5.15*	*5.05*
sharp-shinned hawk	2.78	0.00	6.25	5.15	3.66
Cooper's hawk	0.00	0.00	6.25	0.00	1.39
Buteos	**52.78**	**29.17**	**20.83**	**39.39**	**36.34**
red-tailed hawk	47.22	29.17	15.63	25.45	29.54
rough-legged hawk	25.00	0.00	5.21	20.00	13.52
Eagles	*5.56*	*0.00*	*0.00*	*6.67*	*3.43*
bald eagle	5.56	0.00	0.00	6.67	3.43
golden eagle	0.00	0.00	0.00	1.52	0.46
Falcons					
American kestrel	20.37	18.75	12.50	1.52	12.50
prairie falcon	0.00	3.13	0.00	3.03	1.62
Other Raptors					
great horned owl	9.26	0.00	3.13	4.85	4.49
northern harrier	9.26	0.00	30.21	7.88	11.44
turkey vulture	11.11	18.75	9.38	0.00	9.03
Passerines	**91.67**	**84.38**	**79.17**	**65.15**	**79.17**
American goldfinch	0.00	19.79	14.58	9.39	10.51
American pipit	0.00	0.00	6.25	0.00	1.39
American robin	19.44	16.67	31.25	23.64	22.73
bank swallow	7.41	0.00	0.00	0.00	1.85
barn swallow	10.19	6.25	3.13	0.00	4.63

Table 4. Estimated frequency of occurrence (percent of surveys species/group is recorded) for each species observed within 800 m of the survey point (March 22, 2002 – March 13, 2003).

Species/Group	Spring Freq.	Summer Freq.	Fall Freq.	Winter Freq.	Overall Freq. Occur.
black-capped chickadee	0.00	3.13	5.21	7.88	4.26
Brewer's blackbird	21.30	39.58	0.00	0.00	14.12
Brewer's sparrow	0.00	6.25	0.00	0.00	1.39
Bullock's oriole	7.41	13.54	0.00	0.00	4.86
cedar waxwing	3.70	12.50	3.13	0.00	4.40
chipping sparrow	2.78	0.00	0.00	0.00	0.69
dark-eyed junco	0.00	0.00	5.21	10.00	4.21
eastern kingbird	3.70	12.50	3.13	0.00	4.40
European starling	15.74	15.63	12.50	19.09	16.02
golden-crowned kinglet	0.00	0.00	3.13	0.00	0.69
gray-crowned rosy finch	0.00	0.00	6.25	0.00	1.39
horned lark	8.33	10.42	29.17	12.42	14.68
house finch	0.00	0.00	0.00	3.33	1.02
house wren	2.78	0.00	0.00	0.00	0.69
lark sparrow	0.00	3.13	0.00	0.00	0.69
Lincoln's sparrow	0.00	0.00	3.13	0.00	0.69
mountain bluebird	2.78	10.42	3.13	1.52	4.17
Nashville warbler	2.78	0.00	0.00	0.00	0.69
northern shrike	0.00	0.00	5.21	13.33	5.23
orange-crowned warbler	2.78	0.00	0.00	0.00	0.69
red-winged blackbird	13.89	0.00	0.00	4.55	4.86
ruby-crowned kinglet	0.00	0.00	3.13	1.52	1.16
sage thrasher	8.33	27.08	0.00	0.00	8.10
savannah sparrow	0.00	0.00	6.25	0.00	1.39
song sparrow	5.56	3.13	0.00	0.00	2.08
spotted towhee	5.56	3.13	3.13	1.52	3.24
tree swallow	0.00	13.54	0.00	0.00	3.01
unidentified empidonax	2.78	0.00	0.00	0.00	0.69
unidentified finch	0.00	3.13	0.00	1.52	1.16
unidentified passerine	0.00	0.00	0.00	1.82	0.56
unidentified swallow	0.00	3.13	3.13	0.00	1.39
varied thrush	0.00	0.00	0.00	1.82	0.56
vesper sparrow	40.74	39.58	6.25	0.00	20.37
violet-green swallow	2.78	0.00	0.00	0.00	0.69
western kingbird	3.70	12.50	0.00	0.00	3.70
western meadowlark	80.56	46.88	25.00	9.09	38.89
western tanager	3.70	3.13	0.00	0.00	1.66
white-crowned sparrow	0.00	0.00	9.38	0.00	2.08
winter wren	0.00	0.00	0.00	1.52	0.46
yellow-rumped warbler	5.56	0.00	0.00	0.00	1.39
Other Birds	**11.11**	**6.25**	**3.13**	**13.64**	**9.03**
common nighthawk	0.00	3.13	0.00	0.00	0.69
downy woodpecker	2.78	0.00	0.00	0.00	0.69
northern flicker	8.33	0.00	3.13	13.64	6.94
unidentified hummingbird	0.00	3.13	0.00	0.00	0.69

Table 5. Flight characteristics of bird species observed during fixed-point surveys.

Species/Group	Number groups flying	Number birds flying	Percent of birds flying	<25 m	25-125 m	> 125 m
American pipit	2	11	100.00	0.00	100.00	0.00
gray-crowned rosy finch	2	9	100.00	0.00	100.00	0.00
northern pintail	1	4	100.00	0.00	100.00	0.00
unidentified passerine	1	3	100.00	0.00	100.00	0.00
violet-green swallow	1	2	100.00	0.00	100.00	0.00
common nighthawk	1	1	100.00	0.00	100.00	0.00
golden eagle	1	1	100.00	0.00	100.00	0.00
common snipe	14	14	70.00	0.00	100.00	0.00
Canada goose	1	13	40.63	0.00	100.00	0.00
unidentified finch	2	127	100.00	5.51	94.49	0.00
mallard	19	483	98.17	6.83	93.17	0.00
western kingbird	4	7	63.64	14.29	85.71	0.00
bald eagle	8	9	69.23	11.11	77.78	11.11
unidentified swallow	2	4	100.00	25.00	75.00	0.00
red-tailed hawk	47	48	80.00	22.92	72.92	4.17
European starling	26	1059	87.52	32.29	67.71	0.00
prairie falcon	3	3	100.00	33.33	66.67	0.00
sharp-shinned hawk	3	3	100.00	33.33	66.67	0.00
turkey vulture	17	18	100.00	33.33	61.11	5.56
rough-legged hawk	24	24	75.00	45.83	54.17	0.00
bank swallow	2	4	100.00	50.00	50.00	0.00
great blue heron	3	4	100.00	50.00	50.00	0.00
unidentified buteo	2	2	100.00	50.00	50.00	0.00
American robin	28	462	86.36	51.73	48.27	0.00
Cooper's hawk	5	5	83.33	60.00	40.00	0.00
common raven	38	67	78.82	47.76	38.81	13.43
American kestrel	19	21	91.30	66.67	33.33	0.00
barn swallow	6	26	100.00	69.23	30.77	0.00
American goldfinch	11	49	38.58	71.43	28.57	0.00
killdeer	24	49	76.56	73.47	26.53	0.00
red-winged blackbird	3	13	26.53	76.92	23.08	0.00
cedar waxwing	5	23	85.19	78.26	21.74	0.00
Brewer's blackbird	23	96	88.07	80.21	19.79	0.00
eastern kingbird	6	6	100.00	83.33	16.67	0.00
horned lark	8	24	45.28	83.33	16.67	0.00
black-billed magpie	43	74	74.00	85.14	14.86	0.00
northern harrier	19	21	91.30	85.71	14.29	0.00
western meadowlark	21	43	27.74	97.67	2.33	0.00
house finch	2	78	100.00	100.0	0.00	0.00
savannah sparrow	2	8	100.00	100.0	0.00	0.00
mourning dove	4	5	100.00	100.0	0.00	0.00
lark sparrow	1	2	100.00	100.0	0.00	0.00
Lincoln's sparrow	1	1	100.00	100.0	0.00	0.00
downy woodpecker	1	1	100.00	100.0	0.00	0.00
unid’d hummingbird	1	1	100.00	100.0	0.00	0.00
Bullock's oriole	6	7	87.50	100.0	0.00	0.00
mountain bluebird	5	11	84.62	100.0	0.00	0.00

Table 5. Flight characteristics of bird species observed during fixed-point surveys.

Species/Group	Number groups flying	Number birds flying	Percent of birds flying	<25 m	25-125 m	> 125 m
western tanager	1	3	75.00	100.0	0.00	0.00
gray partridge	1	5	71.43	100.0	0.00	0.00
tree swallow	3	5	71.43	100.0	0.00	0.00
northern shrike	7	7	70.00	100.0	0.00	0.00
dark-eyed junco	3	60	52.17	100.0	0.00	0.00
American crow	2	4	50.00	100.0	0.00	0.00
spotted towhee	2	4	40.00	100.0	0.00	0.00
yellow-rumped warbler	1	5	38.46	100.0	0.00	0.00
sage thrasher	4	4	33.33	100.0	0.00	0.00
northern flicker	3	4	30.77	100.0	0.00	0.00
white-crowned sparrow	2	4	28.57	100.0	0.00	0.00
vesper sparrow	7	14	21.88	100.0	0.00	0.00
black-capped chickadee	1	2	10.53	100.0	0.00	0.00
Brewer's sparrow	0	0	0.00	N/A	N/A	N/A
California quail	0	0	0.00	N/A	N/A	N/A
Nashville warbler	0	0	0.00	N/A	N/A	N/A
chipping sparrow	0	0	0.00	N/A	N/A	N/A
golden-crowned kinglet	0	0	0.00	N/A	N/A	N/A
great-horned owl	0	0	0.00	N/A	N/A	N/A
house wren	0	0	0.00	N/A	N/A	N/A
orange-crowned warbler	0	0	0.00	N/A	N/A	N/A
ring-necked pheasant	0	0	0.00	N/A	N/A	N/A
ruby-crowned kinglet	0	0	0.00	N/A	N/A	N/A
song sparrow	0	0	0.00	N/A	N/A	N/A
unid’d empidonax	0	0	0.00	N/A	N/A	N/A
varied thrush	0	0	0.00	N/A	N/A	N/A
winter wren	0	0	0.00	N/A	N/A	N/A
Overall	505	3067	76.83	41.90	57.68	0.42

Table 6. Flight characteristics of avian groups observed during the fixed-point surveys.

Species/Group	Number groups flying	Number birds flying	Percent of birds flying	<25 m	25-125 m	> 125 m
Waterfowl/Waterbirds	24	504	94.74	6.94	93.06	0.00
Shorebirds	38	63	75.00	57.14	42.86	0.00
Raptor	148	155	80.31	43.23	54.19	2.58
Accipiters	8	8	88.89	50.00	50.00	0.00
Buteos	73	74	77.08	31.08	66.22	2.70
Northern harrier	19	21	91.30	85.71	14.29	0.00
Eagles	9	10	71.43	10.00	80.00	10.00
Small Falcons	19	21	91.30	66.67	33.33	0.00
Large Falcons	3	3	100.00	33.33	66.67	0.00
Owls	0	0	0.00	N/A	N/A	N/A
Vultures	17	18	100.00	33.33	61.11	5.56
Corvids	83	145	75.13	68.28	25.52	6.21
Passerines	201	2183	75.93	47.27	52.73	0.00
Upland gamebirds	1	5	5.32	100.0	0.00	0.00
Dove	4	5	100.00	100.0	0.00	0.00
Other Birds	6	7	43.75	85.71	14.29	0.00
Overall	505	3067	76.83	41.90	57.68	0.42

Table 7. Exposure indices calculated for species observed during fixed-point surveys.

