YEAR 1 AVIAN AND BAT MONITORING REPORT

Biglow Canyon Wind Farm – Phase III
Sherman County, Oregon

September 13, 2010 – September 9, 2011

Prepared for:

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1.0 EXECUTIVE SUMMARY

The Biglow Canyon Wind Farm is located in the Columbia Plateau Ecoregion, approximately five miles (eight kilometers) northeast of Wasco, Oregon. Biglow Canyon consists of three individual phases (I, II, and III). Phase III contains 76 Siemens 2.3-megawatt (MW) wind turbines with a nameplate capacity of 150 MW. The Site Certificate issued by the State of Oregon Energy Facility Siting Council (EFSC) for the Biglow Canyon Wind Farm requires the certificate holder, Portland General Electric (PGE), to conduct a 2-year Fatality Monitoring Program to determine bird and bat fatality rates and habitat effects.

This report summarizes the results for the first year (Year 1) of post-construction monitoring at Biglow Canyon Phase III, which was conducted between September 13, 2010 and September 9, 2011. Year 1 monitoring included searches for bird and bat carcasses at turbines (Fatality Monitoring Program) and fixed-point avian use surveys (Avian Use and Behavior Study) in accordance with the protocols outlined in the *Biglow Canyon Wind Farm: Wildlife Monitoring and Mitigation Plan*. This report summarizes the results of bird and bat fatality searches, fixed-point avian use surveys, and incidental wildlife observations, and presents annual adjusted Year 1 bird and bat fatality rates.

Fatality Monitoring Program

The primary objective of the Fatality Monitoring Program was to estimate the annual number of avian and bat casualties attributable to collisions with wind turbines. The program consisted of four primary components: 1) standardized carcass surveys at 50 turbines; 2) searcher efficiency trials; 3) carcass removal trials; and 4) statistical analyses including estimates of annual avian and bat fatality rates adjusted for searcher efficiency and carcass removal.

Carcass searches were conducted at 50 turbines selected in consultation with the Oregon Department of Fish and Wildlife. Square search plots (252 meters [m]; 830 feet [ft)] on a side) were established around each search turbine, and surveyors walked parallel transects spaced approximately 6 m (20 ft) apart while scanning the ground for carcasses. In accordance with the *Wildlife Monitoring and Mitigation Plan*, standardized searches were conducted at each of the 50 search turbines once every two weeks during the spring and fall migration periods and once every four weeks during summer and winter. Each turbine was searched 16 times, resulting in a total of 800 individual turbine searches during Year 1.

Forty birds representing 16 species were documented during standardized carcass searches. Bird species were similar to species composition documented during fatality monitoring at Biglow Canyon Phases I and II and other wind projects in the Pacific Northwest. The horned lark was the most common species (19 fatalities), and represented 47.5% of all birds found during standardized searches. Raptor fatalities included one red-tailed hawk, one rough-legged hawk, and one American kestrel. No special status bird species (federal/state threatened and endangered or state sensitive) were documented as fatalities during Year 1 fatality monitoring.

Bird fatalities were found at 26 of the 50 turbines monitored in Year 1, and the maximum number of bird fatalities found at an individual turbine was four. A higher proportion of fatalities were found at the northern ends of strings along the John Day River canyon compared to interior turbines. However, search effort was concentrated on these turbines and the spatial pattern of Year 1 fatalities may have been the result of disproportionate search intensity and the presence of native habitats along the John Day River canyon. Bird fatalities were documented throughout the year, with the highest proportion (40.0%) occurring during fall migration.

Five bats representing two species, hoary bat and silver-haired bat, were documented during Year 1 standardized carcass searches. Both species are classified as state sensitive. All bat fatalities appeared to be associated with the fall migration period. While fatalities appeared to be concentrated at turbines along the John Day River canyon, the limited number of fatalities and disproportionate search intensity precluded spatial analysis of bat fatalities.

A total of eight searcher efficiency trials utilizing 174 trial carcasses (78 large birds and 96 small birds) were conducted in Year 1. Mean searcher efficiency rates across all seasons were 75.6% for large birds and 32.6% for small birds. A total of 160 carcasses (80 large birds and 80 small birds) were utilized for Year 1 carcass removal trials. The estimated mean removal times varied by season for both large and small birds. Across all seasons, approximately 60% of small birds and 30% of large birds were removed by day ten of the trial.

Year 1 annual adjusted fatality rates were 2.28 birds/MW for all birds, 2.17 birds/MW for all birds excluding non-native species, 0.11 birds/MW for all large birds, 2.17 birds/MW for all small birds, 0.52 birds/MW for nocturnal avian migrants, 0.05 birds/MW for raptors, and 0.22 bats/MW for bats. No fatalities were documented for target grassland birds, state sensitive avian species, and raptors of special concern. Analyses indicated no statistically-significant differences in fatality rates between turbines with and without required Federal Aviation Administration lights.

The adjusted annual Year 1 bird fatality rates were generally similar to fatality rates documented at Biglow Canyon Phase I and slightly lower than other CPE wind energy facilities including Klondike II, Bighorn I, Leaning Juniper I, and Nine Canyon I. The Year 1 bird fatality rate is in the middle of the range for regional wind energy facilities. The adjusted annual bat fatality rate is lower than fatality rates documented at Biglow Canyon Phase I and II and other regional facilities. Bird and bat species documented as fatalities during Year 1 monitoring were similar to other phases at Biglow as well as other regional wind facilities. Adjusted annual fatality rates were below threshold values for all target groups identified in the *Wildlife Monitoring and Mitigation Plan*.

Avian Use and Behavior

The primary objective of the Avian Use and Behavior Surveys was to record bird use and abundance in the Biglow Canyon Phase III project area. In accordance with the *Wildlife Monitoring and Mitigation Plan*, the surveys were conducted at four fixed points along the John Day River canyon (JDC surveys) and at each of the 50 search turbines (PWT surveys). Both JDC and PWT surveys utilized fixed-point (circular plot) methods. JDC survey plots were 800-m

(2,625 ft) radius circles centered on a fixed point, and PWT survey plots were 400-m (1,312 ft) radius circles centered on the turbine. Each JDC point was surveyed for 30 minutes six times per month throughout the year. Each PWT point was surveyed for 5 minutes immediately prior to a standardized carcass search. All birds observed within the survey plot were recorded, and flight paths were documented for large birds observed during JDC surveys. Protocols were the same as used for JDC and PWT surveys conducted at Biglow Canyon Phases I and II. Bird diversity, species richness, bird use, percent composition, and frequency of occurrence were calculated for individual species and major bird types (e.g., raptors) by season for both JDC and PWT surveys.

Each JDC point was surveyed 71 times for a total of 284 JDC surveys during Year 1. A total of 11,684 individual bird observations in 941 separate groups were recorded. Forty-eight unique species were identified, with a mean of 0.82 large bird species and 1.43 small bird species per plot per survey. The European starling was the most common species (6,269 individuals), and European starling, horned lark, and Canada goose represented 80.6% of all birds observed. A total of 194 individual raptors representing 13 species were recorded, and the red-tailed hawk accounted for over 55% of raptor observations.

Each PWT point was surveyed 16 times for a total of 800 PWT surveys during Year 1. A total of 3,350 individual birds in 970 separate groups were recorded during PWT avian use surveys. Twenty-six unique species were identified, with a mean of 1.03 bird species recorded per plot per survey. Species richness was slightly higher in winter and spring than in summer and fall.

Passerines accounted for over 74% of all PWT bird observations, and three species (horned lark, western meadowlark, and European starling) represented 96.3% of all passerines observed during PWT surveys. Red-tailed hawk and northern harrier accounted for over 65% of all raptor observations during PWT surveys. Peak bird use occurred in winter, and seasonal use estimates were largely driven by passerines. Mean annual use for all birds at individual turbines ranged from 0.81 to 9.44 birds/5-min survey. Fifteen of the 50 points had mean use values that exceeded the average, and higher use points were generally located at the northern end of turbine strings along the John Day River canyon.

A total of 78 individual birds representing seven special status species were recorded during Year 1 JDC and PWT surveys at Biglow Canyon Phase III. American white pelican (54 individuals) and golden eagle (12 individuals) were the most common special status bird species observed. All seven species were recorded during JDC surveys, and five individuals representing three species (golden eagle, Swainson's hawk, and long-billed curlew) were recorded during PWT surveys. All seven species have been previously documented during surveys conducted at Biglow Canyon Phases I and II.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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A number of individuals from different organizations were instrumental in the completion of the first year of monitoring at the Biglow Canyon Phase III Wind Project. Review of project habitats and selection of study plots was conducted in collaboration with Jeremy Thompson, Oregon Department of Fish and Wildlife. PGE provided funding for the field studies and access to the Biglow Canyon facility. Greg Concannon and Dale Coyle of PGE served as outstanding project managers administering information and coordination to WEST field staff and guiding communication with other project O&M personnel. Other PGE personnel, Robert Marheine and Christy Brown were helpful in additional safety instruction, access, storage, and other logistical considerations for the study. All the landowners in the Biglow Canyon project deserve recognition for their support and cooperation in allowing safe, secure, and trouble-free access.

1.0 INTRODUCTION

Portland General Electric (PGE) owns and operates the Biglow Canyon Wind Farm (BCWF), which consists of three phases (I, II, and III) with a total installed capacity of approximately 450 megawatts (MW). Phase III, completed in August 2010, contains 76 Siemens 2.3-MW wind turbines with a total nameplate capacity of 150 MW. These turbines are 415 feet tall (ft; 126 meters [m]) from base to the tip of the fully extended blade and have a rotor diameter of 305 ft (93 m).

The *Biglow Canyon Wind Farm: Wildlife Monitoring and Mitigation Plan* (*Wildlife Monitoring and Mitigation Plan*; ODOE 2007) requires PGE to complete two years of fatality monitoring and avian use surveys at each of the three project phases to determine bird and bat fatality rates and assess habitat impacts for avian species. This report presents the results of the first year (Year 1) of monitoring, which was conducted from September 13, 2010 through September 9, 2011. Specifically, this report summarizes the methods and results of 1) fatality monitoring at 50 turbines, 2) fixed-point bird use surveys at four points along the John Day Canyon (JDC surveys), and 3) fixed-point bird use surveys at the 50 turbines utilized for fatality monitoring (PWT surveys). The report presents annual adjusted fatality rate estimates for birds and bats, compares the estimated fatality rates with Biglow Canyon Phases I and II and regional wind energy facilities, and compares estimated fatality rates with threshold values established in the *Wildlife Monitoring and Mitigation Plan*. All studies were conducted in accordance with the protocols presented in the *Wildlife Monitoring and Mitigation Plan*.

2.0 STUDY AREA

The BCWF is located in Sherman County, Oregon, approximately five miles northeast of the city of Wasco (Figure 1). The facility encompasses approximately 25,000 acres (39 mi^2; 101 km^2) and is generally bordered by the John Day River to the east, the Columbia River to the north, and smaller canyons and agricultural lands to the south and west. Elevations range from approximately 250 ft (76 m) above mean sea level (amsl) near the mouth of the John Day River to 1,600 ft (488 m) amsl on the higher ridges. Phase III is situated in the southeast portion of the BCWF project area (Figure 1).

The BCWF lies within the Columbia Plateau Level III Ecoregion (CPE; Thorson et al. 2003). Native shrub-steppe and grassland-steppe habitats in the CPE have largely been converted to agriculture and rangeland, and the ecoregion is characterized by upland plateaus dominated by dry-land wheat dissected by river canyons that support remnant shrub-steppe and grassland-steppe habitats as well as lands enrolled in the Conservation Reserve Program (CRP). The Biglow Canyon Phase I Year 1 report (Jeffrey et al. 2009a) contains a detailed description of habitat types in the general BCWF project area. Nearly all Phase III turbines are located in cultivated wheat fields.

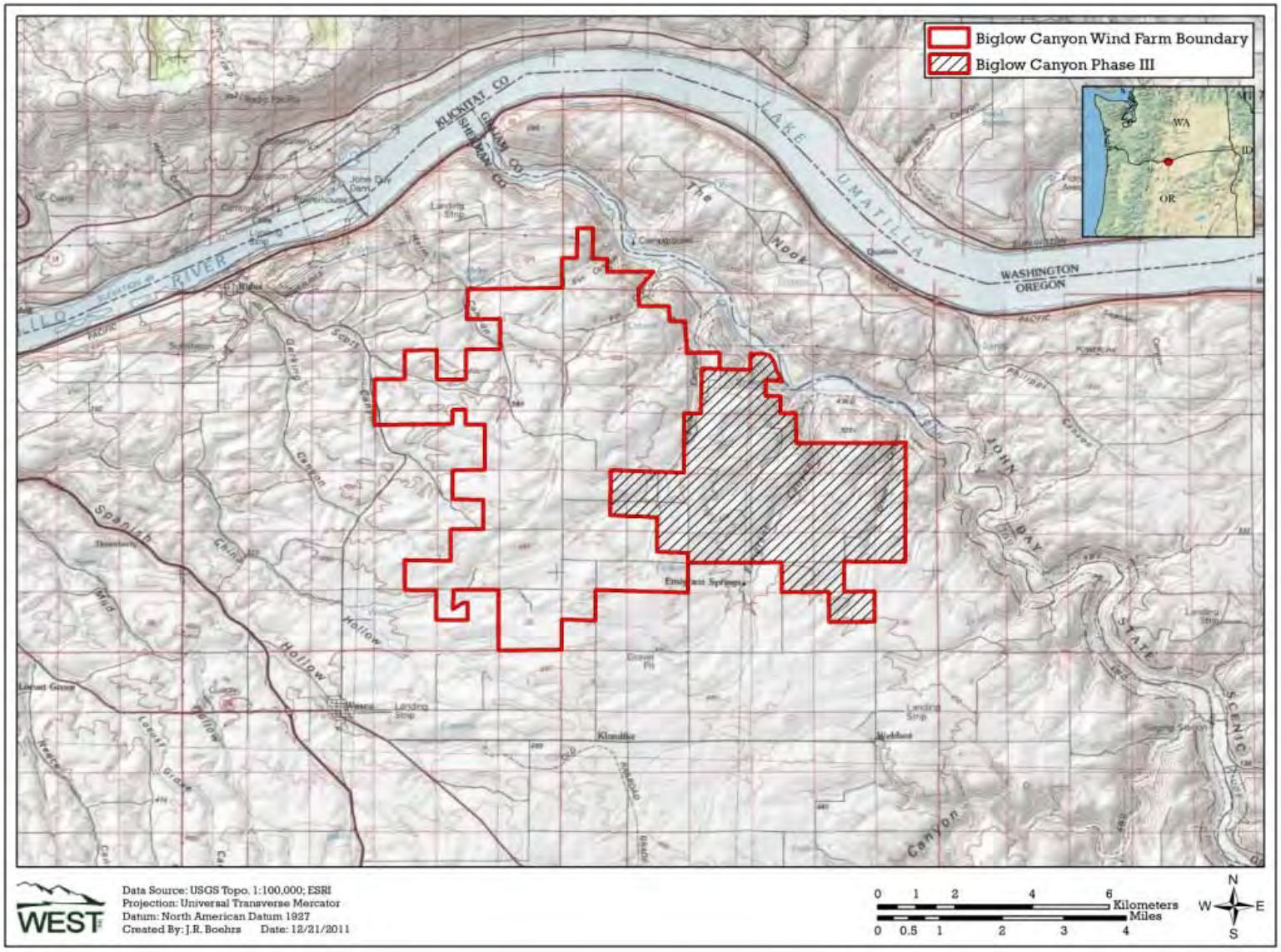

Figure 1. Location of Biglow Canyon Wind Farm and Phase III project area.

3.0 FATALITY MONITORING

3.1 Methods

The primary objective of the fatality monitoring program was to develop annual estimates of bird and bat fatalities attributable to collisions with the Phase III wind turbines. The fatality monitoring program consisted of four primary components: 1) standardized carcass searches at select turbines; 2) searcher efficiency trials to estimate the proportion of carcasses missed by searchers; 3) carcass removal trials to estimate the length of time that a carcass remained in the field for potential detection by searchers; and 4) statistical analyses, including the calculation of adjusted estimates of annual avian and bat fatality rates that incorporate searcher efficiency and carcass removal trial data. All aspects of the fatality monitoring program were conducted in accordance with the protocols presented in the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007).

There are three scenarios under which avian and bat fatalities were found at Phase III: 1) by study personnel during standardized carcass searches; 2) by study personnel while in the project area but not conducting a standardized search (incidental find); and 3) by facility operations and maintenance personnel (incidental find). All fatalities found by study personnel (regardless of whether found during a standardized search or incidentally) were documented as described below. Carcasses found incidentally within search plots were recorded and assumed to be turbine casualties for purposes of this study. While this approach likely resulted in an overestimate of the actual number of facility-related fatalities, this is standard protocol for fatality monitoring at wind energy facilities (Johnson et al. 2000).

3.1.1 Search Plots

Year 1 fatality monitoring was conducted at 50 Phase III turbines selected in consultation with the Oregon Department of Fish and Wildlife. In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), the 50 search turbines included all turbines along the John Day River canyon and end-of-string turbines (Figure 2). Carcass searches were conducted within square plots established around each of the 50 turbines. Search plot dimensions measured 126 m (415 ft) from the turbine to the nearest plot edge for a total plot size of 252 x 252 m (830 x 830 ft; Figure 3).

3.1.2 Standardized Carcass Searches

Standardized carcass searches were conducted to find bird and bat fatalities at the 50 selected turbines. Carcass searches were conducted by trained field technicians who systematically walked parallel transects spaced approximately 6 m apart, which provided 100% visual coverage of the search plot. In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), standardized searches were conducted at each of the 50 turbines once every two weeks during the spring and fall migration periods (March 15 – May 15 and August 15 – October 31, respectively) and once per month during the remainder of the year.

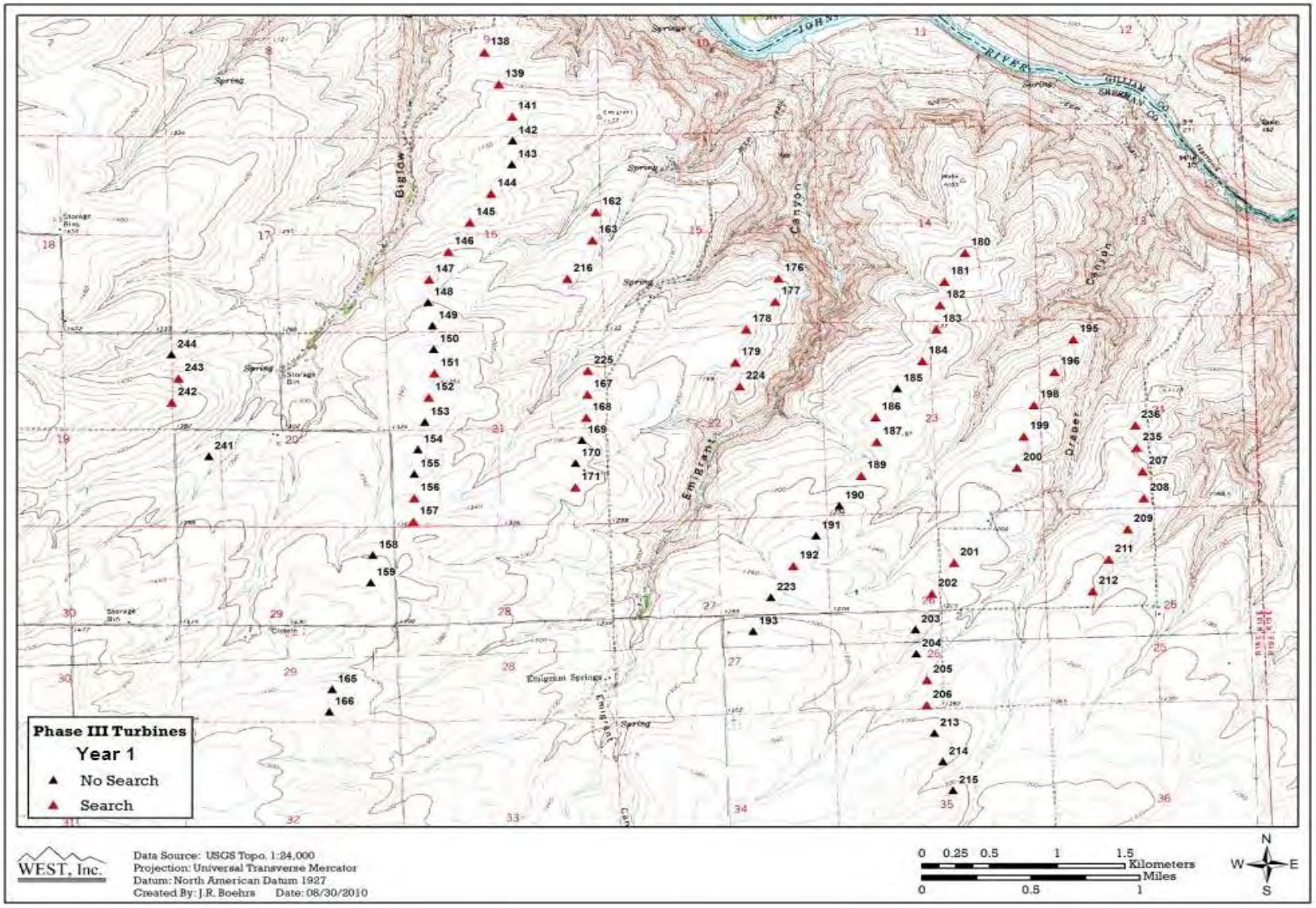

Figure 2. Turbines searched during Year 1 monitoring at Biglow Canyon Phase III.

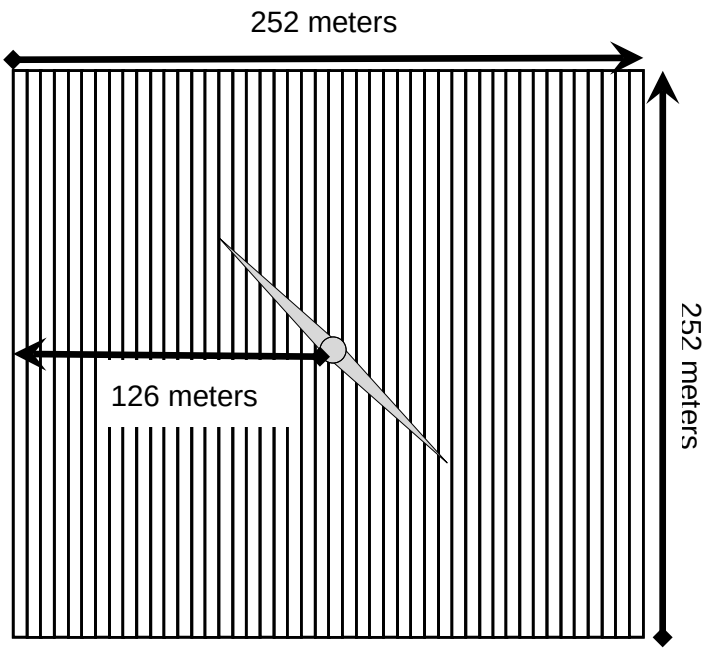

Figure 3. Schematic of turbine search plot and transects

For each bird and bat carcass discovered during standardized searches, field technicians completed a data sheet that included a unique identification number, date and time found, GPS location, species, sex and age, condition, and likely cause of death. All casualties were photographed and the location was plotted on a topographic map that illustrated the search plot and nearest wind turbine. Carcasses were stored with the data sheet in a freezer at the Biglow Canyon Operation and Maintenance (O&M) building for future reference. Incidental finds were documented and stored in the same manner. Carcass condition was classified as follows:

- ***Intact*** - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- ***Scavenged*** - an entire carcass with signs of being fed upon by a predator or scavenger, a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that is heavily infested by insects.
- ***Feather Spot*** - ten or more feathers or two or more primaries at one location indicating a bird fatality had been there.

3.1.3 Searcher Efficiency Trials

The objective of the searcher efficiency trials was to determine the proportion of carcasses that technicians detected, and the trial results were used to adjust bird and bat fatality estimates for detection bias. Searcher efficiency trials were conducted simultaneously with fatality searches. Trial carcasses were randomly placed within turbine search plots by a field supervisor immediately prior to a scheduled carcass search. Searchers were not told when trials were being conducted or in which search plot trial carcasses were located. Each trial carcass was discreetly marked with electrical tape to distinguish it from an actual fatality. Carcasses were dropped from waist height and allowed to land in a variety of postures. The number and location of the trial carcasses found by searchers were recorded. Immediately following completion of

the search, the field supervisor attempted to retrieve all carcasses not collected by searchers to determine the proportion of carcasses that remained available for detection.

Searcher efficiency trials were conducted throughout the year utilizing two size classes of trial carcasses (large and small). Large birds were represented by mallard (*Anas platyrhynchos*) and ring-necked pheasant (*Phasianus colchicus*). Small birds were represented by house sparrow (*Passer domesticus*) and rock pigeon (*Columba livia*). House sparrows were used as surrogates for bats. Trial results were analyzed to distinguish effects of carcass size and season.

3.1.4 Carcass Removal Trials

The objective of carcass removal trials was to determine the average length of time a carcass remained in the search plot and was available for detection by searchers, and the trial results were used to adjust bird and bat fatality estimates for removal bias resulting from scavengers or agricultural activities. Carcass removal trials were conducted throughout the year to incorporate seasonal variability in weather, vegetation, and scavenger densities. Trials were not conducted at search turbines to minimize the potential for confusing a trial bird with a turbine casualty.

Two size classes of trial carcasses (small and large) were randomly placed in an area that was similar in size to the carcass search plots. Carcasses generally included the same species that were used for the searcher efficiency trials. Field technicians monitored the trial carcasses over a 40-day trial period, checking them every day for the first four days and then on days seven, 10, 14, 20, 30, and 40. Removal trial carcasses were discreetly marked with electrical tape for recognition by searchers and other personnel. The day on which the carcass was no longer present was recorded, and any carcasses or evidence (e.g., feathers) remaining at day 40 were removed. In an effort to minimize attraction of common raven (*Corvus corax*) to field technician activities, efforts were made to place and check removal trial carcasses at/near dark.

3.1.5 Statistical Methods

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including field studies, data entry, data analysis, and report writing. All field data sheets were inspected for completeness, accuracy, and legibility. A sample of records from the electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems were traced back to the raw data forms and rectified. All data sheets and electronic data files were retained for reference.

In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), adjusted annual fatality estimates were calculated for all birds, all bats, small birds, large birds, raptors, nocturnal avian migrants, raptor species of special concern, target grassland birds, and state sensitive avian species. Year 1 fatality estimates were based upon the number of carcasses found during standardized searches and adjusted for searcher efficiency bias (proportion of trial carcasses not found by searchers) and carcass removal bias (probability that a carcass remained in the study plot and was available for detection by the searchers over the 40-day trial period). The following define the statistical methods utilized to develop adjusted annual fatality estimates.

Definition of Variables

The following variables were used in the equations below:

- c_i the number of carcasses detected at plot *i* during the study period for which the cause of death was either unknown or was attributed to the facility
- n the number of search plots
- k the number of turbines searched
- $\bar{c}$ the average number of carcasses observed per turbine per monitoring year
- s the number of carcasses used in removal trials
- s_c the number of carcasses in removal trials that remain in the study area after 40 days
- se standard error (square of the sample variance of the mean)
- t_i the average time (in days) a carcass remained in the study area before it was removed, as determined by the removal trials
- $\bar{t}$ the average time (in days) a carcass remained in the study area before it was removed, as determined by the removal trials
- d the total number of carcasses placed in searcher efficiency trials
- p the estimated proportion of detectable carcasses found by searchers, as determined by the searcher efficiency trials
- I the average interval between standardized carcass searches, in days
- $\hat{\pi}$ the estimated probability that a carcass was available to be found during a search and was found, as determined by the carcass removal and searcher efficiency trials
- m the estimated annual average number of fatalities per turbine per year, adjusted for removal and searcher efficiency bias

Observed Number of Carcasses

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

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

Estimation of Carcass Non-Removal Rates

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

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

Estimation of Searcher Efficiency Bias

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

Estimation of Facility-Related Fatality Rates

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

$$m = \frac{\bar{c}}{\hat{\pi}} \tag{3}$$

where $\hat{\pi}$ included adjustments for both carcass removal (from scavenging and other means) and searcher efficiency bias. Data for carcass removal and searcher efficiency bias were pooled across the study to estimate $\hat{\pi}$. $\hat{\pi}$ was calculated as follows:

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left(I / \bar{t} \right) - 1}{\exp\left(I / \bar{t} \right) - 1 + p} \right] \tag{4}$$

This formula (4) has been independently verified by Shoenfeld (2004). Adjusted fatality estimates were calculated by season, and an annual estimate was developed using a weighted average of these estimates by length of season. This formula was used because search effort was more frequent during the migration seasons compared to non-migration periods. This estimate more accurately reflects the true value since it accounted for the differences between search efforts and variability in carcass removal. The final estimates of *m* and associated standard errors and 90% confidence intervals (CI) were calculated using bootstrapping (Manly 1997). The reported estimates are the mathematical means of 1,000 bootstrap estimates. The standard deviation of the bootstrap estimates is the estimated standard error, and the lower 5th and upper 95th percentiles of the 1,000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

Turbine Lighting

In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), the effect of turbine lighting was evaluated by comparing fatality rates of nocturnal avian migrants and bats between lit turbines, unlit turbines, and unlit turbines adjacent to lit turbines using one-way ANOVA.

3.2 Results

3.2.1 Overview

This section presents results of standardized carcass searches and searcher efficiency and carcass removal trials, as well as adjusted annual fatality estimates for all birds, all bats, small birds, large birds, raptors, nocturnal avian migrants, raptor species of special concern, target grassland birds, and state sensitive avian species. Fifty turbines were each searched 16 times between September 13, 2010 and September 9, 2011, resulting in a total of 800 turbine searches (Table 1).

