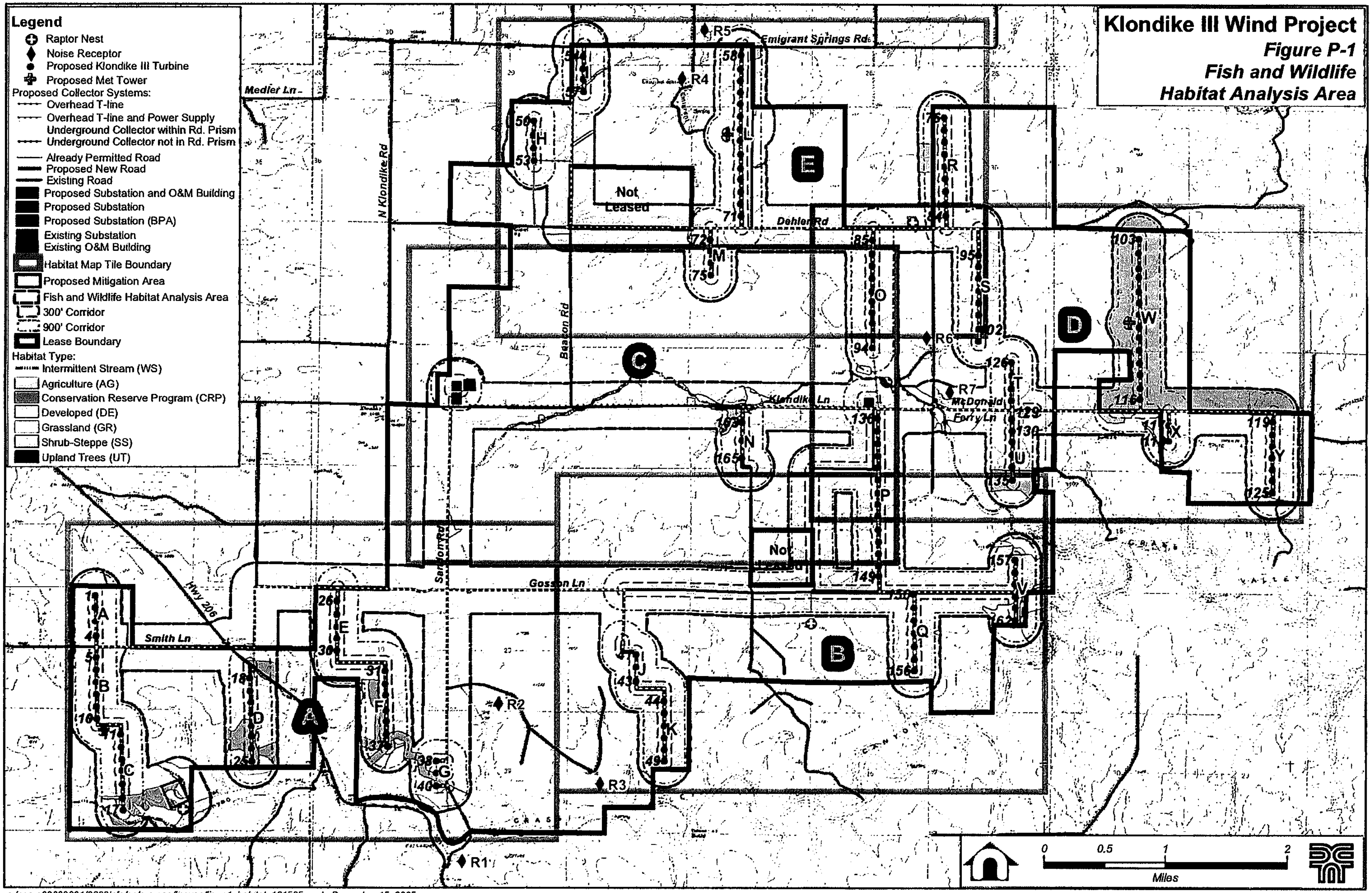

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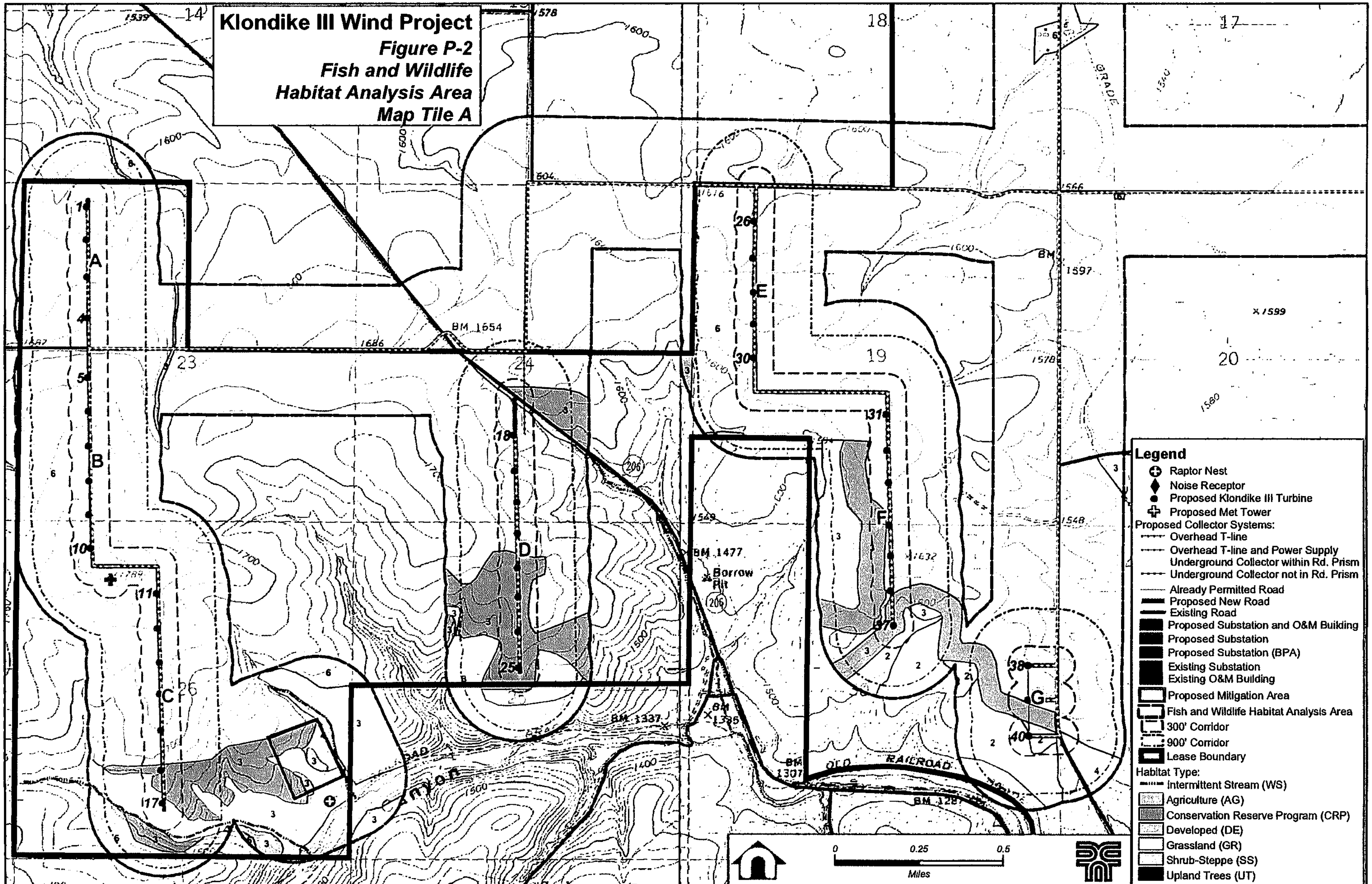

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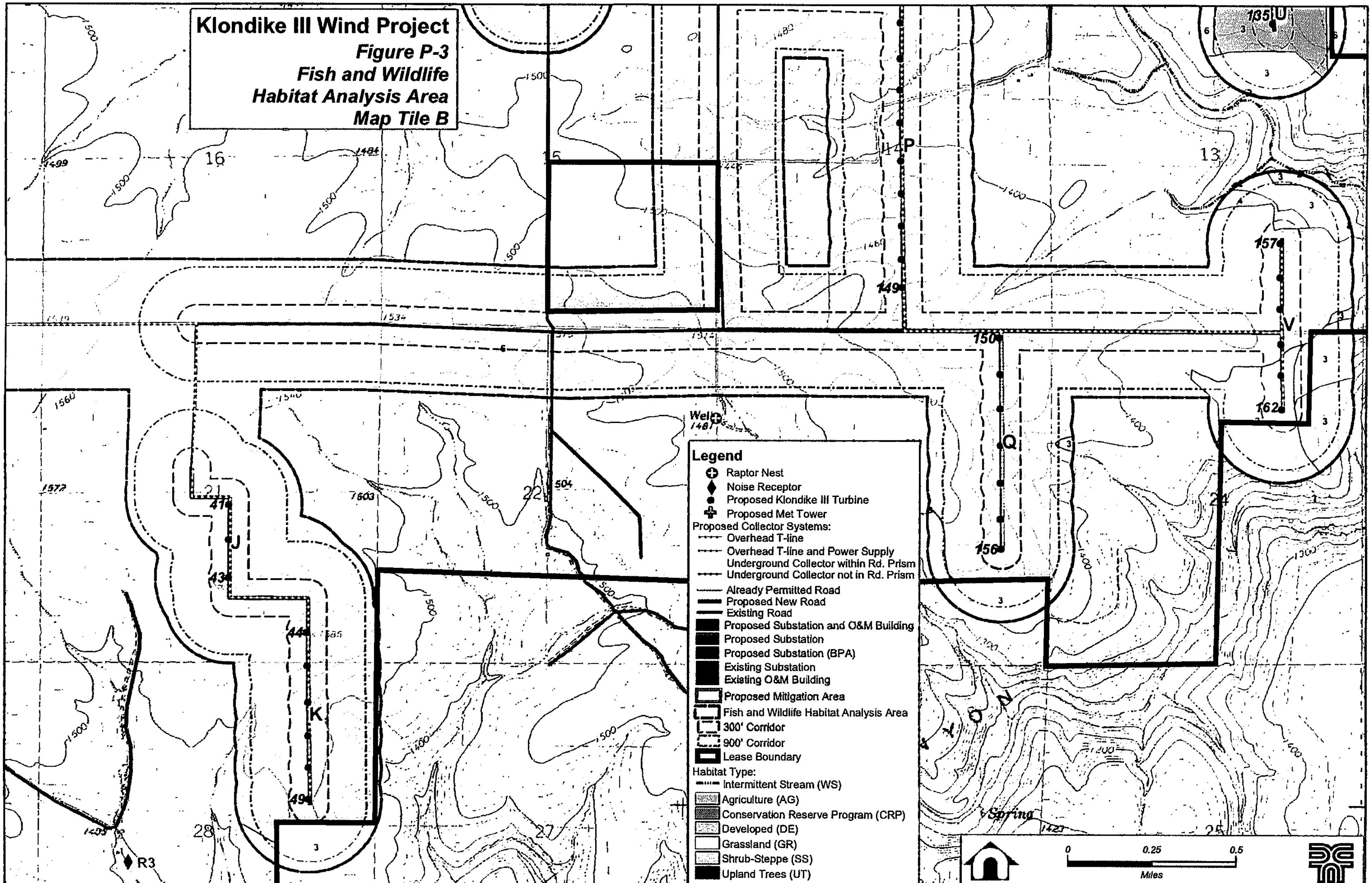
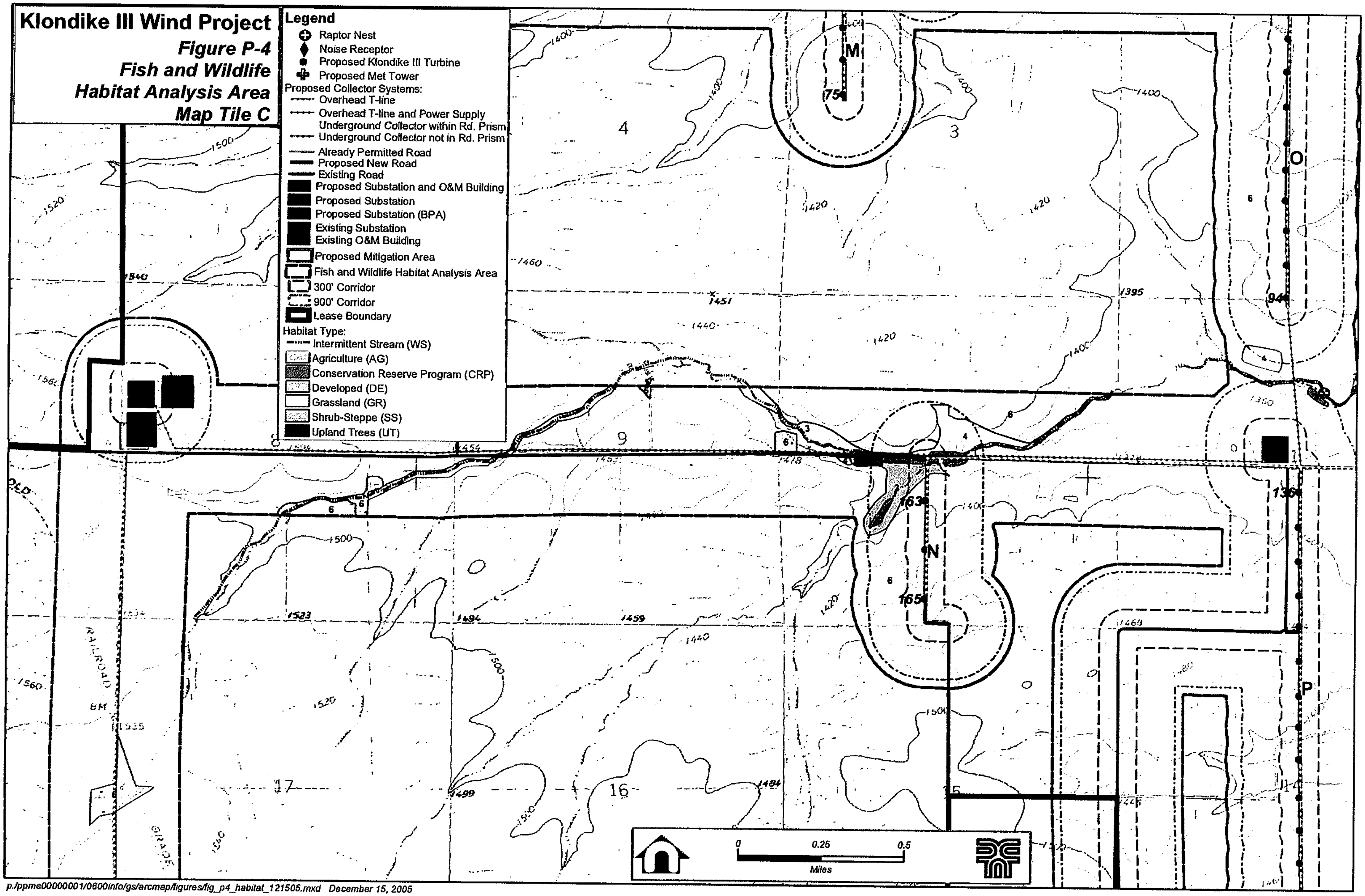


p:/ppme00000001/0600info/gs/arcmap/figures/fig_p3_habitat_121505.mxd December 15, 2005

Klondike III Wind Project
Figure P-4
Fish and Wildlife Habitat Analysis Area
Map Tile C



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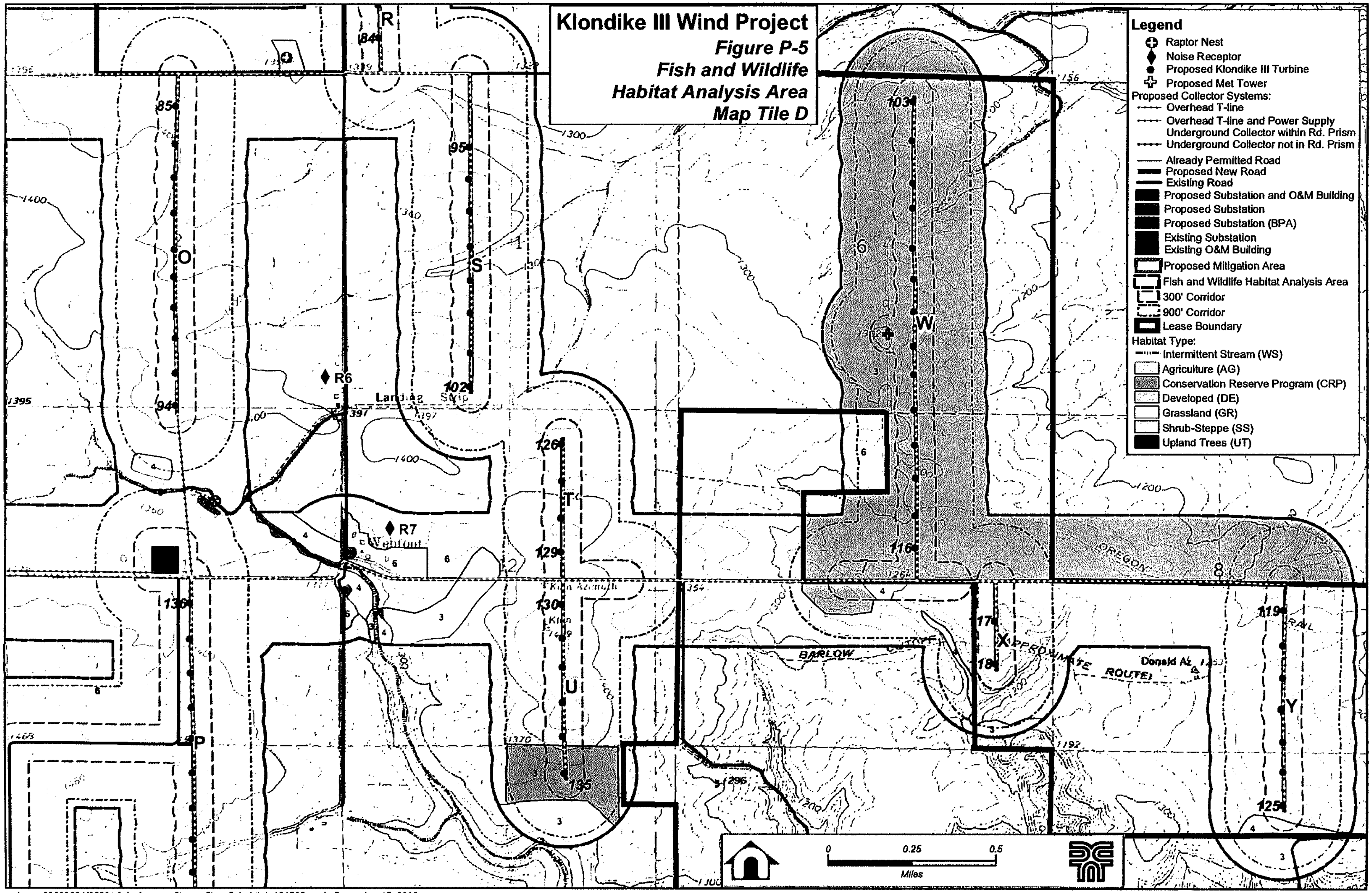