Species/Group	Mean use	Percent flying	Percent flying within RSA	Exposure Index
European starling	6.464	87.52	67.71	3.830
mallard	2.399	98.17	93.17	2.194
American robin	3.214	86.36	48.27	1.340
unidentified finch	0.604	100.00	94.49	0.571
red-tailed hawk	0.370	80.00	72.92	0.216
common raven	0.487	78.82	38.81	0.149
Brewer's blackbird	0.833	88.07	19.79	0.145
common snipe	0.139	70.00	100.00	0.097
killdeer	0.438	76.56	26.53	0.089
rough-legged hawk	0.193	75.00	54.17	0.078
American pipit	0.076	100.00	100.00	0.076
American goldfinch	0.662	38.58	28.57	0.073
turkey vulture	0.111	100.00	61.11	0.068
Canada goose	0.160	40.63	100.00	0.065
black-billed magpie	0.572	74.00	14.86	0.063
gray-crowned rosy finch	0.063	100.00	100.00	0.063
barn swallow	0.192	100.00	30.77	0.059
American kestrel	0.162	91.30	33.33	0.049
western kingbird	0.086	63.64	85.71	0.047
cedar waxwing	0.192	85.19	21.74	0.036
bald eagle	0.049	69.23	77.78	0.026
horned lark	0.321	45.28	16.67	0.024
unidentified swallow	0.028	100.00	75.00	0.021
red-winged blackbird	0.329	26.53	23.08	0.020
northern harrier	0.142	91.30	14.29	0.019
bank swallow	0.037	100.00	50.00	0.019
northern pintail	0.019	100.00	100.00	0.019
unidentified passerine	0.017	100.00	100.00	0.017
great blue heron	0.028	100.00	50.00	0.014
sharp-shinned hawk	0.021	100.00	66.67	0.014
violet-green swallow	0.014	100.00	100.00	0.014
Cooper's hawk	0.037	83.33	40.00	0.012
prairie falcon	0.016	100.00	66.67	0.011
eastern kingbird	0.044	100.00	16.67	0.007
western meadowlark	1.127	27.74	2.33	0.007
common nighthawk	0.007	100.00	100.00	0.007
golden eagle	0.005	100.00	100.00	0.005
dark-eyed junco	0.584	52.17	0.00	0.000
California quail	0.494	0.00	N/A	N/A
vesper sparrow	0.479	21.88	0.00	0.000
house finch	0.431	100.00	0.00	0.000
sage thrasher	0.097	33.33	0.00	0.000
white-crowned sparrow	0.097	28.57	0.00	0.000
black-capped chickadee	0.097	10.53	0.00	0.000

Table 7. Exposure indices calculated for species observed during fixed-point surveys.

Species/Group	Mean use	Percent flying	Percent flying within RSA	Exposure Index
mountain bluebird	0.093	84.62	0.00	0.000
yellow-rumped warbler	0.090	38.46	0.00	0.000
northern flicker	0.074	30.77	0.00	0.000
Bullock's oriole	0.067	87.50	0.00	0.000
spotted towhee	0.065	40.00	0.00	0.000
western tanager	0.060	75.00	0.00	0.000
savannah sparrow	0.056	100.00	0.00	0.000
tree swallow	0.053	71.43	0.00	0.000
northern shrike	0.052	70.00	0.00	0.000
great-horned owl	0.045	0.00	N/A	N/A
American crow	0.044	50.00	0.00	0.000
gray partridge	0.037	71.43	0.00	0.000
mourning dove	0.035	100.00	0.00	0.000
golden-crowned kinglet	0.028	0.00	N/A	N/A
Brewer's sparrow	0.021	0.00	N/A	N/A
Nashville warbler	0.021	0.00	N/A	N/A
song sparrow	0.021	0.00	N/A	N/A
ring-necked pheasant	0.019	0.00	N/A	N/A
ruby-crowned kinglet	0.019	0.00	N/A	N/A
lark sparrow	0.014	100.00	0.00	0.000
orange-crowned warbler	0.014	0.00	N/A	N/A
unidentified empidonax	0.014	0.00	N/A	N/A
Lincoln's sparrow	0.007	100.00	0.00	0.000
downy woodpecker	0.007	100.00	0.00	0.000
unidentified hummingbird	0.007	100.00	0.00	0.000
chipping sparrow	0.007	0.00	N/A	N/A
house wren	0.007	0.00	N/A	N/A
varied thrush	0.006	0.00	N/A	N/A
winter wren	0.005	0.00	N/A	N/A
unidentified buteo	N/A	100.00	50.00	N/A

Table 8. Big game species observed during fixed-point surveys (March 26, 2002 – March 13, 2003).

Species/Group	Spring		Summer		Fall		Winter		Total	
	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups	Number Individuals	Number Groups
Big Game Species										
Rocky Mountain elk	0	0	0	0	0	0	0	0	0	0
mule deer	8	2	4	2	9	6	37	7	58	17
Total	8	2	4	2	9	6	37	7	58	17

Table 9. Raptor and large bird nests located in the raptor nest survey area (study area plus area within a two-mile radius buffer).

Species	Number Active Nests[a]	Number of Nests Which Produced Young[b]	Total Young Observed (young per successful nest)
Red-tailed hawk	12	8	18 (2.25)
Unknown buteo	3	0	unk
Great horned owl	3	2	7 (2.3)
Inactive nests	11	N/A	N/A

[a] based on May 5 survey
[b] based on June 5 survey

Table 10. Results of winter roadside bald eagle surveys in the project vicinity.

	Number of Eagle Observations								
	Route					Age Classification			
	Reecer		Wilson						
Date	Groups	Obs	Groups	Obs	Total	AD[a]	SA[b]	JUV[c]	Unk
03/01/2002	0	0	7	18	18	9	0	9	0
03/12/2002	3	3	1	1	4	2	0	2	0
03/22/2002	0	0	1	1	1	0	1	0	0
03/28/2002[d]	0	0	0	0	0	0	0	0	0
04/05/2002	0	0	0	0	0	0	0	0	0
04/12/2002	0	0	0	0	0	0	0	0	0
12/13/2002	0	0	0	0	0	0	0	0	0
12/20/2002	0	0	0	0	0	0	0	0	0
12/27/2002	0	0	0	0	0	0	0	0	0
01/15/2003	0	0	0	0	0	0	0	0	0
01/24/2003	0	0	0	0	0	0	0	0	0
02/07/2003	2	3	0	0	3	3	0	0	0
02/13/2003	0	0	5	5	5	2	0	3	0
02/27/2003	0	0	2	3	3	3	0	0	0
03/12/2003	1	1	1	1	2	1	1	0	0
03/27/2003	0	0	1	2	2	0	0	0	2
04/01/2003	0	0	1	1	1	1	0	0	0
04/12/2003	0	0	0	0	0	0	0	0	0
Total	6	7	19	32	39	21	2	14	2
#/survey		0.39		1.78	2.17				

[a] Adults (>3 years old)
[b] Subadults (1-3 years old)
[c] Juveniles (<1 year old)
[d] Wilson Creek route surveyed on 03/28/2002; Reecer Creek route surveyed on 03/30/2002.

Table 11. Number of groups and the total number of individuals of avian species of interest, mammals, and reptiles observed incidentally on or near the site.

Species	Number of Groups	Number of Individuals
Birds		
mallard	7	292
bald eagle	31	54
red-tailed hawk	52	74
rough-legged hawk	32	51
Canada goose	3	28
common goldeneye	4	20
American kestrel	11	18
northern pintail	2	6
northern harrier	3	4
bufflehead	2	4
ring-necked duck	1	4
Cooper's hawk	3	3
gray partridge	1	3
common raven	2	2
loggerhead shrike	2	2
ring-necked pheasant	1	2
barn owl	1	1
common snipe	1	1
long-billed curlew	1	1
great blue heron	1	1
northern goshawk	1	1
northern shoveler	1	1
prairie falcon	1	1
sharp-shinned hawk	1	1
spotted sandpiper	1	1
turkey vulture	1	1
Mammals		
mule deer	2	42
coyote	2	2
porcupine	1	1
elk	1	11
raccoon	1	1
long-tailed weasel	1	1
yellow-bellied marmot	3	3
least chipmunk	NR	NR
Reptiles		
short-horned lizard	1	1

NR = not recorded but commonly observed.

Table 12. Vegetation types in the study area.

Vegetation Type	Approx. Acres	Percent of Study Area	General Habitat Description
Agricultural	252.3	4.8	For this project, agricultural areas are those sites used for irrigated hay meadows that are periodically mowed. While other habitats (e.g., shrub steppe and grasslands) are used for agricultural purposes, these areas are not considered "Agricultural" because they consist primarily of native vegetation.
Developed	16.5	0.3	Areas where human activity has removed or altered natural vegetation, such as residential homes and farm buildings and yards.
Grassland	1,578.7	30.2	Areas dominated by grass species, primarily bunchgrasses bluebunch wheatgrass, Sandberg's bluegrass, cheatgrass, and bulbous bluegrass. Grasslands are primarily used for cattle grazing.
Grassland/ Lithosol	199.8	3.8	A subset of the grassland habitat type found on exposed ridges in shallow soils (lithosol) in the northern-most parcel. Sparse grasses (Sandberg's bluegrass) dominate, along with scattered forbs and occasional shrubs.
Open Water	23.4	0.5	Areas of open water including natural ponds, stock ponds, and the irrigation canal.
Pine Forest	33.4	0.6	Pine forest dominated by Ponderosa pine found in the higher elevations of the northern most parcel.
Riparian Forest	70.5	1.4	Riparian zones dominated by trees and tall shrubs, typically located in narrow drainages with perennial or intermittent streams. The dominant tree and shrub species include cottonwoods and various willows. In some locations, the shrub understory is very dense, limiting herbaceous growth. These areas probably receive some use by cattle and wildlife for shade and water.
Riparian Shrub	108.6	2.1	Riparian areas adjacent to streams or irrigation ditches where shrubs are common, but often scattered. Common shrub species include black hawthorn and coyote willow. Various herbaceous species are present in the understory. Weedy species, including and knapweed were often observed.
Shrub Steppe	2,794.5	53.4	Upland areas dominated by shrubs, primarily bitterbrush and rigid sagebrush, with an understory of mixed grasses and forbs. Livestock grazing is the primary land use in most of the shrub steppe. A few weedy species, such as cheatgrass and knapweed, were observed, but weedy species in general were not found over large extents of the area.
Wet Meadow	149.6	2.9	Areas dominated by hydrophytic vegetation, including various sedges, grasses, and rushes and other herbaceous species. These areas appear to be saturated or inundated most of the year, either from leakage from the irrigation canal or stockponds, or due to high groundwater in low spots and swales. Evidence of cattle use was observed in most wet meadows. Weeds were observed in some of the wet meadows, primarily chicory.
Total	5,227.3	100	

Table 13. Rare plants potentially occurring in the project area based on range and habitat requirements.