Table 1. Summary of Year 1 carcass searches at Biglow Canyon Phase III.

Season	Dates	# of Surveys	# Turbine Searches	# of Bird Species	# of Bird Fatalities	# of Bat Species	# of Bat Fatalities
Fall Migration	8/16 - 10/31	5	250	11	16	1	4
Winter	11/1 - 3/15	4	200	3	8	0	0
Spring Migration	3/16 - 5/15	4	200	4	8	0	0
Summer	5/16 - 8/15	3	150	5	8	1	1
Overall		**16**	**800**	**16**	**40**	**2**	**5**

3.2.2 Bird Fatalities

A total of 40 birds representing 15 species were found during Year 1 (Table 2; Appendix E). Two birds could not be identified to species. Thirty-six fatalities were found during standardized carcass searches, and four fatalities were found incidentally. The horned lark (*Eremophila alpestris*) represented nearly half (47.5%) of all bird fatalities and no other individual species accounted for more than five percent of bird fatalities (Table 2). Thirty-two fatalities (80.0%) involved passerines and other small birds.

Three raptor fatalities were documented, including one red-tailed hawk (Buteo jamaicensis), one rough-legged hawk (*Buteo lagopus*), and one American kestrel (*Falco sparverius*). Other large bird fatalities included two ring-necked pheasants, one common nighthawk (*Chordeiles minor*), one gray partridge (*Perdix perdix*), and an unidentified gull. No bird species listed as federally or state threatened or endangered or state sensitive (ODFW 2008; USFWS 2011a, 2011b) were documented as fatalities during Year 1 monitoring.

Table 2. Bird and bat fatalities found during Year 1 monitoring at Biglow Canyon Phase III.

Species	Fatalities	% Composition
horned lark	19	47.5
golden-crowned kinglet	2	5.0
house sparrow	2	5.0
ring-necked pheasant	2	5.0
unidentified warbler	2	5.0
yellow-rumped warbler	2	5.0
American kestrel	1	2.5
American robin	1	2.5
common nighthawk	1	2.5
gray partridge	1	2.5
northern flicker	1	2.5
red-tailed hawk	1	2.5
rough-legged hawk	1	2.5
Townsend's warbler	1	2.5
unidentified gull	1	2.5
varied thrush	1	2.5
Vaux's swift	1	2.5
Total Birds	**40**	**100**
hoary bat	4	80.0
silver-haired bat	1	20.0
Total Bats	**5**	**100**

Spatial and Seasonal Characteristics

Bird fatalities were found at 26 of the 50 (52.0%) turbines monitored in Year 1 (Figures 4 and 5). The maximum number of bird fatalities found at an individual turbine was four (Turbine 406). Three fatalities were found at two turbines, two fatalities were found at seven turbines, and one fatality was found at 16 turbines (Figure 4). The majority of fatalities (95.0%) were found within 120 m (394 ft) of the search turbines (Figure 6).

A higher proportion of fatalities were found at the northern ends of strings along the John Day River canyon compared to interior "plateau" turbines (Figure 5). However, in accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), search effort was concentrated on these turbines and the spatial pattern of Year 1 fatalities was likely influenced by disproportionate search intensity. Bird fatalities were documented throughout the year, with a higher proportion occurring during fall migration (40.0%) than other seasons (Table 1; Figure 7).

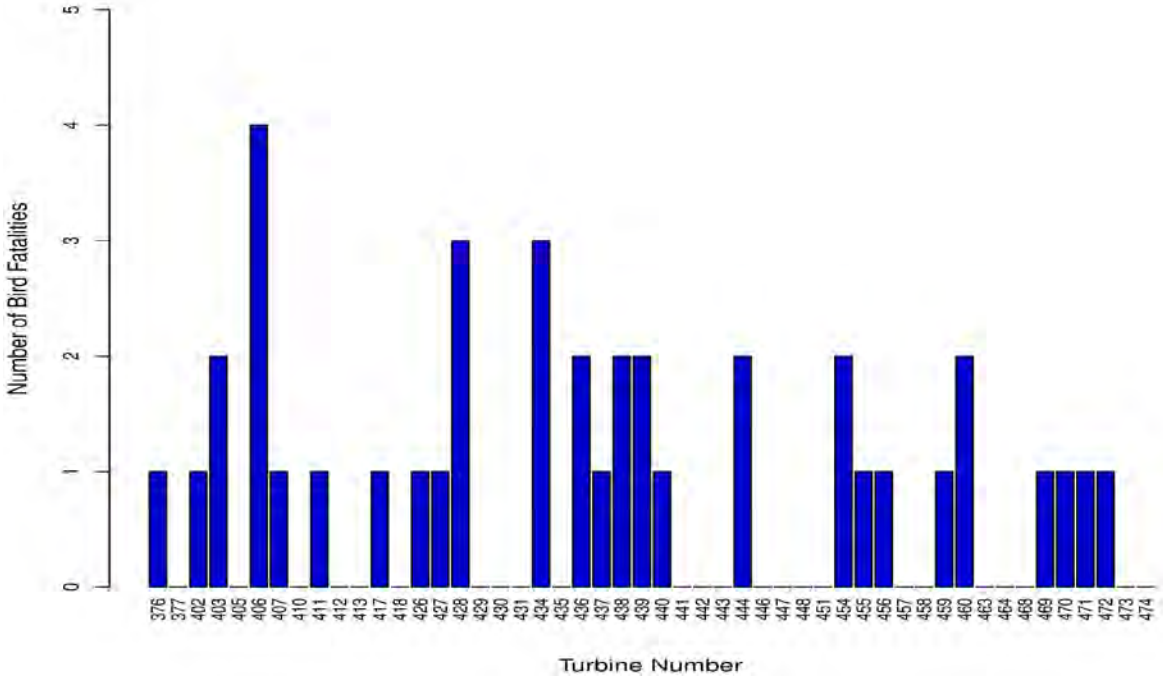

Figure 4. Bird fatalities by turbine during Year 1 monitoring at Biglow Canyon Phase III.

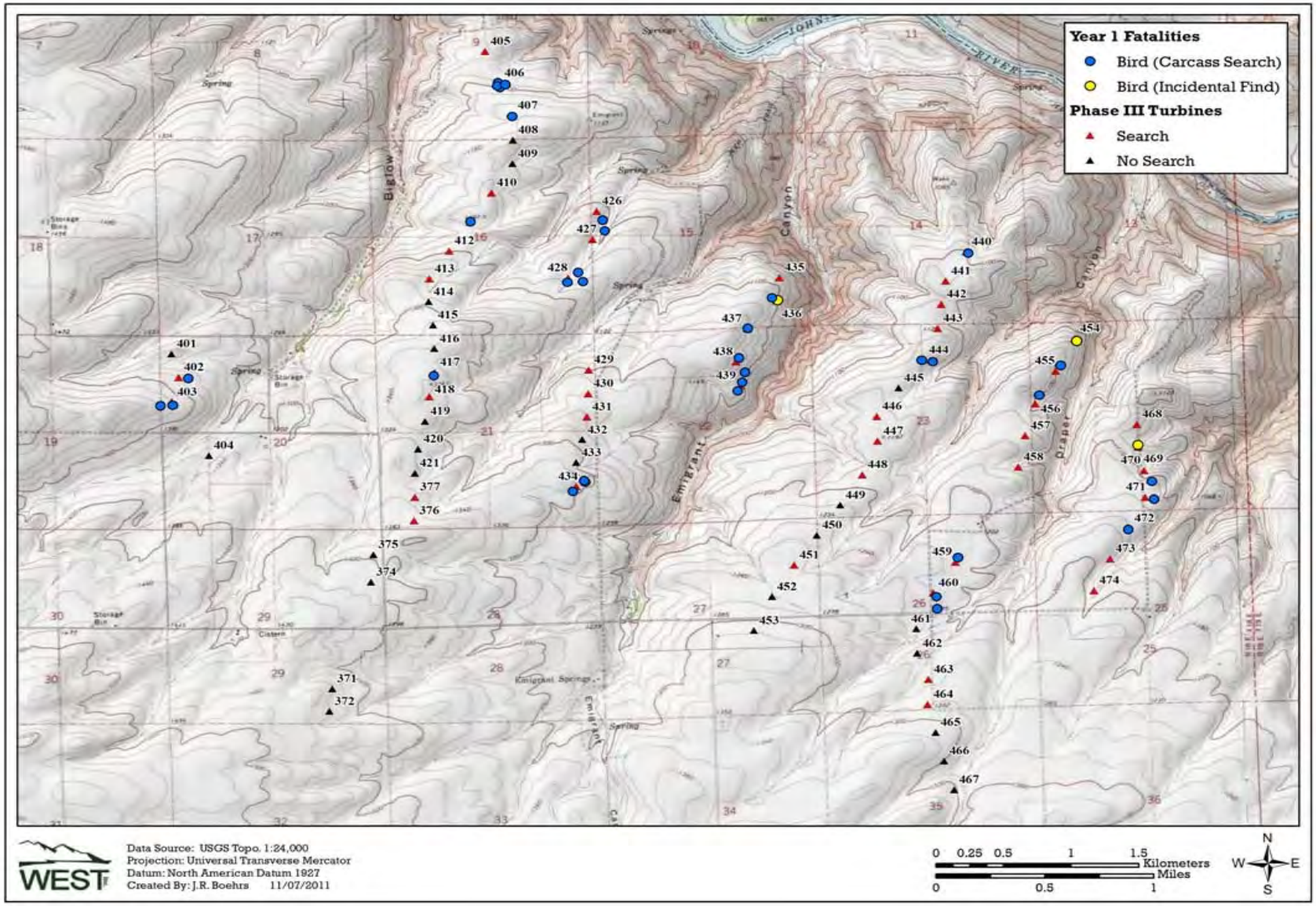

Figure 5. Locations of bird fatalities during Year 1 monitoring at Biglow Canyon Phase III.

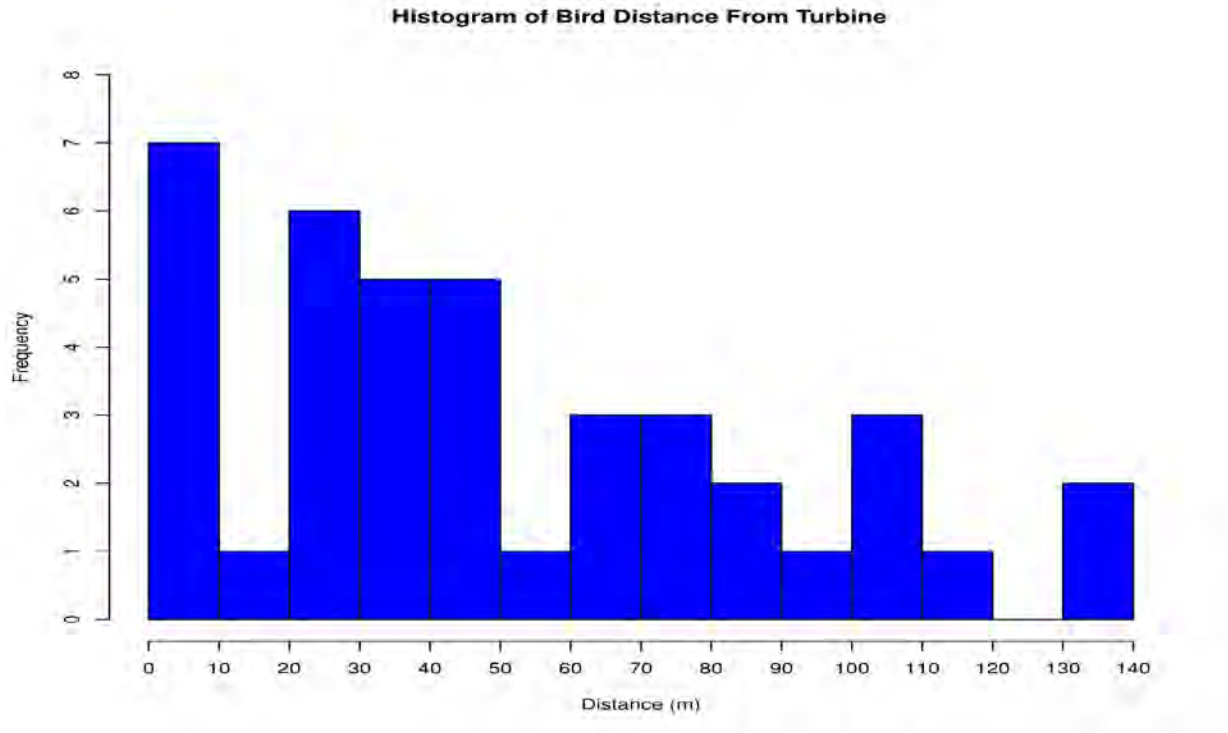

Figure 6. Distance of bird carcasses from turbines during Year 1 monitoring at Biglow Canyon Phase III.

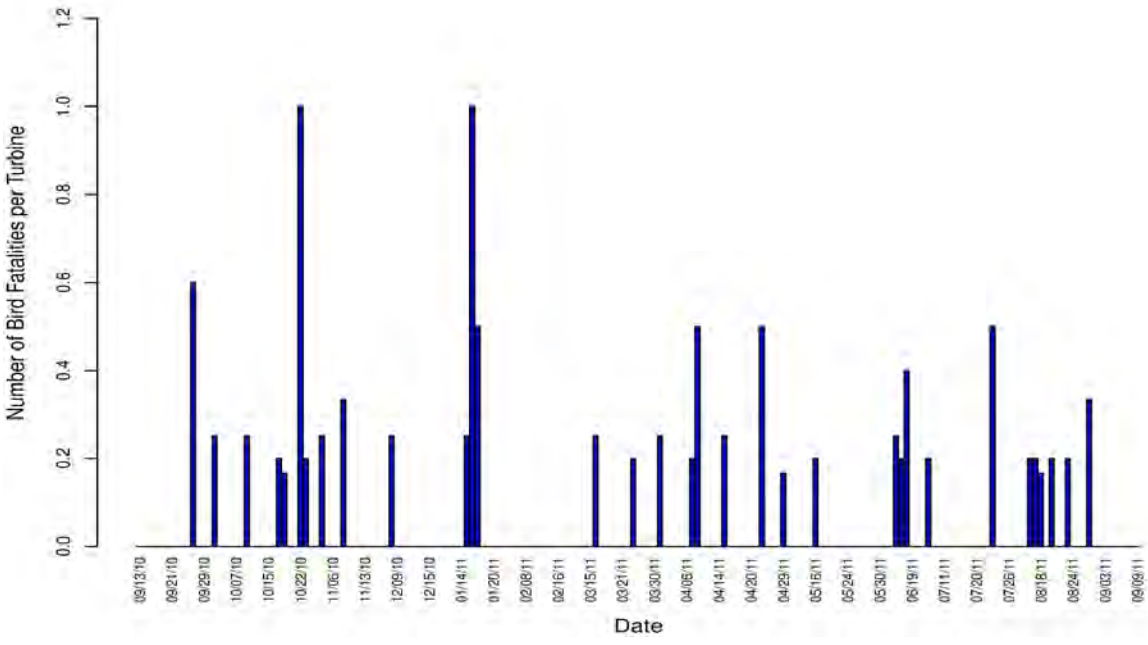

Figure 7. Timing of bird fatalities during Year 1 monitoring at Biglow Canyon Phase III.

3.2.3 Bat Fatalities

A total of five bat carcasses consisting of four hoary bats (*Lasiurus cinereus*) and one silver-haired bat (*Lasionycteris noctivagans*) were found during Year 1 fatality monitoring (Tables 1 and 2). The hoary bat and silver-haired bat are both classified as state sensitive species.

Spatial and Seasonal Characteristics

Bat fatalities were found at five of 50 search turbines during Year 1 fatality monitoring (Figure 8). While the limited number of fatalities and disproportionate search intensity precluded analysis of bat fatality spatial patterns, fatalities were more common at turbines at the northern edges of strings along the John Day River canyon compared to interior turbines (Figure 9). Most carcasses (80.0%) were found within 70 m (230 ft) of the turbine (Figure 10).

Four of the five (80.0%) bat fatalities documented during Year 1 occurred during the fall migration period as defined in the *Wildlife Monitoring and Mitigation Plan* (Table 1; Figure 11; ODOE 2007). The remaining bat fatality was found on July 26, 2011. While this technically falls within the summer season, the date is within the general fall migration period for bats in the Pacific Northwest.

3.2.3 Searcher Efficiency Trials

A total of eight searcher efficiency trials utilizing 174 trial carcasses (78 large birds and 96 small birds) were conducted as part of the Year 1 fatality monitoring program (Table 3). Mean searcher efficiency rates across all seasons were 75.6% for large birds and 32.6% for small birds (Table 3).

Table 3. Results of Year 1 searcher efficiency trials at Biglow Canyon Phase III.

	Season	# Placed	#Available	#Found	%Found
Large Birds	Fall	14	14	11	78.6
	Winter	18	18	16	88.9
	Spring	20	20	16	80.0
	Summer	26	26	16	61.5
Total		**78**	**78**	**59**	**75.6**
Small Birds and Bats	Fall	22	22	8	36.4
	Winter	25	25	11	44.0
	Spring	23	22	7	31.8
	Summer	26	26	5	19.2
Total		**96**	**95**	**31**	**32.6**

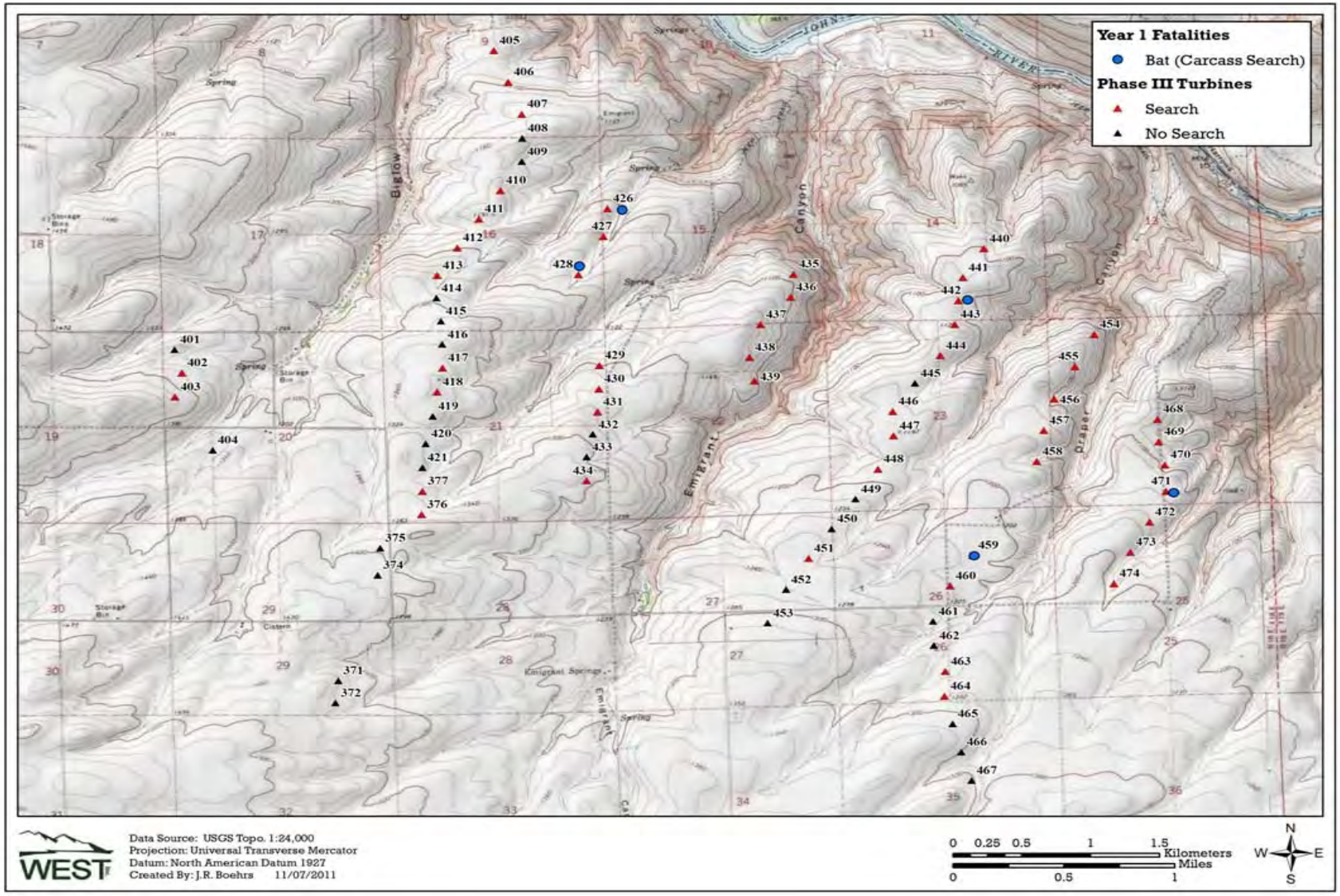

Figure 8. Locations of bat fatalities found during Year 1 monitoring at Biglow Canyon Phase III.

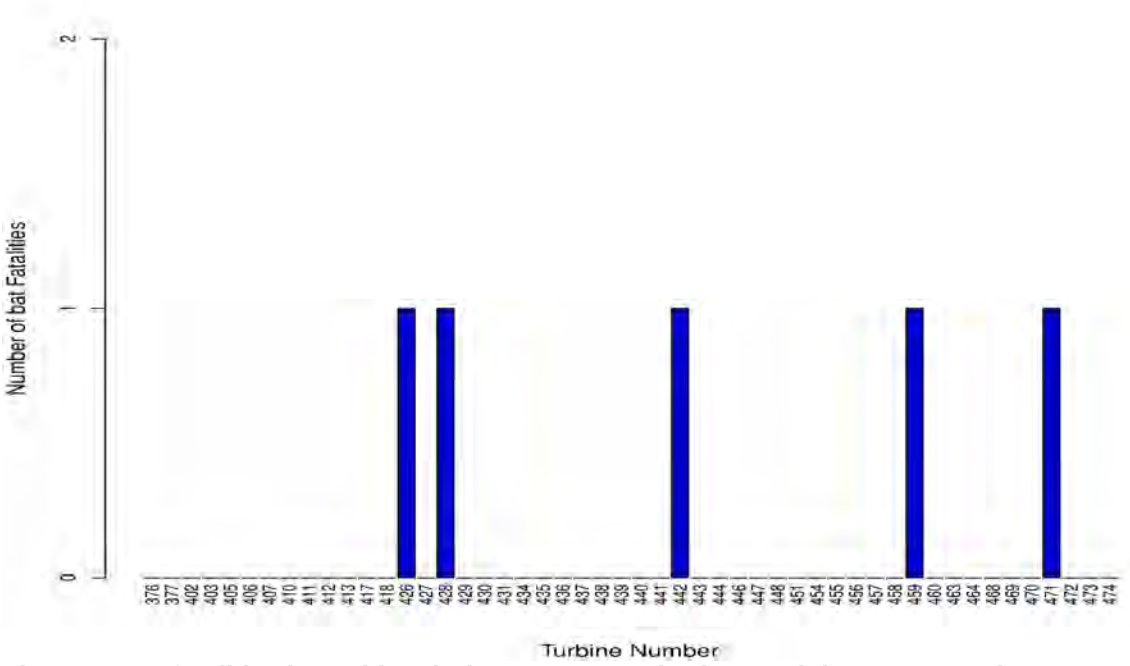

Figure 9. Bat fatalities by turbine during Year 1 monitoring at Biglow Canyon Phase III.

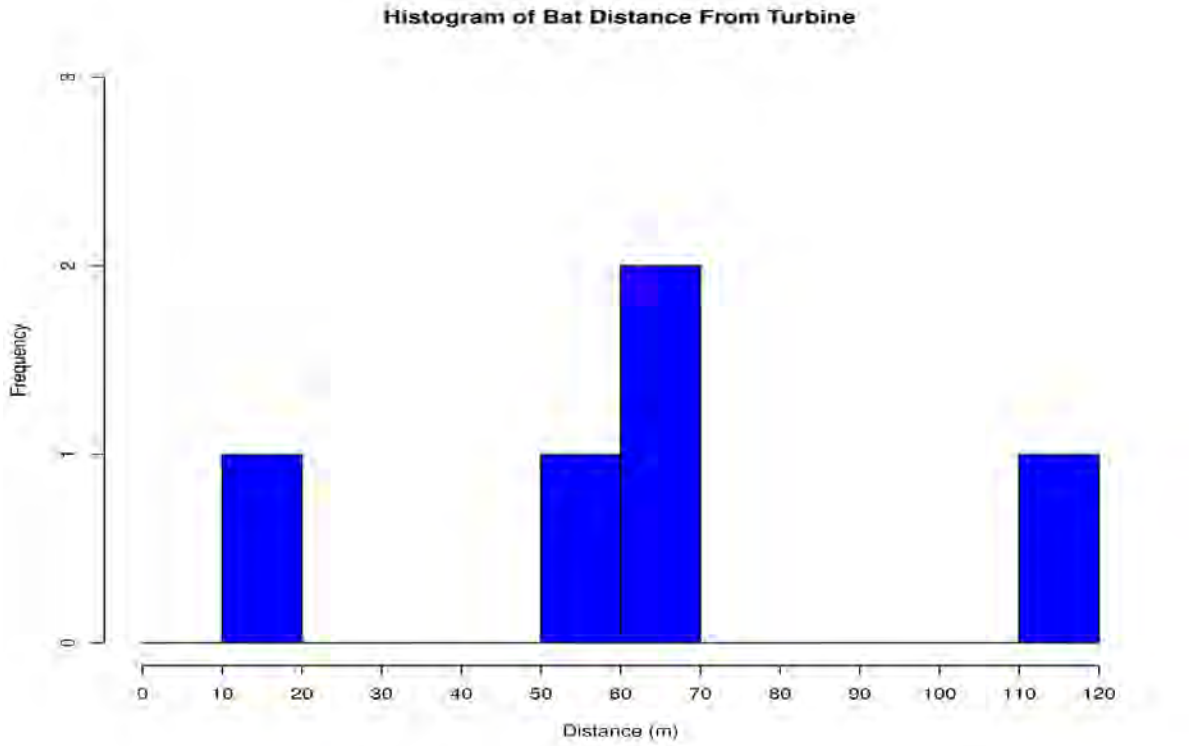

Figure 10. Distance of bat carcasses from turbines during Year 1 monitoring at Biglow Canyon Phase III.

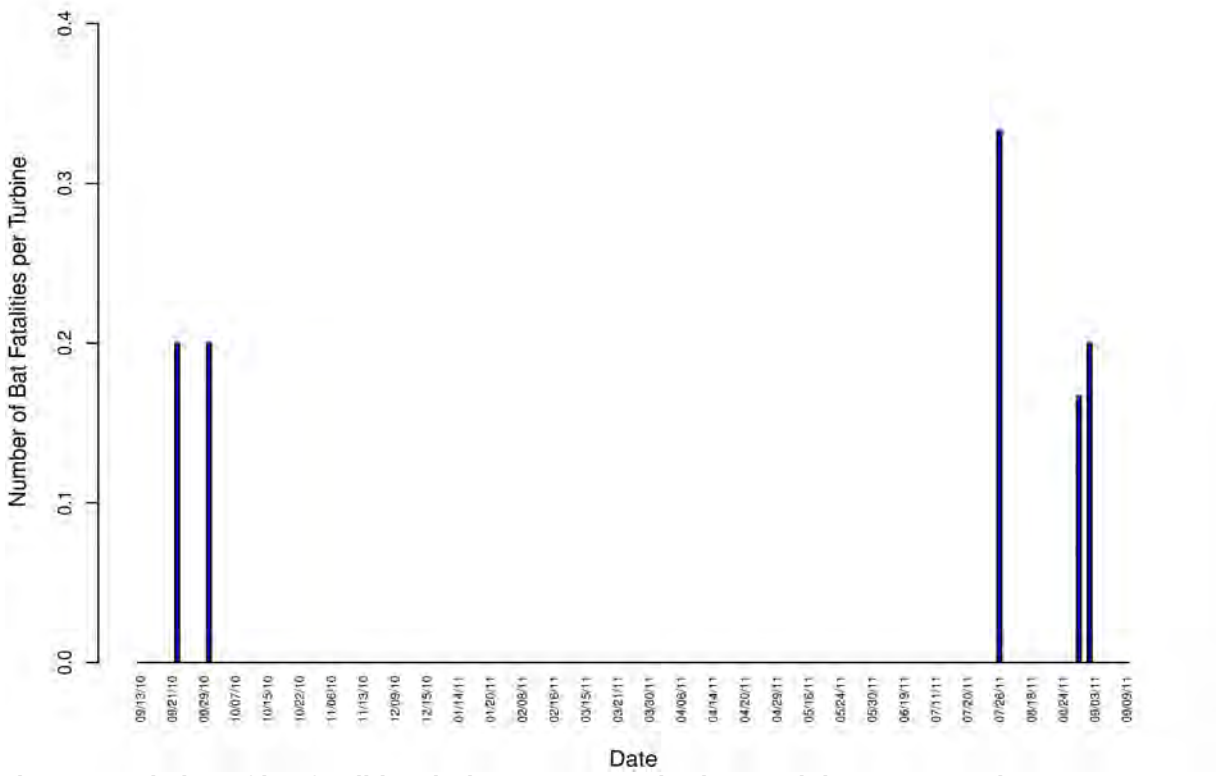

Figure 11. Timing of bat fatalities during Year 1 monitoring at Biglow Canyon Phase III.

3.2.4 Carcass Removal Trials

A total of 160 carcasses (80 large birds and 80 small birds) were placed in the field during Year 1 carcass removal trials. The estimated mean removal times varied by season for both large and small birds (Table 4). For large birds, removal rates were faster in winter and spring compared to summer and fall. For small birds, removal rates were faster in fall and winter compared to spring and summer (Table 4). Across all seasons, approximately 60% of the small birds and 30% of large birds were removed by day ten of the trial (Figure 12).