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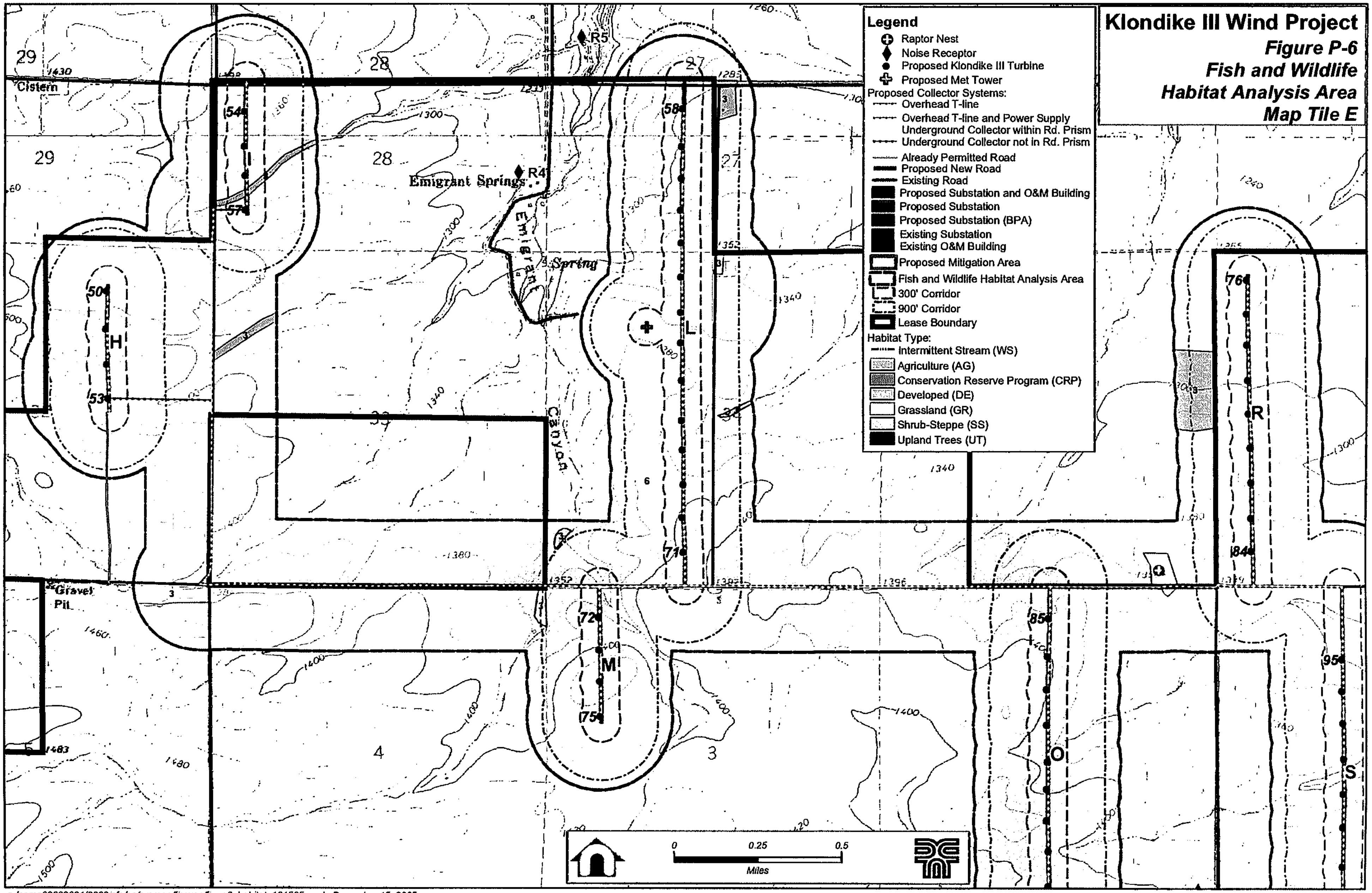

p:/ppme00000001/0600info/gs/arcmap/figures/fig_p6_habitat_121505.mxd December 15, 2005

Table P- 3 (300). Habitat Types and Categories in the Klondike III Wind Project Analysis Area with Area of Impact (Maximum 300-foot Corridor Impacts)

		IMPACTS (Acreage and % of total impact)					
	Total Acres	Temporary Impacts (with turnaround impacts)		Temporary Impacts (turnaround Impacts only)		Permanent	
Category 1	0.00	0.00		0.00		0.00	
Category 2							
Grassland	107.77	1.25	(1.29%)	1.25	(2.46%)	0.52	(0.815%)
Shrub-steppe	39.62	0.00		0.00		0.14	(0.219%)
Category 3							
CRP	865.19	10.46	(10.77%)	8.44	(16.61%)	6.65	(10.420%)
Grassland	382.70	2.20	(2.26%)	2.20	(4.33%)	0.18	(0.282%)
Shrub-steppe	43.96	1.42	(1.46%)	1.42	(2.79%)	0.00	
Intermittent streams	4.85 (miles)	0.00		0.00		0.00	
Upland trees	11.30	0.00		0.00		0.04	(0.062%)
Category 4							
Grassland	97.95	0.022	(.0002%)	0.159	(.315%)	0.05	(0.078%)
Category 5	0.00	0.00		0.00		0.00	
Category 6							
Developed	39.67	0.00		0.00		0.00	
Agricultural	9,614.04	81.79	(84.22%)	37.33	(73.50%)	56.24	(88.123%)
TOTAL	**11,202.9 + 4.85 miles of intermittent stream**	**97.13**	**(100%)**	**50.80**	**(100%)**	**63.82**	**(100%)**

Revised 10-15-05

Table P- 3 (900).

Habitat Types and Categories in the Klondike III Wind Project Analysis Area with Area of Impact (Maximum 900-foot Corridor Impacts)

		IMPACTS (Acreage and % of total impact)					
	Total Acres	**Temporary Impacts (with turnaround impacts)**		**Temporary Impacts (turnaround Impacts only)**		**Permanent**	
Category 1	0.00	0.00		0.00		0.00	
Category 2							
Grassland	107.77	1.25	(1.29%)	1.25	(2.46%)	0.63	(0.987%)
Shrub-steppe	39.62	0.00		0.00		0.03	(0.047%)
Category 3							
CRP	865.19	9.99	(10.28%)	7.97	(15.69%)	7.29	(11.421%)
Grassland	382.70	2.98	(3.07%)	2.98	(5.86%)	0.43	(0.674%)
Shrub-steppe	43.96	1.42	(1.46%)	1.42	(2.79%)	0.00	
Intermittent streams	4.85 (miles)	0.00		0.00		0.00	
Upland trees	11.30	0.00		0.00		0.03	(0.047%)
Category 4							
Grassland	97.95	0.006	(0.01%)	0.00	(0.00%)	0.05	(0.078%)
Category 5	0.00	0.00		0.00		0.00	
Category 6							
Developed	39.67	0.00		0.00		0.00	
Agricultural	9,614.04	81.48	(83.89%)	37.18	(73.19%)	55.36	(86.730%)
TOTAL	**11,202.9 + 4.85 miles of intermittent stream**	**97.13**	**(100%)**	**50.80**	**(100%)**	**63.82**	**(100%)**

Revised 12-21-05

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503-235-9194 ▪ Fax: 503-239-7998

To: Dana Siegfried
David Evans and Associates, Inc.

From: Martha Moore, P.E.

Subject: Klondike III Noise Analysis – Additional Analysis for Towers within the 900 Foot Corridor and EFSC Requested Modification to Transformer Noise Calculations

Project #: 242

Date: December 15, 2005

We have completed an analysis of moving all towers 450 feet closer to potentially affected noise receivers. The purpose of the analysis was to identify, on a worst case basis, all towers that contribute to noise levels in excess of 36 dBA at any residence. Please refer to the figures in the *Noise Analysis Report for the Klondike III Wind Project* dated March 2005 for the locations of substations and noise receivers. One additional tower, Wpt – 126, would be affected by moving towers closer to receivers within the 900-foot corridor. No new noise receivers would be affected.

The towers that would contribute to noise levels in excess of 36 dBA at the four affected receivers, with an assumed 104-dBA max sound power level for all towers simultaneously, are listed in Table 1. Table 1 includes data from our previous analysis submitted in response to RAI 1 from EFSC.

Table 1
Affected Receivers and Towers

Receivers	Contributing Towers (Wpt)
R4	59, 60, 61, and 62
R5	58
R6	89, 90, 91, 92, 93, 94, 97, 98, 99, 100, 101,102, and 126
R7	102, 126, 127, 128, 129, 130, 131, 132, 136, 137, and 138

In addition to the 900 foot corridor analysis completed, Kerrie Standlee (EFSC's reviewing engineer) requested a specific calculation method for transformer noise. He was particularly concerned about the contributions of the transformers to noise levels at the residences identified as R6 and R7. A summary of the results and assumptions for the calculations requested are presented below.

The distance from K3 east substation to R6 is 3,500 feet. The distance from K3 east substation to R7 is 3,300 feet. The ground between the substation and both receivers is dry wheat farm land. The K3 east substation will have two transformers at 230 kV and 83.3 MVA with auxiliary cooling. From the NEMA Table 0-2 (*NEMA TR 1, Transformers, Regulators, and Reactors*), the average sound level for a 900-BIL transformer (the most common BIL for a 230 kV) is 82 dBA.

For two transformers, the source level would be 85 dBA. The distance adjustments to R6 and R7 respectively, assuming the source measurements are at 2 meters, are -54.5 and -54.0. From *Noise and Vibration Control* (Beranek), attenuation over bare rough ground and thick grass can range between 3 dB per 100 meters and 23 dB per 100 meters. The additional ground attenuation for R6 and R7 will be (conservatively) in the range of -30 dBA. In addition, both R6 and R7 have topographic shielding of a minimum of 10 to 15 feet. Thus, the calculations support the previous conclusion that the substation will not contribute to sound levels at R6 and R7.

KLONDIKE III WIND PROJECT

Klondike III Wind Project: Wildlife Monitoring and Mitigation Plan

AUGUST 29, 2005

This plan describes wildlife monitoring the applicant is proposing to conduct during operation[1] of the Klondike III Wind Project facility in Oregon. Note that at the time of operation, the applicant would be a certificate holder, and thus, the monitoring plan makes reference to proposed obligations and commitments of the certificate holder rather than the applicant. The monitoring objectives are to determine whether the facility causes significant fatalities of birds and bats and to determine whether the facility results in a loss of habitat quality. This plan anticipates that the facility will be permitted pursuant to an Oregon energy facility site certificate issued by the Oregon Energy Facility Siting Council. The plan also identifies potential mitigation actions to mitigate for possible avian loss of habitat quality.

The Klondike III Wind Project facility consists of:

- Klondike III: including 162 wind turbines, two unguyed meteorological (met) towers and other related or supporting facilities as described in the Application for Site Certificate (Dated April 1, 2005).

[Insert a paragraph on the monitoring done at KI and the upcoming monitoring at KII; note that data from KIII monitoring will supplement the understanding of avian mortality already gained from KI and KII.] [Also note that the Orion Project may be under construction and operation around the same time as this project, and there may be opportunities for more robust, meaningful, and cost-effective monitoring by conducting the monitoring at both sites at once and merging the data (for a larger sample size.]

Avian and bat mortality studies have been completed for the first year of the Klondike Phase I Wind Project. Data from West, Inc., suggests that wind plant-related avian mortality at Klondike is low. Mortality of resident breeding birds appears very low, involves common species, and is not likely to have any population consequences within the area. The estimated collision rates for all bird species at Klondike I are among the lowest of any wind plant studied in the U.S., and resulted in no documented raptor fatalities, and no apparent displacement of breeding raptors. Finally, on a per rotor swept area equivalence basis, the bat collision rate at the Klondike I wind project is lower than nearby wind power projects and other wind plants studied across the U.S.

Avian and bat mortality studies are currently being completed for Klondike Phase II, and will be supplemented by the larger studies to be conducted for Klondike Phase III to provide a fuller understanding of avian and bat mortality for all phases of the project. In addition, since the Orion Wind Power Project may be under construction and operation concurrently with Klondike Phase III, opportunities for more robust, meaningful, and cost-effective monitoring may be

[1] This plan does not address pre-construction wildlife surveys that PPM Energy carried out in support of its application for a site certificate for the Klondike III project.

possible by conducting monitoring at both sites at once and merging the data to obtain a larger sample size.

Wildlife monitoring is necessary to determine whether operation of the facility results in a net loss of habitat quality. For raptors, this will require that the certificate holder obtain a reasonable estimate of the project's effect on raptors in the context of local raptor populations. Unguyed towers are known to cause minimal, if any, mortality. Therefore, monitoring at the unguyed met towers is not proposed.

The certificate holder shall use experienced personnel to manage this monitoring and properly trained personnel to conduct this monitoring, subject to approval by the Department of Energy as to professional qualifications. For all monitoring except PPM Energy's Klondike III Wind Project Wildlife Response and Reporting System (described below), the certificate holder shall hire an independent third party (not employees of the certificate holder) to perform monitoring tasks.

The Wildlife Monitoring and Mitigation Plan for the Klondike III Wind Project includes the following components:

1) Fatality monitoring program involving:
    a) Removal trials
    b) Searcher efficiency trials
    c) Standardized carcass searches
2) Established monitoring transect searches
3) Raptor nesting surveys
4) PPM Energy's Klondike III Wind Project Wildlife Reporting and Handling System

Following is a discussion of the components of the monitoring plan, statistical analysis methods for fatality data, and data reporting.

1. Definitions and Methods

Seasons

This plan uses the following dates for defining seasons:

Season	Dates
Spring Migration	March 16 to May 15
Summer/Breeding	May 16 to August 15
Fall Migration	August 16 to October 31
Winter	November 1 to March 15

Search Plot Selection

The certificate holder shall conduct standardized carcass searches within search plots. The certificate holder, in consultation with the Oregon Department of Fish and Wildlife, shall select search plots based on a systematic sampling design (every third plot is sampled in a

monitoring year). Turbine strings will be broken into square search plots that contain one turbine each. The edge of plots will be no closer than 90 meters (or the distance equal to the blade tip height of the turbine selected for the project) from the nearest turbine or meteorological (met) tower. The certificate holder shall provide maps of the search plots to the Department of Energy before beginning fatality monitoring at the facility. The certificate holder shall use the same search plots for each search conducted during a monitoring year.

Scheduling and Sampling Frequency

The certificate holder will begin monitoring upon the beginning of operation of the facility, except that the displacement surveys will be completed in grassland habitat in May and June prior to construction in those areas. For example, if construction begins in August 2006 in the grassland habitats, baseline pre-construction displacement surveys will begin in May 2006. The first monitoring year will commence within one month following the completion of construction and commercial operation of the entire Klondike III facility and will conclude twelve months later (for example, if commercial operation is completed for all turbines on December 31, 2006, the monitoring year will commence on January 1, 2007 and conclude on December 31, 2007). Subsequent monitoring years will follow the same schedule (for example, monitoring year two would begin January 1, 2007 or postponed a year and start January 1, 2008).

The certificate holder will also evaluate the potential to combine Klondike Phase II monitoring with the Orion Wind Power Project, or other nearby projects. If these projects are initiated, the certificate holder will coordinate study results, as appropriate, with these projects and with the agencies.

Within each monitoring year, the certificate holder will conduct standardized carcass searches at the rates of frequency shown below. Over the course of one monitoring year, the certificate holder would conduct 16 searches. The total number of searches per season is based on applying the rate to the number of months in the season (as defined above).

Season	Frequency
Spring Migration	2 searches per month (4 searches)
Summer/Breeding	1 search per month (3 searches)
Fall Migration	2 searches per month (5 searches)
Winter	1 search per month (4 searches)

Sample Size for Standardized Carcass Searches

For the standardized carcass searches described below, the sample size is the number of turbines searched per monitoring year. The determination of the sample size is based primarily on the expected precision in the fatality estimates for the entire Klondike III Project. In addition, the habitat is primarily agricultural fields (dryland wheat); diversity of wildlife using the site during the various seasons is expected to be low, and there are strong data sets already from several existing and proposed wind projects in the regions that provide a strong basis for predicting impacts to this project.

Klondike III sample size: The certificate holder shall search a minimum of 54 turbines during the first monitoring year. The certificate holder shall search a minimum of 54 turbines during the second monitoring year. Over the first two monitoring years, 108 of the 162 turbines will be searched.

Duration of Fatality Monitoring

The certificate holder may terminate the fatality monitoring of Klondike III turbines after completing two monitoring years of those turbines, subject to the approval of the Department of Energy.

The certificate holder shall use a worst-case analysis to resolve any uncertainty in the results based on the first two years of data and to determine whether the first two years of data indicate that mitigation is required. In lieu of approving the termination of the fatality monitoring program after two years, the Department of Energy may require additional, targeted monitoring if the first two years of data indicate the potential for unexpected impacts of a type that cannot be resolved appropriately by worst-case analysis and appropriate mitigation.

2. Removal Trials

The objective of the removal trials is to estimate the length of time avian and bat carcasses remain in the search area. Carcass removal studies will be conducted during each season in the vicinity of the search plots. Estimates of carcass removal will be used to adjust carcass counts for removal bias. "Carcass removal" is the disappearance of a carcass from the search area due to predation, scavenging or other means such as farming activity.

The certificate holder shall conduct carcass removal trials within each of the seasons defined above. Planted carcasses will not be placed in the carcass search plots because they might be confused with wind turbine-related fatalities, especially if they have been scavenged. Planted carcasses will be placed in the vicinity of search plots but not so near as to attract scavengers to the search plots themselves. The planted carcasses will be located randomly within the carcass removal trial plots.

Each season, approximately 10 carcasses of birds of two size classes (20 total carcasses) will be distributed among two habitat types (grassland/shrub-steppe and cultivated agriculture).[2] For the whole monitoring year, approximately 100 total carcasses will be placed in cultivated agriculture and 60 in grassland/shrub steppe. The total number of trial carcasses may vary. Small carcasses (e.g., house sparrows, starlings, commercially available game bird chicks or legally obtained native birds {fresh road-killed birds in good condition}) will simulate passerines and large carcasses (e.g., raptor carcasses provided by agencies, commercially available adult game birds or cryptically colored chickens) will simulate large birds such as raptors, game birds and waterfowl. If fresh bat carcasses are available, they may also be used.

The certificate holder shall start trials (i.e., placement of 5 to 10 carcasses) in at least 10 different calendar weeks, with at least one calendar week between start dates, per monitoring year: two trials in the spring season, three trials in summer, two trials in fall, and three in winter. In each trial in the spring and fall, approximately 3 to 6 from each size class (10 total carcasses) will be placed in each of the two habitat types. In each trial in the summer and winter, approximately 2 to 5 carcasses from each size class will be placed in each of the two habitat types. Trials will be spread throughout the year to incorporate the effects of varying weather, climatic conditions, farming practices and scavenger densities.

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[2] This means that approximately 160 trial carcasses would be used in carcass removal trials during one monitoring year.

Carcasses will be placed in a variety of postures to simulate a range of conditions. For example, birds will be: 1) placed in an exposed posture (e.g., thrown over the left shoulder), 2) hidden to simulate a crippled bird (e.g., placed beneath a shrub or tuft of grass), and, 3) partially hidden.

It is expected that carcasses will be checked as follows, although actual intervals may vary. Carcasses will be checked for a period of 40 days to determine removal rates. They will be checked approximately every day for the first 4 days, and then on day 7, day 10, day 14, day 20, day 30, and day 40. This schedule may vary depending on weather and coordination with the other survey work. At the end of the 40-day period, the trial carcasses will be removed. Trial carcasses will be marked discreetly (markers to be determined) for recognition by searchers and other personnel. Trial carcasses will be left at the location until the end of the carcass removal trial. The entire carcass may be marked with a substance that fluoresces under a black light as some carcasses may be reduced to feather spots.

Carcass searchers can check carcasses during their regular schedule of searches and additionally on days they are not conducting the searches. Properly trained personnel will conduct the removal trials.

3. Searcher Efficiency Trials

The objective of searcher efficiency trials is to estimate the percentage of bird and bat fatalities that searchers are able to find.

The certificate holder shall conduct searcher efficiency trials in the same area in which carcass searches occur in both grassland/shrub-steppe and cultivated agriculture habitat types. Trials will be conducted in each season. Searcher efficiency will be estimated by habitat type and season. Estimates of searcher efficiency will be used to adjust the number of carcasses found, correcting for detection bias.

Each season, approximately 10 carcasses of birds of two size classes (20 total carcasses) will be distributed among two habitat types (grassland/shrub-steppe and cultivated agriculture).[3] Approximately 100 total carcasses will be placed in cultivated agriculture and 60 in grassland/shrub steppe. The total number of trial carcasses may vary. Small carcasses (e.g., house sparrows, starlings, commercially available game bird chicks or legally obtained native birds {fresh road-killed birds in good condition}) will simulate passerines and large carcasses (e.g., raptor carcasses provided by agencies, commercially available adult game birds or cryptically colored chickens) will simulate large birds such as raptors, game birds and waterfowl. If fresh bat carcasses are available, they may also be used.

Personnel conducting searches will not know when trials are conducted; nor will they know the location of the trial carcasses. If suitable trial carcasses are available, trials during the fall season will include several small brown birds to simulate bat carcasses. Legally obtained bat carcasses will be used if available.

On the day of a standardized carcass search (described below) but before the beginning of the search, efficiency trial carcasses will be placed at random locations within areas to be

[3] This means that approximately 160 trial carcasses would be used in carcass removal trials during one monitoring year.

searched. If scavengers appear attracted by placement of carcasses, the carcasses will be distributed before dawn.