Species	Federal Status	State Status	Known Locations	General Habitat	Flowering Period
Tall agoseris *Agoseris elata*		S		Meadows, open woods, and exposed rocky ridgetops	June-August
Pasque flower *Anemone nuttalliana*		S		Prairies to mountain slopes, mostly on well-drained soil	May-August
Palouse milk-vetch *Astragalus arrectus*		S		Grassy hillsides, sagebrush flats, river bluffs, and openings in open ponderosa pine and Douglas fir forests	April-July
Columbia milk-vetch *Astragalus columbianus*	SOC	LT		Sagebrush-steppe	March-June
Pauper milk-vetch *Astragalus misellus* var. *pauper*		S		Open ridgetops and slopes	April-mid June
Bristle-flowered collomia *Collomia macrocalyx*		S		Dry, open habitats	late May- early June
Golden corydalis *Corydalis aurea*		R1		Varied habitats, moist to dry and well drained soil	May-July
Beaked cryptantha *Cryptantha rostellata*		S		Very dry microsites within sagebrush steppe	late April –mid June
Shining flatsedge *Cyperus bipartitus*		S		Streambanks and other wet, low places in valleys and lowlands	August-September
Wenatchee larkspur *Delphinium viridescens*	SOC	T		Moist meadows, moist microsites in open coniferous forest, springs, seeps, and riparian areas	July
Piper's daisy *Erigeron piperianus*		S	Historic record from 1959 – includes western portion of study area	Dry, open places, often with sagebrush	May-June
Longsepal globemallow *Iliamna longisepala*		S	Record from 1991 just east of study area	Sagebrush-steppe and open ponderosa pine and Douglas fir forest	June-August
Hoover's desert-parsley *Lomatium tuberosum*	SOC	T		Loose talus and drainage channels of open ridgetops within sagebrush-steppe	March-early April
Suksdorf's monkey-flower *Mimulus suksdorfii*		S		Open, moist to rather dry places within sagebrush-steppe	mid April-July
Coyote tobacco *Nicotiana attenuata*		S		Dry, sandy bottom lands, dry rocky washes, and other dry open places	June-September
Hedgehog cactus *Pediocactus simpsonii* var. *robustior*		R1		Desert valleys and low mountains	May-July

Table 13. Rare plants potentially occurring in the project area based on range and habitat requirements.

Species	Federal Status	State Status	Known Locations	General Habitat	Flowering Period
Fuzzytongue penstemon *Penstemon eriantherus* var.*whitedii*		R1		Dry open places	May-July
Least phacelia *Phacelia minutissima*	SOC	S		Moist to fairly dry open places	July
Sticky goldenweed *Pyrrocoma hirta* var. *sonchifolia*		R1		Meadows and open or sparsely wooded slopes	July-August
Ute ladies'-tresses Spiranthes diluvialis	LT	E		Broad low-elevation intermontane valley plains, with deltaic meandered wetland complexes; restricted to calcareous, temporarily inundated wet meadow zones and segments of channels and swales where there is stable subsurface moisture and relatively low vegetation cover.	Mid July – early September
Hoover's tauschia Tauschia hooveri	SOC	T		Basalt lithosols within sagebrush-steppe	March-mid April

Federal Status
SC = Species of Concern: A taxon whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

State Status
E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.
T = Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.
S = Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

Figure 1. Proposed Desert Claim Wind Power Project location.

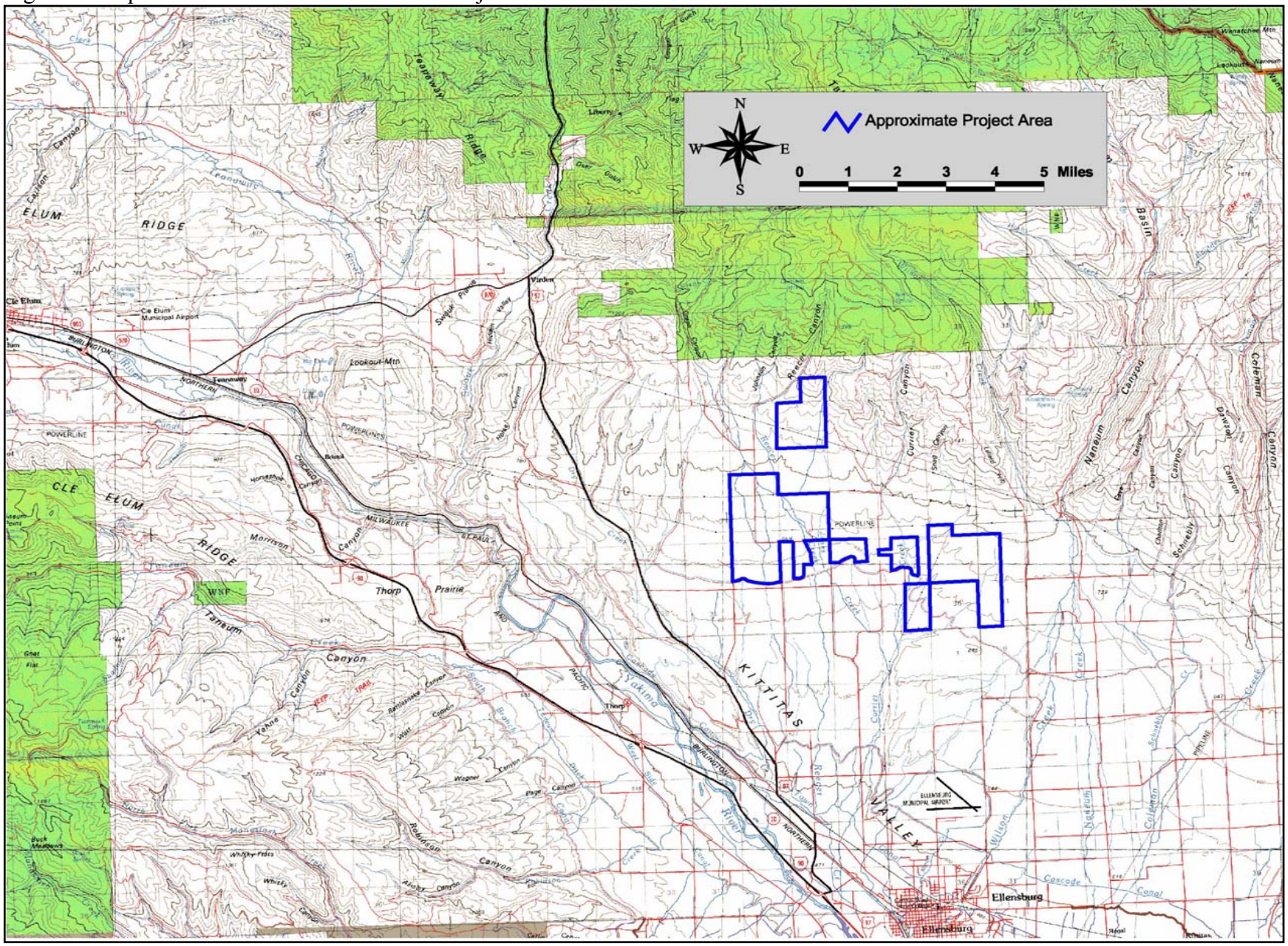


Figure 2. Fixed-point survey plots with 800 m buffer and bald eagle survey routes.

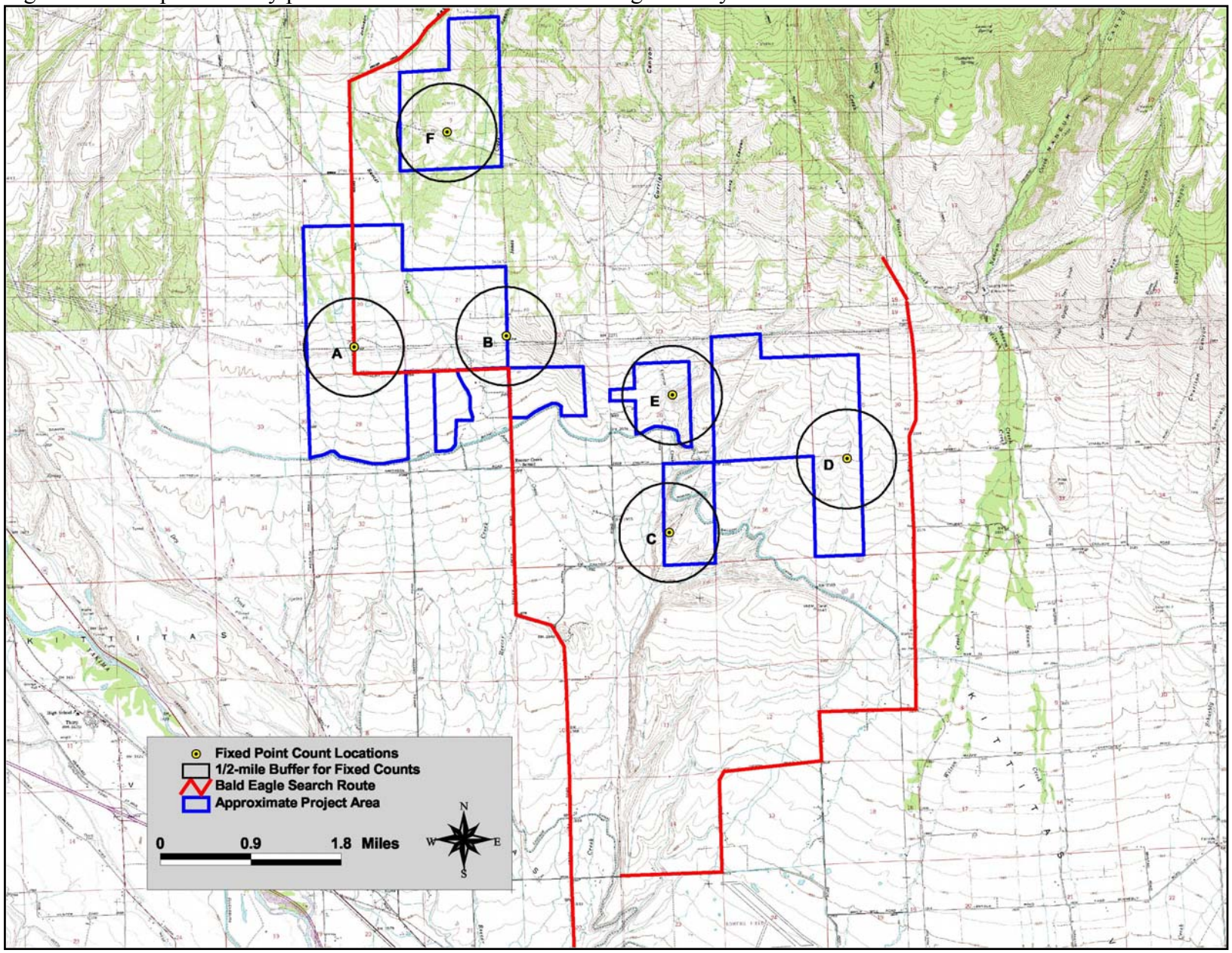


Figure 3. Raptor nest survey area and nests located.