Table 4. Mean seasonal carcass removal times (in days) during Year 1 monitoring at Biglow Canyon Phase III.

	Fall	Winter	Spring	Summer
Large Birds	43.83	21.75	18.82	58.90
Small Birds	4.93	3.95	13.03	29.13

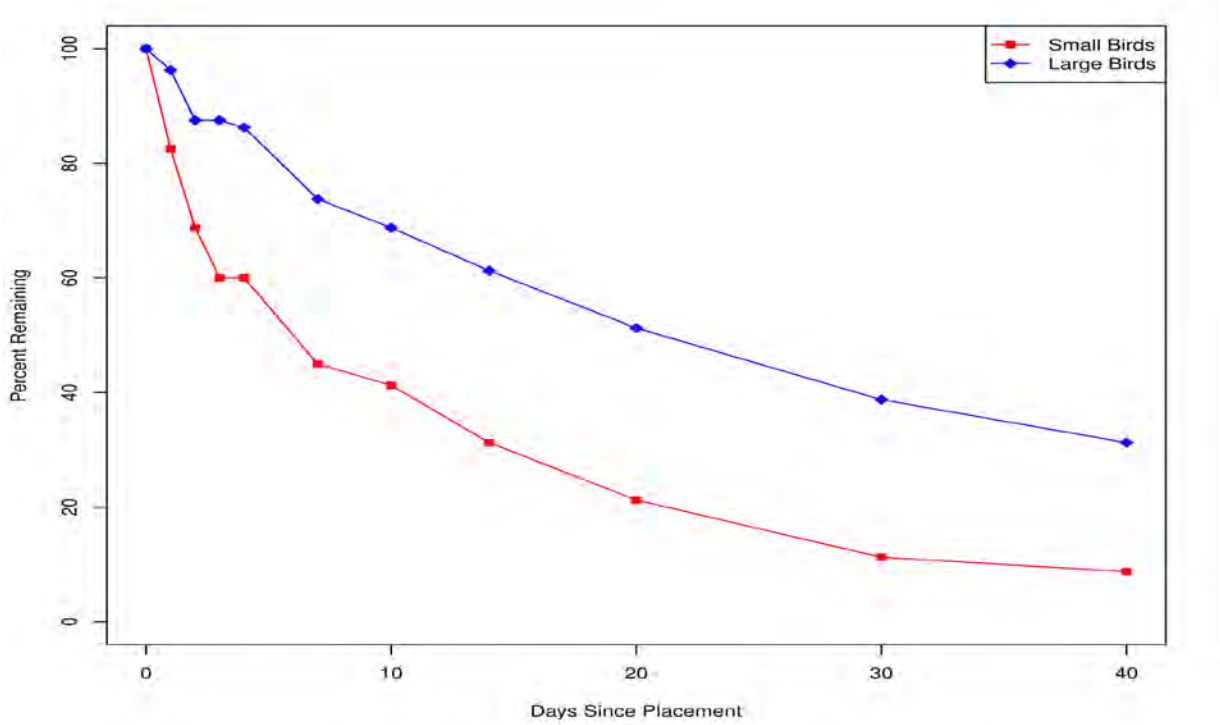

Figure 12. Mean carcass removal rates during Year 1 monitoring at Biglow Canyon Phase III.

3.2.5 Adjusted Fatality Estimates

Adjusted annual fatality estimates were calculated based on the number of carcasses found during standardized searches and corrected for carcass removal rates and searcher efficiency bias. Based on searcher efficiency and carcass removal rates, the probability that a carcass would remain in the plot until a scheduled search and be found by searchers varied across seasons for both the large and small bird size classes (Table 5).

Table 5. Average probability (%) that a carcass was available and detected during Year 1 monitoring at Biglow Canyon Phase III.

	Fall	Winter	Spring	Summer
Large Birds	43.83	21.75	18.82	58.90
Small Birds/Bats	4.93	3.95	13.03	29.13

Fatality estimates were calculated on both a per MW and per turbine basis to facilitate comparison with other wind energy facilities. The adjusted annual fatality estimates and associated standard errors and confidence intervals for Year 1 at Biglow Canyon Phase III are presented in Table 6. The following presents estimated fatality rates for all birds, select bird subtypes, and all bats.

Table 6. Year 1 adjusted annual fatality estimates at Biglow Canyon Phase III.

Group	Fatality Rate	Standard Error	90% Confidence Interval Lower Limit	90% Confidence Interval Upper Limit
#/MW/year				
All Birds	2.28	1.04	1.49	4.69
All Birds (excluding introduced species)	2.17	0.98	1.31	4.37
Large Birds	0.11	0.04	0.06	0.18
Small Birds	2.17	1.04	1.38	4.60
Nocturnal Migrants	0.52	0.35	0.19	1.23
Target Grassland Birds	0	--	--	--
State Sensitive Avian Species	0	--	--	--
Raptors	0.05	0.03	0	0.10
Raptor Species of Special Concern	0	--	--	--
Bats	0.22	0.17	0.07	0.57
#/turbine/yr				
All Birds	5.25	2.39	3.43	10.78
All Birds (excluding introduced species)	4.98	2.26	3.02	10.05
Large Birds	0.26	0.09	0.13	0.42
Small Birds	4.99	2.39	3.18	10.58
Nocturnal Migrants	1.19	0.8	0.44	2.83
Target Grassland Birds	0	--	--	--
State Sensitive Avian Species	0	--	--	--
Raptors	0.11	0.06	0	0.23
Raptor Species of Special Concern	0	--	--	--
Bats	0.51	0.4	0.17	1.31

All Birds

The Year 1 adjusted annual fatality estimate for all birds is 2.28 birds/MW (90% CI = 1.49, 4.69), or 5.25 birds/turbine (Table 6). There were five documented fatalities of non-native bird species during Year 1 monitoring, including one gray partridge, two house sparrows, and two ring-necked pheasants (Table 2). The adjusted annual fatality estimate for all birds excluding non-native species is 2.17 birds/MW (90% CI = 1.31, 4.37), or 4.98 birds/turbine (Table 6).

Large Birds

Nine large birds representing seven species (pheasant, American kestrel, northern flicker, red-tailed hawk, rough-legged hawk, gray partridge, common nighthawk, and an unidentified gull) were documented fatalities during Year 1 monitoring (Table 2). The adjusted annual fatality estimate for large birds is 0.11 birds/MW (90% CI = 0.06, 0.18), or 0.26 birds/turbine (Table 6).

Small Birds

Thirty-one small birds representing eight species were documented as fatalities during Year 1 monitoring (Table 2). Two small birds were not identifiable to species. Passerines (particularly the horned lark), comprised the majority of small bird fatalities. The adjusted annual fatality estimate for small birds is 2.17 birds/MW (90% CI = 1.38, 4.60), or 4.99 birds/turbine (Table 6).

Nocturnal Avian Migrants

Nine nocturnal migrants representing five species (two were not identifiable to species) were documented as fatalities in Year 1 (Table 2). The adjusted annual fatality estimate for nocturnal migrants is 0.52 birds/MW (90% CI = 0.19, 1.23), or 1.19 birds/turbine (Table 6).

Target Grassland Bird Species

No target grassland bird species were documented as fatalities during Year 1 monitoring at Biglow Canyon Phase III (Table 6).

State Sensitive Avian Species

No state sensitive avian species were documented as fatalities during Year 1 monitoring at Biglow Canyon Phase III (Table 6).

Raptors

Three raptors (red-tailed hawk, rough-legged hawk, and American kestrel) were documented as fatalities during Year 1 monitoring (Table 2). The adjusted annual fatality estimate for raptors is 0.05 birds/MW (90% CI = 0, 0.10), or 0.11 birds/turbine (Table 6).

Raptor Species of Special Concern

No raptor species of special concern were documented as fatalities during Year 1 monitoring at Biglow Canyon Phase III (Table 6).

All Bats

Five bats representing two species (hoary bat and silver-haired bat) were documented as fatalities in Year 2 (Table 2). The adjusted Year 1 annual fatality estimate is 0.22 bats/MW (90% CI = 0.07, 0.57), or 0.51 bats/turbine (Table 6).

3.2.6 Turbine Lighting

Twenty-four of the 76 turbines at Biglow Canyon Phase III have Federal Aviation Administration-mandated (FAA) warning lights (ORGA/TWT Medium Intensity Red Obstacle Lights - Model L350-864-G). In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), the effect of turbine lighting was evaluated by comparing fatality rates of nocturnal avian migrants and bats between lit turbines, unlit turbines, and unlit turbines adjacent to lit turbines (Table 7). No statistically-significant differences in nocturnal migrant and bat fatality rates were detected between lit turbines, turbines adjacent to lit turbines, and turbines not adjacent to lit turbines.

Table 7. Analysis of turbine lighting effects on Year 1 fatality rates at Biglow Canyon Phase III.

	Lit Turbines	Non-adjacent Unlit Turbines	Adjacent Unlit Turbines	Total
Number of Turbines	18	11	21	50
Nocturnal Avian Migrant Casualties	0	2	7	9
Nocturnal Avian Migrant Casualties/Turbine	0	0.18	0.33	0.18
One-way ANOVA results[1]	**F = 2.46; p-value = 0.10**			
Bat Casualties	3	1	1	5
Bat Casualties/Turbine	0.17	0.05	0.09	0.10
One-way ANOVA results[1]	**F = 0.75; p-value = 0.48**			

[1] Results indicate insufficient evidence to conclude that there is a difference between means for lit turbines, turbines adjacent to lit turbines, and turbines not adjacent to lit turbines.

4.0 AVIAN USE AND BEHAVIOR SURVEYS

The primary objective of the avian use and behavior surveys was to document post-construction bird use and abundance in the Biglow Canyon Wind Farm, and the data collected through this study will be used to assess indirect impacts to avian species resulting from the operation of the facility. In accordance with the *Wildlife Monitoring and Mitigation Plan* (ODOE 2007), the avian use and behavior study included John Day River canyon fixed-point surveys (JDC surveys) and project wind turbine fixed-point surveys (PWT surveys).

4.1 **Methods**

4.1.1 Survey Plots

Fixed-point circular plots were utilized for both JDC and PWT surveys following general methods described by Reynolds et al (1980). JDC surveys were conducted at four fixed-points established along the John Day River canyon (Figure 13). Each JDC survey plot is an 800-m (2,625-ft) radius circle centered on a fixed point. The JDC points were previously utilized during pre-construction studies as well as post-construction avian use surveys at Biglow Canyon Phase I (Jeffrey et al. 2009a, Enk et al. 2010). PWT survey plots were established at each of the 50 turbines at which Year 1 fatality searches were conducted (Figure 2). Each PWT survey plot is a 400-m (1,312-ft) radius circle centered on the turbine.

4.1.2 Survey Protocols

Avian use and behavior surveys were conducted by qualified field technicians with experience in bird identification and data collection. JDC surveys were conducted six times per month throughout the year. A survey consisted of a 30-minute observation period at each of the four stations following the same protocol that was used for baseline data collection and Phase I JDC monitoring. JDC surveys were not conducted when weather conditions (e.g., wind, precipitation) reduced the surveyor's ability to detect birds. Observer, date, survey start and end time, and general weather information were recorded for each JDC survey. All birds observed during the survey were recorded, and a unique number was assigned for each observation. Small birds (e.g., sparrows) observed beyond 200 m (656 ft) from the fixed point were recorded but excluded from statistical analyses.

Data recorded for each observation included species, number of individuals, sex and age (if possible), distance from plot center when first observed, and closest distance. The behavior of each bird, habitat type over which the bird was first observed, and flight height to the nearest 5-m (16-ft) interval were also recorded. It was also noted whether the observation was visual or auditory. Locations of raptors, waterfowl, or other large birds, as well as sensitive species observed during JDC surveys were recorded. Flight paths of large birds were documented on field maps and subsequently digitized using ArcGIS 9.3.

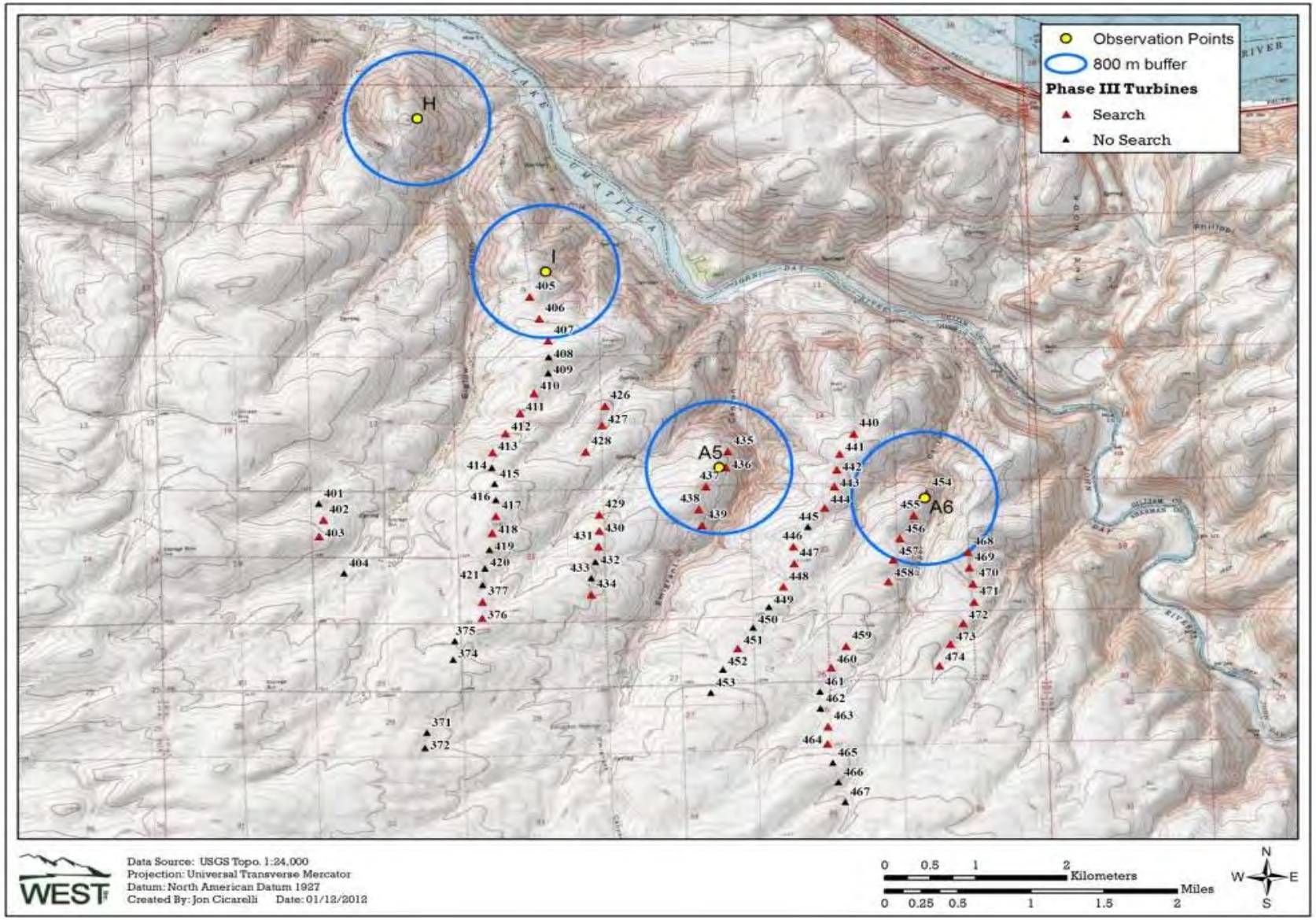

Figure 13. Location of 800-m JDC fixed-points during Year 1 monitoring at Biglow Canyon Phase III.

PWT surveys were conducted for five minutes immediately prior to each standardized carcass search, resulting in each PWT plot being surveyed 16 times during Year 1. PWT surveys were conducted at each turbine on the same schedule as standardized carcass searches (twice per month during spring and fall migration seasons and once per month during summer and winter). Protocols and data collection were similar to JDC surveys except that only birds observed within 400-m of the turbine were recorded and large bird flight paths were not mapped.

4.1.3 Statistical Analysis

Quality Assurance and Quality Control

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

4.1.4 Data Analysis

Bird Diversity and Species Richness

Bird diversity was defined as the total number of unique species observed during Year 1 avian use surveys. Species lists, with the number of individuals and groups observed, were generated by season for both JDC and PWT surveys. Species richness was calculated as the mean (average) number of species observed per survey (e.g., number of species/plot/survey).

Bird Use, Composition, and Frequency of Occurrence

Estimates of bird use (number of birds/plot/survey) were calculated for individual species and major bird types (e.g., raptors) by season for both JDC and PWT surveys. Percent composition was calculated as the proportion of overall mean use for a particular species/bird type. The frequency of occurrence was calculated as the percent of surveys in which a species/bird type was observed.

4.2 **Results**

4.2.1 JDC Surveys

Overview

Each JDC point was surveyed 71 times between September 15, 2010, and August 29, 2011, resulting in a total of 284 JDC surveys during Year 1 monitoring at Biglow Canyon Phase III (Table 8).

Diversity and Species Richness

A total of 11,684 individual bird observations in 941 separate groups were recorded during JDC avian use surveys (Table 9). Forty-eight unique species were identified, with a mean of 0.82 large bird species and 1.43 small bird species recorded per survey (Tables 8 and 9). More unique species were observed during the spring compared to other seasons, and species richness was highest in spring for both large and small birds (Table 8).

Table 8. Summary of species richness (species/plot[a]/30-min survey), mean use (birds/plot[a]/30-min survey) and sample size by season and overall for Year 1 JDC bird use surveys at Biglow Canyon Phase III.

				Species Richness		Mean Use	
Season	# Survey Periods	# Surveys Conducted	# Unique Species	Large Birds	Small Birds	Large Birds	Small Birds
Fall	16	64	26	0.56	1.38	1.06	15.22
Winter	23	92	20	0.73	1.37	4.63	44.51
Spring	16	64	35	1.81	2.02	2.92	11.91
Summer	16	64	16	0.53	1.19	0.91	3.94
Overall	**71**	**284**	**48**	**0.82**	**1.43**	**2.65**	**20.89**

[a] 800-m radius for large birds and 200-m radius for small birds.

The European starling (*Sturnus vulgaris*) was the most common species (6,269 individuals), and represented 53.7% of all birds observed during JDC surveys (Table 9). Cumulatively, three species (6.3% of all species) composed approximately 80.6% of all birds observed: European starling, horned lark (1,707 individuals), and Canada goose (*Branta canadensis*; 1,436 individuals). Other common species included western meadowlark (*Sturnella neglecta;* 438 individuals) and American pipit (*Anthus rubescens*; 435 individuals), each of which represented approximately 3.7% of all observations. No other species individually accounted for more than about two percent of JDC observations (Table 9). A total of 194 individual raptors representing 13 species were recorded during JDC surveys (Table 9). Red-tailed hawks accounted for over 55% of all raptor observations.

Mean Use, Composition, and Frequency of Occurrence by Season

Mean use, percent composition, and frequency of occurrence for all species and bird types recorded during JDC surveys were calculated by season (Table 10). The highest overall mean use by large birds occurred in winter (4.63 birds/plot/30-min survey) followed by spring (2.92), fall (1.06), and summer (0.91; Table 10). Small bird use followed a similar seasonal pattern, with highest use in winter (44.51) followed by fall (15.22), spring (11.91), and summer (3.94). The following presents a discussion of use, composition and frequency of occurrence by bird types listed in Table 10.

Waterbirds, Waterfowl, and Shorebirds

Waterbird use primarily occurred in summer (0.22 birds/plot/30-min survey) and ranged from zero to 0.01 in all other seasons. Waterbird use was largely driven by observations of American white pelican (*Pelecanus erythrorhyncos*), which accounted for 24.1% of large bird observations in summer (Tables 9 and 10).

Waterfowl were documented in all seasons except summer, with peak use occurring in winter (3.32 birds/plot/30-min survey). Waterfowl accounted for 71.6% of large birds observed in winter and were recorded during 5.4% of winter surveys (Table 10). Waterfowl use was primarily associated with Canada geese, which accounted for 91.1% of all waterfowl observed (Table 9). One large group of mallards was observed in winter.

Table 9. Bird species (groups and individuals) observed during Year 1 JDC surveys[a] at Biglow Canyon Phase III.

		Fall		Winter		Spring		Summer		Total	
Type / Species	**Scientific Name**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**
Waterbirds		**1**	**1**	**1**	**1**	**3**	**9**	**6**	**45**	**11**	**56**
American white pelican	*Pelecanus erythrorhynchos*	0	0	0	0	3	9	6	45	9	54
double-crested cormorant	*Phalacrocorax auritus*	1	1	0	0	0	0	0	0	1	1
great blue heron	*Ardea herodias*	0	0	1	1	0	0	0	0	1	1
Waterfowl		**5**	**245**	**22**	**1,330**	**1**	**2**	**0**	**0**	**28**	**1,577**
Canada goose	*Branta canadensis*	4	241	21	1,193	1	2	0	0	26	1,436
mallard	*Anas platyrhynchos*	0	0	1	137	0	0	0	0	1	137
snow goose	*Chen caerulescens*	1	4	0	0	0	0	0	0	1	4
Shorebirds		**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**3**	**3**
killdeer	*Charadrius vociferus*	1	1	1	1	0	0	0	0	2	2
long-billed curlew	*Numenius americanus*	0	0	0	0	1	1	0	0	1	1
Gulls/Terns		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**2**
ring-billed gull	*Larus delawarensis*	0	0	0	0	0	0	1	2	1	2
Diurnal Raptors		**33**	**34**	**52**	**53**	**59**	**65**	**40**	**42**	**184**	**194**
Accipiters		*2*	*2*	*2*	*2*	*0*	*0*	*0*	*0*	*4*	*4*
Cooper's hawk	*Accipiter cooperii*	0	0	1	1	0	0	0	0	1	1
sharp-shinned hawk	*Accipiter striatus*	2	2	1	1	0	0	0	0	3	3
Buteos		*20*	*20*	*32*	*33*	*38*	*43*	*29*	*31*	*119*	*127*
red-tailed hawk	*Buteo jamaicensis*	20	20	20	21	30	35	29	31	99	107
rough-legged hawk	*Buteo lagopus*	0	0	12	12	5	5	0	0	17	17
Swainson's hawk	*Buteo swainsoni*	0	0	0	0	3	3	0	0	3	3
Northern Harrier		*1*	*1*	*11*	*11*	*11*	*12*	*4*	*4*	*27*	*28*
northern harrier	*Circus cyaneus*	1	1	11	11	11	12	4	4	27	28
Eagles		*4*	*5*	*4*	*4*	*4*	*4*	*0*	*0*	*12*	*13*
bald eagle	*Haliaeetus leucocephalus*	0	0	0	0	3	3	0	0	3	3
golden eagle	*Aquila chrysaetos*	4	5	4	4	1	1	0	0	9	10
Falcons		*4*	*4*	*2*	*2*	*3*	*3*	*7*	*7*	*16*	*16*
American kestrel	*Falco sparverius*	1	1	0	0	2	2	7	7	10	10
merlin	*Falco columbarius*	1	1	0	0	0	0	0	0	1	1
peregrine falcon	*Falco peregrinus*	1	1	0	0	0	0	0	0	1	1
prairie falcon	*Falco mexicanus*	1	1	2	2	1	1	0	0	4	4
Osprey		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
osprey	*Pandion haliaetus*	1	1	0	0	0	0	0	0	1	1
Other Raptors		*1*	*1*	*1*	*1*	*3*	*3*	*0*	*0*	*5*	*5*
unidentified hawk		1	1	1	1	1	1	0	0	3	3
unidentified raptor		0	0	0	0	2	2	0	0	2	2

Table 9. Bird species (groups and individuals) observed during Year 1 JDC surveys[a] at Biglow Canyon Phase III.

		Fall		Winter		Spring		Summer		Total	
Type / Species	**Scientific Name**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**
Vultures		**0**	**0**	**0**	**0**	**2**	**3**	**1**	**1**	**3**	**4**
turkey vulture	*Cathartes aura*	0	0	0	0	2	3	1	1	3	4
Upland Game Birds		**5**	**17**	**7**	**35**	**30**	**55**	**4**	**6**	**46**	**113**
California quail	*Callipepla californica*	0	0	0	0	1	1	0	0	1	1
chukar	*Alectoris chukar*	1	13	3	29	9	17	0	0	13	59
ring-necked pheasant	*Phasianus colchicus*	4	4	4	6	20	37	4	6	32	53
Doves/Pigeons		**0**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**3**	**6**
mourning dove	*Zenaida macroura*	0	0	0	0	1	1	0	0	1	1
rock pigeon	*Columba livia*	0	0	0	0	2	5	0	0	2	5
Large Corvids		**41**	**91**	**52**	**69**	**59**	**90**	**14**	**31**	**166**	**281**
black-billed magpie	*Pica pica*	3	3	1	2	1	1	0	0	5	6
common raven	*Corvus corax*	38	88	51	67	58	89	14	31	161	275
Passerines		**111**	**1,199**	**155**	**7,071**	**142**	**851**	**88**	**327**	**496**	**9,448**
American goldfinch	*Carduelis tristis*	0	0	0	0	1	80	0	0	1	80
American pipit	*Anthus rubescens*	10	325	12	110	0	0	0	0	22	435
American robin	*Turdus migratorius*	1	1	0	0	0	0	0	0	1	1
barn swallow	*Hirundo rustica*	1	2	0	0	2	3	0	0	3	5
Brewer's blackbird	*Euphagus cyanocephalus*	2	36	0	0	5	9	1	9	8	54
cliff swallow	*Petrochelidon pyrrhonota*	0	0	0	0	2	62	9	40	11	102
European starling	*Sturnus vulgaris*	5	199	23	6,062	2	2	3	6	33	6,269
grasshopper sparrow	*Ammodramus savannarum*	0	0	0	0	1	1	0	0	1	1
horned lark	*Eremophila alpestris*	50	489	67	661	60	339	45	218	222	1,707
house finch	*Carpodacus mexicanus*	2	2	8	129	3	139	1	1	14	271
n. rough-winged swallow	*Stelgidopteryx serripennis*	0	0	0	0	2	2	0	0	2	2
savannah sparrow	*Passerculus sandwichensis*	0	0	0	0	1	3	0	0	1	3
Say's phoebe	*Sayornis saya*	0	0	0	0	2	3	0	0	2	3
tree swallow	*Tachycineta bicolor*	0	0	0	0	1	33	0	0	1	33
unidentified swallow		0	0	0	0	1	4	0	0	1	4
violet-green swallow	*Tachycineta thalassina*	1	3	0	0	1	3	2	8	4	14
western kingbird	*Tyrannus verticalis*	0	0	0	0	3	4	1	2	4	6
western meadowlark	*Sturnella neglecta*	39	142	45	109	54	144	26	43	164	438
yellow-rumped warbler	*Dendroica coronata*	0	0	0	0	1	20	0	0	1	20
Overall		**197**	**1,588**	**290**	**8,560**	**300**	**1,082**	**154**	**454**	**941**	**11,684**

[a] Regardless of distance from observer.

Shorebird use was low in all seasons (zero to 0.02 birds/plot/30-min survey; Table 10). One killdeer (*Charadrius vociferus*) was observed in fall and winter, and one long-billed curlew (*Numenius americanus*) was observed in spring (Table 9).

Diurnal Raptors and Vultures

Diurnal raptors were documented in all seasons, with highest use in spring (0.84 birds/plot/30-min survey) and lower use in winter, summer, and fall (0.36, 0.34, and 0.23, respectively). The red-tailed hawk was the most common raptor in all seasons, and represented over 55% of all raptors observed during JDC surveys (Tables 9 and 10). The northern harrier *(Circus cyaneus*; 28 individuals), rough-legged hawk *(*17 individuals), American kestrel (10 individuals), and golden eagle (*Aquila chrysaetos*; 10 individuals) were the only other raptors for which more than four individuals were observed.

Diurnal raptors comprised 37.9% of large birds observed in summer, 28.9% in spring, 22.1% in fall, and 7.7% in winter (Table 10). Raptors were recorded during 43.8% of spring surveys, 26.6% of summer surveys, 22.8% of winter surveys, and 17.2% of fall surveys (Table 10). Golden eagles were documented in all seasons except summer. Swainson's hawks (*Buteo swainsoni;* three individuals) and bald eagles (*Haliaeetus leucocephalus*; three individuals) were only observed in spring. One peregrine falcon (*Falco peregrinus*) was observed in fall. Turkey vultures (*Cathartes aura*) were only recorded during spring (0.05 birds/plot/30-min survey) and summer (0.02 birds/plot/30-min survey; Table 10).

Upland Gamebirds

Upland gamebirds were observed in all seasons (Table 9), with highest use documented during the spring (0.86 birds/plot/30-min survey) followed by winter (0.38), fall (0.27), and summer (0.09; Table 10). Chukar (*Alectoris chukar*; 59 individuals) and ring-necked pheasant (53 individuals) accounted for over 99% of all upland game birds observed (Table 9). Upland gamebirds accounted for 29.4% of large birds observed in spring, 25.0% in fall, 10.3% in summer, and 8.2% in winter (Table 10). These species also were recorded during 35.9% of spring surveys and fewer than eight percent of surveys in all other seasons (Table 10).

Doves, Pigeons, and Large Corvids

Doves and pigeons were only observed in spring (0.09 birds/plot/30-min survey). Rock pigeon and mourning dove (*Zenaida macroura*) were the only species recorded (Table 9). Large corvids were observed in all seasons with seasonal use estimates ranging from 0.23 birds/plot/30-min survey in summer to 1.03 in spring. Common raven represented 97.9% of large corvid observations and 2.4% of all bird observations (Table 9).