Efficiency trials will be spread over the entire season to incorporate effects of varying weather and vegetation growth. Carcasses will be placed in a variety of postures to simulate a range of conditions. For example, birds will be: 1) placed in an exposed posture (thrown over the left shoulder), 2) hidden to simulate a crippled bird, and 3) partially hidden. Each carcass will be discreetly secured at its location to discourage removal by scavengers.

Each non-domestic carcass will be discreetly marked so that it can be identified as an efficiency trial carcass after it is found. The number and location of the efficiency trial carcasses found during the carcass search will be recorded. The number of efficiency trial carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses.

If new searchers are brought into the search team, additional detection trials will be conducted to ensure that detection rates incorporate searcher differences.

4. Standardized Carcass Searches

The objective of the standardized carcass searches ("fatality monitoring") is to estimate the number of bird and bat fatalities that are attributable to facility operation. The goal of bird and bat fatality monitoring is to obtain a precise estimate of the fatality rate and associated variances.

On an annual basis, the certificate holder shall report an estimate of fatalities in five categories: 1) all birds, 2) small birds, 3) large birds, 4) raptors and 5) bats. The certificate holder shall base these estimates on search data from the entire Klondike III Wind Project.

The certificate holder shall estimate the number of avian and bat fatalities attributable to operation of the facility based on the number of avian and bat fatalities found at the facility site whose death appears related to facility operation. All carcasses located within areas surveyed, regardless of species, will be recorded and, if possible, a cause of death determined based on blind necropsy results. Total number of avian and bat carcasses will be estimated by adjusting for removal and searcher efficiency bias. If the cause of death is not apparent, the mortality will be attributed to facility operation.

The certificate holder shall conduct two years of fatality monitoring for Klondike III. If analysis of the fatality data collected after any two monitoring years indicates that a significant impact on wildlife and wildlife habitat has occurred, the certificate holder shall implement appropriate mitigation, subject to the approval of the Department of Energy. Mitigation is discussed in Section 12 below.

Personnel trained in proper search techniques ("the searchers") will conduct the carcass searches by walking parallel transects. The searchers will search rectangular search plots with the long axis of the plot centered on the turbine string. All area within a minimum of 90 meters from the turbines will be searched. Transects will be initially set at 6 meters apart in the area to be searched. A searcher will walk at a rate of approximately 45 to 60 meters per minute along each transect searching both sides out to three meters for casualties. Search area and speed may be adjusted by habitat type after evaluation of the first searcher efficiency trial. The searchers will record the condition of each carcass found, using the following condition categories:

- 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 that shows signs of being fed upon by a predator or scavenger, or portions of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.)
- Feather Spot – 10 or more feathers at one location indicating predation or scavenging or 2 or more primary feathers

All carcasses (avian and bat) found during the standardized carcass searches will be photographed, recorded and labeled with a unique number. Each carcass will be bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass will be kept with the carcass at all times. For each carcass found, searchers will record species, sex and age when possible, date and time collected, location, condition (e.g., intact, scavenged, feather spot) and any comments that may indicate cause of death. Searchers will photograph each carcass as found and will map the find on a detailed map of the search area showing the location of the wind turbines and associated facilities. The certificate holder shall coordinate collection of state endangered, threatened or protected species with the Oregon Department of Fish and Wildlife (ODFW). The certificate holder shall coordinate collection of federal endangered, threatened or protected species with the U.S. Fish and Wildlife Service (USFWS). The certificate holder shall obtain appropriate collection permits from ODFW and USFWS.

The searchers might discover carcasses incidental to formal carcass searches (e.g., while driving within the project area). If the incidentally discovered carcasses are found at turbines that are not part of the formal search sample, the searchers will identify, photograph and collect the carcasses as is done for carcasses within the formal search sample during scheduled searches. If the incidentally discovered carcasses are within the formal search plots, the searchers will leave the carcasses undisturbed, unless the carcass is a state or federally threatened or endangered species. The certificate holder shall coordinate collection of state endangered, threatened or protected species with ODFW. The certificate holder shall coordinate collection of federal endangered, threatened or protected species with the USFWS. The searchers will record the location of all incidentally discovered carcasses or injured birds on a detailed map of the study area showing the location of wind turbines and associated facilities such as power lines. Any injured native birds found will be carefully captured by a trained Project Biologist or technician and transported to Jean Cypher (wildlife rehabilitator) in The Dalles, the Blue Mountain Wildlife Center in Pendleton or the Audubon Bird Care Center in Portland in a timely fashion. The certificate holder shall follow a protocol for handling injured birds that has been developed for Klondike I and Klondike II (original Wildlife Reporting and Response Plan plan prepared in 2002 was reviewed by ODFW).

5. Grassland Songbird Displacement

[

The objective of surveys of grassland songbird displacement transects is to collect auxiliary information to combine with similarly collected information at other regional wind projects to determine whether the operation of the facility results in a loss of habitat quality. A reduction in use by grassland/steppe avian species near the facility would indicate a loss of habitat quality.

Klondike III transects: The certificate holder shall establish transects perpendicular to the turbine strings in non-agricultural grassland steppe and CRP habitats.

The transects will be a maximum of 1000 feet (300 meters) long, but, if no alternative exists, some transects may be shorter due to access problems or a change of habitat type from non-agricultural habitats to cultivated agricultural habitats. The certificate holder will provide to the Department of Energy a map or other clear indication of locations where landowners deny access and a map of the locations of the established monitoring transects before beginning the monitoring transect surveys.

A qualified observer will walk the pre-established transects and record observations of grasshopper sparrows, vesper sparrows, savannah sparrows (singing males and perched birds), long-billed curlews and other grassland/steppe avian species. The approximate distance along the transect will be recorded for each detection, and the habitat type will be recorded for each 50 meter (m) segment (50m x 50m) of the transect (6 segments).

Three surveys will be conducted between mid-April and late June. The surveys will occur at times spread throughout the period, and the same timing of surveys will be used for each monitoring year. Observers will record observations of grassland/steppe avian species within 50 m on either side of the transect. Numbers of individual birds (if possible to determine) for each species will be recorded for each transect. Observers will map the locations where individual birds are first observed.

The certificate holder shall conduct a gradient analysis, using regression analysis or other appropriate statistical methods, to determine the relationship between density of grassland/steppe avian species and distance from turbines. A "gradient analysis" means an analysis that assesses whether a significant or a biologically substantial relationship exists between distance from project structures and abundance or use of the area.

Assuming that project construction occurs and is completed in 2007, the certificate holder will conduct a pre-construction survey in 2006, and conduct post-construction established transect surveys for two years (2007 and 2009). Based on the results of these surveys after two years, the certificate holder shall determine whether the gradient analysis indicates that project structures are causing reduced grassland songbird use of habitat near the project. If the cumulative analysis using the Stateline results, combined with this survey effort, and other similarly collected information in Sherman County suggests displacement of grassland/steppe avian species has occurred, the certificate holder shall implement appropriate mitigation, subject to the approval of the Department of Energy.

The Department of Energy may require additional, targeted surveys if the first two years of data from Klondike III indicate the potential for unexpected impacts of a type that cannot be resolved appropriately by worst-case analysis and appropriate mitigation.

In addition, the certificate holder will also evaluate the potential to combine Klondike Phase II monitoring with the Orion Wind Power Project, or other nearby projects. If these projects are initiated, the certificate holder will coordinate study results with these projects and with the appropriate agencies.

6. Raptor Nest Surveys

The objectives of raptor nest surveys are to estimate the size of the local breeding populations of tree-nesting raptor species in the vicinity of the facility and to determine whether operation of the facility results in a reduction of nesting activity or nesting success in the local populations of target raptor species: Swainson's hawk, ferruginous hawk, golden eagle and prairie falcon. Although no nests of ferruginous hawk, golden eagle or prairie falcon were discovered during the 2005 baseline surveys and limited habitat is present within two miles of the turbines, the monitoring surveys will likely focus more on Swainson's hawk, the Sensitive-status species most like to nest in the general project area.

Aerial and ground surveys will be used to gather nest success statistics on active nests, nests with young and young fledged. The certificate holder will share the data with state and federal biologists. The certificate holder will conduct two years of post-construction raptor nest surveys.

During each monitoring year, the certificate holder will conduct one helicopter survey, in late May or early June, and additional surveys as described in this section. Locations of known nests will be obtained and the sites surveyed (the 2005 survey data). All known 2005 and any new nests will be given identification numbers, and nest locations will be recorded on U.S. Geological Survey 7.5-minute quadrangle maps. Global positioning system coordinates will be recorded for each nest and integrated with the baseline database. Locations of inactive nests will also be recorded as they may become occupied during future years. All new nests discovered during surveys or incidentally that were not previously mapped, whether active or inactive, will be given an identification number and their locations (coordinates) will be recorded.

The certificate holder shall conduct the aerial surveys within the Klondike III site and a 2-mile buffer around the turbines to determine nest occupancy. Determining nest *occupancy* will likely require two visits to each nest. For occupied nests of the target raptor species (listed above but likely to be just Swainson's hawk), the certificate holder shall determine nesting *success* by a minimum of one ground visit to determine species, number of young and nesting success. Nests that are unable to be monitored due to landowner denying access permission will be checked from the distance where feasible. "Nesting success" means that the young have successfully fledged (the young are independent of the core nest site).

Given the very low buteo nesting densities in the area, statistical power to detect a relationship between distance from a wind turbine and nesting parameters (e.g., number of fledglings per reproductive pair) will be very low. Therefore, impacts may have to be judged based on trends in the data, results from other wind energy facility monitoring studies and literature on what is known regarding the populations in the region.

If analysis of the raptor nesting data collected after any two monitoring years indicates any reduction in nesting success by the target raptor species within two miles of the facility, the certificate holder shall implement appropriate mitigation, subject to the approval of the Department of Energy. At a minimum, if the surveys reveal that a target raptor species has abandoned a nest or territory within ½ mile of the facility, or has not fledged any young over any two-year period, the certificate holder shall assume the abandonment or unsuccessful fledging is the result of the project unless another cause can be demonstrated conclusively. Based on that assumption, the certificate holder shall implement appropriate mitigation. In addition, if the data

indicate clear evidence of displacement or disturbance of target raptor nesting species between ½ mile and 2 miles from the facility, the certificate holder shall implement appropriate mitigation.

Due to the difficulty of replacing nesting habitat for Swainson's hawks, appropriate mitigation may include determining the status of the tree structures currently supporting Swainson's hawks within three miles of the turbines and, with landowner approval, implementing protection measures to retain those structures and to protect existing nest trees. Another option might be a combination of additional monitoring (monitor nests within ½ mile 3 out of 6 years), banding young to have marked individuals that might fly through the wind facility, and reviewing raptor foraging habitat enhancement opportunities in the general landscape but away from the turbines.

7. Avian Use Surveys

During each standardized carcass search, as described in section 4 above, observers will record birds detected in a ten-minute period at approximately one-third of the turbines within the carcass search plots (e.g., one point count station per carcass search plot which may consist of two to four turbines) using standard variable circular plot point count survey methods. Additional observations of species of concern will be made if observed during the carcass searches, but collecting this information is secondary to the actual searching for carcasses so the searchers are not distracted from their main task of finding carcasses.

8. PPM Energy's Klondike III Wind Project Wildlife Reporting and Handling System

PPM Energy's Klondike III Wind Project Wildlife Reporting and Handling System (WRHS) is a monitoring program set up for searching for and handling avian and bat casualties found by maintenance personnel. This system will be in place prior to construction of the wind project. A similar system is in place for Klondike I and II. Construction and maintenance personnel will be trained in the methods. This monitoring program includes the initial response, the handling and the reporting of bird and bat carcasses discovered incidental to construction and maintenance operations ("incidental finds").

All carcasses discovered by maintenance personnel will be photographed and recorded. If maintenance personnel discover incidental finds at turbines that are *not within* search plots for the standardized carcass searches described in section 4, they will notify a Project Biologist who will collect the carcasses. If maintenance personnel discover carcasses *within* search plots for the standardized carcass searches described in Section 4, they will leave the carcasses undisturbed, unless the carcass is a state or federally threatened or endangered or otherwise protected species. The certificate holder shall coordinate collection of state endangered, threatened or protected species with ODFW. The certificate holder shall coordinate collection of federal endangered, threatened or protected species with the USFWS.

9. Statistical Methods for Fatality Estimates

The estimate of the total number of wind facility-related fatalities is based on:

(1) Observed number of carcasses found during standardized searches during the two monitoring years for which the cause of death is either unknown or is probably facility-related.

(2) Searcher efficiency expressed as the proportion of planted carcasses found by searchers during the entire survey period

(3) Non-removal rates expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the searchers during the entire survey period

Definition of Variables

The following variables are used in the equations below:

c_i	the number of carcasses detected at plot *i* for the study period of interest (e.g., one year) for which the cause of death is either unknown or is attributed to the facility
n	the number of search plots
k	the number of turbines searched (includes the turbines centered within each search plot and a proportion of the number of turbines adjacent to search plots to account for the effect of adjacent turbines on the 90-meter search plot buffer area)
$\bar{c}$	the average number of carcasses observed per turbine per 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 time (days) a carcass remains in the study area before it is removed
$\bar{t}$	the average time (days) a carcass remains in the study area before it is removed
d	the total number of carcasses placed in searcher efficiency trials
p	the estimated proportion of detectable carcasses found by searchers
I	the average interval between searches in days
$\hat{\pi}$	the estimated probability that a carcass is both available to be found during a search and is found
m_t	the estimated annual average number of fatalities per turbine per year, adjusted for removal and observer detection bias
C	nameplate energy output of turbine in Megawatts (MW)

Observed Number of Carcasses

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

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

Estimation of Carcass Removal

Estimates of carcass removal are used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains at the site before it is removed:

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

This estimator is the maximum likelihood estimator assuming the removal times follow an exponential distribution and there is right-censoring of data. In our application, any trial carcasses still remaining at 40 days are collected, yielding censored observations at 40 days. If all trial carcasses are removed before the end of the trial, then s_c is 0, and $\bar{t}$ is just the arithmetic average of the removal times. For the bat trial, carcasses were monitored every day for 20 days. Removal rates were estimated by carcass size (small and large) and season.

Estimation of Observer Detection Rates

Observer detection rates (i.e., searcher efficiency rates) are expressed as p, the proportion of trial carcasses that are detected by searchers. Observer detection rates were estimated by carcass size and season.

Estimation of Facility-Related Fatality Rates

The estimated per turbine annual fatality rate (m_t) is calculated by:

$$m_t = \frac{\bar{c}}{\hat{\pi}}, \quad (3)$$

where $\hat{\pi}$ includes adjustments for both carcass removal (from scavenging and other means) and observer detection bias assuming that the carcass removal times t_i follow an exponential distribution. Data for carcass removal and observer detection bias were pooled across the study to estimate $\hat{\pi}$. Under these assumptions, this detection probability is estimated by

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

The estimated per MW annual fatality rate (m) is calculated by:

$$m = \frac{m_t}{C}.$$

Fatality estimates were calculated for: (1) all birds, (2) small birds, (3) large birds, (4) raptors, (5) grassland birds, (6) nocturnal migrants, and (7) bats. The final reported estimates of *m* and associated standard errors and 90% confidence intervals were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. For each iteration of the bootstrap, the plots were sampled with replacement, trial carcasses were sampled with replacement, and $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated. A total of 5,000 bootstrap iterations were used. The reported estimates are the means of the 5,000 bootstrap estimates. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5^{th}, and upper 95^{th} percentiles of the 5000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

Differences in observed nocturnal migrant and bat fatality rates for lit turbines, unlit turbines that are adjacent to lit turbines, and unlit turbines that are not adjacent to lit turbines were compared graphically and statistically.

10. Data Reporting

The certificate holder will report the monitoring data and analysis to the Council. This report may be included in the annual report required under OAR 345-026-0080 or may be submitted as a separate document at the same time the annual report is submitted. In addition, the certificate holder shall provide to the Council any data or record generated in carrying out this monitoring plan upon request by the Council.

The certificate holder shall notify USFWS and ODFW immediately in the event that any federal or state endangered or threatened species are taken.

The public will have an opportunity to receive information about monitoring results and to offer comment. Within 30 days after receiving the annual report of monitoring results, the Department of Energy will give reasonable public notice and make the report available to the public. The notice will specify a time in which the public may submit comments to the Department. A Technical Advisor Committee (TAC) or an Agency Reporting Group (ARG) may be established and members may offer comments about the results of monitoring programs for the Klondike III project.

11. Mitigation

The selection of the mitigation actions that the certificate holder may be required to implement under this plan should allow for flexibility in creating appropriate responses to monitoring results that cannot be known in advance. If mitigation is needed, the certificate holder shall propose appropriate mitigation actions to the Department of Energy and shall carry out

mitigation actions approved by the Department of Energy. In addition to mitigation described above, possible mitigation actions include but are not limited to the measures discussed in this section.

Grassland Nesting Native Species

Grassland nesting species include grasshopper sparrow, savannah sparrow, vesper sparrow, horned lark, western meadowlark, long-billed curlew and any other resident native grassland nesting bird species found in the area. The certificate holder shall determine significant impact to grassland nesting species based on the fatality monitoring program discussed above. The certificate holder shall calculate the average annual fatality rate separately for turbines. If the average annual fatality rate[4] is greater than 2.0 fatalities per MW or per year for all species combined or if the average annual fatality rate is greater than 0.75 fatalities per MW per year for a single grassland nesting bird species (excluding horned lark), then the certificate holder shall assume that a significant impact on habitat has occurred and shall implement appropriate mitigation. The certificate holder shall include in this estimate any grassland nesting native species fatality that is observed, even if it is observed during the non-nesting period. The certificate holder shall include in the estimate all carcasses unidentified as to species and for which there is no evidence to rule out the carcass as one of the grassland species listed above.

If the analysis of turbine fatality data indicates that mitigation for grassland nesting species is required, the certificate holder shall enhance sufficient habitat to support the number of grassland nesting birds affected. The number of birds affected includes the number of fatalities above the all species threshold (2.00 fatalities/MW/year) and the number of fatalities above the single species threshold (0.75 fatalities/MW/year). The certificate holder shall protect any enhanced habitat for the life of the facility. The certificate holder shall propose the amount of habitat enhancement based on expected densities and habitat requirements of these species as described in the literature and studies of the Stateline facility and other wind energy facilities in the Northwest.

If the mitigation threshold for grassland nesting species is not met but fatalities of a sensitive species, such as grasshopper sparrow, burrowing owl or long-billed curlew are at a level of concern, the Department of Energy may require the certificate holder to implement mitigation for that species.

Raptors

The certificate holder shall determine significant impact to ground and tree nesting raptors based on the fatality monitoring program data and any other raptor fatalities found. If more than an average of 10 raptor fatalities are found per year on standardized search plots, then the certificate holder shall assume that a significant impact on raptor habitat has occurred and shall implement appropriate mitigation.

To mitigate for a significant impact on raptor habitat, the certificate holder shall review limiting factors on the species in the immediate region and develop appropriate mitigation that will provide for foraging or nesting opportunities for the species impacts. If the mitigation threshold is not met but fatalities of a sensitive raptor species, such as Swainson's hawk or

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[4] The "average annual fatality rate" is the average of the two annual estimates of fatalities.

golden eagle are at a level of concern, the Department of Energy may require the certificate holder to implement mitigation for that species.

Other Bird Species and Bats

Mitigation measures for native grassland nesting birds and for raptors, if implemented, would also benefit other bird species and may benefit some species of bats. There is no mitigation threshold for these species. However, if fatalities to these species are higher than expected and are at a level of concern, the Department of Energy may require the certificate holder to implement mitigation for these species. Should higher than expected fatalities occur for migrating birds (those not using the Klondike III habitat but flying through), then specific mitigation will be prepared that addresses the taxa most impacted. Mitigation measures can be a combination of local research that will aid in understanding more about the species and conservation needs or it can be habitat improvement projects.

9. Amendment of the Plan

The certificate holder proposes the following with respect to amendments: this Wildlife Monitoring and Mitigation Plan may be amended from time to time by agreement of the certificate holder and the Council. Such amendments may be made without amendment of the site certificate. The Council authorizes the Department of Energy to agree to amendments to this plan and to mitigation actions that may be required under this plan. The Department of Energy shall notify the Council of all amendments and mitigation actions, and the Council retains the authority to approve, reject or modify any amendment of this plan or mitigation action agreed to by the Department.

This Draft Monitoring Plan was originally prepared by PPM Energy and reviewed and edited by Karen Kronner and Bob Gritski of NWC, Inc. and Wally Erickson, WEST, Inc.