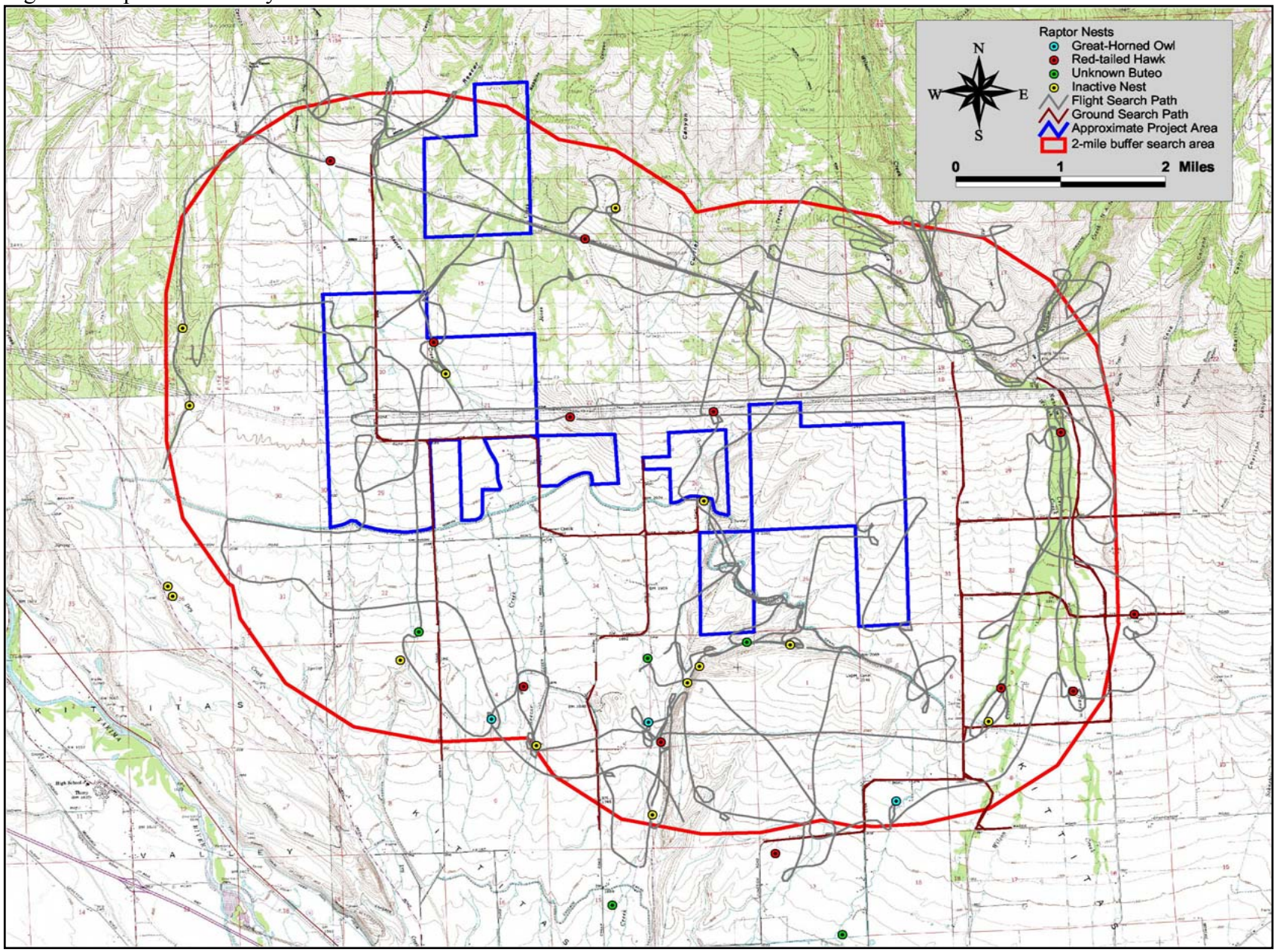


Figure 4. Vegetation type mapping for the study area.

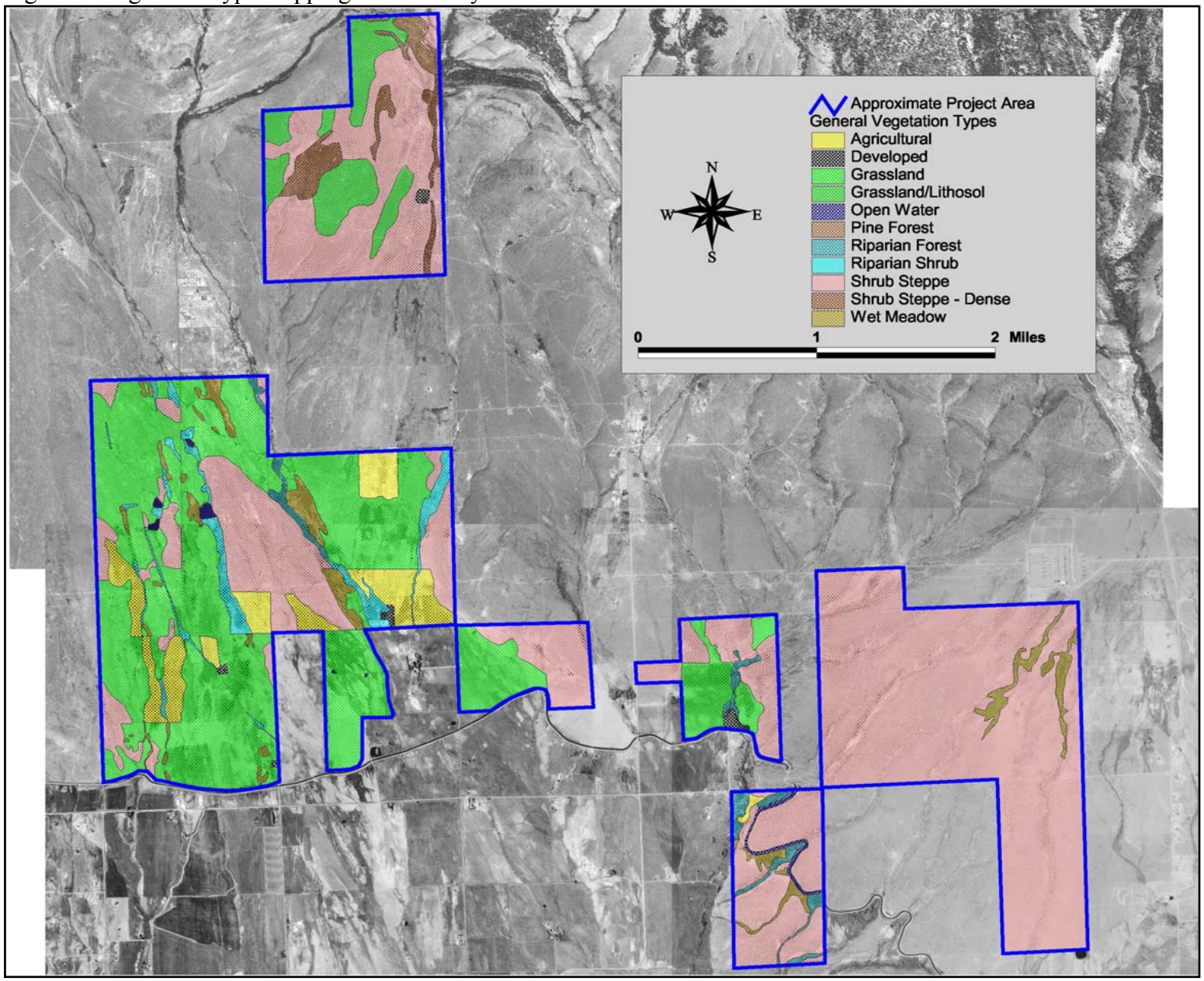


Figure 5. Mean use and frequency of occurrence for avian groups by survey period (dashed line represents a smoothed estimate).

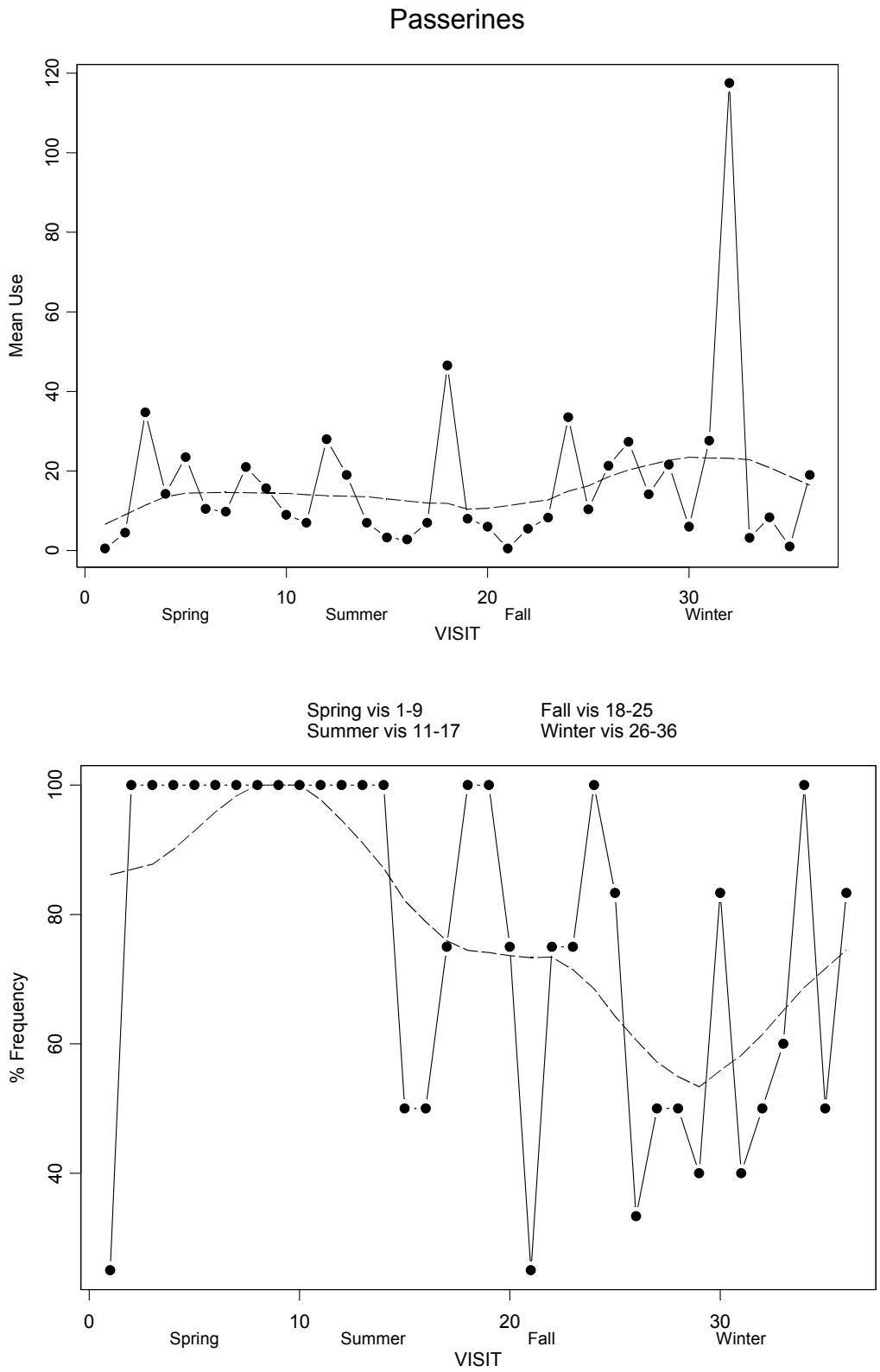


Figure 5. (continued).