Table 10. Mean bird use (number of birds/plot[a]/30-min survey), percent of total composition, and frequency of occurrence (%) by season during Year 1 JDC surveys at Biglow Canyon Phase III.

	Mean Use				% Composition				% Frequency			
Type / Species	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
	Large Birds											
Waterbirds	**0**	**0.01**	**0**	**0.22**	**0**	**0.2**	**0**	**24.1**	**0**	**1.1**	**0**	**3.1**
American white pelican	0	0	0	0.22	0	0	0	24.1	0	0	0	3.1
great blue heron	0	0.01	0	0	0	0.2	0	0	0	1.1	0	0
Waterfowl	**0.06**	**3.32**	**0.03**	**0**	**5.9**	**71.6**	**1.1**	**0**	**1.6**	**5.4**	**1.6**	**0**
Canada goose	0	1.83	0.03	0	0	39.4	1.1	0	0	4.3	1.6	0
mallard	0	1.49	0	0	0	32.2	0	0	0	1.1	0	0
snow goose	0.06	0	0	0	5.9	0	0	0	1.6	0	0	0
Shorebirds	**0.02**	**0.01**	**0.02**	**0**	**1.5**	**0.2**	**0.5**	**0**	**1.6**	**1.1**	**1.6**	**0**
killdeer	0.02	0.01	0	0	1.5	0.2	0	0	1.6	1.1	0	0
long-billed curlew	0	0	0.02	0	0	0	0.5	0	0	0	1.6	0
Diurnal Raptors	**0.23**	**0.36**	**0.84**	**0.34**	**22.1**	**7.7**	**28.9**	**37.9**	**17.2**	**22.8**	**43.8**	**26.6**
Accipiters	*0.03*	*0.01*	*0*	*0*	*2.9*	*0.2*	*0*	*0*	*3.1*	*1.1*	*0*	*0*
sharp-shinned hawk	0.03	0.01	0	0	2.9	0.2	0	0	3.1	1.1	0	0
Buteos	*0.12*	*0.22*	*0.56*	*0.22*	*11.8*	*4.7*	*19.3*	*24.1*	*9.4*	*15.2*	*34.4*	*15.6*
red-tailed hawk	0.12	0.12	0.50	0.22	11.8	2.6	17.1	24.1	9.4	8.7	32.8	15.6
rough-legged hawk	0	0.10	0.03	0	0	2.1	1.1	0	0	7.6	1.6	0
Swainson's hawk	0	0	0.03	0	0	0	1.1	0	0	0	3.1	0
Northern Harrier	*0.02*	*0.09*	*0.17*	*0.03*	*1.5*	*1.9*	*5.9*	*3.4*	*1.6*	*4.3*	*15.6*	*3.1*
northern harrier	0.02	0.09	0.17	0.03	1.5	1.9	5.9	3.4	1.6	4.3	15.6	3.1
Eagles	*0.02*	*0.01*	*0.05*	*0*	*1.5*	*0.2*	*1.6*	*0*	*1.6*	*1.1*	*3.1*	*0*
bald eagle	0	0	0.05	0	0	0	1.6	0	0	0	3.1	0
golden eagle	0.02	0.01	0	0	1.5	0.2	0	0	1.6	1.1	0	0
Falcons	*0.05*	*0.02*	*0.05*	*0.09*	*4.4*	*0.5*	*1.6*	*10.3*	*4.7*	*2.2*	*4.7*	*9.4*
American kestrel	0.02	0	0.03	0.09	1.5	0	1.1	10.3	1.6	0	3.1	9.4
merlin	0.02	0	0	0	1.5	0	0	0	1.6	0	0	0
peregrine falcon	0.02	0	0	0	1.5	0	0	0	1.6	0	0	0
prairie falcon	0	0.02	0.02	0	0	0.5	0.5	0	0	2.2	1.6	0
Other Raptors	*0*	*0.01*	*0.02*	*0*	*0*	*0.2*	*0.5*	*0*	*0*	*1.1*	*1.6*	*0*
unidentified hawk	0	0.01	0.02	0	0	0.2	0.5	0	0	1.1	1.6	0
Vultures	**0**	**0**	**0.05**	**0.02**	**0**	**0**	**1.6**	**1.7**	**0**	**0**	**3.1**	**1.6**
turkey vulture	0	0	0.05	0.02	0	0	1.6	1.7	0	0	3.1	1.6

Table 10. Mean bird use (number of birds/plot[a]/30-min survey), percent of total composition, and frequency of occurrence (%) by season during Year 1 JDC surveys at Biglow Canyon Phase III.

	Mean Use				% Composition				% Frequency			
Type / Species	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
Upland Game Birds	**0.27**	**0.38**	**0.86**	**0.09**	**25.0**	**8.2**	**29.4**	**10.3**	**7.8**	**7.6**	**35.9**	**6.2**
California quail	0	0	0.02	0	0	0	0.5	0	0	0	1.6	0
chukar	0.20	0.32	0.27	0	19.1	6.8	9.1	0	1.6	3.3	14.1	0
ring-necked pheasant	0.06	0.07	0.58	0.09	5.9	1.4	19.8	10.3	6.2	4.3	31.2	6.2
Doves/Pigeons	**0**	**0**	**0.09**	**0**	**0**	**0**	**3.2**	**0**	**0**	**0**	**4.7**	**0**
mourning dove	0	0	0.02	0	0	0	0.5	0	0	0	1.6	0
rock pigeon	0	0	0.08	0	0	0	2.7	0	0	0	3.1	0
Large Corvids	**0.48**	**0.55**	**1.03**	**0.23**	**45.6**	**12.0**	**35.3**	**25.9**	**25.0**	**31.5**	**59.4**	**14.1**
black-billed magpie	0.05	0.02	0.02	0	4.4	0.5	0.5	0	4.7	1.1	1.6	0
common raven	0.44	0.53	1.02	0.23	41.2	11.5	34.8	25.9	20.3	30.4	59.4	14.1
Large Bird Totals	**1.06**	**4.63**	**2.92**	**0.91**	**100**	**100**	**100**	**100**				
Small Birds (Passerines)												
American goldfinch	0	0	1.25	0	0	0	10.5	0	0	0	1.6	0
American pipit	5.08	1.20	0	0	33.4	2.7	0	0	15.6	13.0	0	0
barn swallow	0	0	0.05	0	0	0	0.4	0	0	0	3.1	0
Brewer's blackbird	0.05	0	0.09	0	0.3	0	0.8	0	1.6	0	6.2	0
cliff swallow	0	0	0.03	0.59	0	0	0.3	15.1	0	0	1.6	10.9
European starling	0.95	34.28	0.02	0.09	6.3	77.0	0.1	2.4	3.1	15.2	1.6	4.7
grasshopper sparrow	0	0	0.02	0	0	0	0.1	0	0	0	1.6	0
horned lark	7.64	7.08	5.30	2.64	50.2	15.9	44.5	67.1	78.1	70.7	93.8	67.2
house finch	0.03	1.08	2.17	0.02	0.2	2.4	18.2	0.4	3.1	7.6	4.7	1.6
northern rough-winged swallow	0	0	0.03	0	0	0	0.3	0	0	0	3.1	0
savannah sparrow	0	0	0.05	0	0	0	0.4	0	0	0	1.6	0
Say's phoebe	0	0	0.05	0	0	0	0.4	0	0	0	3.1	0
tree swallow	0	0	0.52	0	0	0	4.3	0	0	0	1.6	0
violet-green swallow	0.05	0	0.05	0.02	0.3	0	0.4	0.4	1.6	0	1.6	1.6
western kingbird	0	0	0.06	0.03	0	0	0.5	0.8	0	0	4.7	1.6
western meadowlark	1.42	0.88	1.92	0.55	9.3	2.0	16.1	13.9	34.4	30.4	70.3	31.2
yellow-rumped warbler	0	0	0.31	0	0	0	2.6	0	0	0	1.6	0
Small Bird Totals	**15.22**	**44.51**	**11.91**	**3.94**	**100**	**100**	**100**	**100**	**87.5**	**84.8**	**95.3**	**76.6**

[a] 800-meter (m) radius plot for large birds and 200-m for small birds.

Passerines

Passerine species represented 80.9% of all birds observed during Year 1 JDC surveys (Table 9). Passerines were observed in all seasons and passerine use was considerably higher in winter (44.51 birds/plot/30-min survey) than spring, summer, and fall (Table 10). Seasonal frequency of passerine observations ranged from 76.6% in summer to 95.3% in spring (Table 10). Seasonal passerine use was largely driven by European starling and horned lark which accounted for over 68% of all birds observed during the JDC surveys (Table 9). European starling use was concentrated during winter and fall while horned lark use was fairly consistent throughout all seasons (Table 10). American pipit, western meadowlark, and house finch (*Carpodacus mexicanus*) were the other most commonly observed passerine species (Table 9).

Spatial Use

Mean use was calculated by point for all bird types and subtypes (Table 11). Small bird use was highest at points I and A6 (32.99 and 29.24 birds/30-min survey, respectively), somewhat lower at point H (15.45), and lowest at point A5 (8.00; Table 11). For all large bird species combined, use ranged from 1.52 to 3.46 birds/30-min survey. Large bird types with the highest use at point A5 included waterfowl (1.13), large corvids (0.52), and diurnal raptors (0.45). Large bird types with the highest use at point A6 included waterfowl (1.14), upland game birds (0.65), large corvids (0.59), and diurnal raptors (0.52). Large bird types with the highest use at point H included waterfowl (2.08), large corvids (0.66), diurnal raptors (0.44), and upland game birds (0.25). Large bird types with the highest use at point I included upland game birds (0.59), large corvids (0.52), and diurnal raptors (0.34). Figures A1 – A9 in Appendix A illustrate use by point for selected bird types.

Table 11. Mean bird use (number of birds/30-min survey) by JDC observation point[a].

	Observation Point			
Bird Types	**A5**	**A6**	**H**	**I**
All small birds	8.00	29.24	15.45	32.99
All large birds	2.37	3.06	3.46	1.52
Waterbirds	0.17	0.04	0	0
Waterfowl	1.13	1.14	2.08	0.03
Shorebirds	0	0	0.03	0.01
Diurnal Raptors	0.45	0.52	0.44	0.34
Accipiters	0	0	0.03	0.01
Buteos	0.31	0.31	0.28	0.20
Northern Harrier	0.07	0.13	0.04	0.07
Eagles	0.01	0.01	0.04	0
Falcons	0.06	0.06	0.04	0.04
Other Raptors	0	0.01	0	0.01
Vultures	0	0.03	0	0.03
Upland Game Birds	0.10	0.65	0.25	0.59
Doves/Pigeons	0	0.08	0	0
Large Corvids	0.52	0.59	0.66	0.52

[a.] 800-meter (m) radius plot for large birds, 200-m for small birds.

Flight paths for buteos, falcons, golden eagles, other raptors, waterfowl, and waterbirds/shorebirds observed during the JDC bird use surveys were digitized and mapped (Appendix B). Buteo flight paths illustrate use as widespread and relatively consistent among points (Figure B1). While buteos did show some affinity toward the canyon slopes, they also used open ridge tops. No other avian groups exhibited any characteristic flight patterns around the JDC points, and no obvious flight paths, flyways, or concentration areas could be delineated based upon the flight path data. Golden eagles' and pelicans' flight paths were concentrated along the John Day River canyon (Figures B3 and B6). Waterfowl flight paths were generally in an east-west direction (Figure B5).

4.2.2 PWT Surveys

Overview

A total of 800 PWT surveys were conducted during 16 visits between September 13, 2010, and September 9, 2011 (Table 12).

Table 12. Summary of species richness (species/plot/5-min survey), mean use (birds/plot/5-min survey), and sample size by season for Year 1 PWT surveys at Biglow Canyon Phase III.

Season	# Survey Periods	# Surveys Conducted	# Unique Species	Mean Species Richness	Mean Use
Fall	5	250	13	0.97	2.77
Winter	4	200	13	1.15	7.00
Spring	4	200	13	1.27	2.31
Summer	3	150	13	0.73	1.23
Overall	**16**	**800**	**26**	**1.03**	**3.86**

Diversity and Species Richness

A total of 3,350 individual birds in 970 separate groups were recorded during PWT avian use surveys (Table 13). Twenty-six unique species were identified, with a mean of 1.03 bird species recorded per survey (Table 12). The number of unique species recorded was similar across all seasons, and species richness was slightly higher in winter and spring than in summer and fall (Table 12).

Passerines accounted for over 74% of all bird observations (Table 13). The horned lark (1,622 individuals), western meadowlark (412 individuals), and European starling (379 individuals) represented 96.3% of all passerines observed during PWT surveys (Table 13). Canada goose (619 individuals) was the second most abundant species, but was only recorded during winter. Common raven and diurnal raptors were observed in all seasons. Red-tailed hawk and northern harrier accounted for over 65% of all raptor observations during PWT surveys (Table 13).

Mean Use, Composition, and Frequency of Occurrence by Season

Mean use, percent composition, and frequency of occurrence for all species and bird types recorded during PWT surveys were calculated by season (Tables 12 and 14). Seasonal mean use for all birds combined ranged from 1.23 birds/plot/5-min survey in summer to 7.00 in winter (Table 12). Percent composition data indicate that seasonal use estimates were largely driven by passerines, which represented over 89% of all birds observed in all seasons (Table 14).

Canada goose contributed to higher winter use estimates. Corvids were documented in all seasons with use ranging from 0.05 to 0.18 birds/plot/5-min survey (Table 14). Diurnal raptors were the only other avian group with use estimates exceeding 0.02 birds/plot/5-min survey. Raptor use was similar across seasons (Table 14).

Spatial Use

Mean annual use for all birds at individual turbines ranged from 0.81 birds/5-min survey to 9.44 birds/5-min survey (Appendix D). Fifteen of the 50 points had use values that exceeded the average mean use value of 3.86 (Table 12). The higher use points were generally located at the northern end of the turbine strings along the John Day River canyon. However, only one higher use point was located at an end-of-string turbine (Appendix D and Figure 14).

4.2.3 Special Status Species

Seven special status species were recorded during JDC and PWT bird use surveys at Biglow Canyon Phase III (Table 15). Five species are classified as state sensitive (vulnerable) and two (bald eagle and golden eagle) are protected under the Bald and Golden Eagle Protection Act (ODFW 2008, 2011; BGEPA 1940).

All seven species were recorded during JDC surveys (Table 15). A total of 73 individual birds were observed, with American white pelican (54 individuals) and golden eagle (12 individuals) representing the most commonly observed species. Five individuals representing three special status species (golden eagle, Swainson's hawk, and long-billed curlew) were recorded during PWT surveys.

5.0 INCIDENTAL OBSERVATIONS

Field technicians documented wildlife observed incidentally during the course of conducting carcass searches and JDC and PWT avian use surveys. For each incidental observation, technicians recorded date, time, species, number of individuals, sex/age class, distance from observer, activity, and habitat type. Eight species (four birds and four mammals) were recorded as incidental observations in Year 1 (Table 16). The American crow (*Corvus brachyrhynchos*) was the most numerous bird species recorded, and mule deer (*Odocoileus hemionus*) was the most numerous mammal species. No special status species were recorded as incidental observations.

Table 13. Birds (groups and individuals) observed during Year 1 PWT surveys at Biglow Canyon Phase III.

	Fall		Winter		Spring		Summer		Total	
Type / Species	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**	**# grps**	**# ind**
Waterfowl	**0**	**0**	**9**	**619**	**0**	**0**	**0**	**0**	**9**	**619**
Canada goose	0	0	9	619	0	0	0	0	9	619
Shorebirds	**2**	**2**	**0**	**0**	**1**	**1**	**1**	**2**	**4**	**5**
killdeer	2	2	0	0	1	1	0	0	3	3
long-billed curlew	0	0	0	0	0	0	1	2	1	2
Diurnal Raptors	**7**	**8**	**10**	**11**	**14**	**17**	**14**	**16**	**45**	**52**
American kestrel	0	0	1	2	3	5	2	2	6	9
Cooper's hawk	0	0	0	0	1	1	0	0	1	1
golden eagle	1	2	0	0	0	0	0	0	1	2
merlin	1	1	0	0	0	0	0	0	1	1
northern harrier	3	3	4	4	6	6	4	4	17	17
prairie falcon	0	0	2	2	0	0	0	0	2	2
red-tailed hawk	2	2	1	1	4	5	7	9	14	17
rough-legged hawk	0	0	2	2	0	0	0	0	2	2
Upland Game Birds	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**2**
ring-necked pheasant	0	0	0	0	0	0	1	2	1	2
Doves/Pigeons	**1**	**1**	**0**	**0**	**8**	**8**	**3**	**3**	**12**	**12**
rock pigeon	1	1	0	0	8	8	3	3	12	12
Corvids	**18**	**47**	**17**	**28**	**30**	**46**	**12**	**27**	**77**	**148**
American crow	1	25	0	0	0	0	0	0	1	25
common raven	17	22	17	28	30	46	12	27	76	123
Passerines	**257**	**636**	**211**	**1,246**	**251**	**453**	**102**	**172**	**821**	**2,507**
American pipit	4	12	0	0	0	0	0	0	4	12
barn swallow	0	0	0	0	0	0	1	1	1	1
Brewer's blackbird	2	2	1	4	1	1	0	0	4	7
European starling	0	0	10	366	1	12	1	1	12	379
horned lark	181	510	129	723	139	268	62	121	511	1,622
house finch	0	0	4	45	0	0	0	0	4	45
house sparrow	0	0	0	0	1	1	0	0	1	1
savannah sparrow	4	23	0	0	0	0	0	0	4	23
unidentified swallow	0	0	0	0	0	0	1	2	1	2
western kingbird	0	0	0	0	0	0	1	2	1	2
western meadowlark	66	89	67	108	108	170	36	45	277	412
white-crowned sparrow	0	0	0	0	1	1	0	0	1	1
Overall	**285**	**694**	**248**	**1,909**	**304**	**525**	**133**	**222**	**970**	**3,350**

Table 14. Mean bird use (number of birds/plot/30-min survey), percent of total composition, and frequency of occurrence (%) by season during Year 1 PWT surveys at Biglow Canyon Phase III.

	Mean Use				% Composition				% Frequency			
Type / Species	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
Waterfowl	**0**	**0.65**	**0**	**0**	**0**	**9.3**	**0**	**0**	**0**	**2.5**	**0**	**0**
Canada goose	0	0.65	0	0	0	9.3	0	0	0	2.5	0	0
Shorebirds	**<0.01**	**0**	**0**	**0.01**	**0.3**	**0**	**0**	**1.1**	**0.8**	**0**	**0**	**0.7**
killdeer	<0.01	0	0	0	0.3	0	0	0	0.8	0	0	0
long-billed curlew	0	0	0	0.01	0	0	0	1.1	0	0	0	0.7
Diurnal Raptors	**0.03**	**0.04**	**0.04**	**0.05**	**1.2**	**0.6**	**2**	**3.8**	**2.8**	**3.5**	**3.5**	**4**
American kestrel	0	0.01	0.02	0.01	0	0.1	1.1	1.1	0	0.5	1.5	1.3
Cooper's hawk	0	0	<0.01	0	0	0	0.2	0	0	0	0.5	0
golden eagle	<0.01	0	0	0	0.3	0	0	0	0.4	0	0	0
merlin	<0.01	0	0	0	0.1	0	0	0	0.4	0	0	0
northern harrier	0.01	0.02	0.02	0.01	0.4	0.2	0.7	1.1	1.2	1.5	1.5	1.3
prairie falcon	0	0.01	0	0	0	0.1	0	0	0	1	0	0
red-tailed hawk	<0.01	<0.01	0	0.02	0.3	<0.1	0	1.6	0.8	0.5	0	1.3
rough-legged hawk	0	<0.01	0	0	0	<0.1	0	0	0	0.5	0	0
Upland Game Birds	**<0.01**	**0**	**<0.01**	**<0.01**	**0.1**	**0**	**0.2**	**0.5**	**0.4**	**0**	**0.5**	**0.7**
ring-necked pheasant	<0.01	0	<0.01	<0.01	0.1	0	0.2	0.5	0.4	0	0.5	0.7
Doves/Pigeons	**0**	**0.02**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0**	**0.5**	**0**	**0**
rock pigeon	0	0.02	0	0	0	0.4	0	0	0	0.5	0	0
Corvids	**0.18**	**0.08**	**0.1**	**0.05**	**6.5**	**1.1**	**4.6**	**3.8**	**5.6**	**4.5**	**7.5**	**4.7**
American crow	0.1	0	0	0	3.6	0	0	0	0.4	0	0	0
common raven	0.08	0.08	0.1	0.05	2.9	1.1	4.6	3.8	5.2	4.5	7.5	4.7
Passerines	**2.72**	**6.28**	**2.25**	**1.16**	**98.4**	**89.7**	**97.8**	**94.6**	**68.8**	**74**	**85**	**52**
American pipit	0.05	0	0	0	1.7	0	0	0	1.6	0	0	0
barn swallow	0	0	0	<0.01	0	0	0	0.5	0	0	0	0.7
Brewer's blackbird	<0.01	0.02	<0.01	0	0.3	0.3	0.2	0	0.8	0.5	0.5	0
European starling	0	1.83	0.06	<0.01	0	26.1	2.6	0.5	0	5	0.5	0.7
horned lark	2.04	3.62	1.34	0.8	73.7	51.6	58.1	65.2	60.8	64.5	69.5	40
house finch	0	0.22	0	0	0	3.2	0	0	0	2	0	0
house sparrow	0	0	<0.01	0	0	0	0.2	0	0	0	0.5	0
savannah sparrow	0.09	0	0	0	3.3	0	0	0	1.6	0	0	0
unidentified swallow	0	0	0	0.01	0	0	0	1.1	0	0	0	0.7
western kingbird	0	0	0	0.01	0	0	0	1.1	0	0	0	0.7
western meadowlark	0.36	0.52	0.74	0.27	12.9	7.4	31.9	22.3	22.8	31	44.5	20.7
white-crowned sparrow	0	0	<0.01	0	0	0	0.2	0	0	0	0.5	0
Overall	**2.77**	**7.00**	**2.31**	**1.23**	**100**	**100**	**100**	**100**				

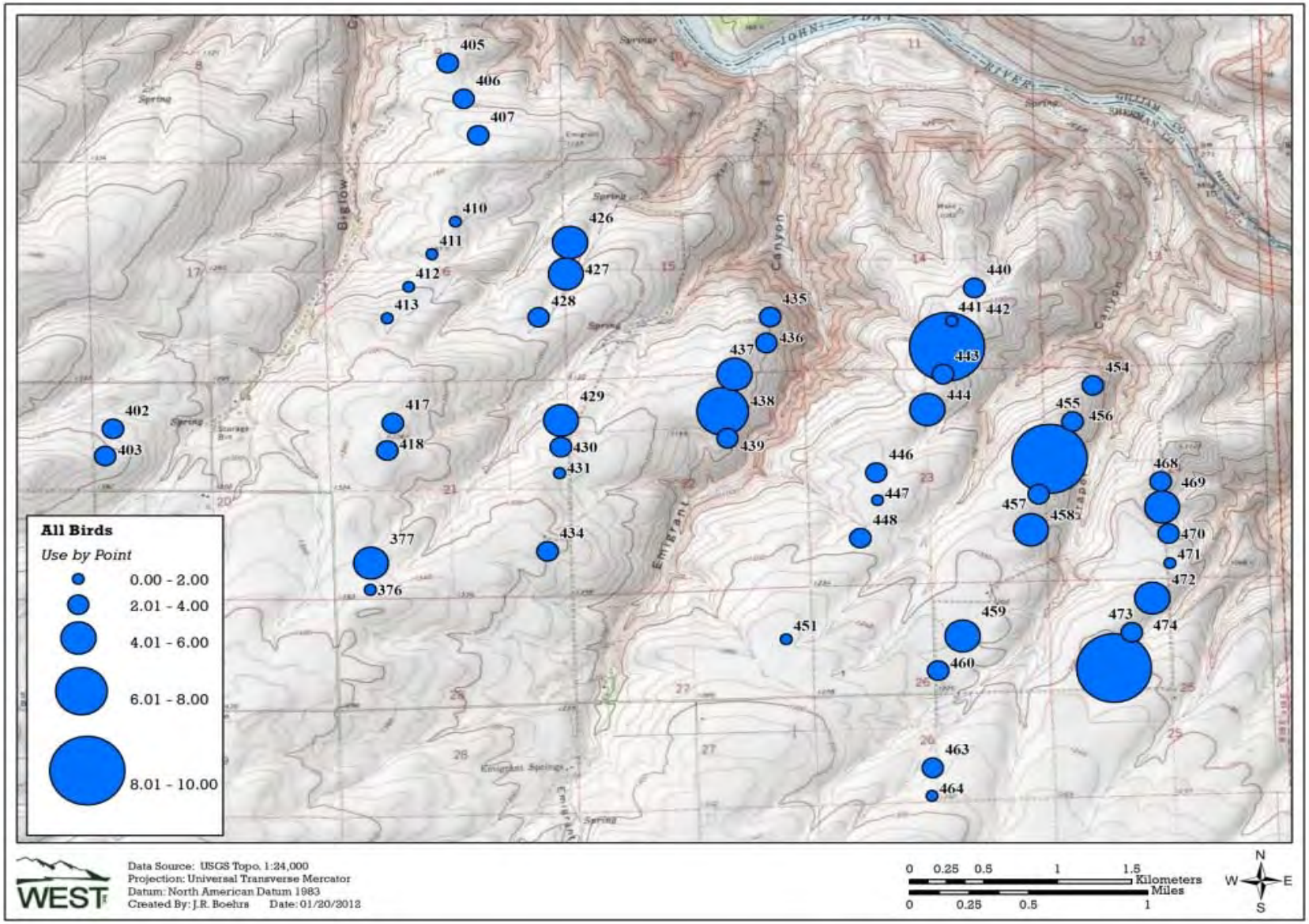

Figure 14. Mean avian use by point/turbine during Year 1 PWT surveys at Biglow Canyon Phase III.

Table 15. Special status species (groups and individuals) observed during Year 1 JDC and PWT surveys at Biglow Canyon Phase III.

			JDC		PWT		Total	
Species	**Scientific Name**	**Status**	**# grps**	**# ind**	**# grps**	**# ind**	**#grps**	**# ind**
American white pelican	*Pelecanus erythrorhynchos*	SV	9	54	--	--	9	54
golden eagle	*Aquila chrysaetos*	EA	9	10	1	2	10	12
Swainson's hawk	*Buteo swainsoni*	SV	3	3	1	1	4	4
bald eagle	*Haliaeetus leucocephalus*	EA	3	3	--	--	3	3
long-billed curlew	*Numenius americanus*	SV	1	1	1	2	2	3
grasshopper sparrow	*Ammodramus savannarum*	SV	1	1	--	--	1	1
peregrine falcon	*Falco peregrinus*	SV	1	1	--	--	1	1
Total	**7 species**		**27**	**73**	**3**	**5**	**31**	**78**

SV = state sensitive-vulnerable; EA = protected by the Bald and Golden Eagle Protection Act); ST = state threatened (ODFW 2008, 2011; BGEPA 1940).

Table 16. Wildlife species (groups and individuals) observed incidentally while conducting Year 1 surveys at Biglow Canyon Phase III.

Species	**Scientific Name**	**# groups**	**# individuals**
American crow	*Corvus brachyrhynchos*	1	80
killdeer	*Charadrius vociferus*	1	3
prairie falcon	*Falco mexicanus*	1	1
red-tailed hawk	*Buteo jamaicensis*	1	1
Bird Total	**4 species**	**4**	**85**
mule deer	*Odocoileus hemionus*	69	332
coyote	*Canis latrans*	9	17
pronghorn	*Antilocapra americana*	2	4
porcupine	*Erethizon dorsatum*	1	1
Mammal Total	**4 species**	**81**	**354**

6.0 DISCUSSION

4.3 Fatality Monitoring Studies

4.3.1 Assumptions and Potential Biases

The methods used to develop Year 1 adjusted annual fatality estimates at Biglow Canyon Phase III are consistent with industry standards (Shoenfeld 2004, Erickson 2006) and were based upon results of carcass searches as well as search interval, searcher efficiency bias, and carcass removal rates. Searcher efficiency and carcass removal trials were conducted throughout the year to encompass seasonal variability and changing environmental conditions, including vegetative cover and scavenger densities. The fatality monitoring program at Biglow Canyon Phase III was designed to provide estimates of annual avian and bat fatality rates that are comparable to previous phases at Biglow Canyon as well as other regional wind energy facilities. Post-construction fatality monitoring data are available from 14 wind energy facilities in

the CPE, four of which (Bighorn I, Klondike I and II, and Leaning Juniper I) are located within 40 miles (64 km) of Biglow Canyon. The methods and statistical analyses for these regional studies were similar (all included standardized carcass searches, searcher efficiency trials, and carcass removal trials), and the resulting fatality estimates are comparable.

There are several assumptions in the design of fatality monitoring studies that potentially bias fatality rate estimates, either positively or negatively (Erickson 2006). First, all bird and bat carcasses found within the standardized search plots during the study were included in the analysis. If carcasses were found incidentally within a search plot during other activities, it was assumed that these carcasses would have been found during a scheduled carcass search. Second, it was assumed that all fatalities found during the study resulted from collision with wind turbines, although the actual cause of death was unknown for most fatalities. While all bat fatalities were likely due to wind turbines, a portion of bird fatalities likely resulted from other factors such as predation, agricultural activities, vehicles, and natural causes. These assumptions result in a potential positive bias and associated overestimate of bird fatality rates.