Klondike III Wind Project
Summary of 2004-2005 Wildlife Surveys

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July 28, 2005

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1 INTRODUCTION

The Klondike III Wind Project is a proposed energy facility with a peak electric generating capacity of approximately 273 megawatts (MW) and an average electric generating capacity of approximately 91 MW. The project site is located in Sherman County approximately 4 miles east of Wasco, Oregon, on private land that has been leased by Klondike III to develop the project. The project will consist of: (i) 165 turbines with an installed peak-generating-capacity of either 1.5 MW or 1.65 MW per turbine, and associated turbine towers, turbine pads, and related equipment; (ii) underground collector lines with a capacity of 34.5 kV to transmit electric power generated by the wind turbines to two collector substations located within the project boundary; (iii) two collector substations; (iv) an operations and maintenance (O&M) facility to serve the Klondike III project; (v) an above ground 230 kV collector line to transmit power between the collector substation near Webfoot, and the point of interconnection with the Bonneville Power Administration's (BPA's) facilities, located at BPA's Klondike Schoolhouse substation; and (vi) new access roads.

The Energy Facility Siting Council (EFSC) fish and wildlife habitat standard states that "to issue a site certificate, the Council must find that the design, construction, operation, and retirement of the facility, taking into account mitigation, are consistent with the fish and wildlife habitat mitigation goals and standards..." The Council requires information about the fish and wildlife habitats, as well as the fish and wildlife species that may be affected by the proposed facility. The purpose of this document is to provide a summary of the sensitive species surveys and to describe wildlife use within the project analysis area.

The avian baseline surveys and aerial raptor surveys mentioned in this report were conducted by ABR, Inc., and the rare plant surveys were conducted by Eagle Cap Consulting, Inc. (ECC). These surveys were conducted between November 2004 and May 2005 and separate reports have been prepared summarizing these findings (referenced in the attached bibliography). DEA conducted the wildlife habitat analysis, which was included in the Application for Site Certificate (DEA 2005a).

2 GENERAL METHODS

Prior to conducting surveys, DEA coordinated with ODFW and U.S. Fish and Wildlife Service (USFWS) to develop the target species list and a Biological Protocol to guide all surveys associated with the Klondike III Wind Project. The Biological Protocol was approved by ODFW (ODFW Concurrence letter included as Appendix P-3 of the Application for Site Certificate [ASC]) and finalized in February 2005. It is included as Appendix Q-6 of the ASC.

DEA mapped and categorized all fish and wildlife habitat types within 1,000 feet of all project components, according to the ODFW Fish and Wildlife Habitat Mitigation Policy. Wildlife use within the analysis area, based on these habitat types, is discussed below. Full descriptions of the wildlife habitat types found within the analysis areas are included in Exhibit P of the ASC.

Very high-resolution aerial photography, at an acquisition scale of 1:400, was used to map boundaries of the fish and wildlife habitat types within the project area. Habitat boundaries were then ground-truthed by qualified biologists. For each habitat polygon, field notes included dominant vegetation and habitat quality (structure, age, presence/absence of invasive vegetation, history of disturbance).

On February 2, 2005, DEA conducted a site visit with ODFW to review habitat mapping and survey protocol methodology. During the site visit, habitat types were reviewed, and it was agreed that all habitat types, other than agricultural and developed areas, would be surveyed to protocol. Specifically, it was agreed that the CRP lands had developed sufficient structure to begin providing some habitat for sensitive species and their prey.

2.1 ANALYSIS AREAS

The analysis areas define the boundaries within which the Applicant must evaluate potential impacts to fish and wildlife habitat and special status species. The analysis areas for the rare plant survey are described within the Rare Plant Survey Report (ECC 2005), and the analysis areas for the aerial raptor survey and avian baseline survey are addressed in the Avian Baseline Report (ABR 2005). The following analysis areas are consistent with other EFSC-approved wind projects and with Klondike I and Klondike II Wind Projects.

- **Fish and wildlife habitat:** The analysis area for fish and wildlife habitat is within 1,000 feet of the turbine strings, transmission line, and any other project component (e.g., construction staging areas and new roads).
- **Threatened and endangered animal species:** An initial database search was conducted within five miles of the project boundary. The only state or federally listed species with the potential to occur within the project vicinity are the bald eagle and the peregrine falcon.
- **Non-listed, sensitive wildlife species:** The following non-listed, sensitive wildlife species may occur within the project area: golden eagle, burrowing owl, loggerhead shrike, all raptors species (with an emphasis on the Swainson's hawk), long-billed curlew, and the white-tailed jackrabbit. The analysis area for evaluating non-listed wildlife species is within 1,000 feet of project components in areas of suitable (non-agricultural) habitat. In addition, evening spotlight surveys, designed specifically for the white-tailed jackrabbit, were conducted within 300 feet of project components in areas of suitable habitat.

The vast majority of the project vicinity is under dry land wheat production. Very little acreage of native plant communities remain within the lease boundary, occurring predominantly along the edges of agricultural lands and steep side slopes of Grass Valley Canyon along the southern edge of the lease boundary. These communities consist of sage and rabbitbrush-dominated shrub lands, and native bunchgrass grasslands, with varying percent cover by invasive species. Agricultural areas that are enrolled under the Conservation Reserve Program (CRP) are located throughout the analysis area, occurring as narrow strips in previously plowed drainageways, and as large blocks in other areas. CRP areas have been planted with a mix of native and non-native bunchgrasses, with the primary intent being to increase wildlife habitat in the area.

3 WHITE-TAILED JACKRABBIT SURVEYS

3.1 METHODS

Because the white-tailed jackrabbit is generally most active at night, nocturnal survey routes were established in accordance with the *Survey Methodologies for Sensitive, Threatened, and Endangered Species in Oregon* (ODFW 1994), in addition to the diurnal sensitive species surveys. Nocturnal surveys were conducted twice during the spring, during the weeks of May 30 and June 20, during nights of relatively low winds and no precipitation.

Equipment for the surveys included a diesel pick-up truck, binoculars, spotlights, and GPS equipment. Using two spotlights with one million candlepower, surveyors scanned those areas within 300 feet of project components. The observers watched for eyeshine and jackrabbit ears near brush, as well as for flushed jackrabbits. Whenever possible, jackrabbits were identified to species (white-tailed vs. black-tailed).

Surveys were conducted between dusk and dawn on nights when winds were low. Skies were mostly clear and there was no precipitation. Two experienced biologists and/or technicians, who were familiar with the area and the habitats, conducted the surveys. One or two surveyors drove or walked the facility centerline, shining the spotlight out to the side and ahead of the traveled path. Roads were driven slowly, at approximately 8 to 12 mph. Areas that were difficult to drive, or were out of sight from the traveled centerline, due to topography limitations, were searched on foot.

Observers noted all jackrabbit observations and GPS coordinates on a map of the project area. Observers kept notes of dates, hours of surveys, weather conditions, areas surveyed and wildlife observations. Transects were named for the nearest turbine number at the end of a turbine string, as shown in Figure 1.

3.2 RESULTS

One white-tailed jackrabbit was found outside the lease boundary and analysis area on June 21, 2005 just north of McDonald Ferry Lane, at the easternmost edge of the project (Figure 1). The jackrabbit was seen within the CRP lands immediately north of McDonald Ferry Lane (Photo 1, Appendix A). The CRP lands in this area have developed fairly dense sagebrush compared to the majority of CRP lands within the analysis area to the east. Within the remainder of the CRP in the analysis area, sagebrush was quite uncommon. In the eastern edge of the analysis area, east of Transect 116, rabbit scat was commonly found under the few young sagebrush shrubs that exist there. However, the scat was undersized, suggesting the presence of cottontail or black-tailed jackrabbit, rather than white-tailed jackrabbit (Verts and Carraway, 1998).

Another, unidentified jackrabbit was seen on May 23, 2005, along the edge of the Lease Boundary, within the analysis area at the end of Transect 125 (Figure 1). The grassland habitat in this area is generally shallow soil, contains a mixture of native bunchgrasses and weeds, such as cheatgrass, and drops steeply toward Grass Valley Canyon. It contains large, scattered sagebrush of insufficient density and patch size to be labeled shrub-steppe. However, the scattered shrubs provide shelter for such varied species as jackrabbits, chukar, and elk.

This sighting lies less than a mile to the south of the confirmed white-tailed jackrabbit, but the two sightings are completely separated by agricultural lands, and no jackrabbit scat was found in the area.

4 TARGET NON-LISTED SPECIES SURVEYS

4.1 METHODS

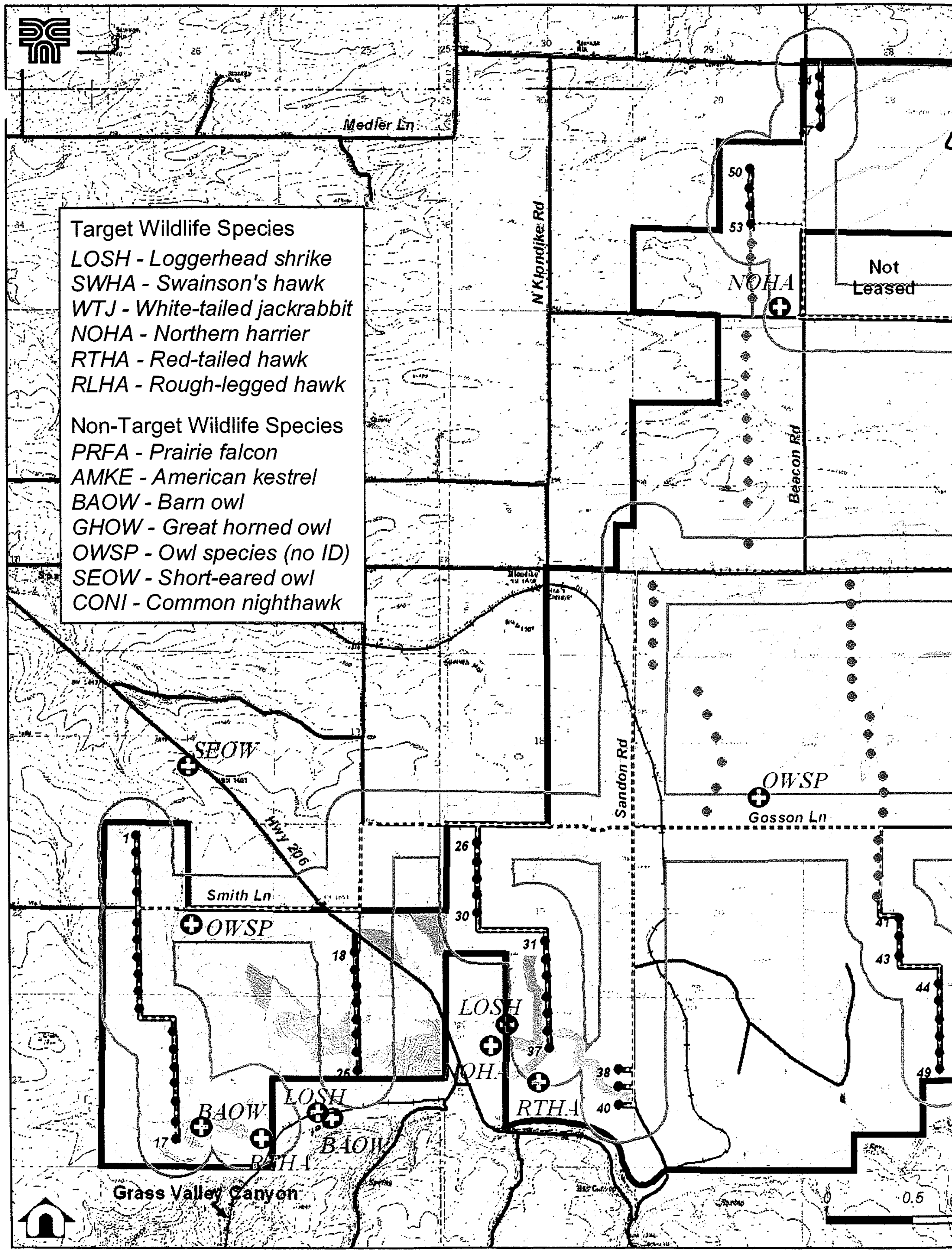
Targeted non-listed species included: golden eagle, burrowing owl, loggerhead shrike, all raptors species (with an emphasis on the Swainson's hawk), and long-billed curlew. Transects for these non-listed species were meandering line transects no more than 195 feet (60 m) apart; they covered 100 percent of the suitable habitat within the analysis area. Surveys were paused or stopped if wind conditions were greater than approximately 15 miles per hour (mph) or if other weather conditions impacted visual or auditory observations. These surveys were designed to provide information on presence/absence and habitat use rather than population estimates.

As the biologists were walking the meander transects, binoculars were used to scan the area for wildlife. The presence, location, and behavior (foraging, nesting, loafing) of species were also noted during in-transit travel in and near the project area. Non-target species sightings are included on Figure 1, and are also described below, but are distinguished as non-target species. Non-target species that were mapped in Figure 1 include owls, prairie falcon, and nighthawks.

Based on preliminary coordination with ODFW, bat surveys were not included within the biological protocol. Existing bat mortality data will be analyzed to evaluate the potential impacts to bat populations.

4.2 RESULTS

Based upon the USFWS and ORNHIC database searches (ORNHIC 2005 and USFWS 2005), 31 state sensitive species or federal species of concern (collectively referred to as non-listed or "rare" species) have the potential to occur within five miles of the project boundary. Table 1 summarizes special status/sensitive plants, fish, and wildlife species that may occur within the analysis area, according to the results of the pre-field review (ORNHIC 2005 and USFWS 2005) and the Biological Protocol that was approved by ODFW (ODFW Concurrence letter 2005, Appendix P-3). A preliminary version of this table was included in Exhibit P of the ASC, but the table in this document has been updated by recent survey data. If there was no suitable habitat for the species within the proposed project vicinity, it was not addressed further.



p:/ppme00000001/0600info/gs/arcmap/wildlife_survey_summary/fig1_wildlife_071405.mxd 7/14/05

Those species considered endangered, threatened, proposed, or candidates for listing under the state and/or federal Endangered Species Act, with the potential to occur in the analysis area, are addressed in Exhibit Q of the EFSC Application. These species included only the bald eagle and peregrine falcon, which were not encountered within the vicinity during any of the surveys conducted for the project.

Table 1. Special Status/Sensitive Species with the Potential to Occur within the Analysis Area of the Klondike III Wind Project

Species	Federal Status1	State Status1	ORNHIC List2	Observed/Documented in Analysis Area
Birds				
Golden eagle (*Aquila chrysaetos*)	EA	--	--	One nest documented in the project vicinity during the 2001-2003 Klondike I and II surveys. Also documented in the 2004-2005 avian baseline surveys, and seen within the analysis area during the February 2 meeting with ODFW, but not during the wildlife surveys. No nests found.
Swainson's hawk (*Buteo swainsoni*)	--	SV	4	11 nests documented in the project vicinity during the 2001-2003 Klondike I and II surveys. 3 nests were documented in the project vicinity in the 2004-2005 avian baseline surveys, but none of these fell within the designated Klondike III analysis area for sensitive wildlife species. These nests are identified in the Avian Baseline Report (ABR 2005).
Rough-legged hawk (*Buteo lagopus*)	--	--	--	Individuals documented within the 2001-2003 Klondike I and II surveys as well as the 2004-2005 avian baseline surveys. Also observed during the 2005 sensitive species surveys outside of the analysis area. No nests found.
Red-tailed hawk (*Buteo jamaicensis*)	--	--	--	18 nests documented in the project vicinity during the 2001-2003 Klondike I and II surveys, and seen within the analysis area during the 2005 sensitive species surveys. 3 nests were documented in the 2004-2005 avian baseline surveys, but none of these fell within the analysis area for the sensitive species survey. Nests are identified in the Avian Baseline Report (ABR 2005).
Ferruginous hawk (*Buteo regalis*)	SoC	SC	4	Documented within the 2001-2003 Klondike I and II surveys. None observed during the 2004-2005 Klondike III surveys.
Eastern Oregon Willow flycatcher (*Empidonax traillii adastus*)	SoC	SU	4	None observed. No suitable habitat.
Yellow-breasted chat (*Icteria virens*)	SoC	SC	4	None observed. No suitable habitat.
Lewis' woodpecker (*Melanerpes lewis*)	SoC	SC	4	None observed. No suitable habitat.

Species	Federal Status1	State Status1	ORNHIC List2	Observed/Documented in Analysis Area
Long-billed curlew (*Numenius americanus*)	--	SV	4	Documented within the 2001-2003 Klondike I and II surveys. Observed during the Klondike III avian baseline surveys in the eastern portion of the project area. No nests observed.
Western burrowing owl (*Athene cunicularia hypugaea*)	SoC	SC	2	None observed. Suitable habitat may exist within grassland areas.
Loggerhead shrike (*Lanius ludovicianus*)	--	SV	4	Documented within the 2001-2003 Klondike I and II surveys. Observed once during the winter avian baseline surveys. Documented in one location within the analysis area and two locations outside of the analysis area during the 2005 sensitive species surveys (see Figure 1).
Mammals				
White-tailed jackrabbit (*Lepus townsendii*)	--	SU	3	Five individuals documented within the 2001-2003 Klondike I and II surveys. At least one individual documented outside the analysis area during the 2005 sensitive species surveys.
Spotted bat (*Euderma maculatum*)	SoC	--	2	None observed. Bat field investigation not conducted.
Pale western big-eared bat (*Corynorhinus townsendii pallescens*)	SoC	SC	2	None observed. Bat field investigation not conducted.
Silver-haired bat (*Lasionycteris noctivagans*)	SoC	SU	4	None observed. Bat field investigation not conducted.
Small-footed myotis (*Myotis ciliolabrum*)	SoC	SU	4	None observed. Bat field investigation not conducted.
Long-eared myotis (*Myotis evotis*)	SoC	SU	4	None observed. Bat field investigation not conducted.
Long-legged myotis (*Myotis volans*)	SoC	SU	4	None observed. Bat field investigation not conducted.
Yuma myotis (*Myotis yumanensis*)	SoC	--	4	None observed. Bat field investigation not conducted.
Desert bighorn sheep (*Ovis canadensis nelsoni*)	SoC	--	4	None observed. No suitable habitat within analysis area.
Amphibians & Reptiles				
Northern sagebrush lizard (*Sceloporus graciosus graciosus*)	SoC	SV	4	None observed during 2001-2003 Klondike I and II surveys. Suitable habitat not anticipated in analysis area.
Western toad (*Bufo boreas*)	--	SV	4	None observed. No suitable habitat within analysis area.

Species	Federal Status1	State Status1	ORNHIC List2	Observed/Documented in Analysis Area
Painted turtle (*Chrysemys picta*)	--	SC	2	None observed. No suitable habitat within analysis area.
Invertebrates				
Pristine springsnail (*Pristinicola hemphilli*)	--	--	3	None observed. No suitable habitat within analysis area.
Shortface lanx (*Fisherola nuttalli*)	--	--	1	None observed. No suitable habitat within analysis area.
Dalles mountainsnail (*Oreohelix variabilis variabilis*)	--	--	1	None observed. No suitable habitat within analysis area.
California floater (*Anodonta californiensis*)	SoC	--	3	None observed. No suitable habitat within analysis area.
Minor Pacific sideband (*Monadenia fidelis minor*)	SoC	--	1	None observed. No suitable habitat within analysis area.
Columbia Gorge oregonian (*Cryptomastix hendersoni*)	--	--	1	None observed. No suitable habitat within analysis area.
Fish				
Pacific lamprey (*Lampetra tridentata*)	SoC	SC	4	None observed. No suitable habitat within analysis area.
Interior redband trout (*Oncorhynchus mykiss gibbsi*)	SoC	SV	2	None observed. No suitable habitat within analysis area.

[1] **State and Federal Status Definitions**

EA – Bald and Golden Eagle Protection Act

SoC – Species of Concern. Former Category 2 candidates for which additional information is needed in order to propose as threatened or endangered under the ESA; these species are under review for consideration as Candidates for listing under the ESA.

SC – State Sensitive-Critical. Species for which listing is pending; or those for which listing may be appropriate if immediate conservation activities are not taken. Also considered critical are some peripheral species which are at risk throughout their range, and some disjunct populations.

SV – State Sensitive-Vulnerable. Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable, and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.

SU – State Sensitive-Undetermined Status. Animals in this category are species whose status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical or vulnerable status, but scientific study would be required before a judgment can be made.