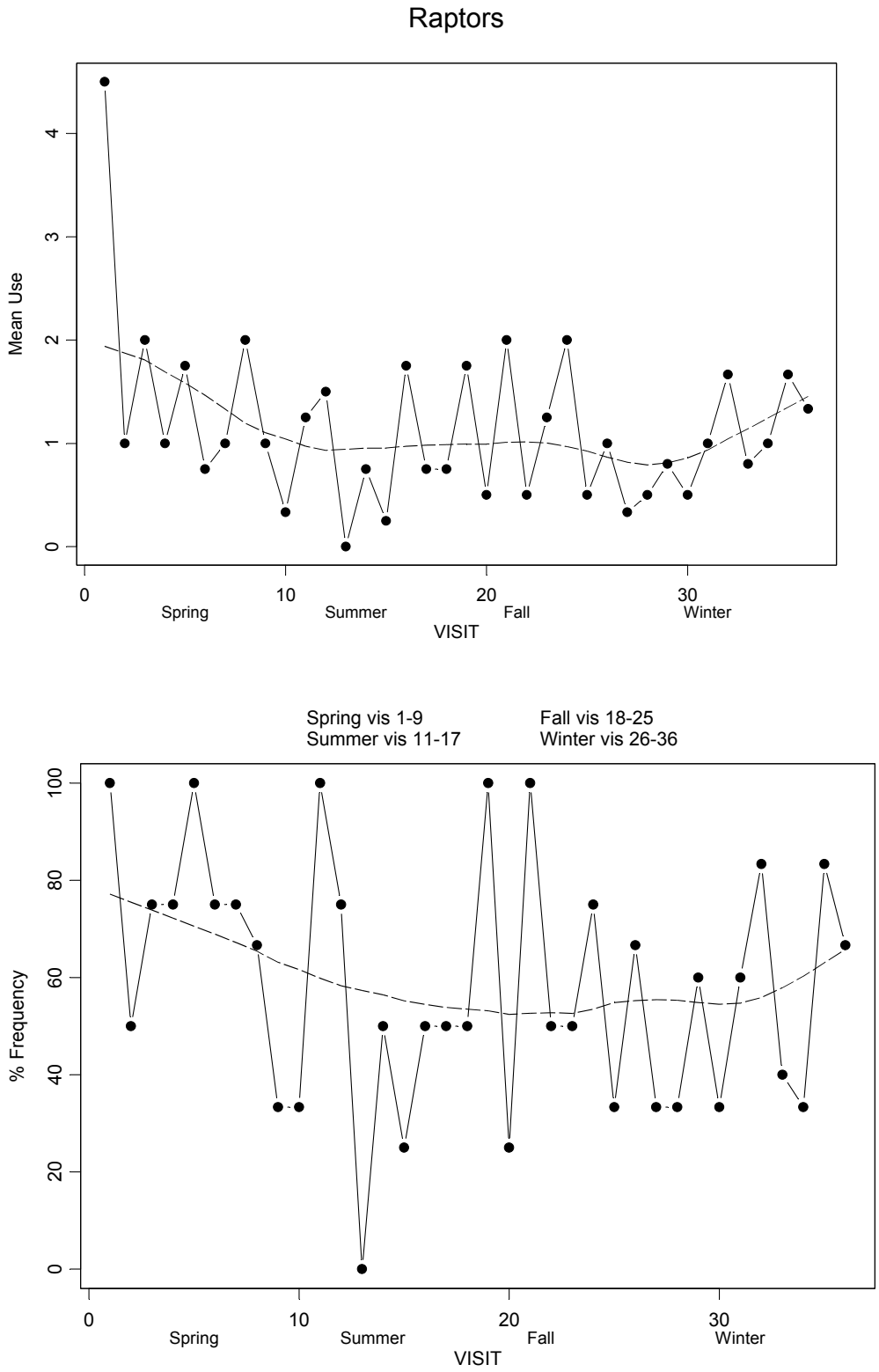


Figure 6. Mean use and frequency of occurrence for avian groups by survey station (bar represents ±1 standard error).

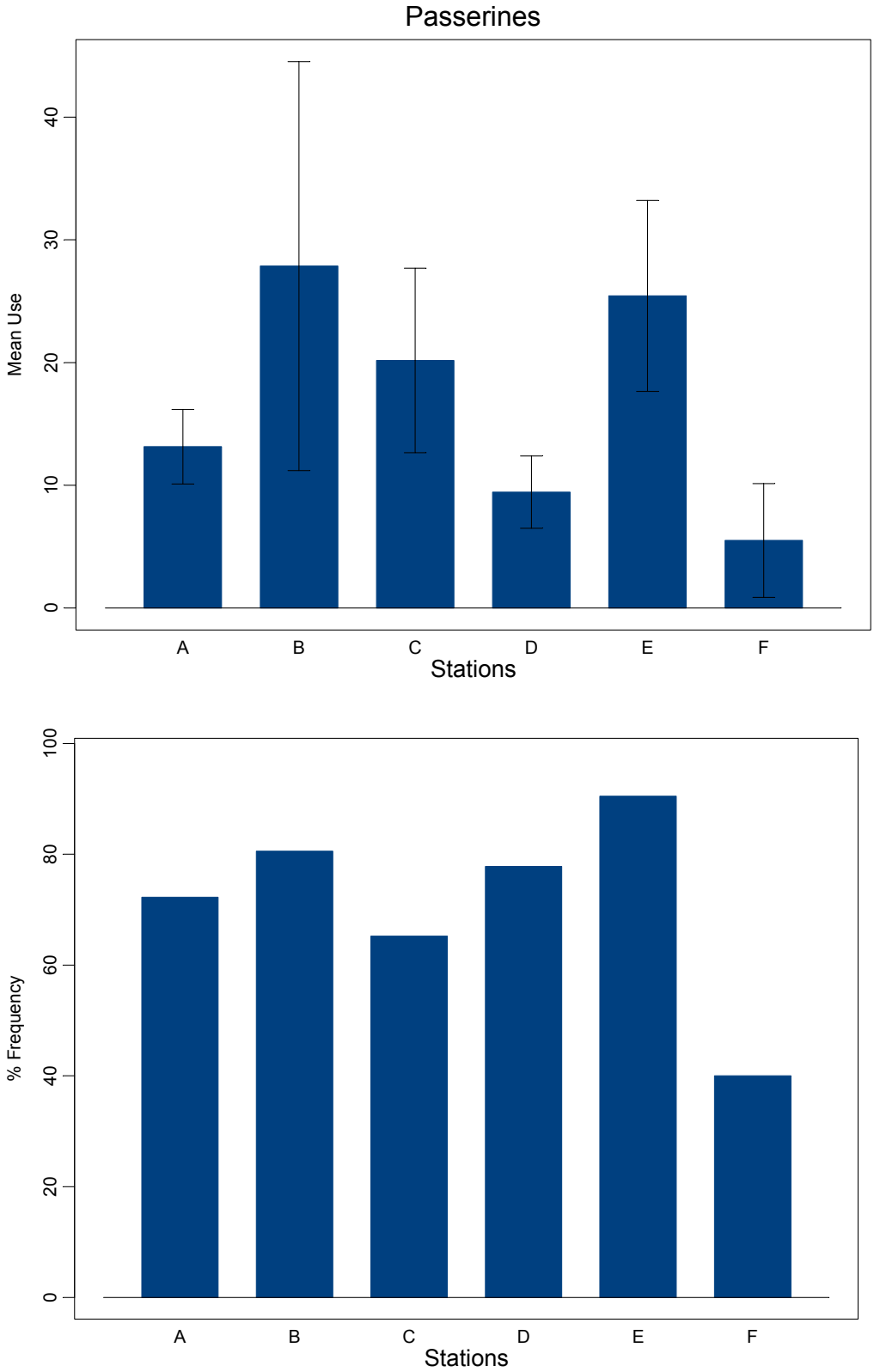
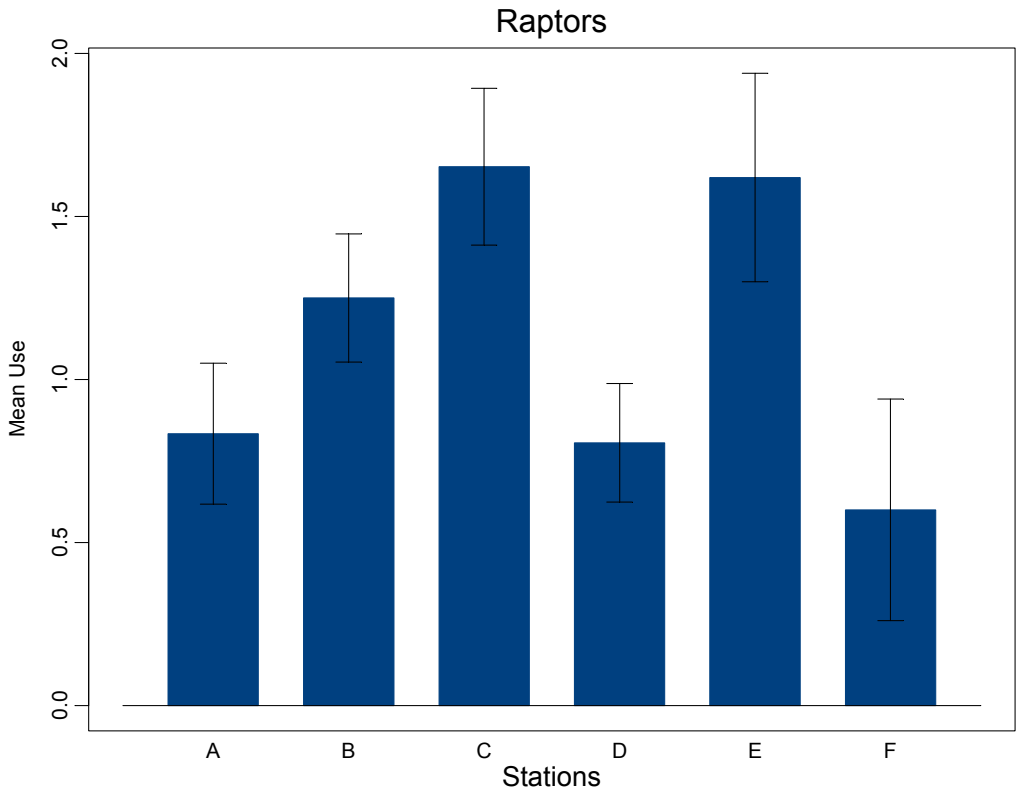


Figure 6. (continued).



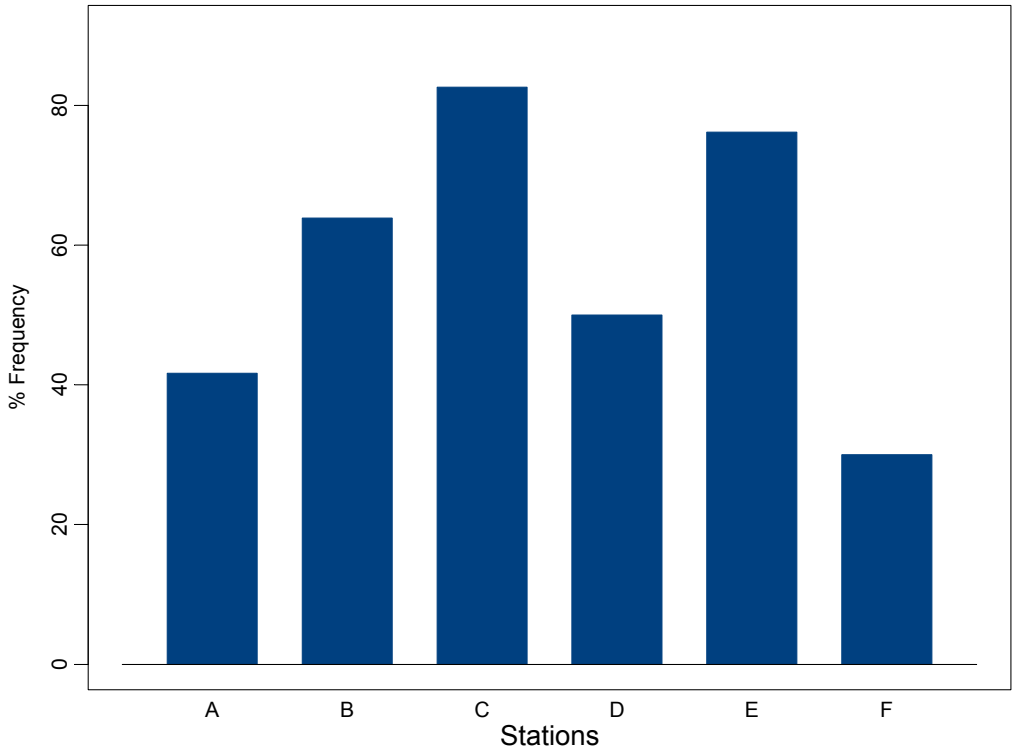


Figure 7. Mean number of species per survey (dashed line represents a smoothed estimate).