There are also several factors that could negatively bias fatality estimates. First, the size of the carcass search plots was based on the maximum turbine height (126 m [415 ft]). This standard protocol is based upon previous studies conducted at wind energy facilities which indicated that nearly all turbine-related bird and bat fatalities are found within an area that is approximately equal to the maximum turbine height (Erickson et al. 2004; Higgins et al. 1996; Johnson et al. 2002, 2003a, 2004; Kerlinger et al. 2007; Young et al. 2003, 2007). However, a small proportion of fatalities could have landed outside the search plot boundaries, which would lead to an underestimate of fatality rates. This is more likely to apply to birds since bat casualties are typically found closer to turbines (e.g., Erickson et al. 2004; Kerns and Kerlinger 2004; Kerlinger et al. 2007; Young et al. 2003).

Second, carcasses used in searcher efficiency and carcass removal trials may not be representative (may be more or less cryptic) of actual fatalities. Rock pigeons, house sparrows, ring-necked pheasants, and mallards were used for trial birds and house sparrows were used to represent bats. The range of trial carcasses provided a realistic representation of natural bird and bat carcasses and, therefore, resulted in an accurate estimate of scavenging rates.

Third, if the density of trial carcasses was greater than would be expected under natural conditions, the potential exists to underestimate scavenging rates as scavengers would not be able to access all trial carcasses (Smallwood et al. 2010). Alternatively, placing too many carcasses may attract scavengers into the area and artificially increase scavenging rates (Smallwood 2007). The protocol utilized for this study involved placing no more than three trial carcasses in each plot, a number which minimizes potential bias related to carcass densities.

Fourth, there is evidence that some scavengers may learn to associate human activity with carcass availability and thereby artificially inflate estimates of carcass removal rates. This effect was recently demonstrated at Biglow Canyon, where after multiple years of carcass searching ravens had keyed on searcher activity at Phase II turbines (Enk et al. 2011). In an effort to

minimize potential biases associated inflated scavenging rates as a result of scavenger habituation, the trial protocol was modified to place and check trial carcasses between sunset and sunrise. While this did not alter the availability or accessibility of trial carcasses to scavengers, it did reduce visual attraction of diurnal scavengers to searcher activity.

4.3.2 Bird Fatality Estimates

The Year 1 adjusted annual bird fatality rate for Biglow Canyon Phase III (including non-native species such as ring-necked pheasant, gray partridge, and rock pigeon) was 2.28 birds/MW/year (Table 6). This is generally similar to fatality rates documented at Biglow Canyon Phase I (1.76 and 2.47 for Year 1 and Year 2, respectively; Jeffrey et al. 2009a, Enk et al. 2010) and slightly lower than other CPE wind energy facilities such as Klondike II (3.10), Bighorn I (2.60), Leaning Juniper I (3.20), and Nine Canyon I (2.80; Table 17; NWC and WEST 2007, Kronner et al. 2008 and 2007, Erickson et al. 2003). The Year 1 adjusted annual bird fatality rate at Biglow Canyon Phase III is in the middle of the range for regional wind energy facilities (Figure 15).

The Year 1 bird fatality estimates for Phase III are generally similar to estimates developed for Biglow Canyon Phase II/Year 2 (Table 17). Fatality estimates from Phase II/Year 1 were erroneous and are therefore not comparable. Compared with Phase II/Year 2, the Phase III estimates were lower for All Birds and marginally higher for Raptors. Fatality estimates for all birds and the bird subgroups analyzed have been relatively consistent across all three phases of Biglow Canyon.

Table 17. Fatality estimates for wind energy projects in the Columbia River Plateau.

	Fatality Rate (#/MW/study period)			
Project	**All Birds**	**Raptors**	**Bats**	**Source**
Biglow Canyon Phase III, Year 1	**2.28**	**0.05**	**0.22**	**This report**
Biglow Canyon II, OR (Yr. 2)	2.60	0.03	0.57	Enk et al. 2012
Klondike III, OR	3.00	0.15	1.11	Gritski et al. 2009a
Leaning Juniper, OR	6.70	0.21	1.98	Kronner et al. 2007
Klondike II, OR	3.10	0.11	0.40	NWC and WEST 2007
Nine Canyon, WA	2.80	0.05	2.47	Erickson et al. 2003
Bighorn I, WA	2.60	0.15	1.90	Kronner et al. 2008
Combine Hills, OR	2.60	0	1.88	Young et al. 2006
Biglow Canyon I, OR (Yr. 2)	2.47	0.04	0.58	Enk et al. 2010
Stateline, OR/WA	2.40	0.10	1.70	Erickson et al. 2004, 2007
Biglow Canyon I, OR (Yr. 1)	1.76	0.03	1.99	Jeffrey et al. 2009a
Wild Horse, WA	1.60	0.09	0.40	Erickson et al. 2008
Hopkins Ridge I, WA (2006)	1.20	0.14	0.60	Young et al. 2007
Klondike I, OR	0.90	0	0.80	Johnson et al. 2003b
Vansycle, OR	1.00	0	1.12	Erickson et al. 2000

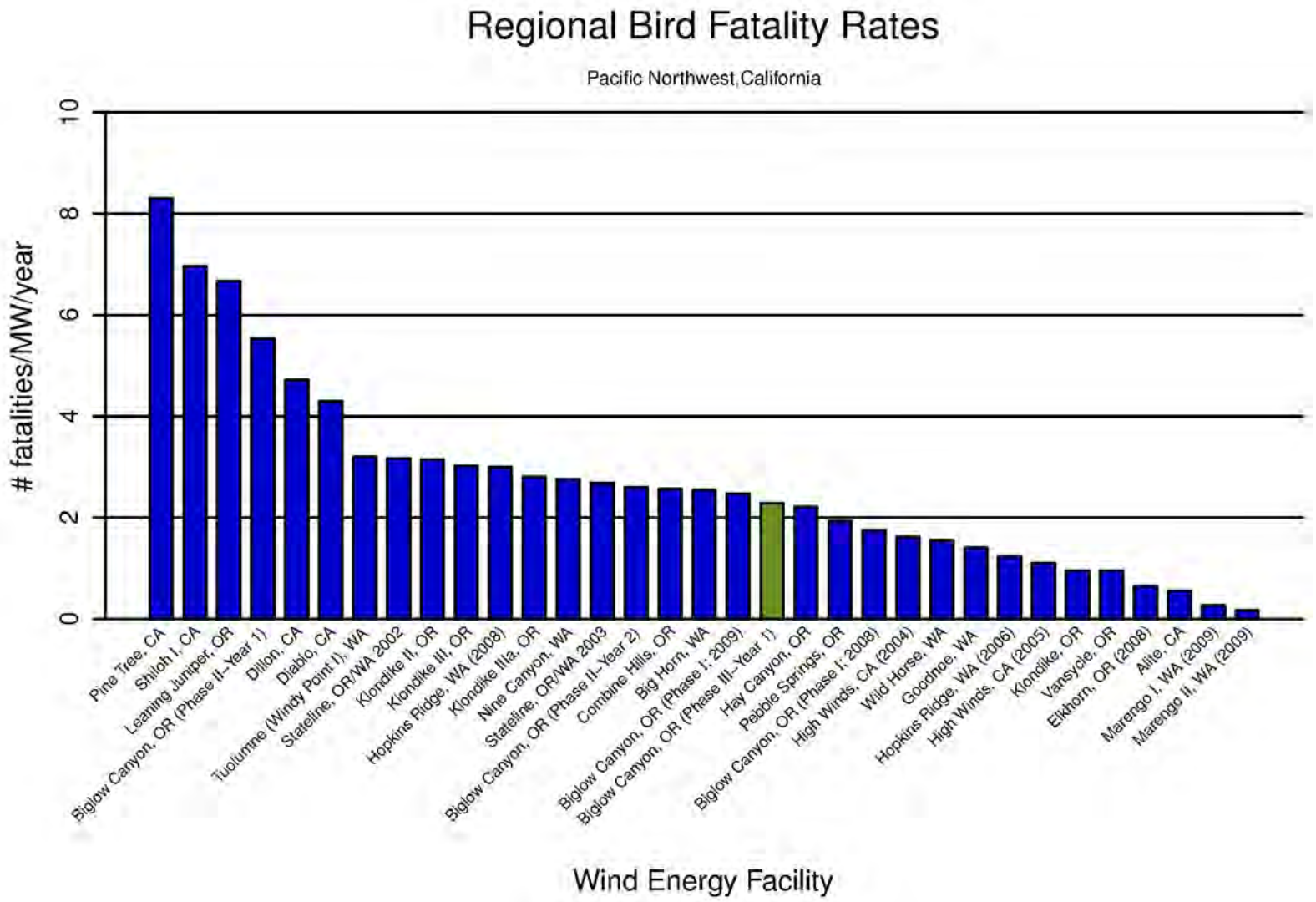

Figure 15. Estimated annual bird fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Figure 15 (*continued*). Estimated annual bird fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Data from the following sources:

Facility, Location	Reference	Facility, Location	Reference
Biglow Canyon, OR (Phase III-Year 1)	This study		
Pine Tree, CA	BioResource Consultants 2010	Big Horn, WA	Kronner et al. 2008
Shiloh I, CA	Kerlinger et al. 2010a	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010
Leaning Juniper, OR	Kronner et al. 2007	Hay Canyon, OR	Gritski and Kronner 2010a
Biglow Canyon, OR (Phase II-Year 1)	Enk et al. 2011	Pebble Springs, OR	Gritski and Kronner 2010b
Dillon, CA	Chatfield et al. 2009	Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a
Diablo Winds, CA	WEST 2006, WEST 2008	High Winds, CA (04)	Kerlinger et al. 2006
Tuolumne (Windy Point I), WA	Enz and Bay 2010	Wild Horse, WA	Erickson et al. 2008
Stateline, OR/WA (02)	Erickson et al. 2004	Goodnoe, WA	URS Corporation 2010a
Klondike II, OR	NWC and WEST 2007	Hopkins Ridge, WA (06)	Young et al. 2007
Klondike III, OR	Gritski et al. 2009a	High Winds, CA (05)	Kerlinger et al. 2006
Hopkins Ridge, WA (08)	Young et al. 2009	Klondike, OR	Johnson et al. 2003b
Klondike IIIa (Phase II), OR	Gritski et al. 2009b	Vansycle, OR	Erickson et al. 2000
Nine Canyon, WA	Erickson et al. 2003	Elkhorn, OR (08)	Jeffrey et al. 2009b
Stateline, OR/WA (03)	Erickson et al. 2004	Alite, CA	Chatfield et al. 2010
Biglow Canyon, OR (Phase II-Year 2)	Enk et al. 2012	Marengo I, WA (09)	URS Corporation 2010b
Combine Hills, OR	Young et al. 2006	Marengo II, WA (09)	URS Corporation 2010c

A higher proportion of bird fatalities were found at the northern ends of strings along the John Day River canyon, and this pattern appears to correspond with higher bird use documented in these areas during JDC and PWT avian use surveys. However, search intensity was disproportionately higher along the northern ends of strings, which complicates spatial analyses.

Bird species documented as fatalities at Biglow Canyon Phase III were similar to Biglow Canyon Phases I and II as well as other wind energy facilities in the CPE (Johnson and Erickson 2011). Passerines represented the majority of avian fatalities, with the horned lark representing the most species (47.5% of all avian fatalities). The horned lark was the most common bird during the PWT surveys.

Raptor fatalities documented at Biglow Canyon Phase III during Year 1 monitoring included one red-tailed hawk, one rough-legged hawk, and one American kestrel. The adjusted annual raptor fatality rate of 0.05 birds/MW/year (Table 6) was similar to Biglow Canyon Phase I (0.03; Jeffrey et al. 2009a; 0.04; Enk et al. 2010) and similar to or lower than many other CPE wind energy facilities, including Bighorn I (0.15), Klondike II (0.11), and Leaning Juniper I (0.21; Table 17; Kronner et al. 2008, NWC and WEST 2007, Kronner et al. 2007). The Year 1 raptor fatality rate Biglow Canyon Phase III is at the lower end of the range for regional wind energy facilities (Figure 16). The red-tailed hawk and American kestrel are relatively abundant species, and have been frequently documented as fatalities at wind energy facilities in the CPE (Johnson and Erickson 2011, 2007; Jeffrey et al. 2009a; Enk et al. 2010). No spatial patterns could be discerned given the limited number of raptor fatalities documented during Year 1.

No special status avian species were documented as fatalities during Year 1 monitoring. The Year 1 bird fatality rates at Biglow Canyon Phase III did not exceed the threshold values for any target avian groups (Table 18).

Table 18. Year 1 adjusted estimated fatality rates and 90% confidence intervals for Biglow Canyon Phase III and associated EFSC thresholds (# fatalities/MW/year).

Group	Year Average Fatality rate (90% CI)	EFSC Threshold
All Birds	2.28 (1.49, 4.69)	None
All Birds (excluding non-native species)	2.17 (1.31, 4.37)	None
Large Birds	0.11 (0.06, 0.18)	None
Small Birds	2.17 (1.38, 4.60)	None
Nocturnal Migrants	0.52 (0.19, 1.23)	None
Target Grassland Songbirds	0 (--, --)	0.59
State Sensitive Avian Species	0 (--, --)	0.20
Raptors	0.05 (0, 0.10)	0.09
Raptors of Special Concern	0 (--, --)	0.06
All Bats	0.22 (0.07, 0.57)	2.50

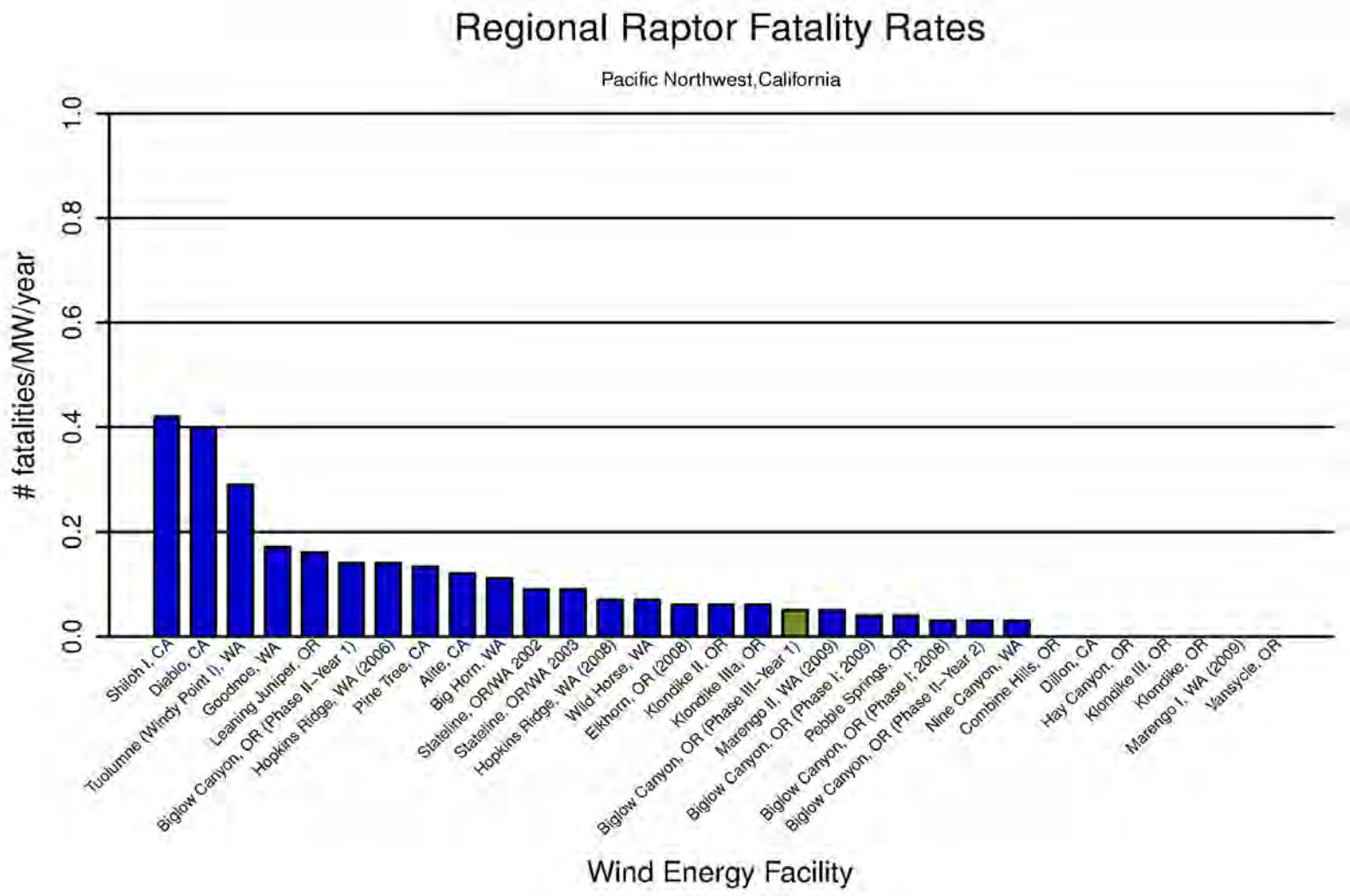

Figure 16. Estimated annual raptor fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Figure 16 (*continued*). Estimated annual raptor fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Data from the following sources:

Facility, Location	Reference	Facility, Location	Reference
Biglow Canyon, OR (Phase III-Year 1)	This study		
Shiloh I, CA	Kerlinger et al. 2010a	Klondike II, OR	NWC and WEST 2007
Diablo Winds, CA	WEST 2006, WEST 2008	Klondike IIIa (Phase II), OR	Gritski et al. 2009b
Tuolumne (Windy Point I), WA	Enz and Bay 2010	Marengo II, WA (09)	URS Corporation 2010c
Goodnoe, WA	URS Corporation 2010a	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010
Leaning Juniper, OR	Kronner et al. 2007	Pebble Springs, OR	Gritski and Kronner 2010b
Biglow Canyon, OR (Phase II-Year 1)	Enk et al. 2011	Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a
Hopkins Ridge, WA (06)	Young et al. 2007	Biglow Canyon, OR (Phase II – Year2)	Enk et al. 2012
Pine Tree, CA	BioResource Consultants 2010	Nine Canyon, WA	Erickson et al. 2003
Alite, CA	Chatfield et al. 2010	Combine Hills, OR	Young et al. 2006
Big Horn, WA	Kronner et al. 2008	Dillon, CA	Chatfield et al. 2009
Stateline, OR/WA (02)	Erickson et al. 2004	Hay Canyon, OR	Gritski and Kronner 2010a
Stateline, OR/WA (03)	Erickson et al. 2004	Klondike III, OR	Gritski et al. 2009a
Hopkins Ridge, WA (08)	Young et al. 2009	Klondike, OR	Johnson et al. 2003b
Wild Horse, WA	Erickson et al. 2008	Marengo I, WA (09)	URS Corporation 2010b
Elkhorn, OR (08)	Jeffrey et al. 2009b	Vansycle, OR	Erickson et al. 2000

4.3.3 Bat Fatalities

The Year 1 adjusted annual bat fatality rate at Biglow Canyon Phase III (0.22 bats/MW; Table 6) is lower than fatality rates documented at Biglow Canyon Phase I Year 1 (1.99) and Year 2 (0.58; Enk et al. 2010, Jeffrey et al. 2009a) and other regional projects such as Bighorn I, Leaning Juniper I, and Klondike I (Table 17; Kronner et al. 2008, Kronner et al. 2007, Johnson et al 2003b). The bat fatality rate is at the lower end of the range documented at regional wind energy facilities (Figure 17), and was below the threshold of 2.50 bats/MW/year (Table 18). The Year 1 bat fatality estimates for Phase III are lower than the estimates developed for Biglow Canyon Phase II/Year 2 (Table 17).

Most bat fatalities were found at the northern ends of strings near the John Day River canyon. However, because of the limited number of bat fatalities and the fact that search intensity was disproportionately higher at these turbines, it is difficult to evaluate spatial or geographic patterns.

The two bat species documented as fatalities during Year 1 monitoring at Biglow Canyon Phase III (silver-haired bat and hoary bat) were documented at Biglow Canyon Phase I and Phase II, and have represented 97.8% of all bat fatalities documented at wind energy facility in the CPE (Johnson and Erickson 2011). Both species are classified as state sensitive species in Oregon (ODFW 2008).

Four bat fatalities (80.0% of the total) were found during the fall migration period (August 15 – October 31). As the remaining fatality was found in late July, all five fatalities were likely associated with migrants passing through the project area during fall migration rather than with local breeding populations. This seasonal pattern of bat fatalities is consistent with findings at other wind energy facilities (Cryan et al. 2004).

4.3.4 Turbine Lighting

There were no statistically significant differences in fatality rates of nocturnal avian migrants and bats at lit turbines, unlit turbines, and unlit turbines adjacent to lit turbines (Table 7). These results are similar to previous studies of turbine lighting effects on bird and bat fatality rates at Biglow Canyon Phase I (Enk et al. 2010, Jeffrey et al. 2009a) and Phase II (Enk et al. 2011, Enk et al. 2012), as well as other regional facilities such as Stateline (Erickson et al. 2004), Nine Canyon (Erickson et al 2003), Wild Horse (Erickson et al. 2008), and Bighorn I (Kronner et al. 2008). Meta-analyses of wind energy projects throughout the United States have failed to detect any statistically significant differences between bird and bat fatalities at lit and unlit turbines, and turbine lighting does not appear influence fatality rates (Erickson et al. 2009; Kerlinger et al. 2010b).

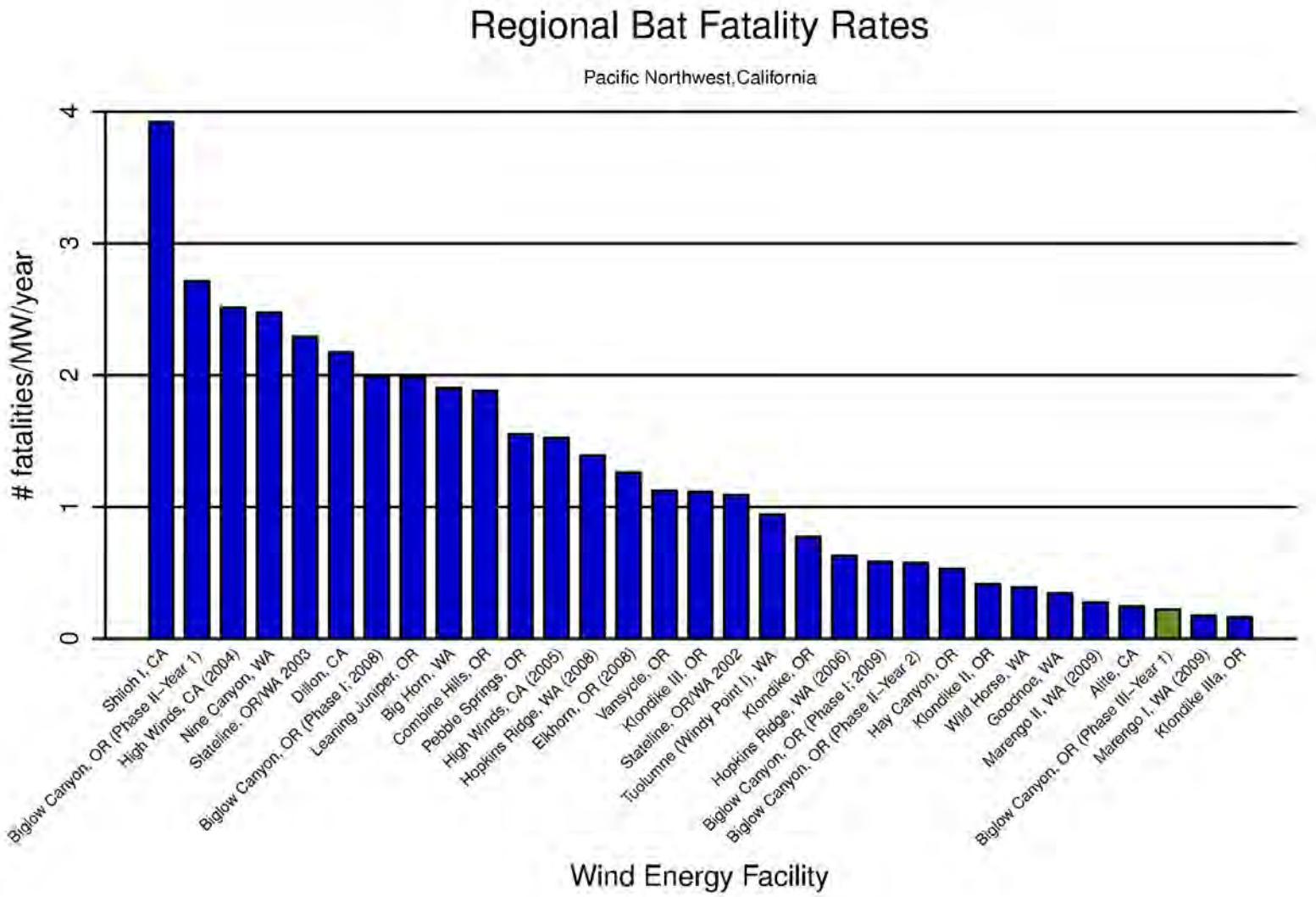

Figure 17. Estimated annual bat fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Figure 17 (*continued*). Estimated annual bat fatality rates for operational wind energy facilities in the western US, including the Columbia Plateau Ecoregion.

Data from the following sources:

Facility, Location	Reference	Facility, Location	Reference
Biglow Canyon, OR (Phase III-Year 1)	This study		
Shiloh I, CA	Kerlinger et al. 2010a	Klondike III, OR	Gritski et al. 2009a
Biglow Canyon, OR (Phase II-Year 1)	Enk et al. 2011	Stateline, OR/WA (02)	Erickson et al. 2004
High Winds, CA (04)	Kerlinger et al. 2006	Tuolumne (Windy Point I), WA	Enz and Bay 2010
Nine Canyon, WA	Erickson et al. 2003	Klondike, OR	Johnson et al. 2003b
Stateline, OR/WA (03)	Erickson et al. 2004	Hopkins Ridge, WA (06)	Young et al. 2007
Dillon, CA	Chatfield et al. 2009	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Biglow Canyon, OR (Phase II-Year 2)	Enk et al. 2012
Leaning Juniper, OR	Kronner et al. 2007	Hay Canyon, OR	Gritski and Kronner 2010a
Big Horn, WA	Kronner et al. 2008	Klondike II, OR	NWC and WEST 2007
Combine Hills, OR	Young et al. 2006	Wild Horse, WA	Erickson et al. 2008
Pebble Springs, OR	Gritski and Kronner 2010b	Goodnoe, WA	URS Corporation 2010a
High Winds, CA (05)	Kerlinger et al. 2006	Marengo II, WA (09)	URS Corporation 2010c
Hopkins Ridge, WA (08)	Young et al. 2009	Alite, CA	Chatfield et al. 2010
Elkhorn, OR (08)	Jeffrey et al. 2009b	Marengo I, WA (09)	URS Corporation 2010b
Vansycle, OR	Erickson et al. 2000	Klondike IIIa (Phase II), OR	Gritski et al. 2009b

4.4 Avian Use and Behavior Studies

4.4.1 JDC Surveys

The results of the Year 1 JDC avian use surveys at Biglow Canyon Phase III were generally similar to JDC surveys previously conducted during Year 1 monitoring at Biglow Canyon Phase I (Jeffery et al. 2009a) with respect to number of birds observed, species richness, and seasonal species diversity. The European starling, horned lark, and Canada goose composed 80% of all birds observed at Phase III, and these three species largely determined annual use estimates. Similarly, these three species represented 82.3% of all birds observed at Phase I (Jeffrey et al. 2009a, Enk et al. 2010). However, whereas the Canada goose was the most abundant species observed during JDC surveys at Phase I (64.6% of all birds), the European starling was the most abundant species observed at Phase III (53.7% of all birds).

Over 73% of all birds recorded during Year 1 JDC surveys were observed in winter (Table 9). While horned lark observations were similar across all seasons, 96.7% of all European starling observations and 83.1% of all Canada goose observations occurred in winter. Raptor use was similar across seasons.

In this study, avian use was significantly higher at observation points I and A6, which contrasts with significantly higher use at point A5 during Phase I surveys. Spatial use was largely driven by small birds, and there was no correlation between small bird and large bird use at individual observation points (e.g., points with high small bird use did not necessarily have high large bird use). There were no distinct patterns relative to recorded flight paths. While there may be some affinity by raptors toward John Day River canyon slopes, open ridge tops west of the observation points were also used.

4.4.2 PWT Surveys

The results of the Year 1 PWT avian use surveys were generally similar to previous PWT surveys conducted at Biglow Canyon Phase I (Jeffery et al. 2009a, Enk et al. 2010) and Phase II (Enk et al. 2011, Enk et al. 2012) relative to the number of birds observed and total/seasonal mean use. Species diversity and richness documented in this study were similar to Phase I and higher than Phase II, which likely reflects the absence of native grassland habitat and CRP in the Phase II project area and the differing proximities of Phases I and III to the John Day River canyon. Similar seasonal mean use patterns were documented at all three phases, with highest use in winter, slightly lower use in fall and spring, and lowest use in summer.

The horned lark, western meadowlark, and European starling, which represented the most abundant small bird species during Year 1 PWT surveys at Biglow Canyon Phase III, were also among the most common species recorded during PWT surveys at Phases I and II. Large birds represented approximately 25% of all birds observed, primarily as a result of Canada goose in the winter. Canada goose and common raven accounted for 88% of all large birds during this study, and were among the most abundant species during PWT surveys previously completed at Phases I and II (Jeffery et al. 2009a, Enk et al. 2010, Enk et al. 2011, Enk et al. 2012). Raptors accounted for less than 1.6% of all bird observations.

While no distinct avian use spatial patterns were evident, it appeared that the points located in the general vicinity of the John Day River canyon had higher use than interior "plateau" points. This is likely due to the presence of native habitat along the canyon and side slopes and the predominance of agricultural lands in interior portions of the Phase III project area. Fatalities appeared to be generally correlated with observed use at the Phase III turbines, as 32 of 40 bird fatalities were found at or adjacent to turbines with mean use that exceeded the average of 3.86 birds/survey. Relatively more fatalities were found at the northern end of the turbine strings along the John Day River canyon. This may be related to the facts that 1) there is more native habitat and CRP in this area and 2) these are the first turbines that birds encounter when flying south from the Columbia River Gorge.