[2] **ONHP Definitions**

List 1 - taxa that are threatened with extinction or presumed to be extinct throughout their entire range.

List 2 – taxa threatened with extirpation or presumed extirpated from Oregon; often peripheral or disjunct species which are of concern considering species diversity within Oregon; can be very significant in protecting the genetic diversity of the taxon; ONHP regards extreme rarity as a significant threat and has included species which are very rare in Oregon on this list.

List 3 – taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

List 4 – taxa which are of conservation concern but not currently threatened or endangered; including taxa that are very rare but considered secure as well as those declining in numbers or habitat but still too common to be proposed as threatened or endangered; these taxa require continued monitoring.

Ex – Presumed extirpated or extinct

The target species that were observed within the analysis area included loggerhead shrike, an unidentified jackrabbit, and several raptor species (Figure 1). In addition, a white-tailed jackrabbit and a Swainson's hawk nest were observed just beyond the analysis area boundary (Figure 1). A Swainson's hawk nest was found in the area west of Turbine location 84 during the Avian Baseline surveys, but this area was not surveyed for sensitive species because it is outside the Lease Boundary. The nest was located low in a small locust tree north of Dehler Road.

Raptors seen in or near the analysis area included: northern harrier, rough-legged hawk, red-tailed hawk, rough-legged hawk, prairie falcon, and American kestrel. Owls seen in the vicinity included great-horned, short-eared, and barn owls, although none were observed within the analysis area. Numerous, non-target passerines were seen, such as: the ubiquitous horned larks and meadowlarks, Say's phoebe, American pipit, western kingbird, grasshopper sparrow, starling, dark-eyed junco, pheasant, mountain quail, gray partridge, chukar, turkey vulture and crows. Mammal observations included: deer, elk, pronghorn antelope, kangaroo rat, coyote, and badger. Species' occurrence is discussed below by habitat type.

A total of seven habitat types were observed within the project vicinity; Agricultural, Conservation Reserve Program (CRP), Intermittent Stream, Developed, Grassland, Shrub-Steppe, and Upland Trees. These habitat types were then assigned specific habitat categories based on the ODFW fish and wildlife habitat mitigation goals and standards defined in OAR 635-415-0025. The habitat types and categories for the project vicinity are illustrated in Figure 1 of this document and Figure P-2 in the original ASC. The following section describes wildlife habitat and wildlife use within these habitat types.

4.2.1 Upland Trees

Within the analysis area, upland tree areas were of two types: cultivated trees surrounding occupied residences, and small non-native trees, typically black locust (*Robinia pseudoacacia*), usually found within or near dry washes or draws or adjacent to abandoned homesteads. The latter type is more valuable for wildlife due to its distance from human disturbance and is discussed in greater detail below.

One small area of upland tree habitat, within the analysis area, north of Klondike Lane, was found to contain a loggerhead shrike breeding area (Figure 1). A pair of loggerhead shrikes was encountered on June 13, 2005, within a small island of very small locust trees (10-15' tall) containing an understory of cheatgrass (*Bromus tectorum*). The island is surrounded by agricultural land near the driest portion of the intermittent drainage that runs through the center of the project area (Photo 3, Appendix A).

The shrikes were displaying aggressive territorial behavior, flying to other nearby islands of locust trees to distract the observers, and returning to the breeding area and giving numerous alarm calls when surveyors approached. In order to avoid disturbance to the pair, the exact location of the nest was not determined.

The site was revisited on June 22, 2005, but the shrikes were not present, which may have been a result of the strong winds (5-15 mph) that were occurring at the time of the visit. A potential nest was found 5 feet above the ground in a small locust tree with scattered whitewash below it, but no prey items were visible beneath it (Photo 4, Appendix A). Songbird remnants were found below a perch, on a different tree in the island of habitat. A portion of a mouse was found as well, indicating that the perch may have been used by an owl or raptor in addition to, or instead of, a loggerhead shrike.

According to ODFW standards, the upland tree-island is considered irreplaceable (Category 1), since it supports loggerhead shrikes. An underground collector is proposed across agricultural land, approximately 220 feet to the west of the westernmost edge of the island of locust trees. This collector is mapped approximately 350 feet from a potential nest tree found in the center of the island. The nest did not contain eggs or young at the time of the site visit, but juveniles would have likely begun to disperse by that time (June 21). The collector will connect a turbine string to the main transmission line along Klondike Lane to the south. The Seasonality and Sensitive Period for the species is April 15 through September 1 (ODFW 1994). As such, it is recommended that construction activities be limited during this time period, and further recommended that the Applicant coordinate with ODFW as necessary to determine which conservation measures would be appropriate.

A Swainson's hawk nest was identified during the ABR avian baseline surveys. It was found outside the lease boundary within the analysis area less than 100 feet north of Dehler road. The nest lies unusually close to the ground (approximately five feet) within a small locust tree in a weedy area used to store old equipment and tractors. A note on mapping: The location of this Swainson's hawk nest was not mapped as upland tree habitat because these trees were too small to show at the scale of maps in the original ASC. The habitat contained scattered locust trees rather than a contiguous area of upland tree habitat such as those mapped in other areas in dark green. The upland tree habitat is considered irreplaceable (Category 1), since it supports a target species. If the Swainson's hawk nests in this area in subsequent years, it is recommended that construction activities be limited during the Seasonality and Sensitive Period for the species, which is June 1 through August 31 (ODFW 1994), and further recommended that the Applicant coordinate with ODFW, as necessary, to determine which conservation measures would be appropriate.

Upland trees are uncommon within the entire analysis area, but many trees are located adjacent to occupied residences near Emigrant Springs, Webfoot, and scattered residences throughout the study area. The upland tree habitat includes locust trees and shrubs over heavily grazed weedy pasture, Lombardy poplar (*Populus nigra*) in hedgerows, and various pine species and cottonwood (*Populus balsamifera*) adjacent to residences and driveways. These trees were used by songbirds for perching and foraging. In addition, several species of non-listed raptors were noted to perch on such trees, likely because other such trees and shrubs are rare in the vicinity. These species include American kestrel and other non-listed raptors such as red-tailed hawk, songbirds such as kingbird, Say's phoebe, and sparrows, as well as mourning dove, and many other common species, including California quail. Due to the presence of human disturbance and very weedy or developed understory, these upland trees are not considered irreplaceable, since they could not support a nest for target species unless the residences were abandoned.

4.2.2 Shrub-steppe

No target species were seen within the analysis area in shrub-steppe habitat during the surveys. Shrub-steppe habitat occurs in several areas within the analysis area, but primarily on the slopes leading to Highway 206 from the agricultural areas west of Sandon Road (Figure 1). This habitat type is found in the few areas where fire has not eliminated it from the landscape. It consists of a robust overstory of sagebrush (*Artemesia tridentata*), with generally at least 40-50% cover. The understory includes native grasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa secunda*), and Idaho fescue (*Festuca idahoensis*). It also includes varying percent cover of invasive grasses such as cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*). Although the habitat is often quite weedy in places, it provides important structure and habitat for wildlife. Common wildlife species included pheasant, lark sparrow, quail, and others.

Two loggerhead shrike breeding areas were found within sagebrush shrub-steppe outside the analysis area. The shrike breeding area that was closest to a project element lies approximately 100 feet west of the analysis area between Highway 206 and Sandon Lane west of Transect 105. (Figure 1). This area is dominated by somewhat dense, large sagebrush between existing agriculture, the CRP, and a narrow strip of native grassland. Dominant herbaceous cover under the sagebrush is cheatgrass. On June 14, 2005, a pair of adult loggerhead shrikes and two juveniles were seen on and around a fence along the lease boundary. They were giving alarm calls within a focal area of activity marked in Figure 1. A nest was not searched for, but breeding habitat was assumed based on the species' behavior.

Shrub-steppe habitat was also mapped within dense sagebrush on the upper terraces of Grass Valley Canyon. Nesting loggerhead shrikes, with juveniles, were confirmed outside the analysis area, near the creek, in the southwest corner of the Lease Boundary, on June 15, 2005. Many other wildlife species were observed in this type of habitat, including nesting barn owls, cougar (based on scat), elk, deer, pheasant, and California quail, as well as numerous songbirds. In places, the shrub-steppe habitat thins quickly as it rises upslope, along the drainages toward the agricultural areas. It was generally replaced by grasses and weeds in the upper portions of the tributaries near the plateaus, which are dominated by agriculture.

4.2.3 Grassland

No target species were seen within grassland habitat during the surveys. An unidentified jackrabbit was seen briefly along the south edge of the lease boundary, within the analysis area at the south end of Transect 125, in grassland habitat.

There are two types of grasslands found within the analysis area: those found on lithosol soils and those found on deep soils. Lithosols consist of soils that are stony and very shallow to bedrock (approximately 4-12 inches [10 to 30 cm] in the Columbia basin). They are somewhat widespread in Oregon and Washington, but are limited in extent locally. In lithosols, Sandberg bluegrass (*Poa secunda*) is sparse but dominant, in addition to native flowering forbs, such as buckwheat (*Eriogonum* sp.), Lomatium (*Lomatium* sp.), and others. Lichen and moss cover the remaining areas. The majority of this habitat was found on south-facing slopes between Webfoot and Grass Valley Canyon and north of Grass Valley and Highway 206.

Lithosols do not support robust bunchgrasses, but maintain enough bunchgrass structure to provide potential habitat for ground-nesting birds such as the grasshopper sparrow (*Ammodramus savannarum*) and long-billed curlew. They also maintain foraging and dispersal habitat for white-tailed jackrabbits, and potential foraging habitat for raptors such as Swainson's hawk and Ferruginous hawk. Steep faces along the southern edge of the analysis area were generally lithosols, and provided habitat for rock wren and canyon wren. Nighthawk and raptors such as northern harrier, prairie falcon, and redtail hawk were seen foraging above this habitat, with ungulates, grasshopper sparrow, and mice and voles utilizing the habitat where bunchgrass is present.

Deeper grassland habitat consists of mainly native bunchgrasses, typically dominated by bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg's bluegrass (*Poa secunda*). Other native species, such as Idaho fescue (*Festuca idahoensis*) and western needle and thread grass (*Stipa comata*) were present, along with various native forbs and both rubber rabbitbrush (*Ericameria nauseosa*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*), which is dense in small patches or in draws.

Invasive species such as cheatgrass, tumblemustard (*Sisymbrium altissimum*), Russian thistle (*Salsola kali*), and fiddleneck tarweed (*Amsinckia* sp.) can be dense, and may somewhat limit wildlife use. Townsends squirrel use was noted in much of this habitat, along with the rare badger burrow. Badger burrows were found mainly in the southwest portion of the Lease Boundary.

4.2.4 CRP

Conservation Reserve Program (CRP) lands are found throughout the analysis area, generally along steeper slopes and more inaccessible areas, below existing agricultural areas and above Grass Valley Canyon and its tributaries. One white-tailed jackrabbit was found on CRP lands, but the sighting took place outside the lease boundary. Within the CRP areas, weed cover is generally low to moderate with scattered cheatgrass and bulbous bluegrass in the spaces between robust intermediate wheatgrass and crested wheatgrass. In the northeastern portion of the analysis area, sheep fescue (*Festuca ovina*) has been planted in strips.

No target species other than white-tailed jackrabbit were found on CRP lands. However, the CRP areas that were surveyed had developed some of the characteristics necessary to provide some habitat for sensitive wildlife, such as density of cover and quality of forage. Sagebrush was uncommon in the CRP within the majority of the analysis area, except for portions of the northeastern boundary. This structure provides shelter for species such as the jackrabbit, and walking nighttime surveys were conducted in it, but without positive results within the analysis area.

The structure available on CRP lands provides habitat for wildlife, and natural wildlife movement has begun to re-emerge in these areas. Deer, elk, and pronghorn were seen feeding and sheltering in the CRP. However, burrows of ground squirrels and kangaroo rats were sparsely distributed, and few badger burrows were documented with certainty. It appears that soil structure has begun to return to the CRP, but burrows and prey base are still lacking in the majority of CRP lands, as they were in most of the habitat types within the analysis area.

Raptors were also surprisingly uncommon above the CRP and grassland, and were not often seen during the wildlife surveys. However, the occasional northern harrier and redtail hawk were seen foraging above this habitat, and prairie falcons were seen moving quickly over portions of the habitat. The most successful aspect of the CRP development could be nesting for grasshopper sparrows, which were seen and heard throughout nearly all CRP areas surveyed. They were much more densely distributed in the CRP than in the native grassland surveyed, and were especially common in the CRP on the eastern border of the analysis area.

In addition, a single reptile was seen within the CRP. A racer (*Coluber constrictor mormon)* was seen at the north end of Transect 116, moving through the grassland. Its presence was fairly surprising since it is thought to be somewhat dependent on wetland or riparian habitat (Brown, et. al. 1995), which does not exist within several miles of the location. However, habitat for the species includes open grassland and sage flats, and dispersal distance from dens can be up to 1.8 kilometers. It is not considered a state sensitive species, but is listed as G5 in General Rank, which is demonstrably secure, though frequently rare in parts of its range (Natureserve 2005).

4.2.5 Agricultural

No target species were seen in agricultural habitat during the surveys. Agricultural areas dominate the landscape, and provide little habitat for wildlife other than forage for ungulates and raptors. Deer and pronghorn were seen crossing large expanses of agricultural land, and elk tracks were found in these same areas. Elk sightings usually took place on agricultural margins and in draws. Rough-legged hawks were noted hovering above working tractors to take advantage of prey, which were scared or wounded by plowing activities.

4.2.6 Intermittent Streams

No target species were seen within intermittent streams during the surveys. Intermittent streams within the analysis area can be divided into two types: lower and upper tributaries to Grass Valley Canyon Creek.

Lower tributaries to Grass Valley Canyon Creek lie in steep drainages, and are often surrounded by dense sagebrush. The only place where this habitat type fell within the analysis area was in the southwest corner of the Lease Boundary. This portion of the project is home to a fairly broad diversity of wildlife, which often travel upslope into the analysis area. A barn owl nest containing at least four individuals was found outside the analysis area in two separate holes in an eroded embankment opposite an abandoned railroad grade south of Transect 25. A barn owl was seen silently flying over the analysis area, east of Transect 17, during jackrabbit surveys. Elk, deer, and cougar were also noted traveling up into the analysis area in this portion of land. Cougar presence was determined by the size of the scat, although no tracks were found and the scat was uncovered, which is somewhat uncommon.

In several intermittent draws within grassland habitat, birds were foraging or nesting. A chukar nest was found at the top of a very shallow draw, where it meets agricultural land south of Transect 125, and quail and pheasant calls were commonly heard near such draws.

The upper portions of these draws were generally plowed over and farmed. One larger uncultivated draw remains within the analysis area, leading east and crossing Klondike Lane, before dropping into Grass Valley Canyon, south of Webfoot town site. This dry channel, within the agricultural lands, ranges from 1 to 5 feet in width, and is incised from 1 to 6 feet. Vegetation within and adjacent to the channels is mostly weedy, with upland species such as cheatgrass and escaped wheat dominating the banks. The channel has been significantly altered by agricultural practices, and provides little habitat for wildlife, other than serving as travel corridors for coyote, rabbits, and other common wildlife.

5 SUMMARY

Target, non-listed species included: golden eagle, burrowing owl, loggerhead shrike, all raptors species (with an emphasis on the Swainson's hawk), and long-billed curlew. The target species that were observed within the analysis area included loggerhead shrike, Swainson's hawk and several raptor species (Figure 1).

The target species that was found closest to the proposed facilities was a Swainson's hawk nest identified less than 100 feet north of Dehler road. The nest lies within a small locust tree in a weedy area used to store old equipment and tractors. An underground collector is proposed within the road prism. The upland tree habitat is considered irreplaceable (Category 1), since it supports a target species. If the Swainson's hawk nests in this area in subsequent years, it is recommended that construction activities be limited during the Seasonality and Sensitive Period for the species, which is June 1 through August 31 (ODFW 1994), and further recommended that the Applicant coordinate with ODFW as necessary to determine which conservation measures would be appropriate.

No other raptors (such as red-tail hawks or northern harrier) seen within the analysis area were associated with known nests, but were incidental sightings within a larger home range.

The second closest target species observation was a loggerhead shrike breeding area within a small island of small locust trees surrounded by agricultural land. An underground collector is proposed in the agricultural land, approximately 220 feet to the west of the clump of locust trees. The Seasonality and Sensitive Period for the species is April 15 through September 1. As such, it is recommended that construction activities be limited during this time period, and further recommended that the Applicant coordinate with ODFW as necessary to determine which conservation measures would be appropriate.

A single white-tailed jackrabbit was found outside the analysis area and lease boundary just north of McDonald Ferry Lane, at the easternmost edge of the project in CRP habitat. No ground-disturbing activities are proposed outside the road prism adjacent to the sighting. Therefore, no seasonal restrictions or coordination with ODFW is recommended.

Another, unidentified jackrabbit was seen briefly along the south edge of the lease boundary, within the analysis area at the south end of Transect 125, in grassland habitat. Mitigation for impacts to grassland habitat are summarized in Exhibit P of the ASC. Since species could not be determined, seasonal restrictions are not recommended.

Finally, an active Swainson's hawk nest was seen in a locust tree near an abandoned house south of Gosson Lane. It lies inside the lease boundary but more than a mile west of Transect 156 (200 feet outside the analysis area). The female was seen sitting on the nest and the male was displaying territorial behavior during the site visit on May 25, 2005 (Figure 1 and Photo 2, Appendix A). Since it falls outside the analysis area, seasonal restrictions would not be necessary.

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APPENDIX A – SITE PHOTOS

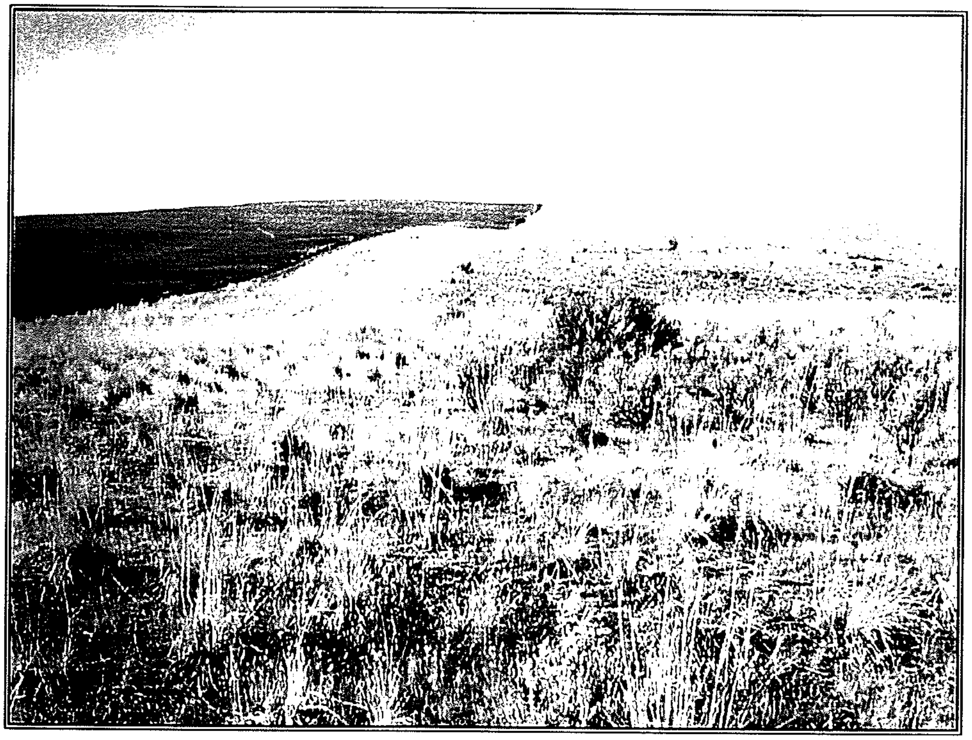

Photo 1: Location of 6-21-05 white-tailed jackrabbit sighting in CRP outside Analysis Area

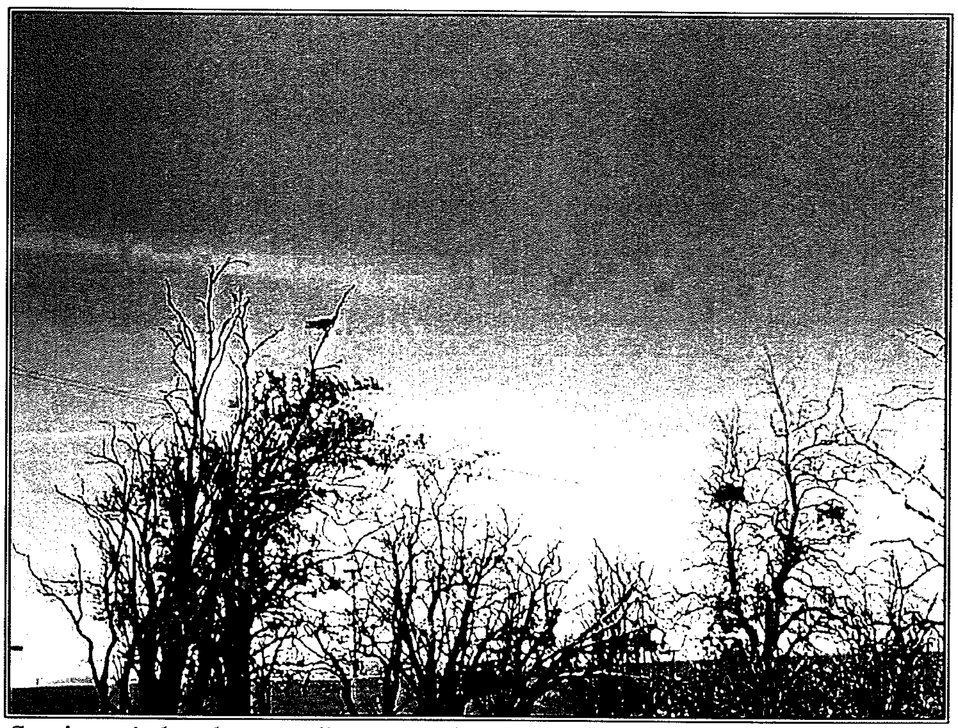

Photo 2: Swainson's hawk nest adjacent to abandoned house just outside the Analysis Area. Female on the nest in black locust tree to right; male perched in tree to left.