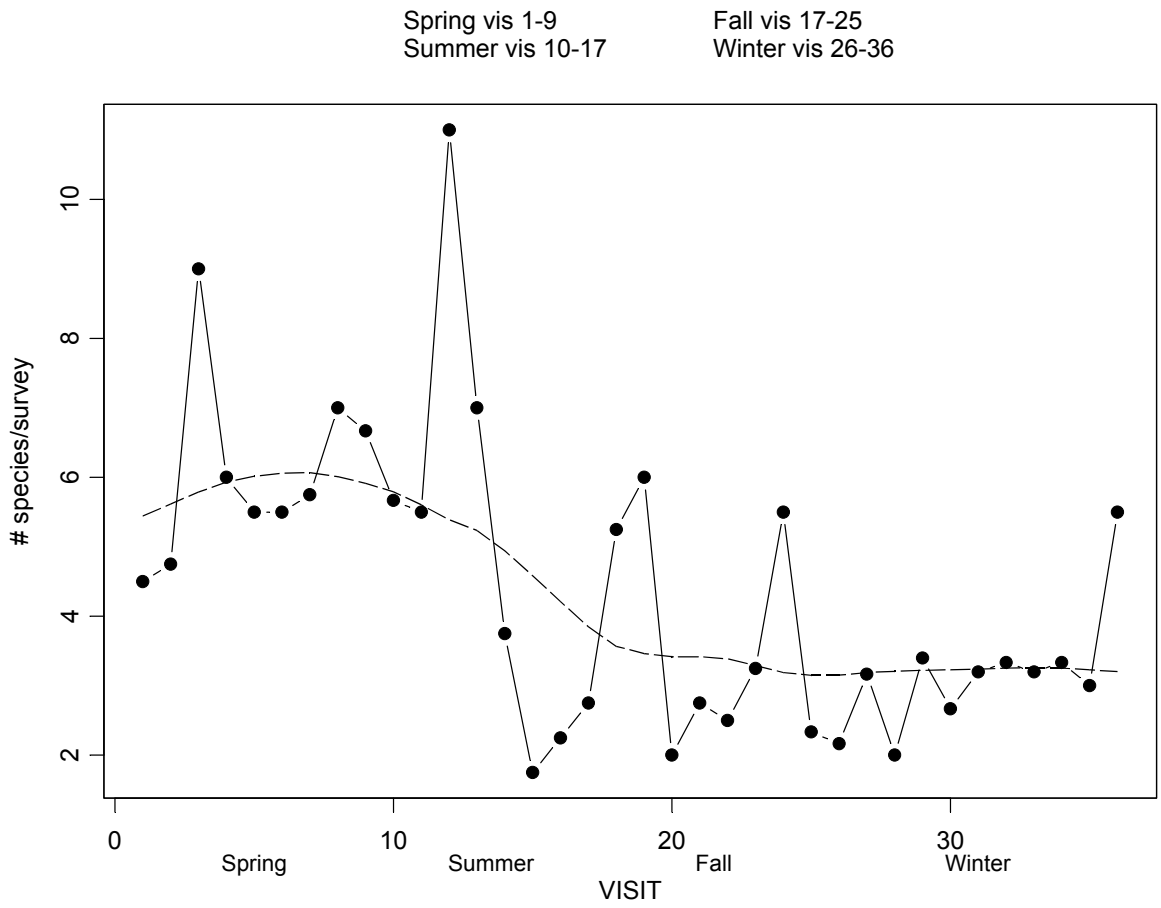


Figure 8. Buteo flight paths and perch locations recorded during fixed-point surveys and incidentally in the study area.

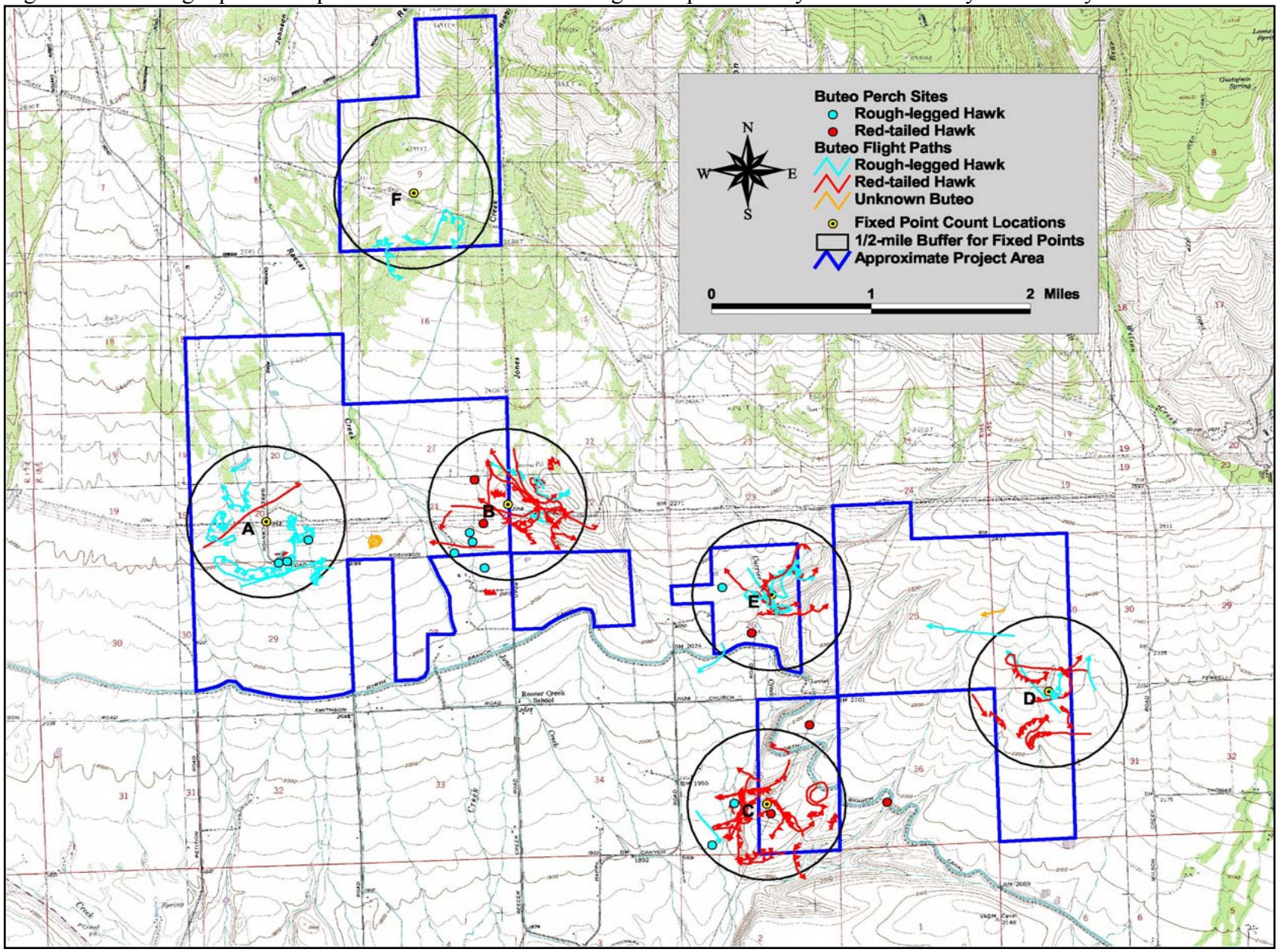


Figure 9. Accipiter and falcon flight paths and perch locations recorded during fixed-point surveys and incidentally in the study area.

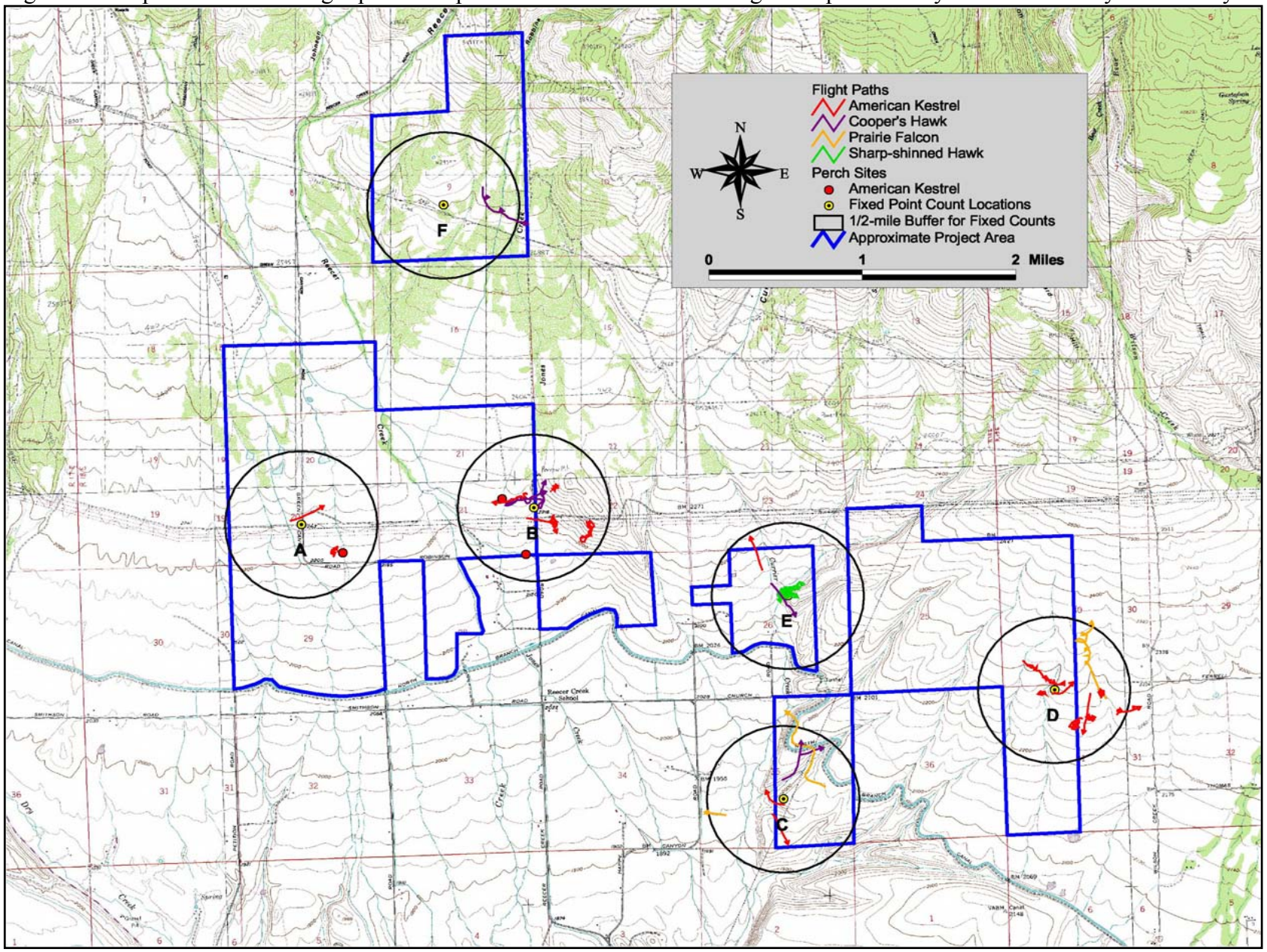


Figure 10. Other raptor flight paths and perch locations recorded during fixed-point surveys and incidentally in the study area.