4.4.3 Special Status Species

The seven special status species recorded during Year 1 monitoring at Biglow Canyon Phase III were all previously documented during JDC surveys at Phase I (Jeffrey et al. 2009a, Enk et al. 2010). The majority (93.5%) of individuals were recorded during JDC surveys, with American white pelican and golden eagle representing the most commonly observed species. Flight path data indicate most of the special status species utilize the John Day River Canyon and side slopes.

The data suggest that the Phase III project area is of limited use for special status species, as only five individuals representing three species (golden eagle, Swainson's hawk, and long-billed curlew) were recorded during 800 PWT surveys. This is corroborated by absence of any documented fatalities involving special status species.

Detailed analyses of all PWT and JDC survey data collected at all three phases of Biglow Canyon will be conducted after Year 2 monitoring at Phase III is completed. A separate report will be prepared to present the data, which will include a comparison across the three phases as well as a comparison of pre- and post-construction use data.

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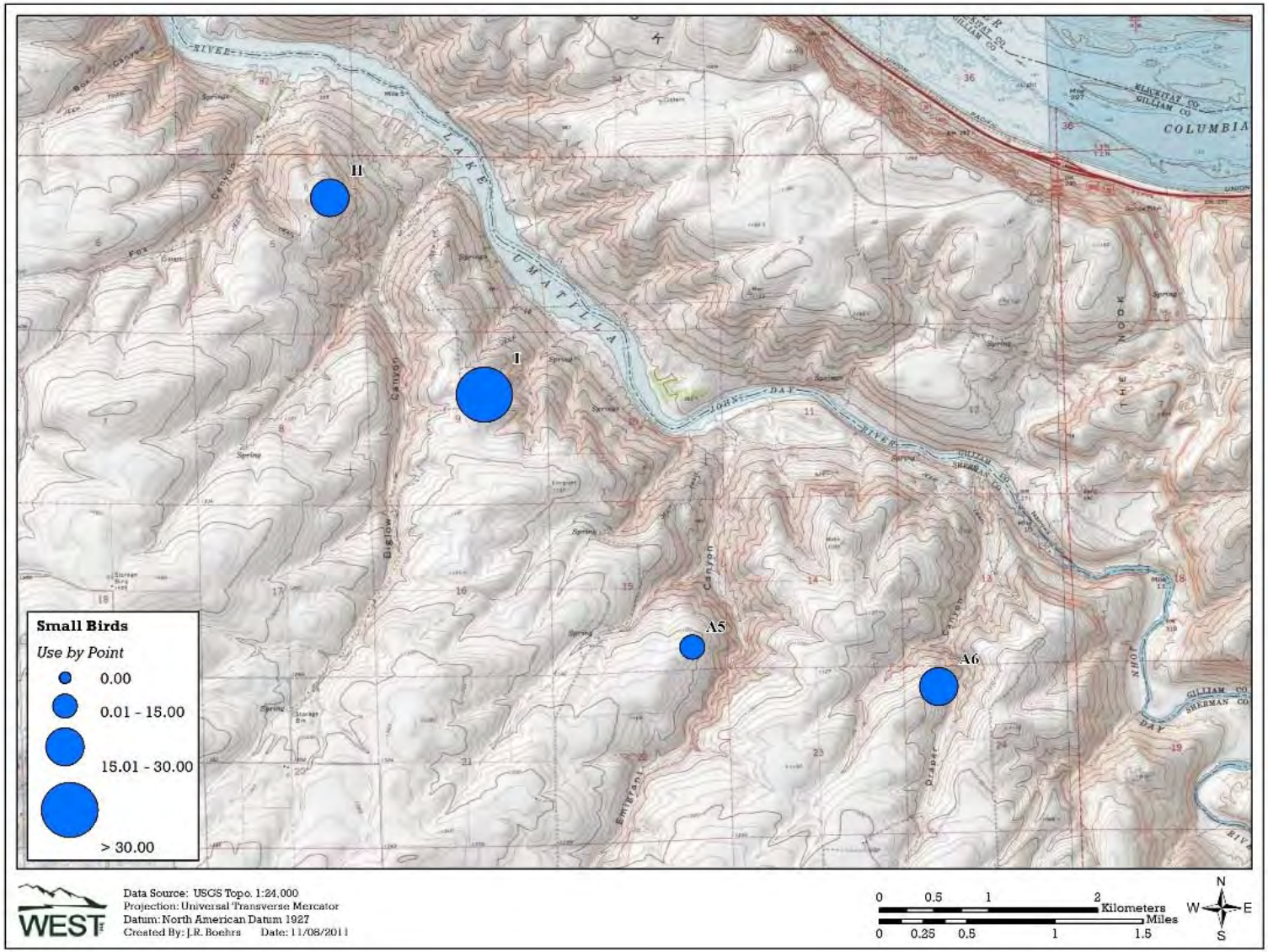
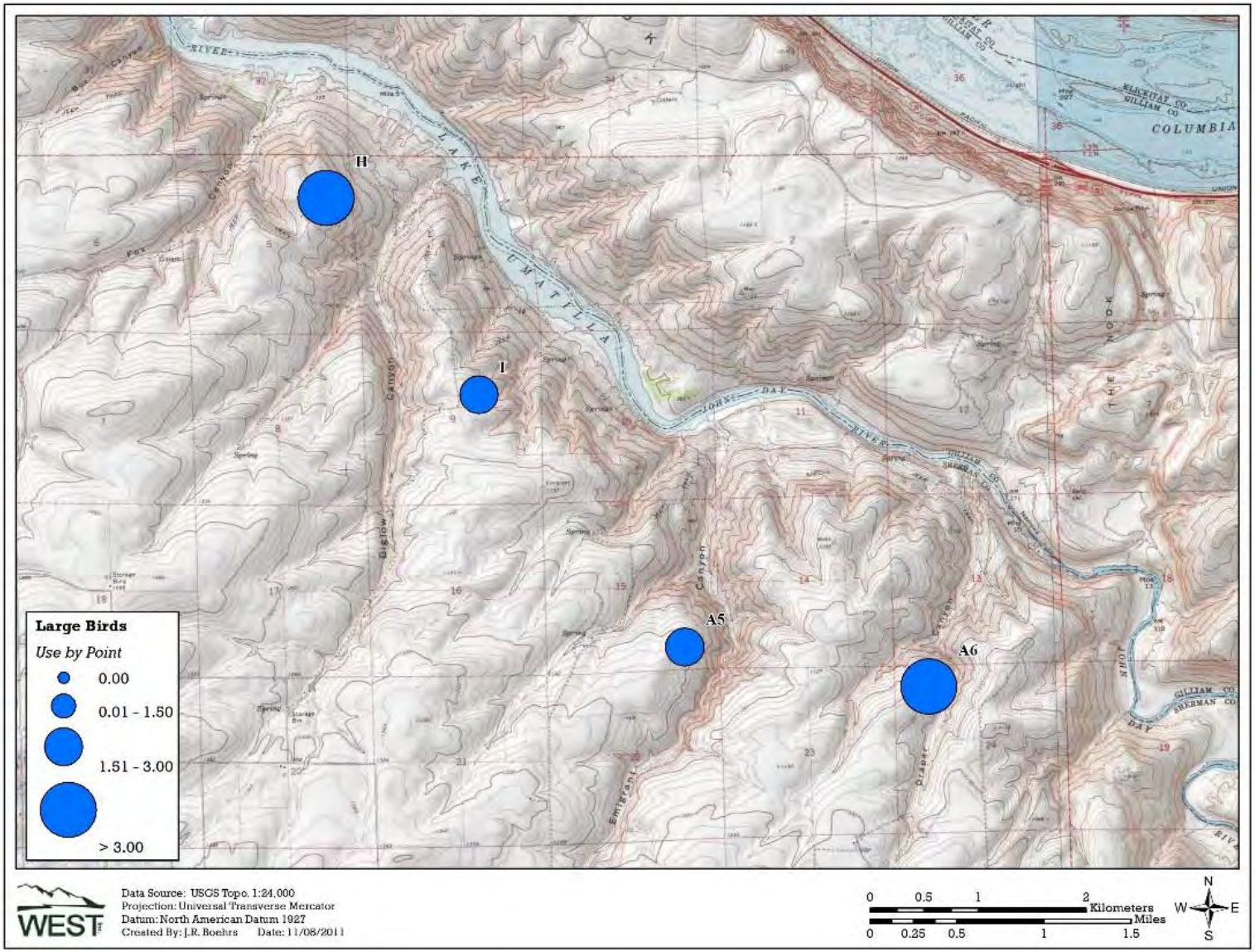
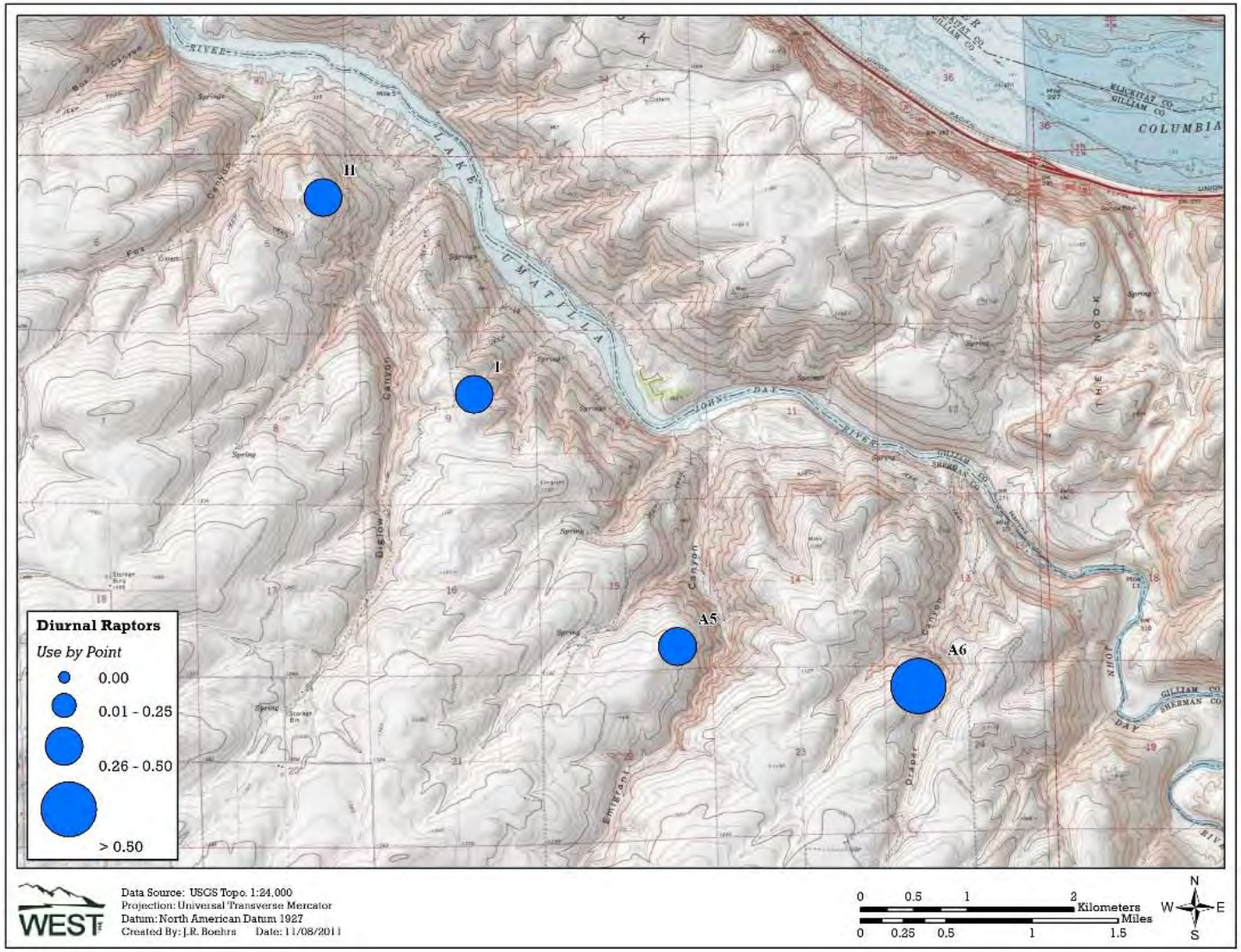
Appendix A. Avian use by observation point during Year 1 JDC surveys at Biglow Canyon Phase III



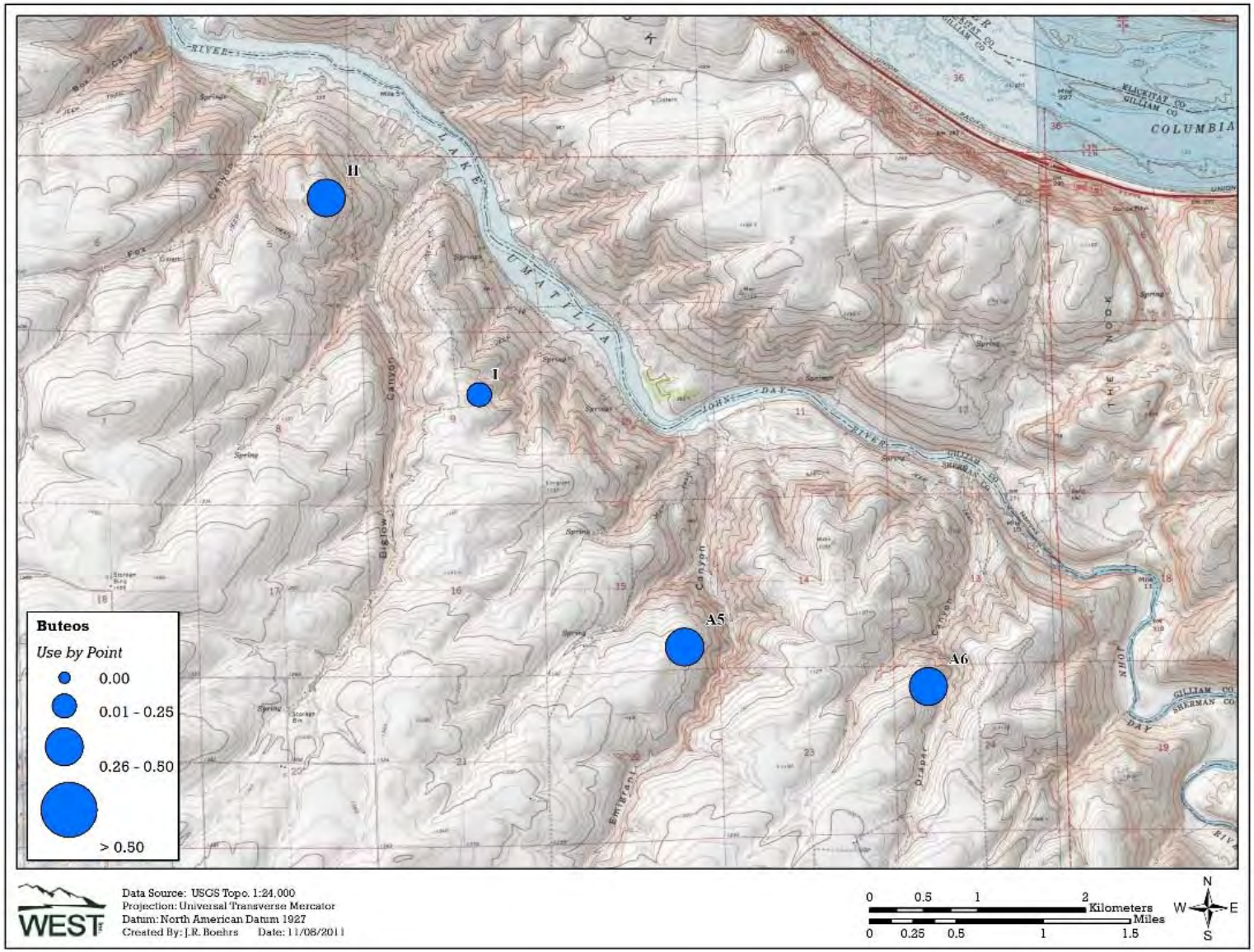
Appendix A1. Small bird (passerine) use (number of birds/30-min survey) by JDC point during Year 1 surveys at Biglow Canyon Phase III.



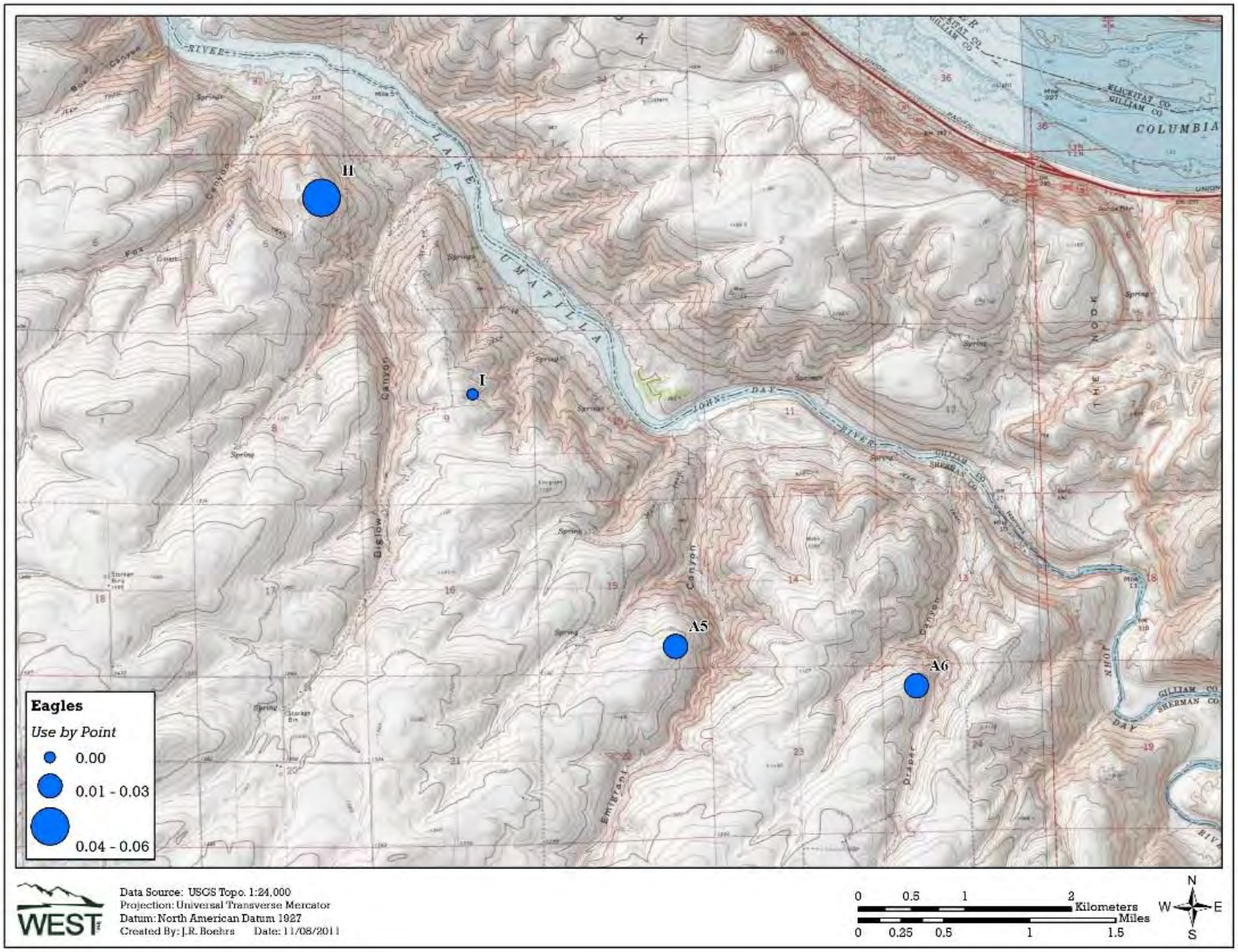
Appendix A2. Large bird use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.



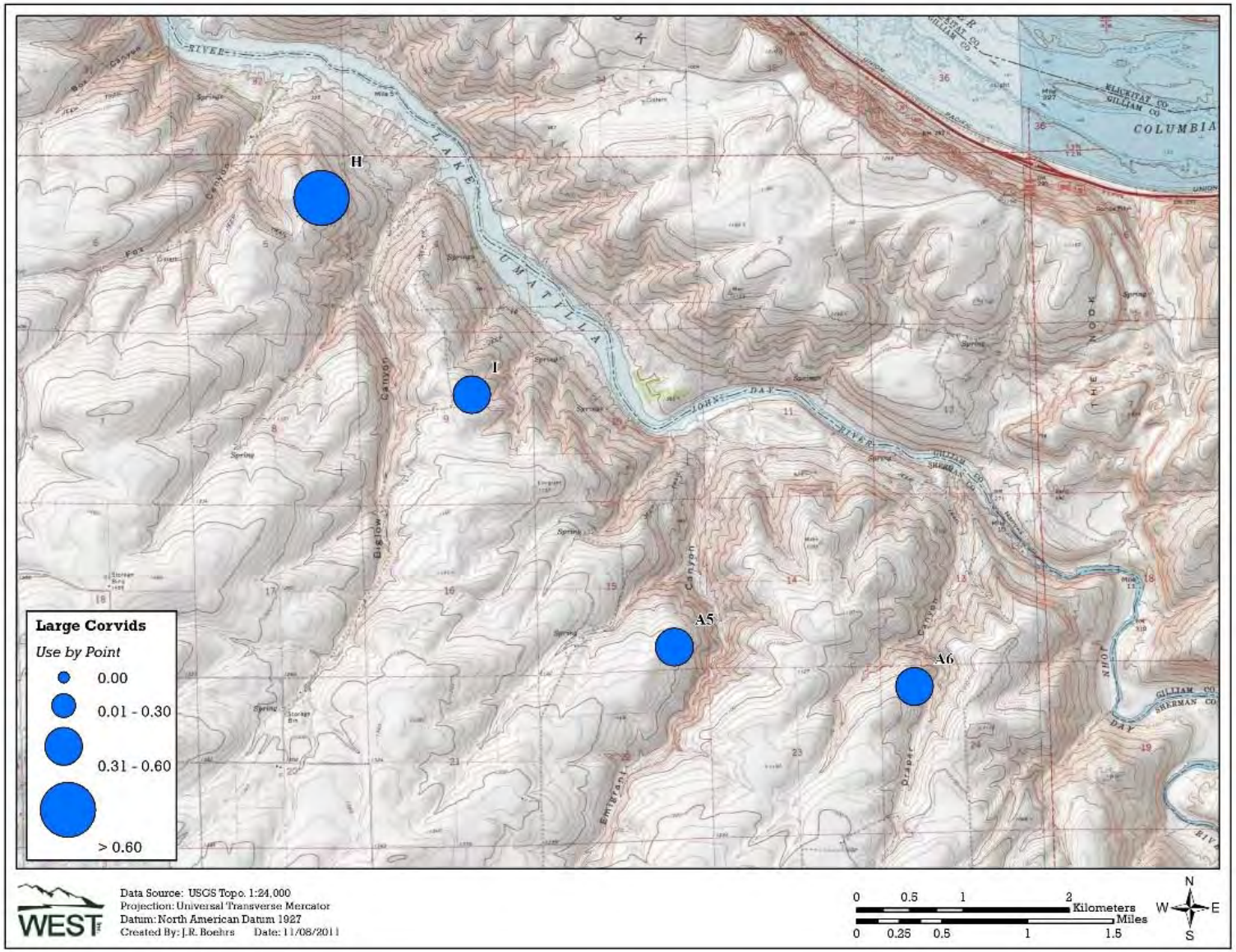
Appendix A3. Diurnal raptor use (all species) by JDC point during Year 1 surveys at Biglow Canyon Phase III.



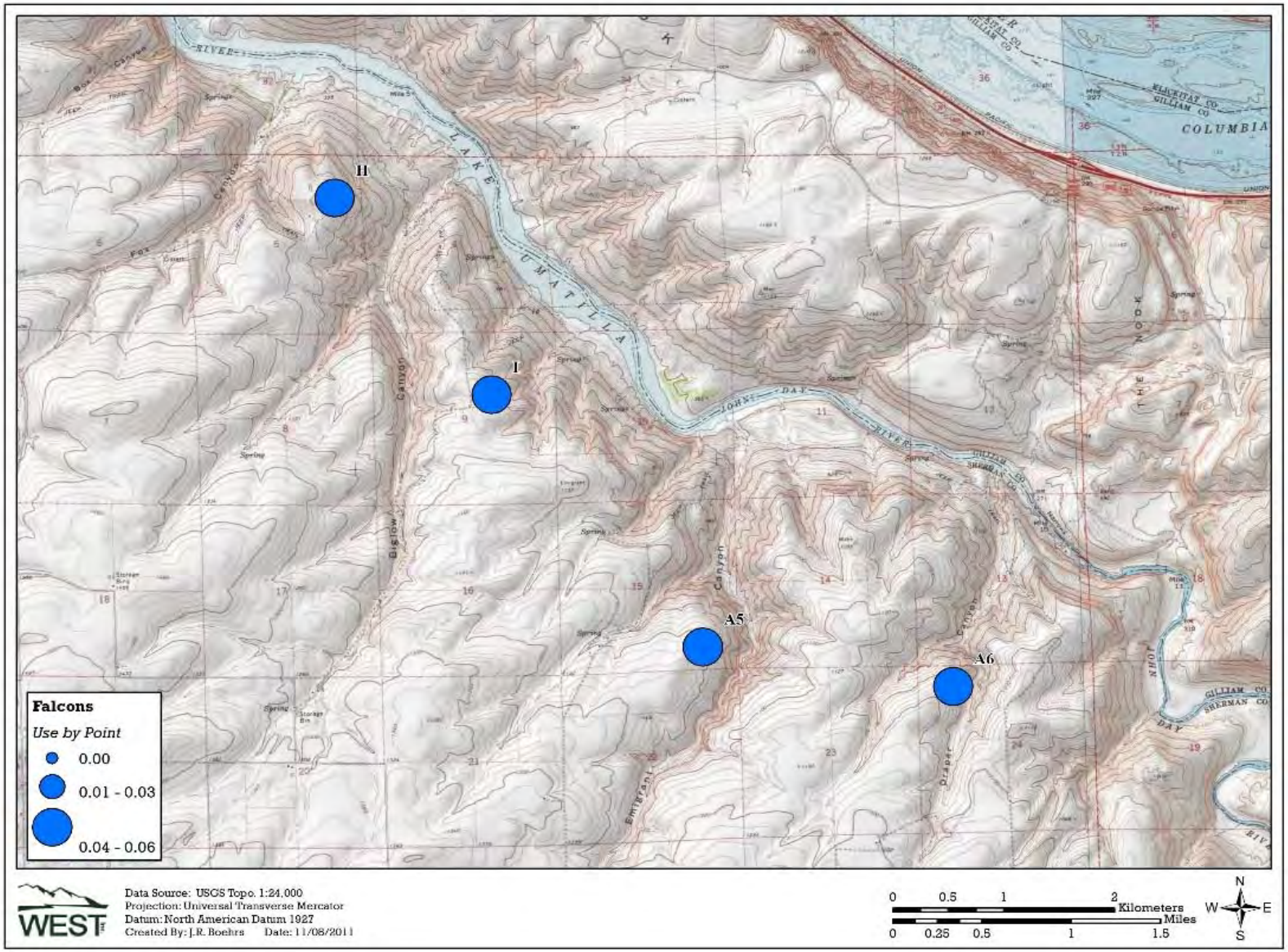
Appendix A4. Buteo use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.



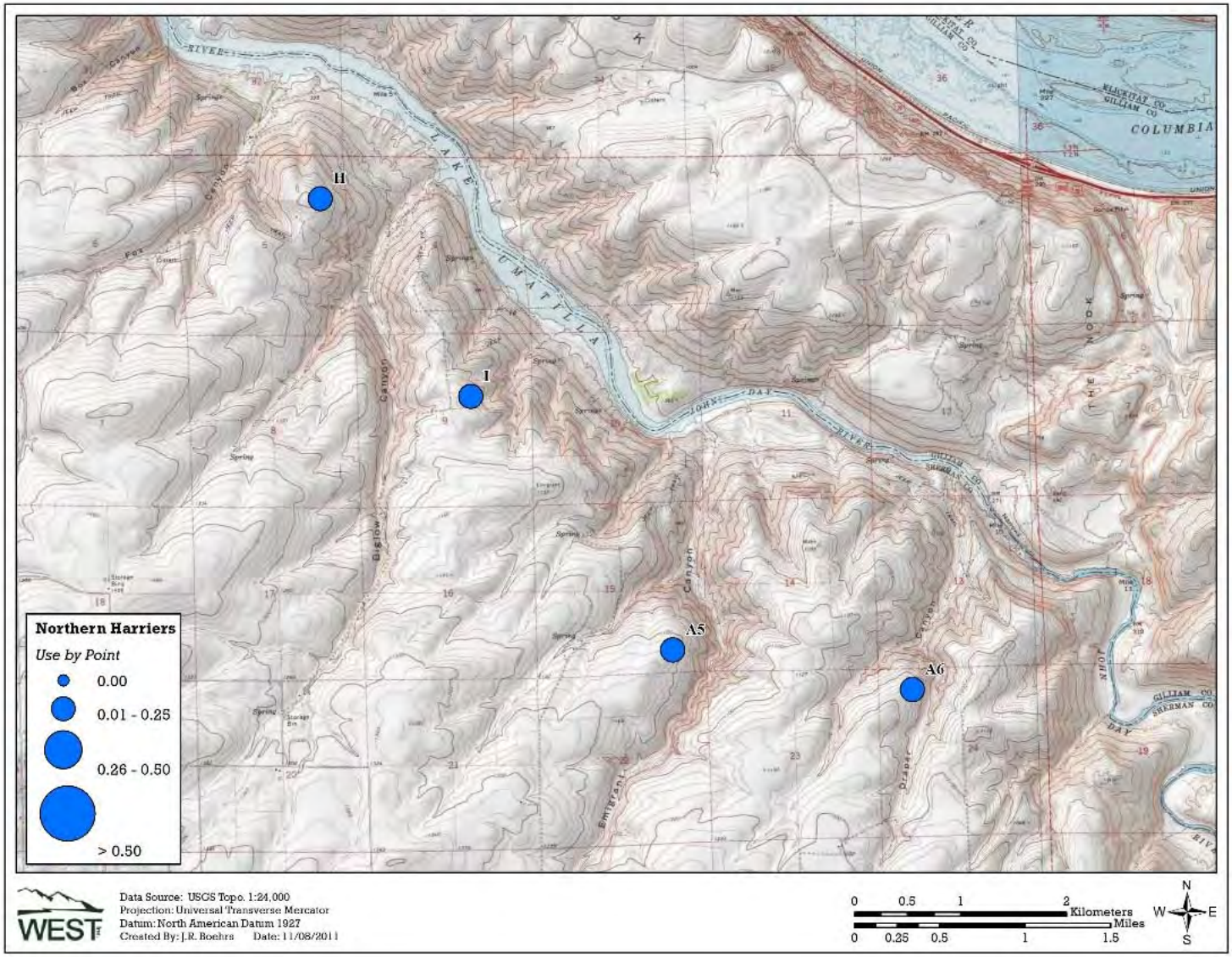
Appendix A5. Eagle use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.