Photo 3: Loggerhead shrike breeding area in black locust tree in small patch of tree amid agriculture within Analysis Area. Potential nest tree in center of patch.

Photo 4: Potential Loggerhead shrike nest in black locust tree within Analysis Area

Table P- 3. Habitat Types and Categories in the Klondike III Wind Project Analysis Area with Area of Impact

		IMPACTS (Acreage and % of total impact)					
	Total Acres	Temporary Impacts (with turnaround impacts)		Temporary Impacts (turnaround Impacts only)		Permanent	
Category 1	0.00	0.00		0.00		0.00	
Category 2							
Grassland	107.77	1.25	(1.29%)	1.25	(2.46%)	0.45	(0.705%)
Shrub-steppe	39.62	0.00		0.00		0.19	(0.298%)
Category 3							
CRP	865.19	10.41	(10.72%)	8.40	(16.54%)	6.10	(9.558%)
Grassland	382.70	1.41	(1.45%)	1.41	(2.78%)	0.15	(0.235%)
Shrub-steppe	43.96	1.42	(1.46%)	1.42	(2.80%)	0.00	
Intermittent streams	4.85 (miles)	0.00		0.00		0.00	
Upland trees	11.30	0.00		0.00		0.03	(0.047%)
Category 4							
Grassland	97.95	1.14	(1.17%)	1.13	(2.22%)	0.08	(0.125%)
Category 5	0.00	0.00		0.00		0.00	
Category 6							
Developed	39.67	0.00		0.00		0.00	
Agricultural	9,614.04	81.50	(83.91%)	37.19	(73.21%)	56.82	(89.032%)
TOTAL	**11,202.9 + 4.85 miles of intermittent stream**	**97.13**	**(100%)**	**50.80**	**(100%)**	**63.82**	**(100%)**

Revised 10-07-05

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Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon

Prepared for:

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Prepared by:

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March 2003

INTRODUCTION AND BACKGROUND

Wind has been used to commercially produce energy in the U.S. since the early 1970's (American Wind Energy Association [AWEA] 1995). Recent advances in wind turbine technologies have reduced costs associated with wind power production, improving the economics of wind energy development (Hansen *et al.* 1992). Wind power produced in the United States in 2001 was comparable in price to conventional power produced using natural gas (AWEA 2001). Commercial wind energy plants have been constructed in 26 states (Anderson *et al.* 1999, AWEA 2002a), and total wind power capacity in the United States increased from 10 megawatts (MW) in 1981 to 4,261 MW in 2001, which is enough to supply the electricity needs of approximately 3.2 million homes (AWEA 2002b). Over 2000 MW of new wind projects have been proposed for 2003 (AWEA 2002c). To date, most wind power development in the U.S. has occurred in California and Texas, but greater than 90% of the wind power potential in the U.S. exists within the Midwestern and western states (Weinberg and Williams 1990).

Although development of renewable energy sources is generally considered environmentally friendly, wind power development has been associated with the deaths of birds colliding with turbines and other wind plant structures, especially in California (Erickson *et al.* 2001). Bat collision mortality has also recently become an issue at some wind plants (Johnson 2003). As a result of these concerns, state and federal agencies have required monitoring of many new wind development areas to assess the extent of and potential for avian and bat collision mortality.

In January 2001, Northwestern Windpower completed development of a 16 turbine 24-megawatt (MW) wind plant on private land in Sherman County, Oregon (Figure 1). A one-year baseline study was conducted at this site prior to wind plant development to assess the potential for bird, bat and sensitive species impacts (Johnson *et al.* 2002a).

The Monitoring Plan used for this study was developed in response to the Sherman County conditional use permit conditions, and through input from both the Oregon Department of Fish and Wildlife and the Central Oregon Audubon Society (COAS). Components of the monitoring study included: (1) fatality monitoring using standardized carcass searches, scavenging and searcher efficiency trials, and a protocol for handling and reporting of fatalities and injured wildlife found by maintenance personnel, (2) a ground survey of existing raptor nests identified during 2001 helicopter surveys within three miles of project features, and (3) formation of a Technical Advisory Committee (TAC) made of stakeholders for review of monitoring protocols and results and mitigation measures and making recommendations to Sherman County, which retains jurisdiction over the Monitoring Plan. The monitoring study was conducted for one full year. The protocol for the fatality monitoring study was similar to protocols used at the Vansycle Wind Plant in northeastern Oregon (Erickson *et al.* 2000), the Stateline Wind Plant in Oregon and Washington (FPL *et al.* 2001), the Buffalo Ridge Wind Plant in southwestern Minnesota (Johnson *et al.* 2000a), and the SeaWest Wind Plant in Wyoming (Johnson *et al.* 2000b).

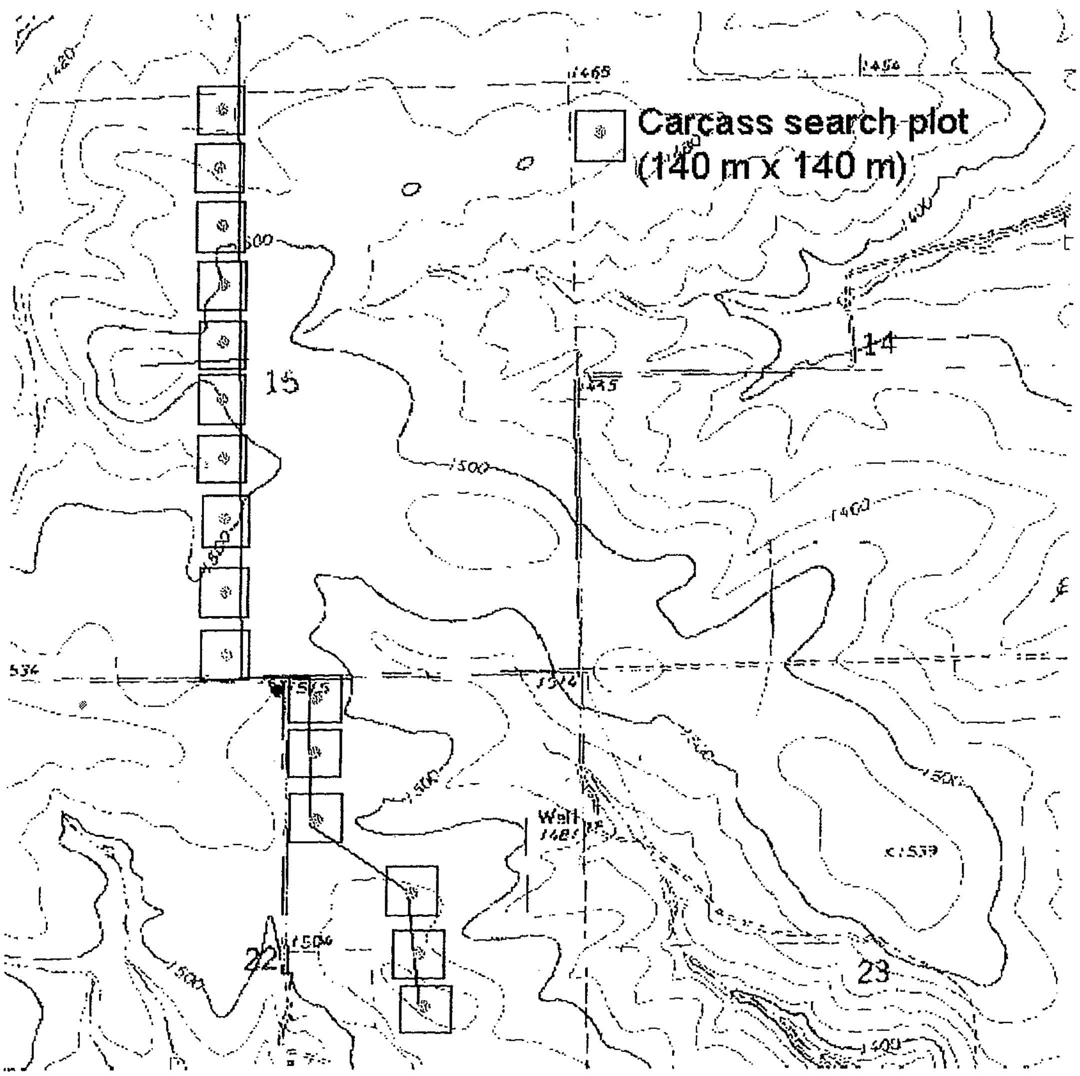

Figure 1. Carcass search plots for the Klondike Wind Project.

STUDY AREA

The Project area is within the Columbia Basin Physiographic Province. The study area (referred to herein as the "Project area") is 3 miles directly east of Wasco and approximately 7.5 miles south of the Columbia River. The initial Project consists of 16 turbines placed in Sections 10, 15 and 22, Township 1 N, Range 18 E (Figure 1). The turbines are 1.5-megawatt Enron turbines with rotor-swept heights of approximately 30 to 100 m above ground.

The original vegetation of this area was the bluebunch wheatgrass-Idaho fescue zonal association, which was predominately grassland and shrub-steppe with deciduous riparian forest and scrub along drainages (Franklin and Dyrness 1973). Agriculture and livestock grazing have

converted the area to a mosaic of grazed shrub-steppe, Conservation Reserve Program ("CRP") fields, and cultivated wheat fields. CRP fields are areas that had previously been farmed, but have been seeded to grasslands for a minimum of 10 years to reduce soil erosion. Most of the Project area is cultivated wheat. Minor habitat types in the vicinity include wooded drainages and woodlots associated with abandoned and occupied farmsteads. Thirteen of the 16 turbines in the first phase were placed within wheat fields and the remaining three (turbines 11-13) were placed within a narrow strip of CRP.

METHODS

The fatality monitoring phase of the study began once all the turbines were constructed and operational. The primary objective of the fatality studies was to estimate the number of avian and bat fatalities attributable to wind turbine collisions for the entire Project. The study was conducted for one full year. The study consisted of four components: 1) standardized carcass searches, 2) an incidental casualty and injured bird reporting system, 3) scavenging/carcass removal trials; and, 4) searcher efficiency trials. Other operations-related bird and bat fatalities may occur such as meteorological (met) tower collisions and vehicle strikes. The study included searches of the permanent met tower and reporting of other fatalities and injured animals that were discovered incidental to conducting other tasks.

The number of avian and bat fatalities attributable to the Project was estimated based on the number of avian and bat fatalities found in the Project area whose death appeared to be related to the Project. All carcasses located within areas surveyed, regardless of species, were recorded. An estimate of the total number of avian and bat mortalities within the search areas was made by adjusting for "removal bias" (scavenging) and searcher efficiency bias. For carcasses where the cause of death was not apparent, the fatality was conservatively attributed to the Project.

We used the following dates to define seasons for this study:

Spring Migration	March 16 – May 15
Summer/Breeding	May 16-August 15
Fall Migration	August 16-October 31
Winter	November 1-March 15

The first search was conducted within one week after the date all turbines become operational (commercially producing electricity) to clear the plots of evidence of old carcasses and document fatalities that may have occurred during the testing and early operational phase. Subsequent searches were conducted at intervals of approximately 28-30 days. A total of 13 searches were conducted at each turbine and the one permanent met tower during the monitoring year.

Standardized Carcass Searches

Personnel trained in proper search techniques conducted the carcass searches. Boundaries of square plots 140 m on a side and centered on the turbine were delineated (Figure 1). The areas within these plots that were within the lease boundaries of the project were searched by walking parallel transects. Studies at the Vansycle Wind Plant (Erickson *et al.* 2000), the Buffalo Ridge Wind Plant (Johnson *et al.* 2002, 2003, Higgins *et al.* 1996) and the Foote Creek Rim Wind Plant

(Johnson *et al.* 2000b) indicate nearly all fatalities are found in this area, with a large majority of carcasses found within 40 meters of the turbine. Transects were initially set at 6 meters apart in the area to be searched, and searchers walked at a rate of approximately 45-60 meters a minute along each transect searching both sides out to five meters for casualties (Johnson *et al.* 1993). Search area and speed were adjusted by habitat type after evaluation of the first searcher efficiency trial. It took approximately 45 to 90 minutes to search each turbine depending on the habitat type.

The condition of each carcass found was recorded using the following condition categories:

- 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 which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).
- Feather Spot - 10 or more feathers at one location indicating predation or scavenging.

All carcasses found were labeled with a unique number, bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass was maintained, bagged and frozen with the carcass at all times. For all casualties found, data recorded included species, sex and age when possible, date and time collected, location, condition (e.g., intact, scavenged, feather spot), and any comments that may indicate cause of death. All casualties were photographed as found.

Casualties or fatalities found by maintenance personnel and others not conducting the formal searches were documented using a wildlife incidental reporting system. When carcasses of animals were discovered by non-study personnel, a Project Biologist was contacted to identify and collect the casualty. Personnel involved in searches received training prior to working in the wind plant. Appropriate wildlife salvage permits were obtained from the Oregon Department of Fish and Wildlife and the U.S. Fish and Wildlife Service.

Northwestern Wind Power's Wildlife Reporting and Handling System for Incidental Fatality and Injured Bird Discoveries

Northwestern Wind Power's Wildlife Reporting and Handling System (WRHS) is a monitoring program for reporting and handling avian and bat casualties or injured wildlife found by maintenance personnel. Construction and maintenance personnel were trained in the methods. This monitoring program includes reporting of carcasses discovered incidental to construction and maintenance operations. This system will be in place for the life of the project.

Carcass Removal Trials

Carcass removal studies were conducted during each season near the carcass search plots. Estimates of carcass removal were used to adjust carcass counts for removal bias. Carcass removal includes removal by predation or scavenging, or removal by other means such as being plowed into a field.

Carcass removal trials were spread throughout the year to account for changes in weather, climatic conditions, farming practices, and scavenger densities. The planted carcasses were

located randomly within the carcass removal trial plots. Carcass removal trial plots were located outside the carcass search areas to avoid confusing trial carcasses with actual wind plant related fatalities.

For each trial, eight carcasses of birds of two size classes (four small, and four medium to large) were distributed within two habitat types (CRP grassland and cultivated agriculture). There were eight trials, resulting in 64 trial carcasses used in carcass removal studies for the monitoring year. Small carcasses (i.e., house sparrows, western meadowlark) were used to simulate passerines and rock doves, chukars and mallards were used to simulate medium to large birds such as raptors, game birds and waterfowl. Carcasses were checked for a period of 28 days to determine removal rates. They were checked every day for the first 4 days, and then on Day 7, Day 14, Day 21, and Day 28. At the end of the 28-day period any remaining birds were removed.

Searcher Efficiency Trials

Searcher efficiency studies were conducted in the same areas carcass searches occurred. Trials were conducted throughout the year. Searcher efficiency was estimated by major habitat type (CRP grassland and cultivated agriculture), size of carcass and season. Estimates of searcher efficiency were used to adjust the number of carcasses found, correcting for detection bias.

Personnel conducting searches did not know when trials were scheduled to be conducted. Before the beginning of a standardized carcass search, observer detection trial carcasses were placed at random locations. Each carcass was discreetly marked so that it could be identified as an efficiency trial carcass after it was found. The number and location of the trial carcasses found during the carcass search were recorded. The number of efficiency trial carcasses available for detection during each trial was determined immediately after the trial by the person responsible for distributing the carcasses. Approximately eight carcasses were used during each trial. Carcasses of birds of two different size classes (same classes as in removal studies) were placed in the search area throughout the search period for the searcher to either detect or not detect, resulting in 72 searcher efficiency trial carcasses over the entire year. Small brown birds (house sparrows) were used to simulate bat carcasses.

Statistical Methods

The estimate of the total number of wind facility-related fatalities was based on:

(1) Observed number of carcasses found during standardized carcass searches.
(2) Searcher efficiency expressed as the proportion of planted carcasses found by searchers
(3) Non-removal rate expressed as the length of time a carcass is expected to remain in the study area and be available for detection by the searchers

The following variables and their symbols are used in the equations in the following sections:

c_i	the number of carcasses detected at plot i for a study period of one year
n	the number of search plots
k	the number of turbines searched
$\bar{c}$	the observed average number of carcasses per turbine per year
s	the number of carcasses used in removal trials

s_c the number of carcasses in removal trials that lasted 28 days or longer before being removed

se abbreviation for standard error, which is the square of the sample variance of the mean

t_i the time (days) a carcass remains in the study area before it is removed

$\bar{t}$ the average time (days) a carcass remains in the study area before it is removed

d the total number of carcasses placed in searcher efficiency trials

p the estimated proportion of searcher efficiency trial carcasses found by searchers

N the total number of turbines in the facility

I the average interval between searches in days

$\hat{\pi}_i$ the estimated probability a carcass is available to be found during a search and is found

m_i the estimated annual number of fatalities, adjusted for removal and observer detection bias

Observed Number of Carcasses

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

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

The final estimate of $\bar{c}$ and its standard error were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances and confidence intervals for complicated test statistics. For each iteration of the bootstrap, the 16 plots were sampled with replacement, and $\bar{c}$ was calculated. A total of 5000 bootstrap iterations were used. The reported estimate is the mean of the 5000 bootstrap estimates. The standard deviation of the bootstrap estimates of $\bar{c}$ is the estimated standard error of $\bar{c}$ (se($\bar{c}$)).

Estimation of Carcass Removal

Estimates of carcass removal were used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains at the site before it is removed:

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

This estimator is the maximum likelihood estimator assuming the removal times follow an exponential distribution and there is right-censoring of data. In our application, any trial carcasses still remaining at 28 days were collected, yielding censored observations at 28 days.

The final estimate of $\bar{t}$, the estimated standard error, and 90% confidence limits were calculated using bootstrapping. For each iteration of the bootstrap, the removal times for the trial birds were sampled with replacement, and $\bar{t}$ was calculated. A total of 5000 bootstrap iterations were used. The standard deviation of the bootstrap estimates of $\bar{t}$ is the estimated standard error of $\bar{t}$ (se ($\bar{t}$)). Removal rates were estimated by carcass size (small and large) and season.

Estimation of Searcher Efficiency
Searcher efficiency rates were expressed as p, the proportion of trial carcasses that were detected by searchers. The standard error (square of variance) and 90% confidence limits were calculated by bootstrapping. A total of 5000 bootstrap iterations were used. Searcher efficiency rates were estimated by carcass size and season.

Estimation of the Total Number of Facility-Related Fatalities
To calculate the total number of facility-related fatalities, the actual number of fatalities found was divided by an estimate of the probability a casualty was available to be picked up during a fatality search (probability it was not removed by a scavenger), and was observed (probability of detection). The estimated total number of annual facility-related fatalities (m) is calculated by:

$$m_2 = \frac{N * \bar{c}}{\hat{\pi}_2} \tag{3}$$

where $\hat{\pi}_2$ is calculated assuming the carcass removal times (t_i) follow an exponential distribution.