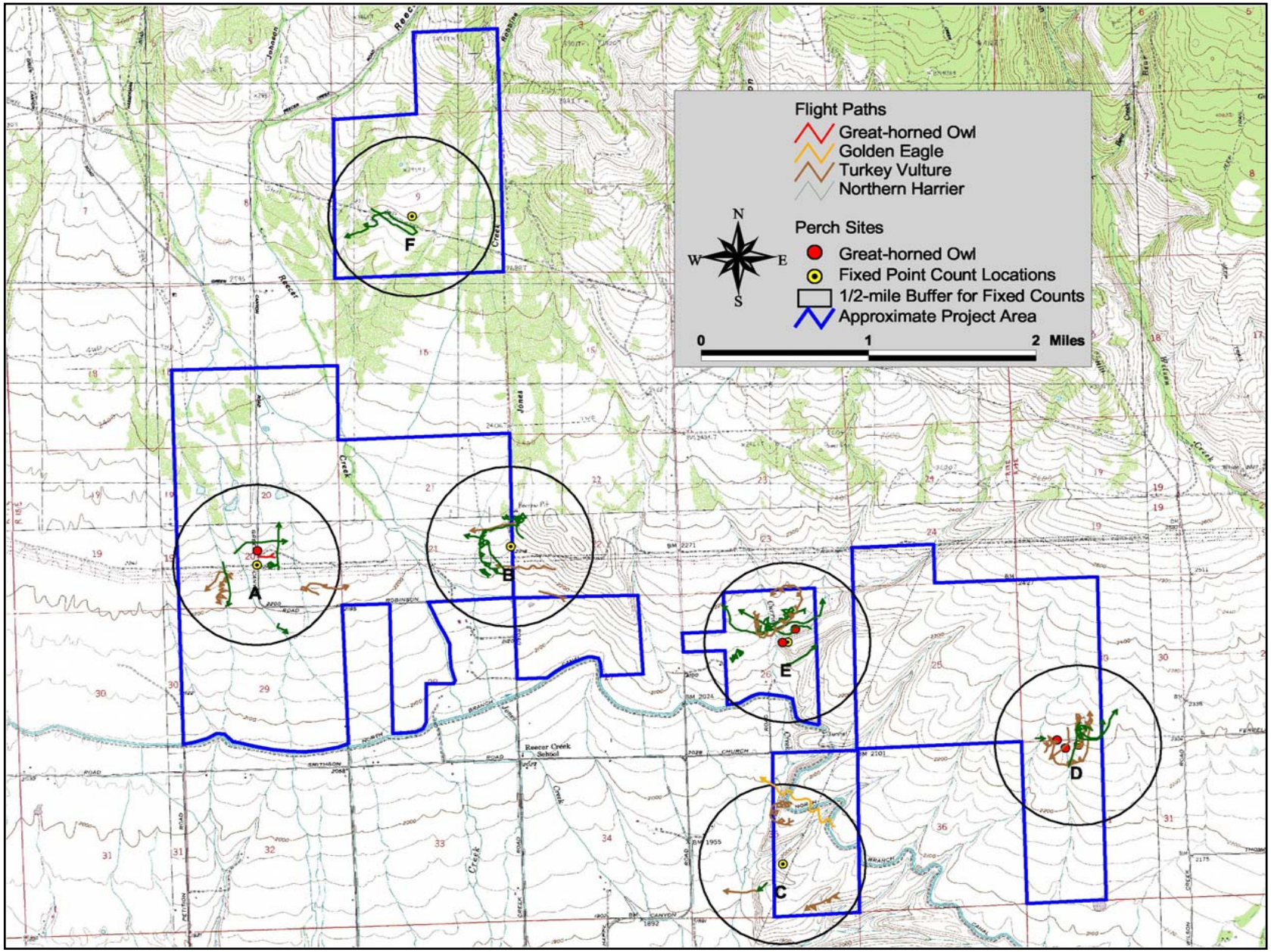


Figure 11. Big game species observations recorded during the fixed-point surveys and incidentally in the study area.

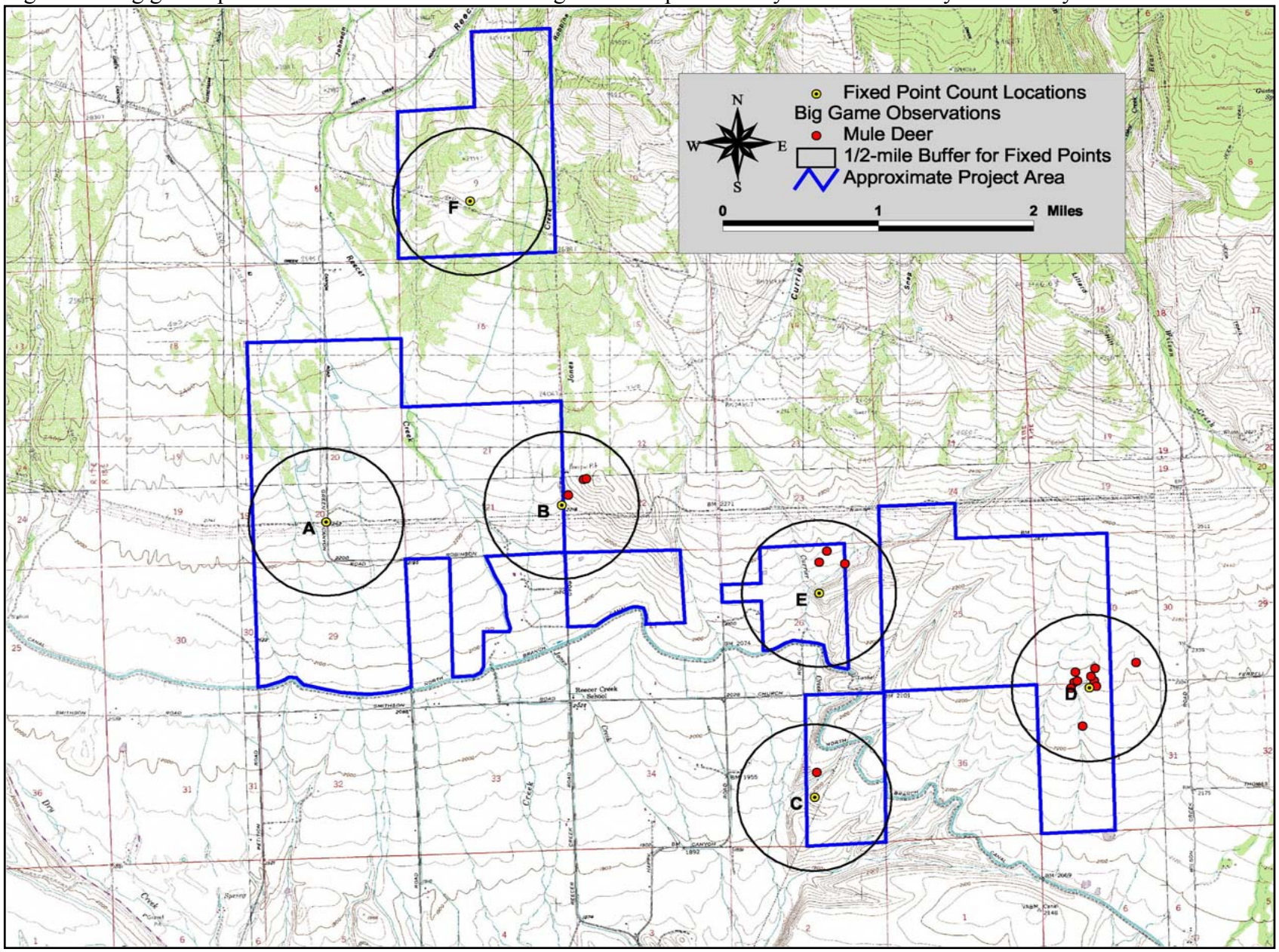
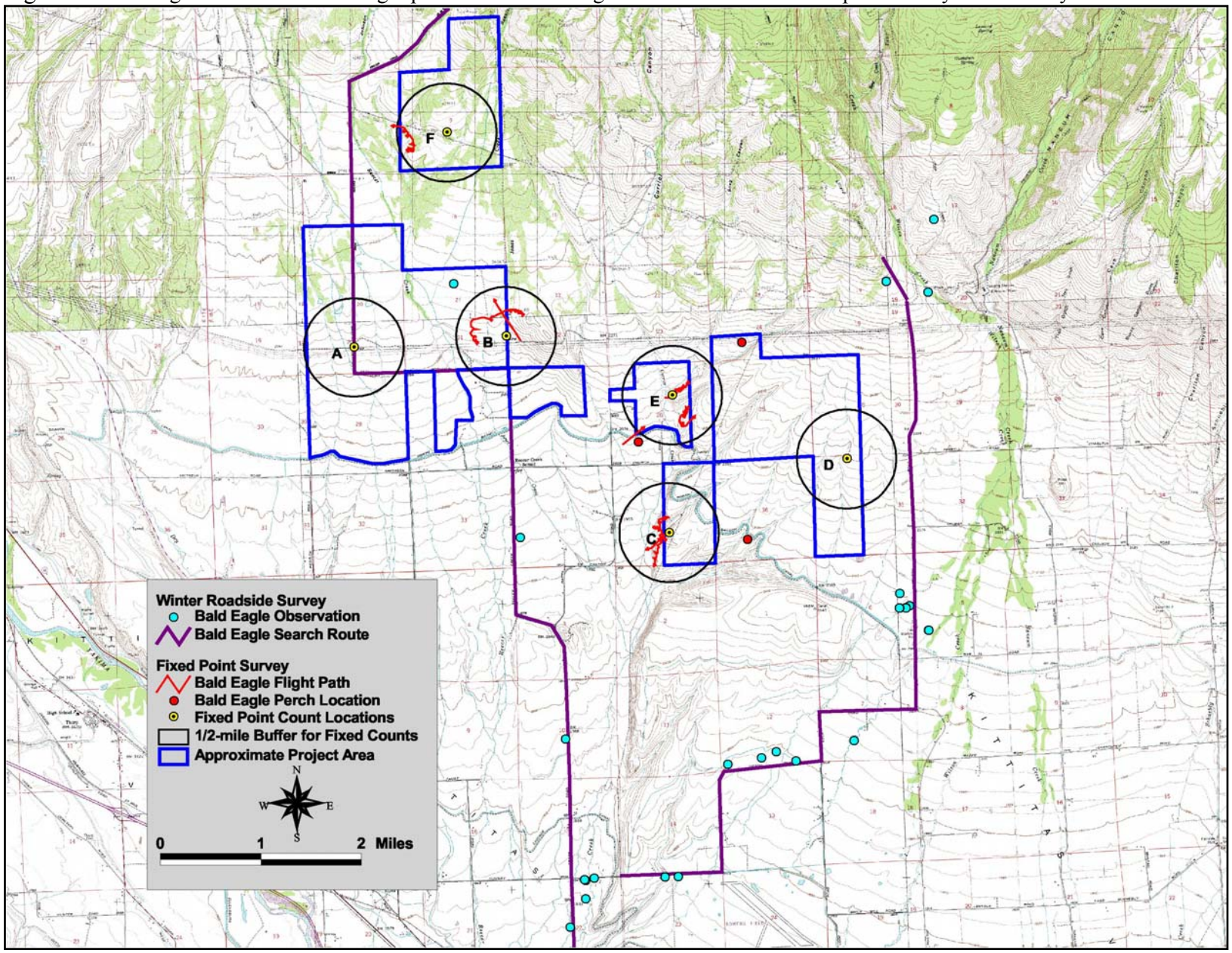


Figure 12 Bald eagle observations and flight paths recorded during winter roadside and fixed-point surveys in the study area.