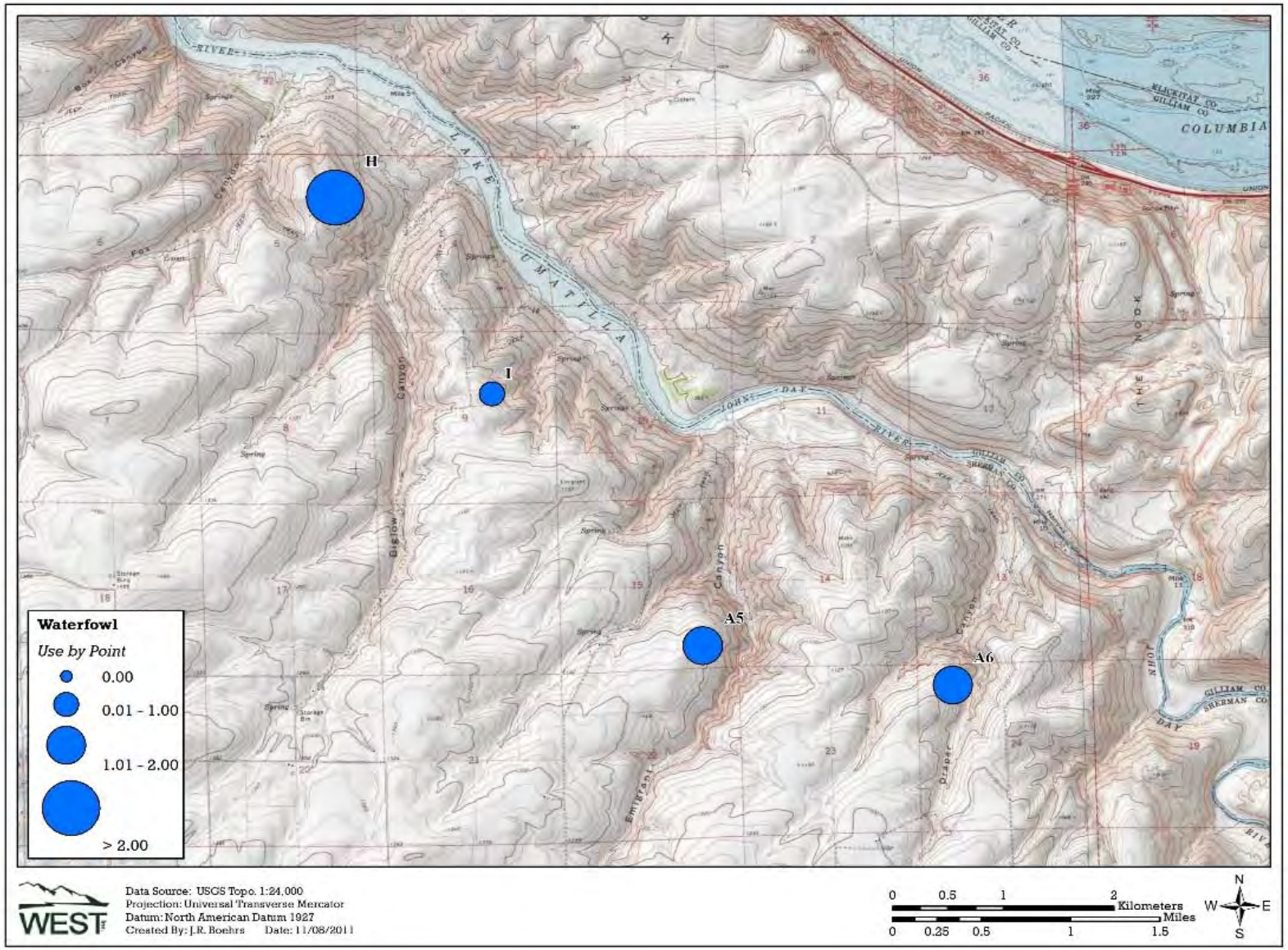
Appendix A6. Large corvid use by JDC point during Year 1 surveys at Biglow Canyon Phase III.



Appendix A7. Falcon use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.

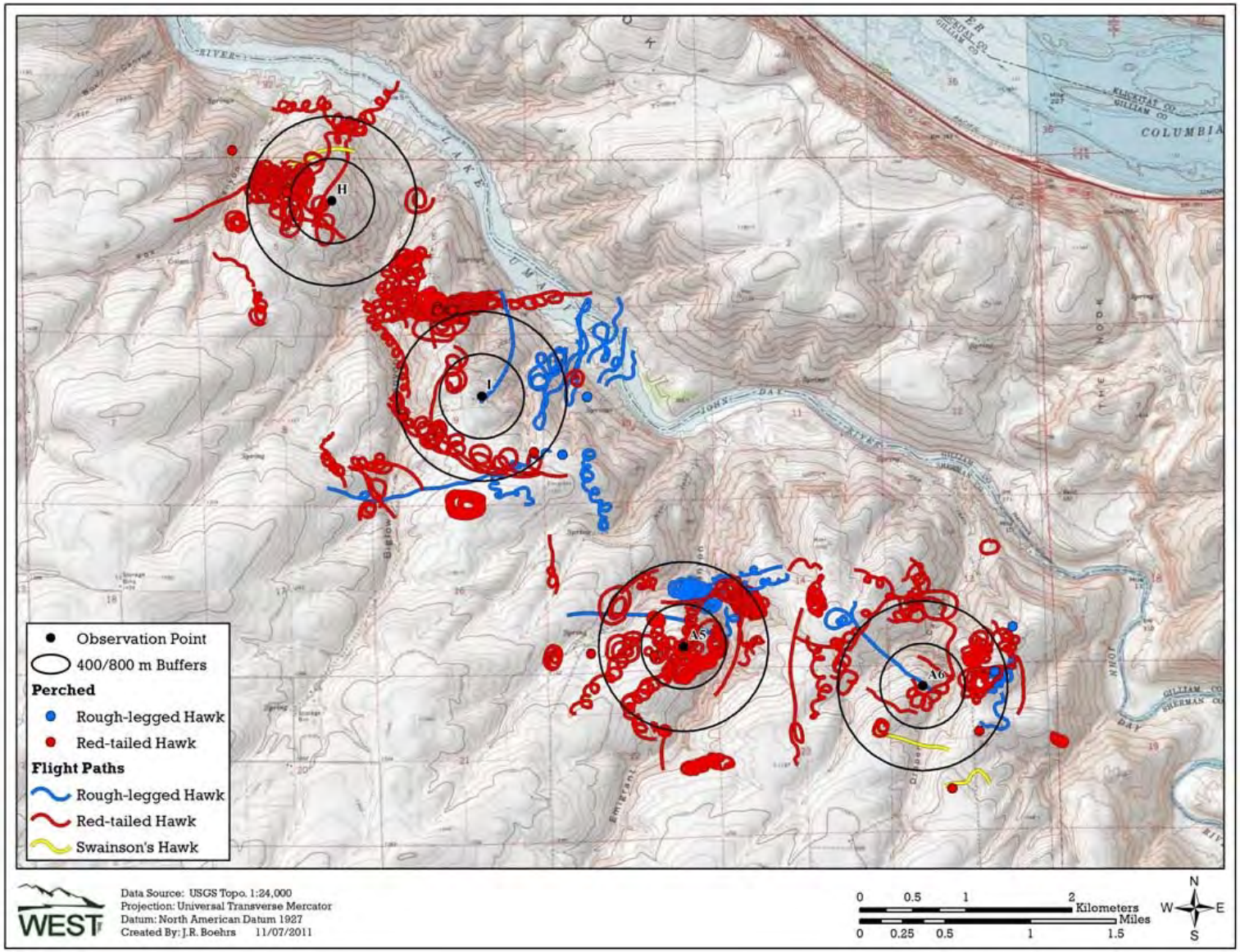


Appendix A8. Northern harrier use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.

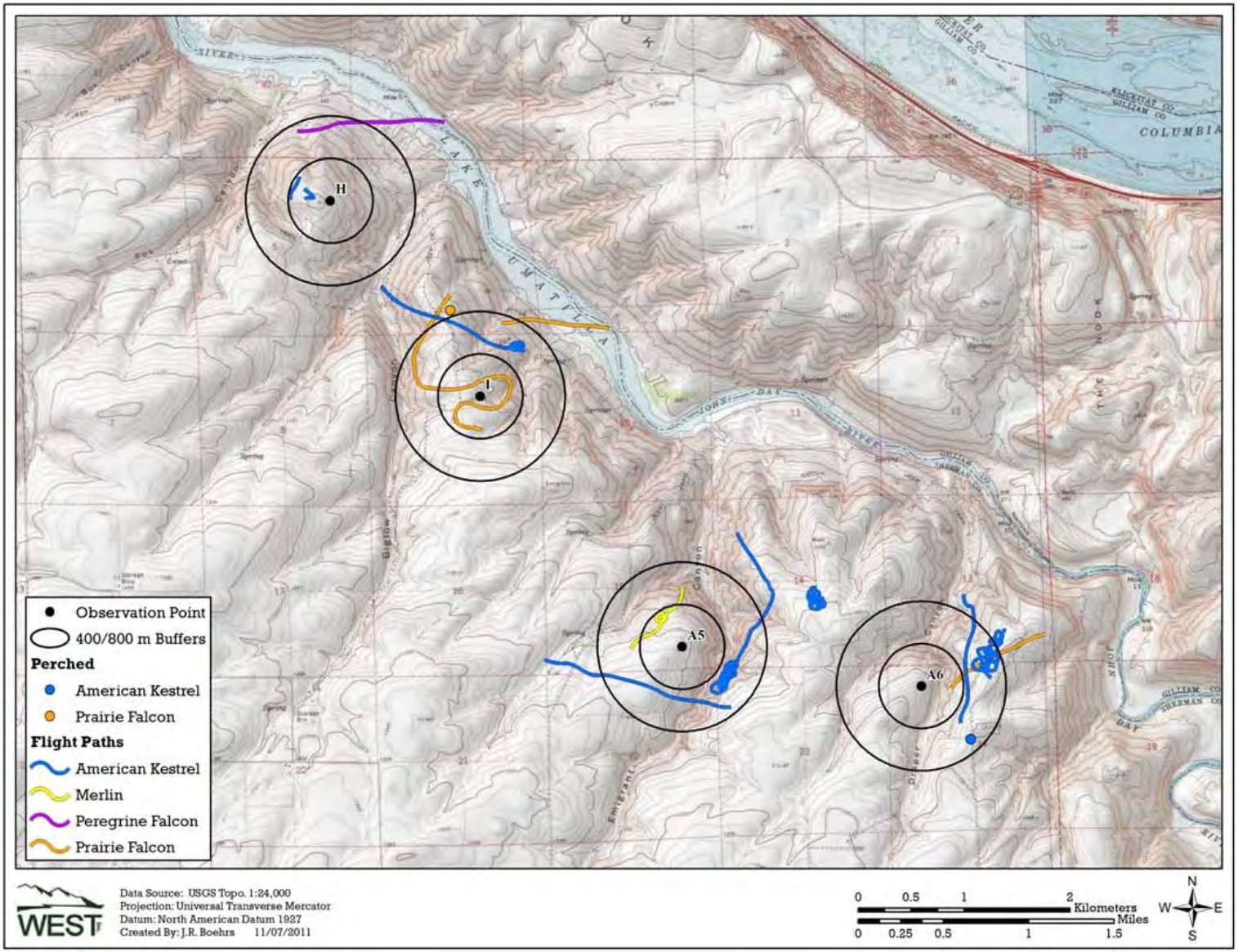


Appendix A9. Waterfowl use by JDC point (number of birds/30-min survey) during Year 1 surveys at Biglow Canyon Phase III.

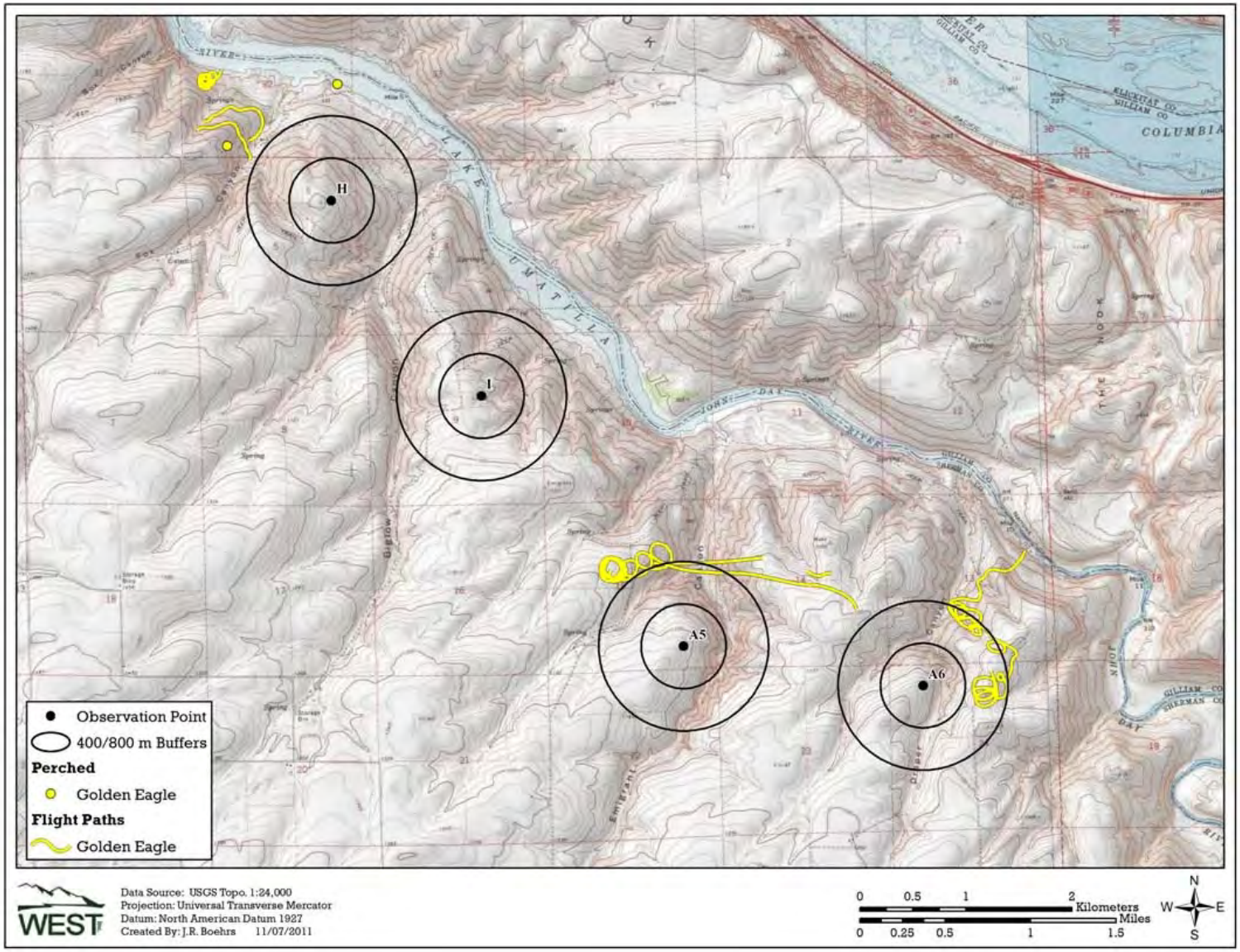
Appendix B. Large bird flight paths documented during Year 1 JDC surveys at Biglow Canyon Phase III



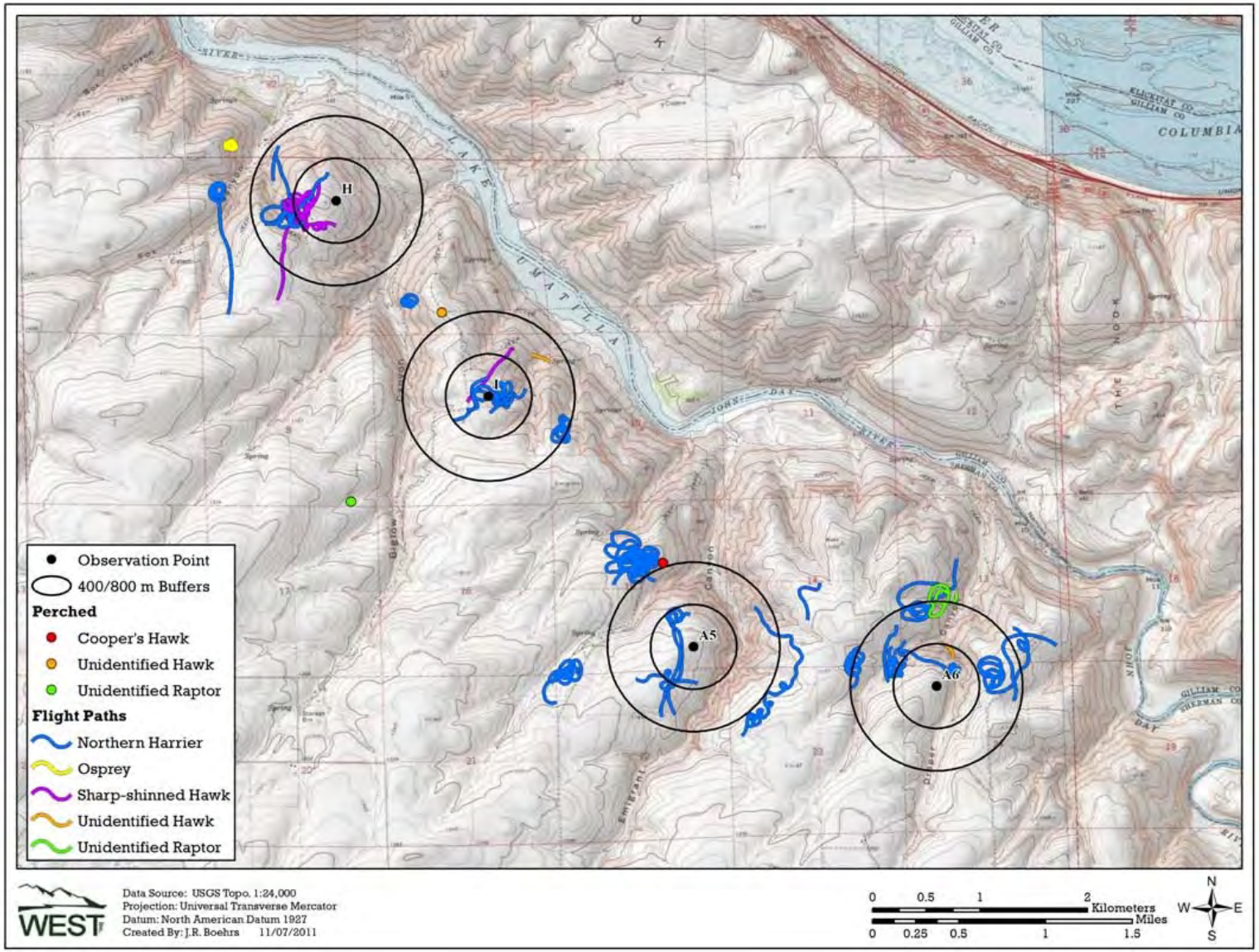
Appendix B1. Buteo flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III.



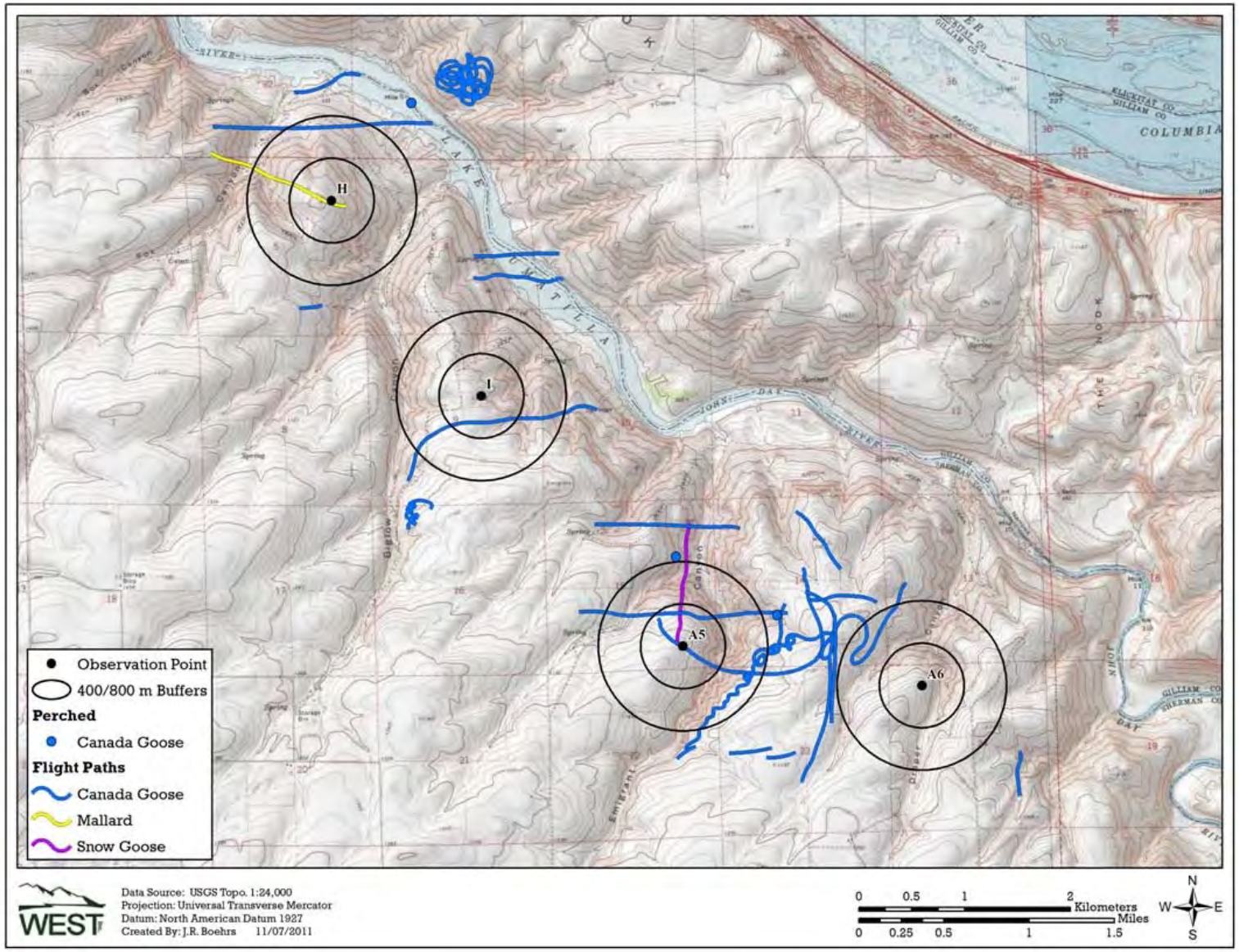
Appendix B2. Falcon flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III.



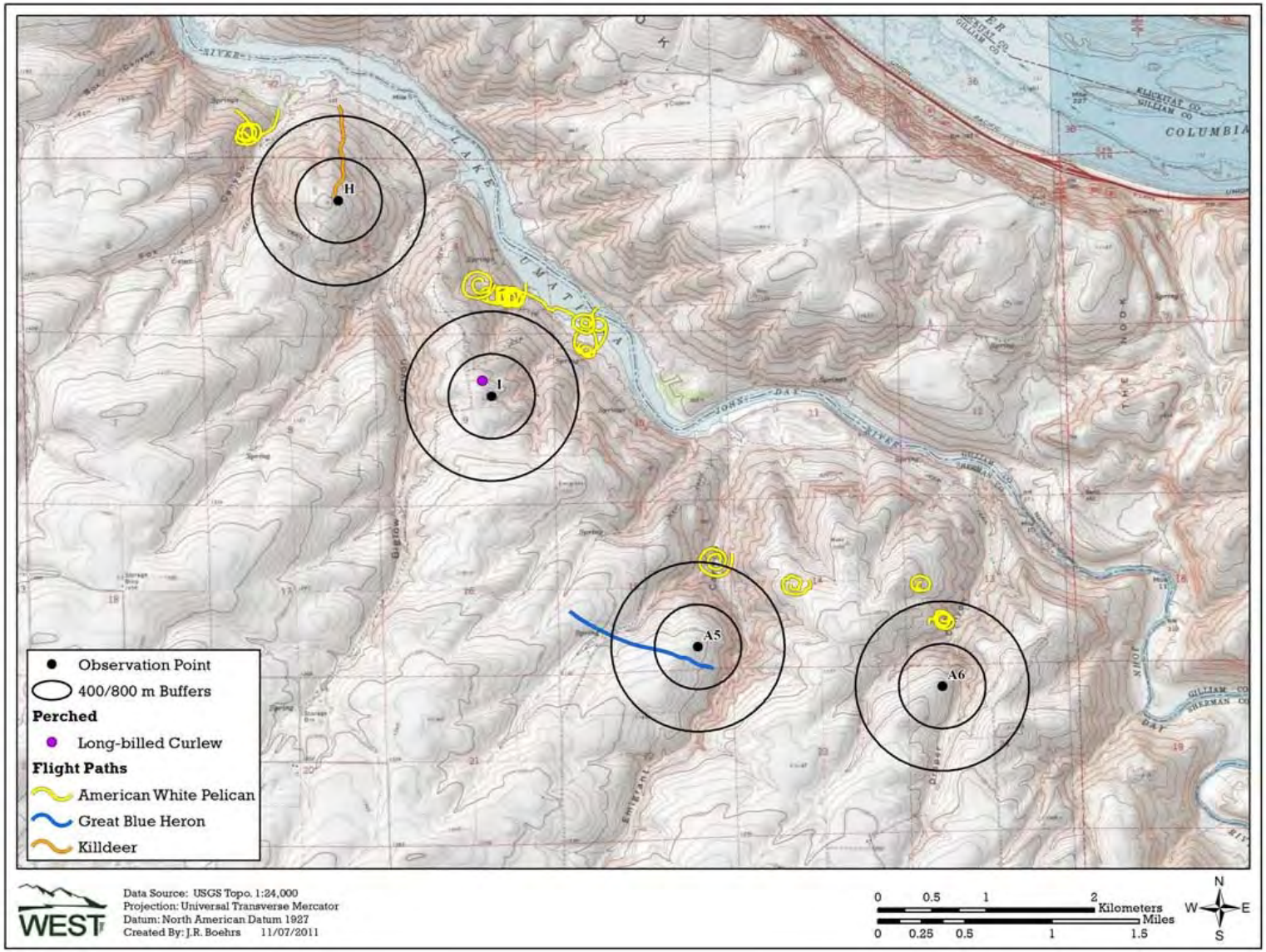
Appendix B3. Golden eagle flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III.



Appendix B4. Flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III for miscellaneous raptors.