We calculated fatality estimates for (1) small birds, (2) large birds, (3) all birds and (4) bats. The final reported estimates of m and associated standard errors and 90% confidence intervals were calculated using bootstrapping (Manly 1997) based on a computer program written in SAS.

Raptor Nest Surveys
Active raptor nests (Swainson's hawk, red-tailed hawk and great horned owl) documented within 3 miles of the turbine strings during the 2001 helicopter surveys were visited from the ground during the breeding season in 2002 to determine activity and reproduction.

RESULTS

Birds
Eight fatalities comprised of seven species of birds were found associated with operational wind turbines during the study (Table 1). No fatalities were found at the meteorological tower during the study. Of the eight turbine fatalities, six were passerines and two were Canada geese. The passerines included European starling, brown-headed cowbird, house wren, golden-crowned kinglet, ruby-crowned kinglet, and dark-eyed junco. No raptor mortalities were found during the study.

Five of the fatalities were intact and three were scavenged. All passerine fatalities were found during scheduled fatality searches; the two geese were found by maintenance personnel and were not found during a scheduled search by study personnel. Dead birds were found from 1 m to 72 m away from turbines, and the mean distance was 31 m. Based on the distribution of bird fatalities surrounding turbines, the plot size established for searching was adequate to detect all fatalities (see Gauthreaux 1996).

Inclement weather did not appear to be related to any of the passerine mortalities. Weather was likely a factor in the two Canada goose collision fatalities. Both birds were fresh and it had been foggy and rainy during the previous 24-hour period. Inclement weather has also been identified as a contributing factor in avian collisions with other obstacles, including power lines, buildings, and communications towers (Estep 1989, Howe *et al.* 1995). Nine of the 16 turbines have FAA airplane warning lights that flash white during the day and red after dark. Presence of Federal Aviation Administration (FAA) lighting on turbines did not appear to be related to mortality; only one of the eight birds (the European starling) was found at a lighted turbine.

Table 1. Avian and bat fatalities associated with Phase 1 of the Klondike Wind Plant, February 2002 through February 2003.

Date	Species	Age	Sex	Turbine	Habitat	Condition	Found during Search?	Distance from turbine	Direction from turbine
Birds									
2/14/02	European Starling	A	U	T5	Plowed	Intact	Yes	33	92
8/09/02	Brown-headed Cowbird	J	U	T15	Plowed	Intact	Yes	72	278
8/24/02	House Wren	A	U	T10	Wheat Stubble	Scavenged	Yes	37	250
10/06/02	Golden-crowned Kinglet	A	U	T8	Wheat Stubble	Intact	Yes	19	245
10/18/02	Ruby-crowned Kinglet	A	U	T15	Plowed	Intact	Yes	55	250
11/02/02	Dark-eyed Junco	A	U	T2	Turbine Pad	Intact	Yes	29	236
2/28/02	Canada Goose	A	U	T10	Turbine Pad	Scavenged	No	1	360
12/28/02	Canada Goose	A	U	T10	Turbine Pad	Scavenged	No	3	360
Bats									
5/18/02	Silver-haired Bat	A	U	T13	Fallow	Intact	Yes	30	229
6/17/02	Unidentified *Myotis*	A	U	T15	Plowed	Intact	Yes	8	90
6/29/02	Unidentified *Myotis*	A	U	T6	Turbine Pad	Scavenged	Yes	10	245
9/09/02	Hoary Bat	A	U	T11	CRP	Scavenged	Yes	27	234
9/16/02	Hoary Bat	A	U	T15	Turbine Road	Scavenged	No	15	45
9/20/02	Hoary Bat	A	U	T3	Plowed	Intact	Yes	15	300

Three of the dead birds were found on turbine pads, three were found in plowed fields, and two were found in wheat stubble. Timing of the mortality suggests that the European starling and brown-headed cowbird were local residents. Based on the species, date found, and habitat, the other four passerines were likely fall migrants. Most of these birds were likely nocturnal migrants that collided with turbines at night.

There was some correlation between the species of turbine fatalities and the turbine exposure index we developed based on observations during the baseline study (Johnson *et al.* 2002a) in that Canada goose had the highest predicted risk of any species in the area. There was little

relationship between the exposure index and species of passerine mortalities. This was expected because the exposure index was developed using data on avian abundance and flight behavior collected during daylight hours, which likely differ substantially from abundance and flight behavior of nocturnal migrants.

Bats

Six dead bats were found during the study (Table 1), including three hoary bats, one silver-haired bat, and two unidentified *Myotis* species that were too decomposed to allow for positive identification. All three hoary bat fatalities were found in September, the silver-haired bat was found in May and the two unidentified *Myotis* bats were found in June. All but one of the bats were located during scheduled fatality searches. Three of the bats were intact and three were scavenged. Virtually all scavenging of bat carcasses was done by insects. Two of the bats were found on the turbine pad or access road, two were found in plowed fields, one was found in CRP and one was found in a fallow field. Distances bats were found from turbines ranged from 8 m to 30 m, with an average of 17.5 m. Based on distribution of bat fatalities surrounding turbines, the search plot was more than adequate to detect all bat fatalities associated with turbines (Gauthreaux 1996).

With the exception of silver-haired bat, which is a species of special concern in Oregon, the identified species of bats found associated with turbines appear to be relatively common in the state. As was the case for songbirds, inclement weather did not appear to be related to bat mortality. One bat was found following a rainstorm but the other five apparently collided with turbines under clear weather conditions. Presence of FAA lighting did not appear to be related to bat fatality rates, as three bats were found at lighted and three were found at unlit turbines.

Fatality Search Biases

<u>Searcher Efficiency</u>

During the study, 72 birds were placed for searcher efficiency trials, divided equally among small and large birds (Table 2). Searcher efficiency remained fairly consistent between seasons and varied by size class of bird. For all habitats combined, 75% of the small birds and 92% of the large birds were detected. The overall detection rate for all bird size classes and habitats combined was 83%. Detection rates were higher than most other studies because of the habitat conditions surrounding turbines. Throughout the study, the gravel turbine pads were surrounded by plowed agricultural fields or wheat stubble because wheat crops were not produced adjacent to the turbines. As a result, visibility was excellent within the search plots throughout the study.

Table 2. Number of birds detected during searcher efficiency trials.

		Large Birds			Small Birds	
Season	# Placed	# Found	%Found	# Placed	# Found	% Found
Fall	4	4	100	4	3	75
Winter	12	9	75	12	8	67
Spring	4	4	100	4	3	75
Summer	16	16	100	16	13	81
Overall	36	33	92	36	27	75

Carcass Removal Rates

Sixty-four bird carcasses were used for scavenger removal trials during the study. The mean length of time that carcasses remained in the study area prior to removal was 14.2 days for small and 19.9 days for large carcasses. After seven days in the field, 81% of the large and 59% of the small carcasses remained. By Day 28, 22% of the large and 16% of the small carcasses remained (Figure 2). Potential scavengers observed during the baseline study included raptors, turkey vultures, common ravens, gulls, coyotes and badgers. During summer, the main cause of small carcass removal was scavenging by insects, primarily maggots and carrion beetles.

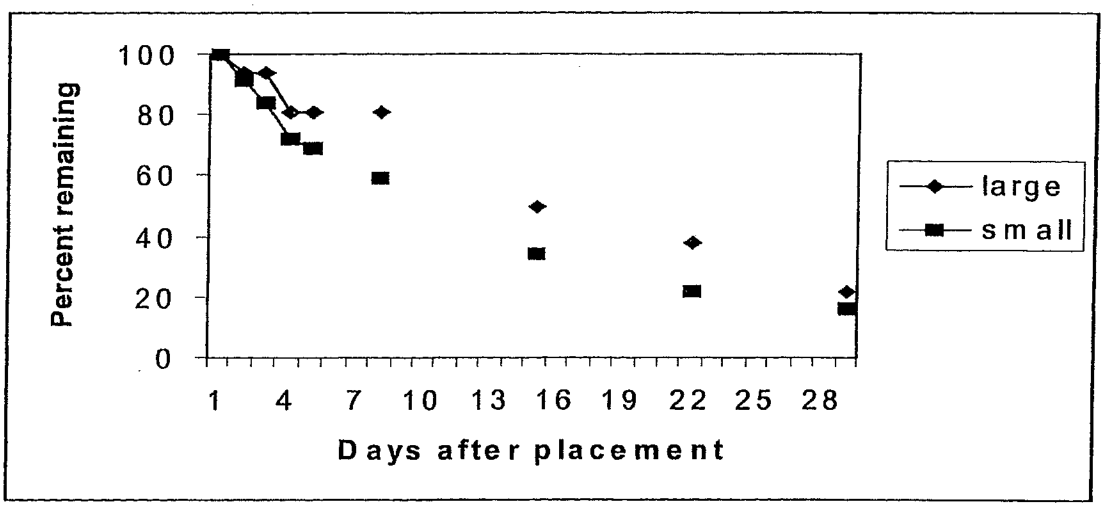

Figure 2. Mean proportion of bird scavenger trial carcasses available for detection over the 28-day interval between carcass searches.

Estimation of the Number of Turbine-Related Fatalities

Birds

Estimated total avian mortality over the one-year study period for the entire windplant was 4 (90% confidence interval [CI] = 2 – 12) large birds, of which none were raptors, and 19 (90% CI = 7 - 34) small birds, for a total of 23 birds (Table 3). The mean number of birds killed per turbine over the 1-year study period was estimated to be 0.26 (90% CI = 0.13 – 0.75) large birds and 1.16 (90% CI = 0.41 – 2.11) small birds, for a total of 1.42 birds per turbine per year.

Bats

Estimated total bat mortality over the one-year study period was 19 (90% CI = 7 - 34) (Table 3). The mean number of bats killed per turbine over the 1-year study period was estimated to be 1.16 (90% CI = 0.41 – 2.12).

Table 3. Annual fatality rate estimates

Group	Number of Fatalities found	Total Mortality Estimate	90% Confidence Interval	No. fatalities per turbine per year	90% Confidence Interval
Small birds	6	18.6	6.5 – 33.7	1.16	0.41 – 2.11
Large birds	2	4.1	2 – 12.0	0.26	0.13 – 0.75
Bats	6	18.6	6.5 – 33.9	1.16	0.41 – 2.12

Raptor Nest Occupancy Near the Wind Plant

Five active raptor nests (2 red-tailed hawk, 2 Swainson's hawk, 1 great horned owl) were documented within 3 miles of the Phase I wind plant during aerial surveys in 2001. The status of these nests was checked on May 8, 2002. The red-tailed hawk nest located about 2.5 miles north of the Phase I turbine string in the NW NW SW of Section 34, T2N R18E was active. The other red-tailed hawk nest located about 1.75 miles east of the turbine strings in the NW NW SW of Section 12, T1N R18E was not active. The great horned owl nest located 1.6 miles east of the turbine strings in the SE NE NE of Section 14, T1N, R18E did not appear to be active. The Swainson's hawk nest located about 3 miles west of the turbine strings in the SE SW SE of Section 19, T1N R18E was apparently not active. The nest closest to the turbine string was a Swainson's hawk nest located 0.25 miles northwest of the turbine strings in the SE NE SW of Section 10, T1N R18E. This nest was active on May 8, 2002 (a Swainson's hawk was incubating eggs on that date). In addition to being within 0.25 miles of the turbine string, this nest was also within 0.25 miles of the access road and O&M facility for the Phase I project.

DISCUSSION

Our data suggest that wind plant-related avian mortality at Klondike is low and involves both resident birds and nocturnal migrant passerines. Mortality of resident breeding birds appears very low, involves common species, and would not likely have any population consequences within the area. The only species with more than one casualty (Canada goose) was found to be very abundant in the area during the baseline study. Over a 1-year period, 4,845 individuals were observed flying over the project area, mostly in the winter. The Canada goose collision

fatality rate is very low in view of the large number of birds using the area, and would not have any population consequences. The nocturnal migrant passerine fatalities all occurred in the fall.

The estimated collision rates for all bird species at Klondike are among the lowest of any wind plant studied in the U.S. (Table 4). Only the Vansycle, Oregon windplant (25 MW facility owned and operated by FPL Energy), which is located in a similar wheat farming setting, has lower bird collision rates than Klondike. Klondike is also one of the few wind plants studied where no raptor fatalities were documented. Furthermore, the rotor swept area of each 1.5 MW GE turbine (3848 m^2) at the Klondike facility is approximately 2.3 times larger than the rotor swept area of the 660 kW Vestes turbine (1661 m^2) at the Vansycle facility. Therefore, fatality rates on a per rotor swept area equivalence basis are nearly identical for the two wind projects.

Table 4. Estimated avian collision fatality rates at U.S. wind plants

Wind Resource Area	# raptors/turbine/year	# birds/turbine/year	Reference
Klondike, OR	0	1.42	This study
Vansycle, OR	0	0.63	Erickson *et al.* 2000
Buffalo Ridge, MN	0.002	2.83	Johnson *et al.* 2000a
Foote Creek Rim, WY	0.036	1.75	Johnson *et al.* 2000b Young *et al.* 2003
Altamont, CA	0.007-0.100 (mean=0.048)	--	Howell and Didonato 1991 Orloff and Flannery 1992 Thelander 2000
Montezuma Hills, CA	0.048	--	Howell and Noone 1992
San Gorgonio, CA	0.01	2.31	McCrary *et al.* 1986
Wisconsin	0	1.29	Howe *et al.* 2002
Buffalo Mountain, TN	0	7.7	Nicholson 2003

Table 5. Estimated bat collision fatality rates at U.S. wind plants.

Wind Resource Area	Bat mortalities per turbine per year	Reference
Klondike, OR 16 turbines	1.2	This study
Buffalo Ridge, MN 281 turbines	2.0	Johnson *et al.* 2003a&b
Northeastern Wisconsin 31 turbines	4.3	Howe *et al.* 2002
Foote Creek Rim, WY 105 turbines	1.3	Johnson *et al.* 2000b, Young *et al.* 2003, Gruver 2002
Buffalo Mountain, TN 3 turbines	28.5	Nicholson 2003
Vansycle, OR 38 turbines	0.7	Erickson *et al.* 2000

The estimated bat collision rate at Klondike is slightly higher than other regional windplants including the Vansycle, Oregon wind plant; however, it is lower than most other wind plants studied across the U.S. (Table 5). On a per rotor swept area equivalence basis, the bat collision rate at the Klondike wind project is less than at the Vansycle wind project. Results of the post-construction monitoring indicate that avian and bat fatality rates are minimal, and that the windplant has apparently not resulted in displacement of breeding raptors.

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BASELINE AVIAN USE AT THE PROPOSED KLONDIKE III WIND POWER PROJECT, OREGON, WINTER 2004–SPRING 2005

FINAL REPORT

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INTRODUCTION

The overall objective of this study was to collect baseline avian information on the spatial and temporal use of birds at the proposed Klondike III Wind Power Project located in Sherman County, Oregon for use in an avian risk assessment. To accomplish this objective, we conducted standard avian point-counts to obtain information on (1) species composition, (2) relative abundance, (3) flight patterns, and (4) flight altitudes of birds, so that (5) an exposure index (a metric for risk assessment) could be calculated for avian species and groups of species.

The Klondike III Wind Power Project is located on ~14,500 acres in Sherman County, Oregon (Fig. 1). It is ~1 mile west of the John Day River at its closest point, ~5 miles south of the Columbia River, and ~12 miles east of the Deschutes River, and ~ 7 miles east of Wasco, Oregon. Grass Valley, which contains an intermittent tributary to the John Day River, extends along the southern edge of the project site. The project will generate up to 273 MW of power and will include up to 165 wind turbines. Although exact turbine dimensions are not yet known, each turbine would consist of ~ 41 m-long blades mounted on 78–80 m towers. Klondike I Wind Power Project is in operation near the Klondike III Wind Power Project site, while Klondike II Wind Power Project is under construction near the Klondike III Wind Power Project site. The tower alignments will be accessed by new and existing 16-foot wide gravel-surfaced roads, the underground collector system will be largely within road corridors. Project elements also include a 4-acre operations and maintenance facility, 19 lay down areas throughout the site, a 3.5-mile 230 kV overhead transmission line, and a new substation.

BACKGROUND

Avian fatalities typically are one of the main concerns when a wind power project is proposed. Proper studies designed to estimate avian use and risk are important, because appropriate siting of wind-energy facilities is one of the best ways to minimize collisions with birds (Nelson and Curry 1995). Meetings that included David Evans & Associates (DEA; the lead contractor on the Klondike III Wind Power Project), ABR, Inc., and the Oregon Department of Fish and Wildlife (ODFW) were held to discuss the potential avian issues at this project and to determine appropriate methods to conduct field studies. All parties agreed to use field methods similar to those used at nearby existing facilities (e.g., the Klondike I Wind Power Project; Johnson et al. 2002), to ensure compatibility and comparability of the data sources for an avian impact assessment. These methods were reviewed and agreed upon by all parties and finalized in February 2005. This report provides a complete description of avian use metrics for both the winter (i.e., 4 November–14 March) and spring (15 March–15 May 2005) periods, and discusses these results in the context of other relevant baseline and operational monitoring data collected at other wind-energy developments in this region.

EXISTING CONDITIONS

The Klondike III Wind Power Project is located in the Deschutes-Columbia Plateau physiographic province. This province is a north-sloping, volcanic plateau that measures over 60,000 sq. mi in Oregon, Washington, and Idaho. This plateau consists of volcanic rocks (basalt) that erupted from vents in central and northeastern Oregon, southeastern Washington, and Idaho, and flowed westward to the Pacific Ocean during the middle Miocene ~6–17 million years ago (Beeson et al. 1989). Topography within the project site is typified by gently rolling to level ground with areas of steep slopes confined to portions of the northeastern and southern margins of the study area that drop down into Grass Valley and several unnamed intermittent tributaries of the John Day River. Elevation in Sherman County varies from North to South: 170 feet ASL along the Columbia River; 1,250–1,500 feet within the project area; ~1,000 feet in Grass Valley, to 3,000 feet in the southern part of the county (Orr et al. 1992).

Located on the eastern side of the Cascade Mountains, the project area predominantly exhibits the continental climate of the Intermountain Region – extreme temperatures and low rainfall (Orr et al. 1992). The Columbia River Gorge, however, also provides a passageway for the normal eastward movement of ocean-conditioned air masses from the Pacific, leading to shorter hot or cool periods than those typical of the

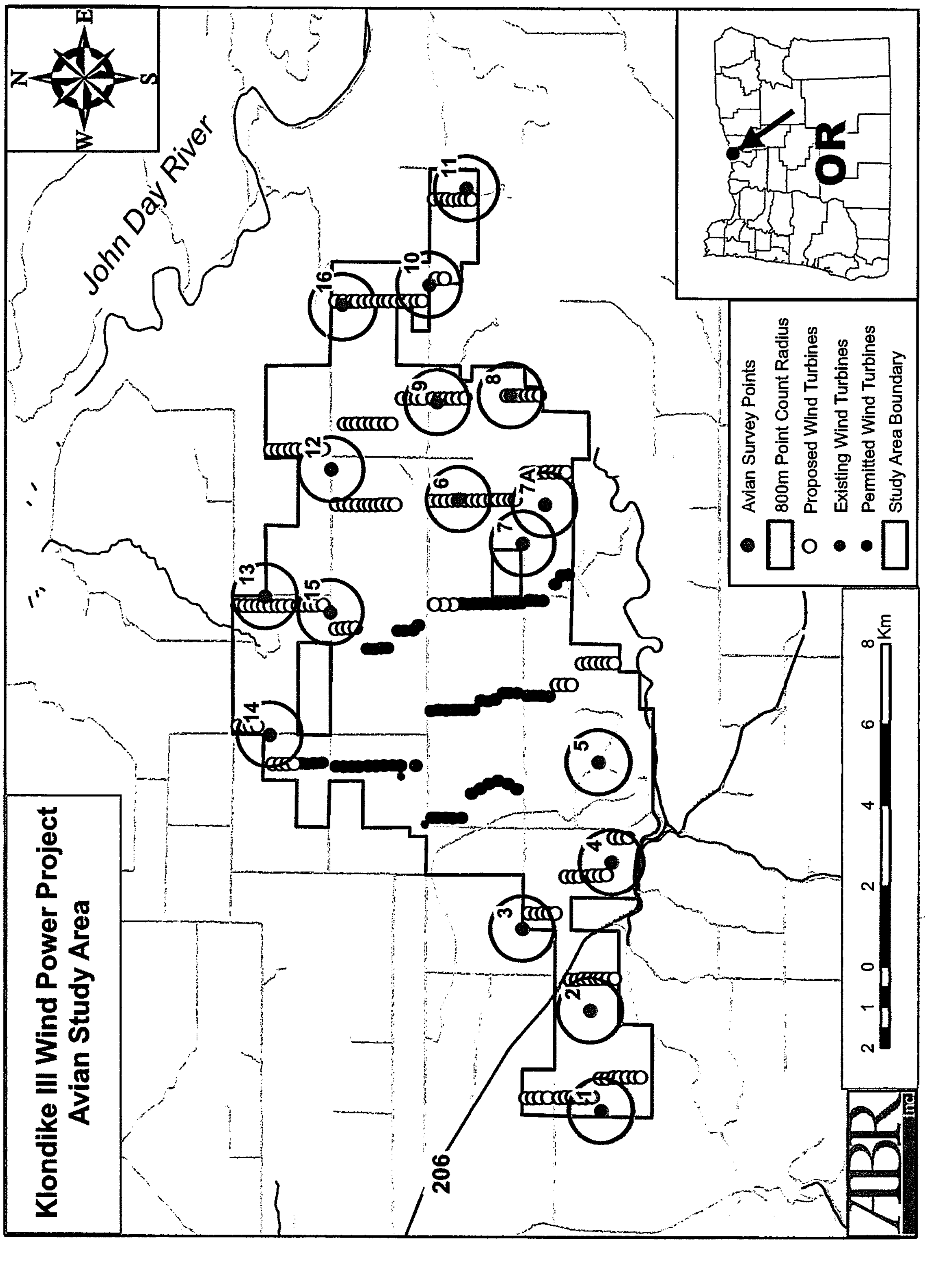

Figure 1. Map of the Klondike Wind Power Project in Sherman County, Oregon showing existing (Klondike I), permitted (Klondike II) and proposed (Klondike III) wind turbines.