APPENDIX A

EXAMPLE
FIXED-POINT SURVEY FIELD DATA SHEET

AVIAN OBSERVATION DATA SHEET: FIXED POINT **KITTITAS VALLEY WIND SITE** **STATION A** _____

DATE: _____ OBSERVER _____ START TIME _____ END TIME _____ PAGE_____ OF_____

WEATHER: VISIBILITY(CIRCLE ONE) good fair poor CLOUD COVER(%) _____ TEMP(^{O}C) _____

WIND DIRECTION (CIRCLE ONE) N NE E SE S SW W NW n/a SPEED(KPH) Low: _____ High: _____

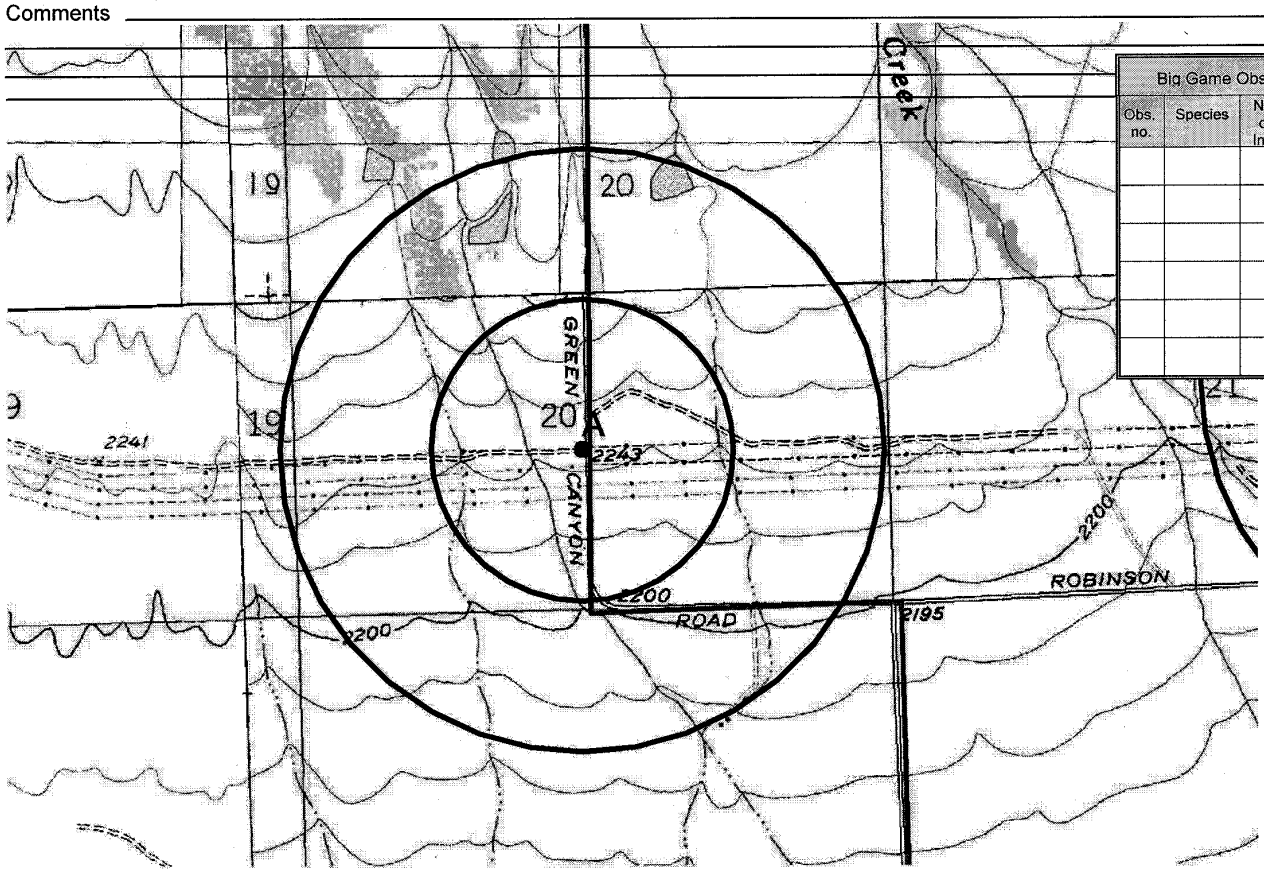
PRECIPITATION(CIRCLE ONE) none light rain rain light snow snow sleet hail other_____

HABITAT w/in 800 m of point: 1st ____ ___% 2nd ____ ___% 3rd ____ ___% 4th ____ ___% 5th ____ ___% 6th ____ ___%

Obs. No.	Species	Sex	Age	# Inds.	Distance (m) from observer		Activity				Flight Characteristics				Habitat					Instantaneous Count (Height/Distance)				A[a]	10 min incr.
											Flight Height (m)			Dir.											
					1st	closest					1st	low	high							1	2	3	4		
1							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
2							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
3							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
4							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
5							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
6							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
7							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
8							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
9							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						
10							PE	SO	FL	FH					GS	CF	DT	CR	WW						
							CS	HO	ST	OT					DS	SS	RK	RI	OT						

[a] check if Auditory only

Comments _____



Big Game Observations			
Obs. no.	Species	No. of Ind.	Distance from (m) observer

APPENDIX B

PLANT SPECIES LIST FROM THE STUDY AREA

Vascular Plant Species
Desert Claim Wind Power Project – Kittitas County, Washington
Survey Dates September 5 - 6, 2002 and April 28 and May 15, 2003

Botanical nomenclature follows Hitchcock & Cronquist 1973; other commonly accepted names in parenthesis, where applicable.

Note: This is not a complete list of vascular plants in the project area – only those identifiable during the survey periods
** = introduced species*

Family	Scientific Name	Common Name
BERBERIDACEAE	*Berberis (Mahonia) repens*	Oregon grape
BETULACEAE	*Alnus incana*	Mountain alder
BORAGINACEAE	*Amsinckia lycopsoides*	Tarweed fiddleneck
	Lithospermum ruderale	Columbia puccoon
	Myosotis sp.	Forget-me-not
CAPRIFOLICAEAE	*Symphoricarpos albus*	Common snowberry
COMPOSITAE (ASTERACEAE)	*Achillea millefolium*	Common yarrow
	Ambrosia psilostachya	Common ragweed
	Antennaria sp.	Pussytoes
	Artemisia rigida	Stiff sagebrush
	Artemisia tridentata	Big sagebrush
	Balsamorhiza hookeri	Hooker's balsamroot
	Balsamorhiza saggitata	Arrowleaf balsamroot
	Centaurea sp.	Knapweed
	Chrysothamnus vicidiflorus	Green rabbitbrush
	*Cichorium intybus**	Chicory
	Cirsium sp.	Thistle
	Erigeron poliospermus	Cushion fleabane
	Haplopappus hirtus	Sticky goldenweed
	Senecio sp.	Groundsel
	Taraxacum officinale	Common dandelion
	Tragopogon dubius	Yellow salsify
CRUCIFERAE (BRASSICACEAE)	*Arabis divaricarpa*	Rockcress
	*Chorispora tenalla**	Blue mustard
	Phoenicaulis cheiranthoides	Daggerpod
	Physaria sp.	Twinpod
	*Sisymbrium altissimum**	Tumble mustard
CYPERACEAE	*Carex nebraskensis*	Nebraska sedge
	Eleocharis palustris	Common spikerush

Family	Scientific Name	Common Name
GERANIACEAE	*Erodium cicutarium**	Filaree
GRAMINEAE (POACEAE)	*Agropyron cristatum*	Crested wheatgrass
	Agropyron spicatum (Pseudoroegneria spicata)	Bluebunch wheatgrass
	Alopecurus pratensis	Meadow foxtail
	*Bromus tectorum**	Cheat grass
	Elymus (Leymus) cinereus	Giant wildrye
	Festuca idahoensis	Idaho fescue
	Poa bulbosa	Bulbous bluegrass
	Poa pratensis	Kentucky bluegrass
	Poa sandbergii (secunda)	Sandberg's bluegrass
	Sitanion hystrix	Squirreltail
GROSSULARIACEAE	*Ribes aureum*	Golden current
HYDROPHYLLACEAE	*Hydrophyllum capitatum*	Ballhead waterleaf
	Phacelia sp.	Phacelia
IRIDACEAE	*Iris*	Iris
JUNCACEAE	*Juncus balticus*	Baltic rush
LEGUMINOSAE (FABACEAE)	*Lupinus sericeus*	Silky lupine
	Lupinus sp.	Lupine
	Trifolium macrcephalum	Big-head clover
LILIACEAE	*Allium sp.*	Onion
	Brodiaea howellii (Triteleia gndiflora var. howellii)	Howell's brodiaea
	Camassia quamash	Common camas
	Zigadenus venenosus	Death camas
OROBANCHACEAE	*Orobanche sp.*	Broomrape
PINACEAE	*Pinus ponderosa*	Ponderosa pine
PLANTAGINACEAE	*Plantago lanceolata**	Plantain
POLEMONIACEAE	*Phlox hoodii*	Hood's phlox
	Phlox longifolia	Long-leaf phlox
POLYGONACEAE	*Eriogonum ovalifolium*	Cushion buckwheat
	Eriogonum sphaerocephalum	Round-headed desert buckwheat
	Eriogonum thymoides	Thyme-leaved eriogonum
	*Polygonum lapathifolium**	Ladysthumb

Family	Scientific Name	Common Name
	Rumex sp.	Dock
PORTULACEAE	*Lewisia rediviva*	Bitterroot
PRIMULACEAE	*Dodecatheon puchellum*	Shooting star
RANUNCULACEAE	*Delphinium nuttallianum*	Larkspur
	Ranunculus glaberrimus	Sagebrush buttercup
ROSACEAE	*Amelanchier alnifolia*	Western serviceberry
	Crataegus douglasii	Black hawthorn
	Potentilla sp.	Cinquefoil
	Prunus virginiana	Chokecherry
	Purshia tridentata	Bitter-brush
	Rosa woodsii	Wood's rose
RUBIACEAE	*Galium boreale*	Northern bedstraw
SALICACEAE	*Populus trichocarpa*	Black cottonwood
	Salix exigua	Sandbar willow
SAXIFRAGACEAE	*Lithophragma bulbifera*	Prairie star
	Lithophragma parviflora	Small flower fringecup
SCROPHULARIACEAE	*Collinsia parviflora*	Small-flowered blue-eyed Mary
	Mimulus guttatus	Yellow monkey flower
	Veronica sp.	Speedwell
UMBELLIFERAE (APIACEAE)	*Lomatium canbyi*	Canby's lomatium
	Lomatium dissectum	Fern-leaved lomatium
	Lomatium grayii	Gray's lomatium
	Lomatium naudicaule	Barestem lomatium
	Lomatium macrocarpum	Large-fruited lomatium
	Lomatium triternatum	Nine-leaf lomatium
VIOLACEAE	*Viola nuttallii*	Violet
	Viola trinervata	Desert pansy