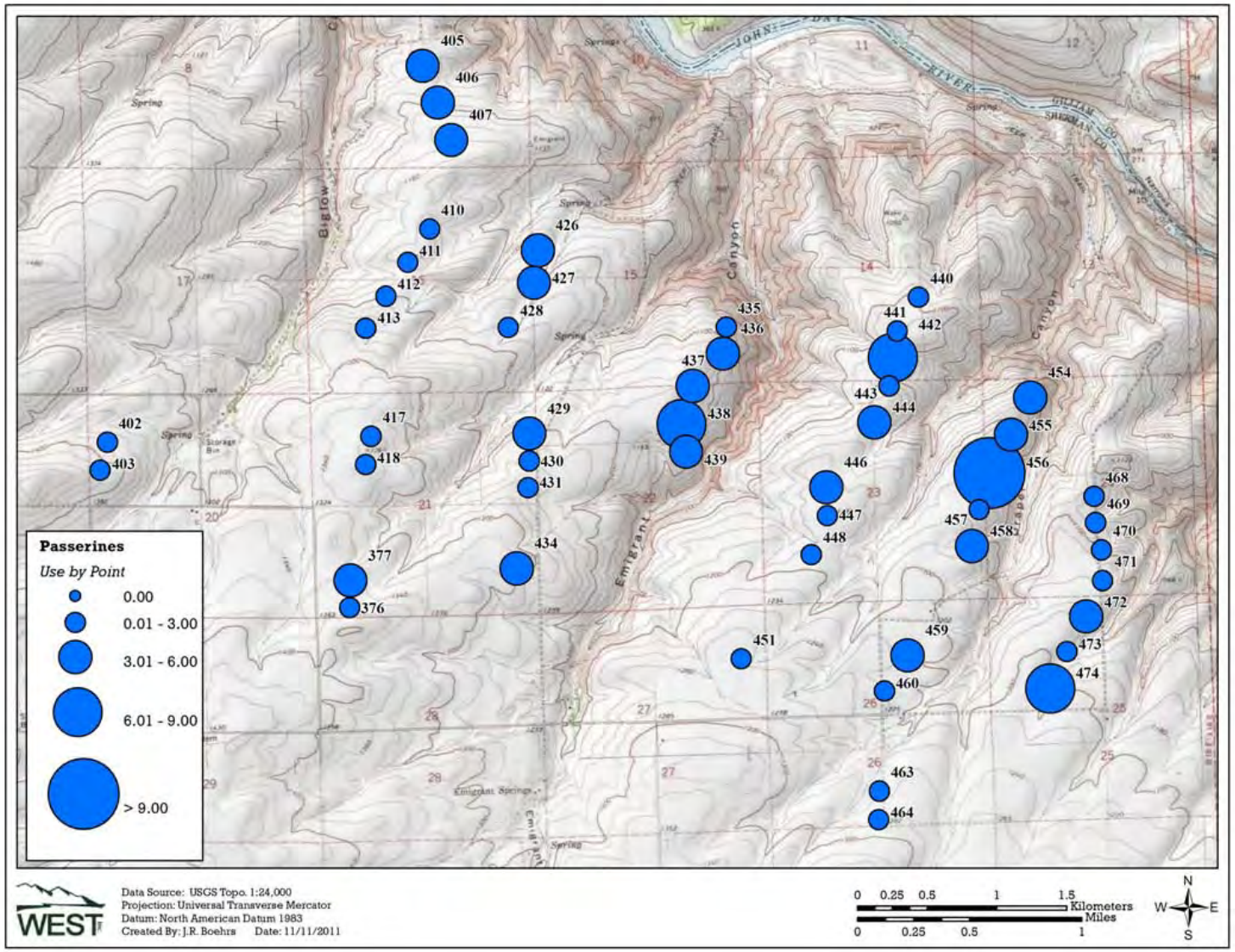


Appendix B5. Waterfowl flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III.

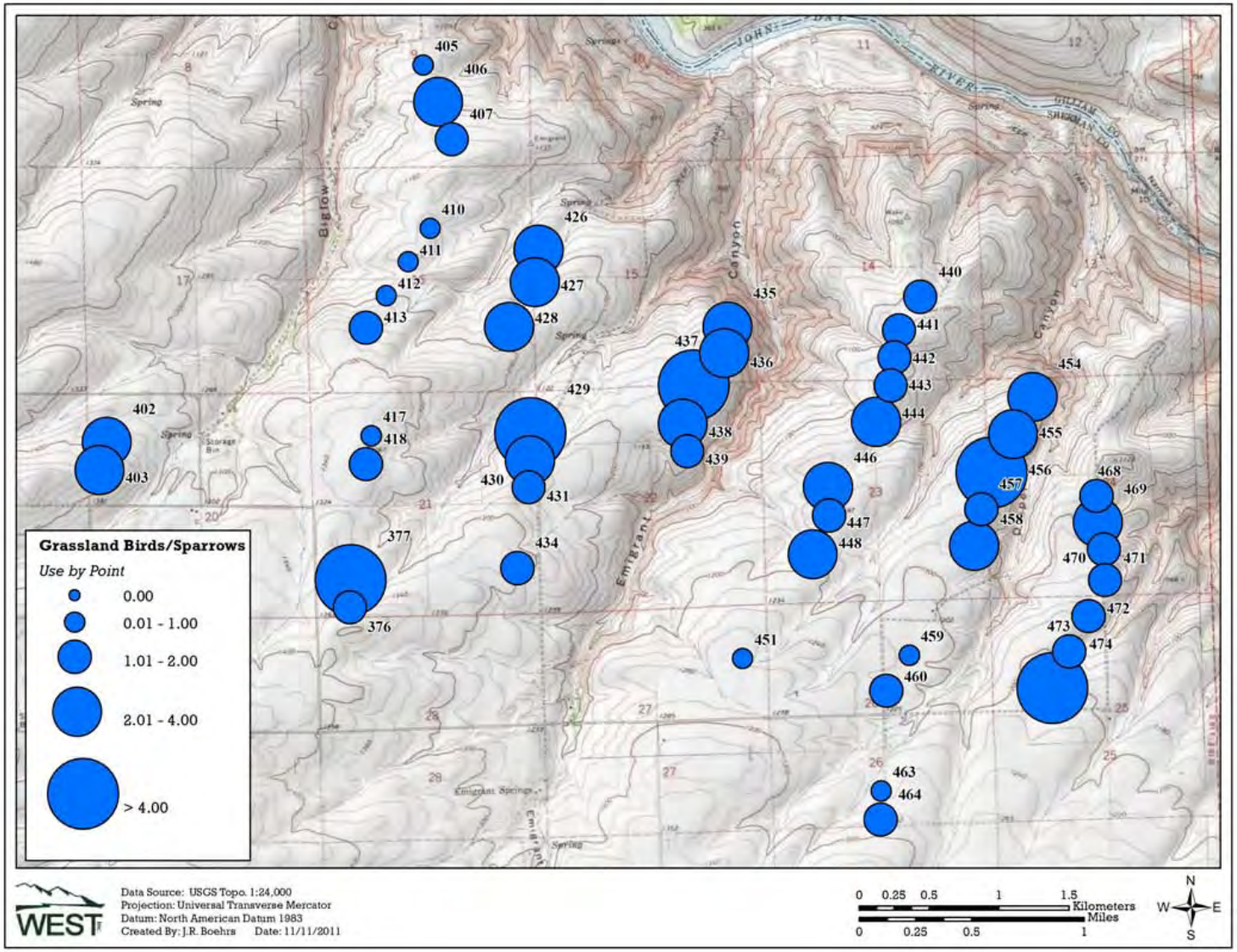


Appendix B6. Waterbird/shorebirds flight paths recorded during Year 1 JDC surveys at Biglow Canyon Phase III.

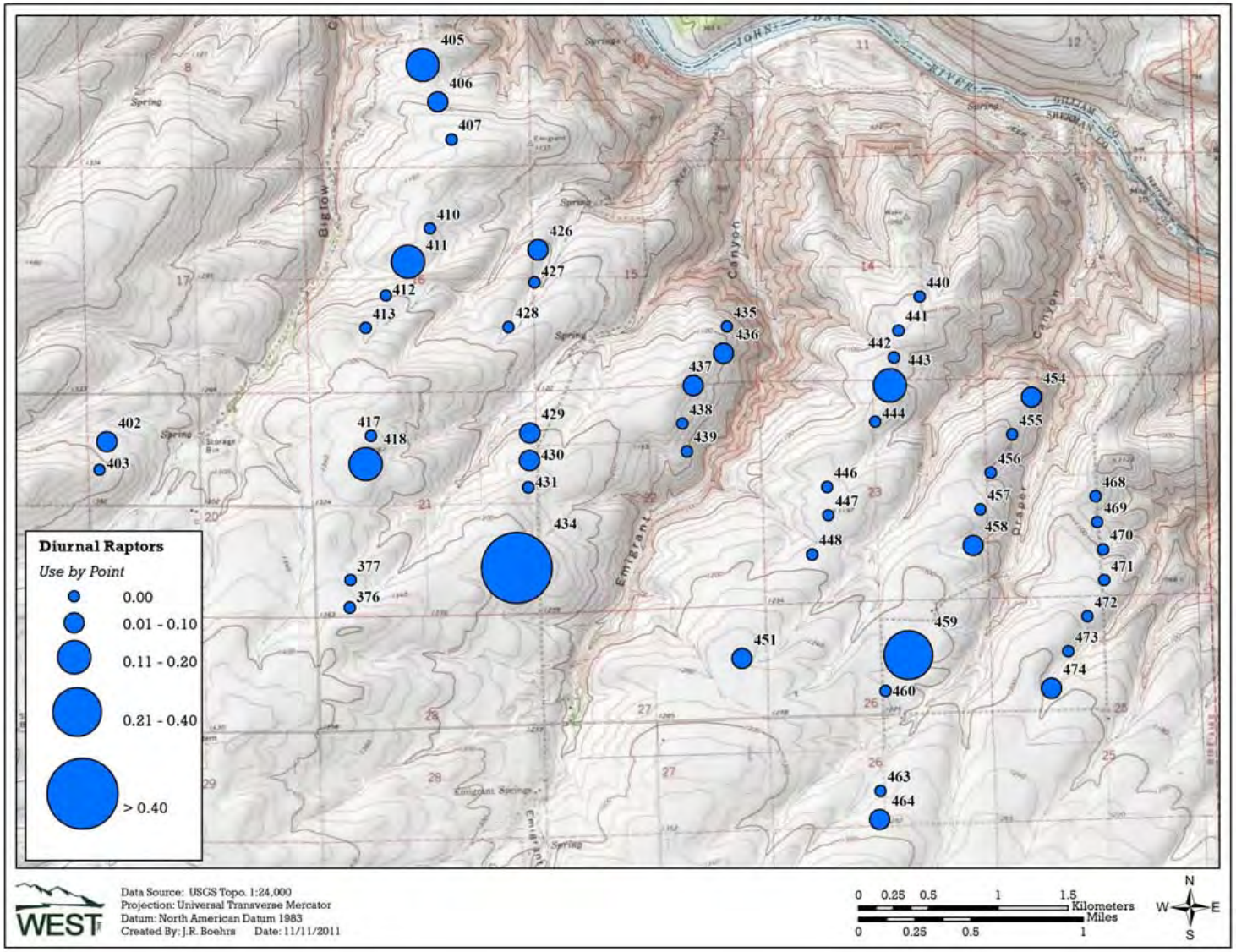
Appendix C. Avian use during Year 1 PWT surveys at Biglow Canyon Phase III



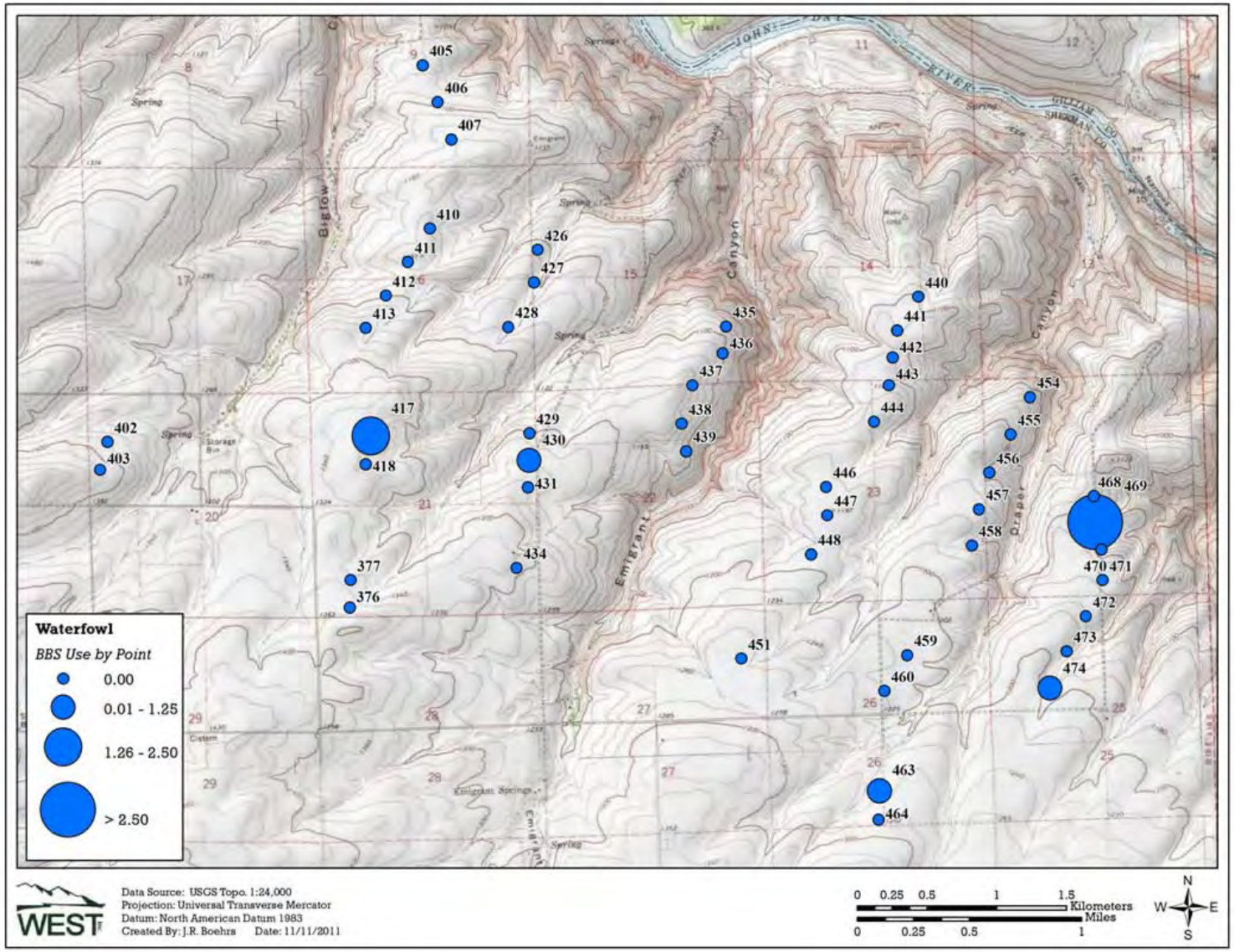
Appendix C1. Passerine use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.



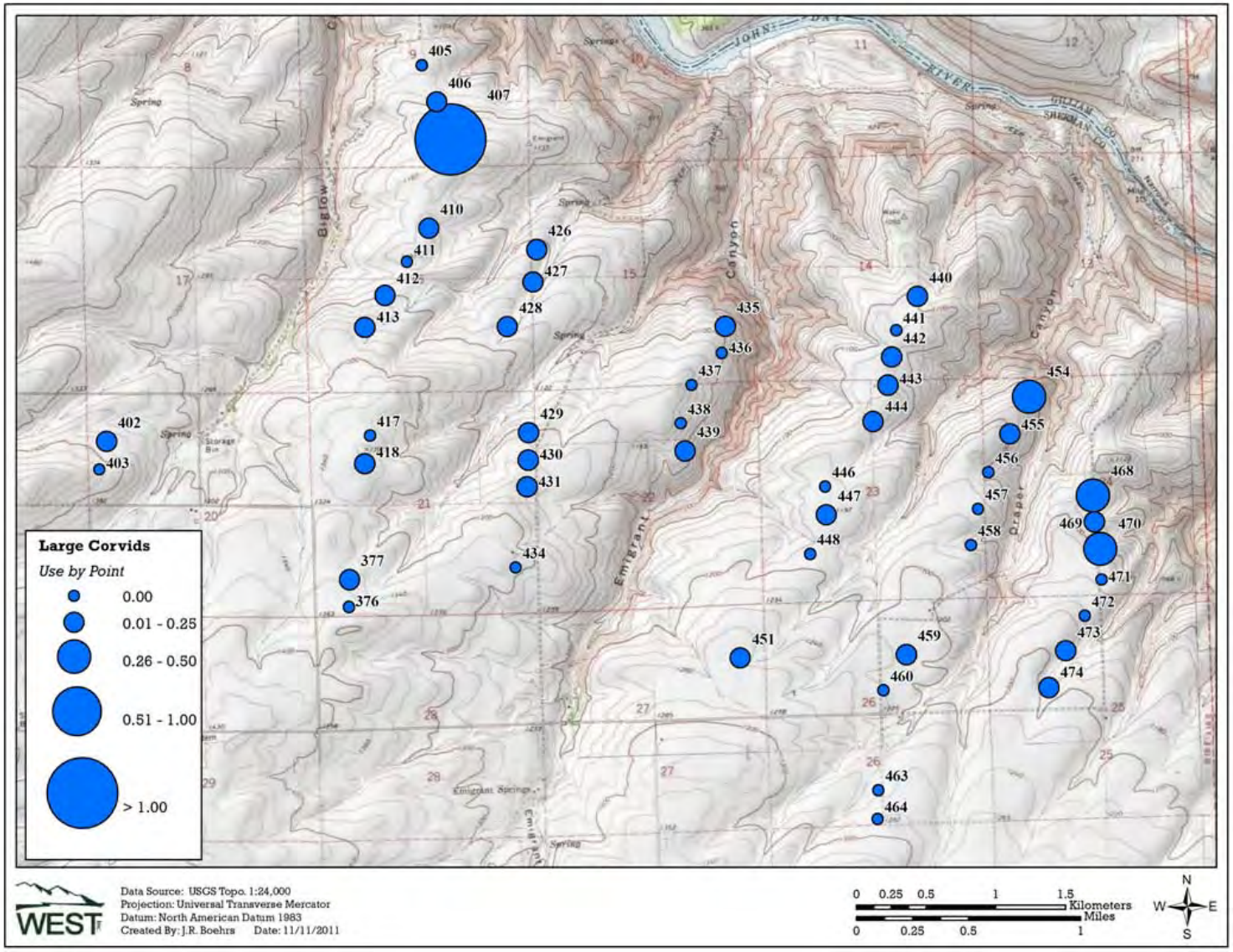
Appendix C2. Mean grassland bird and sparrow use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.



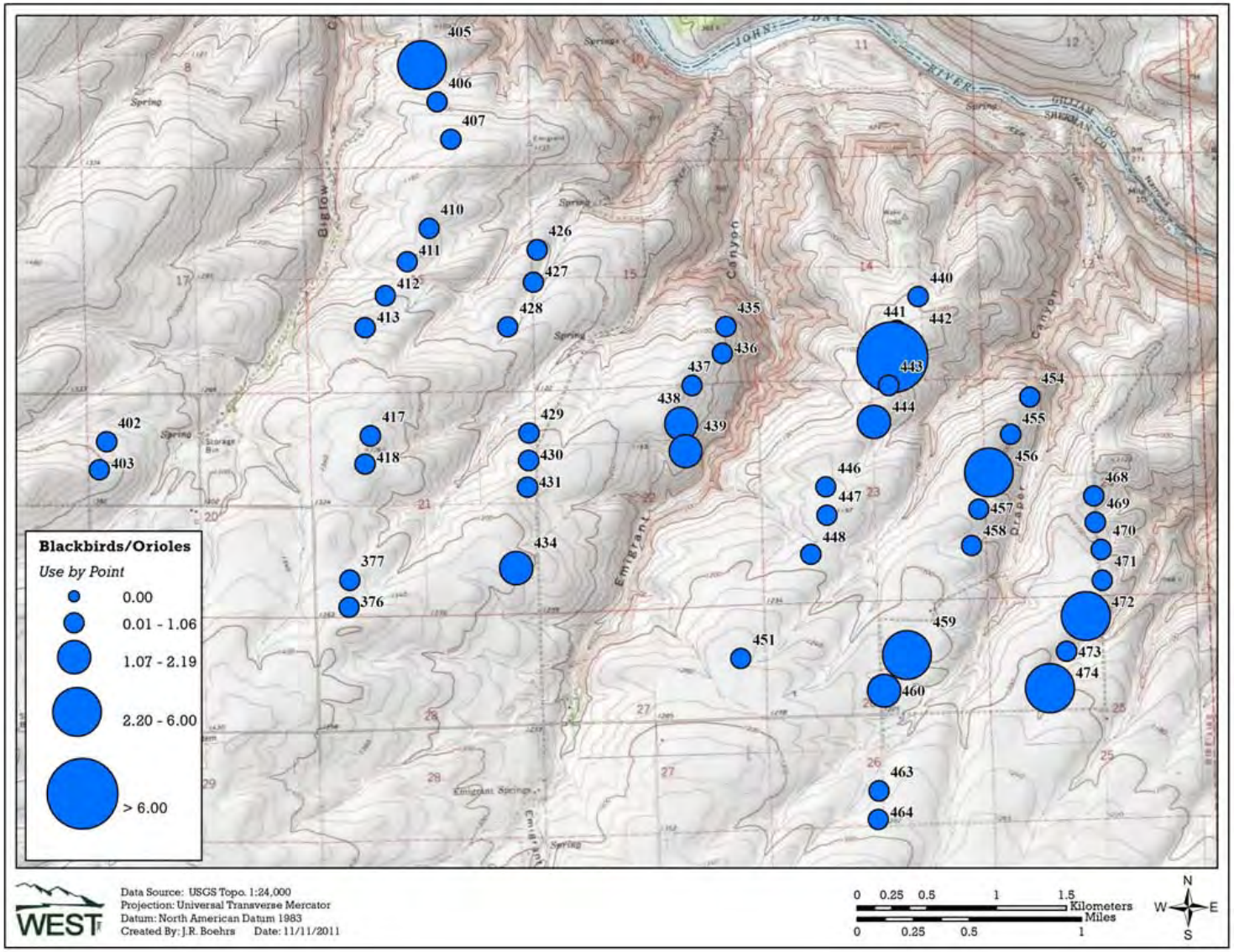
Appendix C3. Mean diurnal raptor use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.



Appendix C4. Mean waterfowl use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.



Appendix C5. Mean large corvid use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.



Appendix C6. Mean blackbird/oriole use by point/turbine (number of birds/5-min survey) during Year 1 PWT surveys at Biglow Canyon Phase III.

Appendix D. Avian use by turbine for Year 1 PWT surveys at Biglow Canyon Phase III

Appendix D1. Avian use (number of birds/5-min survey) by turbine for Year 1 PWT surveys at Biglow Canyon Phase III.

	Turbine Number																	
Type	**376**	**377**	**402**	**403**	**405**	**406**	**407**	**410**	**411**	**412**	**413**	**417**	**418**	**426**	**427**	**428**	**429**	**430**
Waterfowl	0	0	0	0	0	0	0	0	0	0	0	1.56	0	0	0	0	0	1.25
Shorebirds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diurnal Raptors	0	0	0.06	0	0.12	0.06	0	0	0.12	0	0	0	0.12	0.06	0	0	0.06	0.06
Upland Game Birds	0	0	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0
Doves/ Pigeons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Passerines	1.75	4.56	2.69	3	3.88	3.19	3.69	1.19	0.94	1.56	1.75	1.00	2.06	4.62	4.31	2.62	4.25	2.44
Blackbirds	0.12	0.19	0.25	0.38	3.25	0.75	0.19	0.38	0.06	0.50	0.31	0.19	0.38	0.62	0.19	0.12	0.12	0.06
Finches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flycatchers	0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0
Grassland/ Sparrows	1.62	4.31	2.19	2.62	0.5	2.38	1.75	0.69	0.88	1.00	1.25	0.81	1.62	3.88	4.00	2.44	4.06	2.31
Swallows	0	0	0	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0
Corvids	0	0.06	0.25	0	0	0.06	1.75	0.12	0	0.06	0.06	0	0.06	0.12	0.12	0.06	0.06	0.06
Total Use	**1.75**	**4.56**	**2.75**	**3.00**	**4.00**	**3.25**	**3.69**	**1.19**	**1.06**	**1.56**	**1.75**	**2.56**	**2.25**	**4.69**	**4.31**	**2.62**	**4.31**	**3.75**

Appendix D2. Avian use (number of birds/5-min survey) by turbine for Year 1 PWT surveys at Biglow Canyon Phase III.

	Turbine Number																	
Type	**431**	**434**	**435**	**436**	**437**	**438**	**439**	**440**	**441**	**442**	**443**	**444**	**446**	**447**	**448**	**451**	**454**	**455**
Waterfowl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shorebirds	0	0	0	0	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0
Diurnal Raptors	0	0.50	0	0.06	0.06	0	0	0	0	0	0.19	0	0	0	0	0.06	0.06	0
Upland Game Birds	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0	0	0
Doves/ Pigeons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Passerines	1.75	3.19	2.94	3.25	5.19	6.19	3.50	2.56	1.50	8.44	2.12	5.31	3.06	1.94	2.38	0.75	3.75	3.50
Blackbirds	0.12	1.31	0.62	0.25	0.38	1.38	1.50	0.75	0.31	6.75	0.56	2.19	0.19	0.06	0.19	0.19	1.06	0.88
Finches	0	0	0	0	0	2.50	0.19	0	0	0	0	0	0.06	0	0	0	0	0
Flycatchers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grassland/ Sparrows	1.50	1.88	2.25	3.00	4.81	2.31	1.69	1.75	1.19	1.62	1.50	3.00	2.81	1.75	2.19	0.44	2.31	2.50
Swallows	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corvids	0.12	0	0.06	0	0	0	0.12	0.06	0	0.06	0.06	0.12	0	0.12	0	0.12	0.38	0.13
Total Use	**1.75**	**3.69**	**2.94**	**3.31**	**5.25**	**6.19**	**3.5**	**2.56**	**1.50**	**8.44**	**2.38**	**5.44**	**3.06**	**1.94**	**2.38**	**0.81**	**3.81**	**3.50**

Appendix D3. Avian use (number of birds/5-min survey) by turbine for Year 1 PWT surveys at Biglow Canyon Phase III.

	Turbine Number													
Type	**456**	**457**	**458**	**459**	**460**	**463**	**464**	**468**	**469**	**470**	**471**	**472**	**473**	**474**
Waterfowl	0	0	0	0	0	1.25	0	0	2.81	0	0	0	0	1.25
Shorebirds	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0
Diurnal Raptors	0	0	0.06	0.25	0	0	0.06	0	0	0	0	0	0	0.06
Upland Game Birds	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0
Doves/ Pigeons	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0
Passerines	9.44	2.62	4.44	3.94	2.44	1.25	1.31	2.12	2.69	2.31	1.44	4.88	2.81	7.62
Blackbirds	5.38	0.88	0.88	3.38	1.31	0.25	0.19	0.69	0.12	0.31	0.19	3.50	0.75	3.31
Finches	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0
Flycatchers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grassland/S parrows	4.06	1.69	3.56	0.44	1.12	1.00	1.12	1.12	2.31	1.62	1.19	1.38	1.94	4.25
Swallows	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0
Corvids	0	0	0	0.12	0	0	0	0.31	0.25	0.38	0	0	0.12	0.06
Total Use	**9.44**	**2.62**	**4.94**	**4.25**	**2.44**	**2.5**	**1.38**	**2.12**	**5.50**	**2.31**	**1.44**	**4.88**	**2.81**	**8.94**

Appendix E. Bird and bat fatalities documented during Year 1 monitoring at Biglow Canyon Phase III

Appendix E. Bird and bat fatalities documented during Year 1 monitoring at Biglow Canyon Phase III.

Date	Common Name	Turbine Number	Distance From Turbine (meters)	Type Of Find	Carcass Condition
9 /22/2010	hoary bat	459	12	carcass search	complete
9 /27/2010	gray partridge	406	10	carcass search	feather spot
9 /27/2010	horned lark	407	8	carcass search	complete
9 /27/2010	yellow-rumped warbler	469	2	incidental find	complete
9 /30/2010	hoary bat	428	64	carcass search	scavenged
10/01/2010	northern flicker	439	29	carcass search	feather spot
10/11/2010	horned lark	406	47	carcass search	complete
10/18/2010	golden-crowned kinglet	444	77	carcass search	complete
10/19/2010	varied thrush	456	78	carcass search	feather spot
10/22/2010	yellow-rumped warbler	402	74	carcass search	feather spot
10/22/2010	horned lark	403	85	carcass search	partial
11/01/2010	horned lark	406	30	carcass search	complete
11/04/2010	horned lark	437	5	carcass search	complete
11/09/2010	golden-crowned kinglet	455	59	carcass search	complete
11/15/2010	horned lark	436	9	incidental find	partial
12/08/2010	horned lark	454	28	incidental find	complete
1 /15/2011	horned lark	438	109	carcass search	feather spot
1 /16/2011	rough-legged hawk	439	48	carcass search	complete
1 /17/2011	horned lark	454	34	incidental find	partial
3 /16/2011	horned lark	428	39	carcass search	partial
3 /23/2011	horned lark	472	12	carcass search	partial
3 /31/2011	red-tailed hawk	436	29	carcass search	scavenged
4 /07/2011	American robin	470	108	carcass search	feather spot
4 /08/2011	house sparrow	403	37	carcass search	scavenged
4 /15/2011	horned lark	438	38	carcass search	partial
4 /25/2011	horned lark	406	24	carcass search	complete
4 /29/2011	horned lark	440	27	carcass search	complete
5 /16/2011	horned lark	411	7	carcass search	partial
6 /15/2011	horned lark	376	135	carcass search	partial
6 /16/2011	ring-necked pheasant	427	110	carcass search	feather spot
6 /17/2011	American kestrel	434	48	carcass search	feather spot
6 /17/2011	horned lark	434	69	carcass search	feather spot
6 /22/2011	unidentified warbler	460	48	carcass search	feather spot
7 /23/2011	house sparrow	459	44	carcass search	complete
7 /23/2011	horned lark	460	136	carcass search	complete
7 /26/2011	silver-haired bat	471	60	carcass search	complete
8 /16/2011	unidentified gull	417	38	carcass search	partial
8 /17/2011	ring-necked pheasant	426	91	carcass search	feather spot
8 /18/2011	horned lark	434	70	carcass search	feather spot
8 /20/2011	Vaux's swift	444	6	carcass search	complete
8 /23/2011	common nighthawk	471	66	carcass search	feather spot
8 /31/2011	hoary bat	426	112	carcass search	complete
8 /31/2011	Townsend's warbler	428	88	carcass search	complete
8 /31/2011	unidentified warbler	428	116	carcass search	feather spot
9 /02/2011	hoary bat	442	69	carcass search	complete