Intermountain Region. Most of the annual rainfall in Sherman County occurs between November and February, reflecting the strong influence of marine air masses entering from the Pacific Ocean. Between 1910 and 1995, mean total annual precipitation was 11.76 inches in Wasco, Oregon. Mean monthly rainfall measured between 1971 and 2000 at Moro, Oregon ranged from 0.31 inches in July to 1.57 inches in January. Winter 2004–2005 was atypical, however, and was much drier than average. Between 1971 and 2000, mean minimum and maximum temperatures ranged from 24.7 to 38.3°F during January, to 52.6–81.8°F during August, with extremes ranging from -16 to 106°F (Oregon Climate Center 2005).

Agriculture, particularly dry land wheat, is the predominant land use and there are very few residential dwellings within the project area. Conservation Reserve Program (CRP) lands planted with a mix of native and non-native bunchgrasses are located throughout the project area. Very little acreage of native plant communities (sage, rabbit brush, bunchgrass) remains within the project site, occurring predominantly along the plateau margins and steep side slopes of Grass Valley.

METHODS

We conducted avian point-counts with a variable circular-plot method to obtain information on species-composition and relative abundance of birds (Reynolds et al. 1980) and collected information on avian flight paths and flight altitudes during diurnal hours of winter (4 November 2004–14 March 2005) and spring (15 March–15 May 2005). Survey points were non-overlapping and were chosen to provide excellent viewing conditions and thorough coverage of the proposed turbine strings, representative habitats, and topographical features within the proposed project (Fig. 1). Some survey point locations were modified slightly after conversations with ODFW personnel, resulting in one substantive change in location (i.e., moving point 7 to a nearby location 7A, Fig. 1). Points 7 and 7A were sampled sequentially over time (i.e., point 7 sampled from 4 November–16 December and point 7A sampled from 28 December 2004–15 May 2005).

Our survey protocol was similar to that used in the Klondike I Wind Power Project (Johnson et al. 2002) and in the nearby Scenic Vista (Mabee and Cooper 2004a), Stateline (URS and WEST 2001), Vansycle (URS and WEST 1997), and Columbine Hills (Young et al. 2002) projects. These projects all entailed recording every observation (regardless of distance) although only data from ≤800 m (0.5 mi) radius was used for all the analyses. Although this survey was designed for large birds (i.e., waterfowl and raptors), we recorded all information for all species observed during each survey. Survey starting point locations were alternated among surveys to reduce spatial and temporal bias. All sites were visited on a weekly basis for a total of 27 surveys.

At each Avian Survey Point we visually scanned and listened for birds for a 20-minute period and recorded the following information for each observation: time, number of minutes elapsed from the beginning of each 20 minute point count, species, number of birds and flocks, closest distance to bird(s), flight altitude and direction (when first observed), flight behavior (straight line, local/erratic, circling/soaring), breeding behavior (singing/calling, aerial display, sitting on nest), other behavior (aerial forage, ground forage, perch/sit, unknown), habitat (dry agriculture, canyon, Conservation Reserve Program lands, riparian (forested or non-forested), shrub-steppe, steppe grassland, developed, upland trees, or other), sex, age, Avian Survey Point number, and identification number—a unique number for each raptor or species of interest recorded on maps with the flight path of the bird(s). We also recorded weather information at each Survey Point, including wind direction, wind speed, cloud cover, ceiling elevation, visibility, temperature, and precipitation. In addition to information collected at the Survey Points, for all waterfowl, raptors, and ODFW species of interest (i.e., Long-billed Curlew, Loggerhead Shrike, Grasshopper Sparrow), we recorded species, number of individuals (and flocks), and mapped their flight paths while we were conducting the avian point counts and when traveling between the survey points (termed in-transit observations).

AERIAL RAPTOR NEST SURVEYS

We conducted aerial surveys for raptor nests on 6 and 31 May 2005 within 2 mi of the Klondike III Wind Power Project boundary to gather information on species nesting distributions, nest type, nest substrate, and nest status. The project area was surveyed by flying a series of transects in combination with deviations to investigate potential nest sites (e.g., tree belts or old homesteads) or canyons to ensure complete coverage of the project area. All potential raptor nests were recorded, regardless of activity status. We determined nest status (active or inactive) by observing adult behavior. Active nests were defined by observing an incubating adult, eggs, chicks, or fledglings. Inactive nests were defined by the absence of adults near nests with no eggs and included nests in both good and poor (built in previous years) condition. Nest site locations were recorded with a hand-held GPS unit. All surveys were conducted in an Enstrom F28F helicopter with South County Helicopters of Pendleton, Oregon.

DATA ANALYSIS

We used the same avian-use metrics found in other studies in the region (Young et al. 2002, Mabee and Cooper 2004a). To maintain comparability with other studies in the region, we excluded data from Avian Survey Points that had compromised visibility due to fog (i.e., when average visibility during the survey was <0.5 mi [800 m]), eliminating one survey day from the database. We computed standardized metrics for avian species or species-groups on mean use, percent composition, frequency of occurrence, and an exposure index based on mean use and flight behavior characteristics.

Mean use for a species equals the mean number of individuals/20-min point count for each species and provides an index of avian relative abundance per survey point. This index does not describe density, however, because individuals may have been observed at multiple points (particularly raptors) and data were not corrected for differences in detectability. *Percent composition* equals the mean use for a species/total use for all species, multiplied by 100, and provides an estimate of the relative use of a particular species compared with the use of all other species. *Frequency of occurrence* equals the percentage of 20-min point counts in which a species is observed and it provides an index of how often a species occurs in the project area. Mean use and frequency of occurrence reflect different aspects of abundance, in that mean use is based on the number of individuals (i.e., large flocks can produce high estimates), whereas frequency of occurrence is based on the number of flocks (i.e., it is not influenced by flock size). Together, these two estimates help one to discern the importance of high mean use values.

The *exposure index*, a relative index of collision exposure (R) for bird species can be calculated as:

$$R = A * P_f * P_t$$

Where A = mean use for a species, P_f = percentage of all observations when a species was observed flying (an index of the approximate percentage of time a species spends flying during diurnal hours), and P_t = percentage of all flight observations within the rotor-swept area (RSA). Note that this index accounts only for differences in certain aspects of flight behavior and does not directly address other behaviors or ecological attributes of a particular species that may influence collision exposure (e.g., turbine avoidance behavior, high-density prey locations that may increase foraging behavior, flight movements along proposed turbine strings).

We investigated patterns of temporal variation (winter vs. spring) of mean use values with a Mann-Whitney Test and examined spatial variation (across all survey points) with a Kruskal-Wallis Test. All analyses were conducted in SPSS v. 12.0 (SPSS 2003).

AVIAN FLIGHT PATHS

Flight paths of raptors and species of interest observed at all distances were mapped in the field and later were digitized, summarized, and presented with ArcView GIS software. We mapped flight paths of raptors and other species of interest to summarize seasonal movement patterns throughout the proposed project area. All flight paths presented on Figures 7–12 come from observations within 800 m, so that our statements on the patterns of spatial use in the project area are consistent with the previous information in this report. The presentation of flight paths allows one to examine if flight paths of a species or group of species are concentrated (or overlapping) within circles. Statements on the relative abundance of species (or species groups) among points are based only on mean use values and not flight paths.

RESULTS

ALL DATA

Table 1 provides a list of the species observed, and the corresponding number of individuals and groups observed within 800 m of the Avian Survey Points (with good visibility conditions) during the entire study duration. Although we attempted to minimize duplicate sightings of the same bird(s), these data may contain duplicate sightings because individual birds were not marked and they could have traveled between survey points. All scientific names of species are presented in Table 1.

Twenty-six avian species totaling 7,739 individuals in 481 flocks were observed during winter (Table 1). Waterfowl (predominantly Canada Geese) were fairly common in small to large flocks (3–180 individuals), whereas Trumpeter Swans were only observed in one small group (n = 5). Raptors were generally uncommon, with Rough-legged Hawk being the most numerous (n = 12), followed by smaller numbers of Northern Harrier (n = 4), American Kestrel (n = 3), Golden Eagle (n = 2), and Red-tailed Hawk (n = 1). Passerines such as Horned Lark (n = 5,218) numerically dominated during winter, along with unidentified Blackbirds (n = 1,057; with one large flock of 1,000 individuals), and smaller numbers of Western Meadowlark (n = 93). We did not observe any state- or federally-listed species during winter surveys; although we did observe one Loggerhead Shrike which is classified as 'vulnerable' on the Oregon Department of Fish and Wildlife (ODFW) sensitive species list (ODFW 1997). This designation means that a listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of protective measures and monitoring (ODFW 1997).

Twenty-seven avian species totaling 952 individuals in 560 flocks were observed during spring (Table 1). Waterfowl were absent during the spring surveys. Raptors were generally uncommon, with Swainson's Hawk being the most numerous (n = 15), and fewer observations of Northern Harrier (n = 10), Red-tailed Hawk (n = 9), Prairie Falcon (n = 4), American Kestrel (n = 3), Rough-legged Hawk (n = 2), and an unidentified eagle (n = 1). Common passerines included Horned Lark (n = 523), with fewer numbers of Western Meadowlark (n = 149), Brewer's Blackbird (n = 86), Common Raven (n = 19), and other species (Table 1). We did not observe any state- or federally-listed species during spring surveys; although we did observe Swainson's Hawk (n = 15), Grasshopper Sparrow (n = 6), and Long-billed Curlew (n = 7 beyond our 800 m radius) which are classified as 'vulnerable' on the Oregon Department of Fish and Wildlife (ODFW) sensitive species list (ODFW 1997).

AVIAN USE

SPECIES

Avian use (mean number of individuals within 800 m/20-min point count) is a metric that provides an index of the numbers of birds using the project area and, therefore, evaluates which species may be affected by the project. Because we are interested in making risk comparisons among species at the proposed project facilities, mean use is an appropriate metric for this comparison.

Avian use varied among species and was low for raptors relative to mean use of passerines (Table 2). During winter, raptor mean use was low, ranging from 0.048 for Rough-legged Hawk to 0.004 for Red-tailed Hawk. Overall mean use was dominated by passerines, particularly Horned Lark (20.872 individuals within 800 m/20-min point count), followed by unidentified Blackbird (4.224) and Canada Goose (3.660), with all remaining species having a mean use value of <1.0 (Table 2).

During spring, raptor mean use was also low, ranging from 0.104 for Swainson's Hawk to 0.014 for Rough-legged Hawk. Horned Lark (3.632) and Western Meadowlark (1.035) were the dominant species in the study area, with all remaining species having a mean use value of <1.0 (Table 2).

Avian use by raptors (a species-group of interest) and passerines (the numerically dominant species-group) was graphed to illustrate the

Table 1. Avian species recorded within survey points (≤ 800 m with good visibility) while conducting point counts on the Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

Species-group/species		Winter		Spring		Total	
		Number	Groups	Number	Groups	Number	Group
Wading birds		0	0	1	1	1	1
Great Blue Heron	*Ardea herodias*	0	0	1	1	1	1
Vultures		0	0	2	2	2	2
Turkey Vulture	*Cathartes aura*	0	0	2	2	2	2
Waterfowl		920	14	0	0	920	14
Trumpeter Swan	*Cygnus buccinator*	5	1	0	0	5	1
Canada Goose	*Branta canadensis*	915	13	0	0	915	13
Raptors		35	34	47	45	82	79
Northern Harrier	*Circus cyaneus*	4	4	10	10	14	14
Eagles		4	4	1	1	5	5
Golden Eagle	*Aquila chrysaetos*	2	2	0	0	2	2
Unidentified eagle		2	2	1	1	3	3
Buteos		18	18	26	24	44	42
Red-tailed Hawk	*Buteo jamaicensis*	1	1	9	8	10	9
Swainson's Hawk[1]	*Buteo swainsoni*	0	0	15	14	15	14
Rough-legged Hawk	*Buteo lagopus*	12	12	2	2	14	14
Unidentified buteo		5	5	0	0	5	5
Small falcons		3	2	3	3	6	5
American Kestrel	*Falco sparverius*	3	2	3	3	6	5
Large falcons		1	1	4	4	5	5
Prairie Falcon	*Falco mexicanus*	0	0	4	4	4	4
Unidentified falcon		1	1	0	0	1	1
Unidentified raptor		5	5	1	1	6	6
Upland game birds		12	5	16	14	28	19
Chukar	*Alectoris chukar*	7	3	4	2	11	5
Ring-necked Pheasant	*Phasianus colchicus*	5	2	12	12	17	14

Table 1. Continued

Species-group/species		Winter Number	Winter Groups	Spring Number	Spring Groups	Total Number	Total Groups
Shorebirds		3	3	4	3	7	6
Killdeer	*Charadrius vociferus*	3	3	4	3	7	6
Woodpeckers		1	1	0	0	1	1
Northern Flicker	*Colaptes auratus*	1	1	0	0	1	1
Doves		0	0	1	1	1	1
Mourning Dove	*Zenaida macroura*	0	0	1	1	1	1
Passerines		6768	424	883	496	7651	1220
Songbirds		6721	394	864	479	7585	873
Say's Phoebe	*Sayornis saya*	6	4	3	2	9	6
Western Kingbird	*Tyrannus verticalis*	0	0	2	2	2	2
Loggerhead Shrike[1]	*Lanius ludovicianus*	1	1	0	0	1	1
Unidentified shrike		1	1	0	0	1	1
Horned Lark	*Eremophila alpestris*	5218	317	523	327	5741	644
Violet-green Swallow	*Tachycineta thalassina*	0	0	1	1	1	1
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0	0	2	2	2	2
Barn Swallow	*Hirundo rustica*	0	0	3	3	3	3
Unidentified swallow		0	0	40	2	40	2
American Robin	*Turdus migratoirus*	5	2	0	0	5	2
European Starling	*Sturnus vulgaris*	74	8	1	1	75	9
Spotted Towhee	*Pipilo maculatus*	1	1	0	0	1	1
Grasshopper Sparrow[1]	*Ammodramus savannarum*	0	0	6	6	6	6
Savanna Sparrow	*Passerculus sandwichensis*	0	0	7	5	7	5
Vesper Sparrow	*Pooecetes gramineus*	0	0	1	1	1	1
Dark-eyed Junco	*Junco hyemalis*	1	1	0	0	1	1
Western Meadowlark	*Sturnella neglecta*	93	35	149	105	242	140
Red-winged Blackbird	*Agelaius phoeniceus*	1	1	0	0	1	1
Brewer's Blackbird	*Euphagus cyanocaephalus*	55	3	86	7	141	10

Table 1. Continued.

Species-group/species		Winter		Spring		Total	
		Number	Groups	Number	Groups	Number	Groups
Unidentified blackbird		1056	6	1	1	1057	7
Brown-headed Cowbird	*Molothrus ater*	3	1	0	0	3	1
House Finch	*Carpodacus mexicanus*	0	0	2	1	2	1
Common Redpoll	*Carduelis flammea*	7	1	0	0	7	1
Unidentified finch		12	1	1	1	13	2
Unidentified songbirds		187	11	36	12	223	23
Corvids		47	30	19	17	66	47
American Crow	*Corvus brachyrhynchos*	1	1	0	0	1	1
Common Raven	*Corvus corax*	46	29	19	17	65	46
Total		7739	481	952	560	8691	1041

[1] ODFW sensitive species list (vulnerable)

Table 2. Estimated mean use (mean number of observations within 800 m/20-min point count) of avian species and species groups on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

Species-group/species	Winter	Spring
Wading birds	0	0.007
Great Blue Heron	0	0.007
Vultures	0	0.014
Turkey Vulture	0	0.014
Waterfowl	3.680	0
Trumpeter Swan	0.020	0
Canada Goose	3.660	0
Raptors	0.140	0.326
Northern Harrier	0.016	0.069
Eagles	0.016	0.007
Golden Eagle	0.008	0
Unidentified eagle	0.008	0.007
Buteos	0.072	0.181
Red-tailed Hawk	0.004	0.063
Swainson's Hawk[1]	0	0.104
Rough-legged Hawk	0.048	0.014
Unidentified buteo	0.020	0
Small falcons	0.012	0.021
American Kestrel	0.012	0.021
Large falcons	0.004	0.028
Prairie Falcon	0	0.028
Unidentified falcon	0.004	0
Unidentified raptor	0.020	0.007
Upland game birds	0.048	0.111
Chukar	0.028	0.028
Ring-necked Pheasant	0.020	0.083
Shorebirds	0.012	0.028
Killdeer	0.012	0.028
Woodpeckers	0.004	0
Northern Flicker	0.004	0
Doves	0	0.007
Mourning Dove	0	0.007

Table 2. Continued.

Species-group/species	Winter	Spring
Passerines	27.072	6.132
Songbirds	26.884	6.000
Say's Phoebe	0.024	0.021
Western Kingbird	0	0.014
Loggerhead Shrike[1]	0.004	0
Unidentified shrike	0.004	0
Horned Lark	20.872	3.632
Violet-green Swallow	0	0.007
Northern Rough-winged Swallow	0	0.014
Barn Swallow	0	0.021
Unidentified swallow	0	0.278
American Robin	0.020	0
European Starling	0.296	0.007
Spotted Towhee	0.004	0
Grasshopper Sparrow[1]	0	0.042
Savanna Sparrow	0	0.049
Vesper Sparrow	0	0.007
Dark-eyed Junco	0.004	0
Western Meadowlark	0.372	1.035
Red-winged Blackbird	0.004	0
Brewer's Blackbird	0.220	0.597
Unidentified blackbird	4.224	0.007
Brown-headed Cowbird	0.012	0
House Finch	0	0.014
Common Redpoll	0.028	0
Unidentified finch	0.048	0.007
Unidentified songbirds	0.748	0.250
Corvids	0.188	0.132
American Crow	0.004	0
Common Raven	0.184	0.132

[1] ODFW sensitive species list (vulnerable)

temporal variation in mean use for these groups (Figs. 2 and 3). Compared to passerines, mean use by raptors was very low throughout the entire survey period, but mean use values were significantly higher during spring than winter (Mann-Whitney U = 29.50, $P = 0.023$; Fig. 2). In contrast, mean use by passerines was significantly higher during winter than spring (Mann-Whitney U = 14.50, $P = 0.002$; Fig. 3) and was unusually high on survey number 2 during November. This mean use value was high because of the observation of two large flocks of Horned Larks and unidentified Blackbirds (1,000 individuals/flock) and poor visibility conditions that caused the removal of 8 survey points from the analysis. Mean use of passerines was much lower after the second survey primarily because extremely large flocks of birds were not observed after this time (the largest flock observed was 300 Horned Larks on 2 January 2005).

Avian use by raptors and passerines also was graphed to illustrate the spatial variation in mean use for these groups among the Avian Survey Points (Figs. 4 and 5). During both winter and

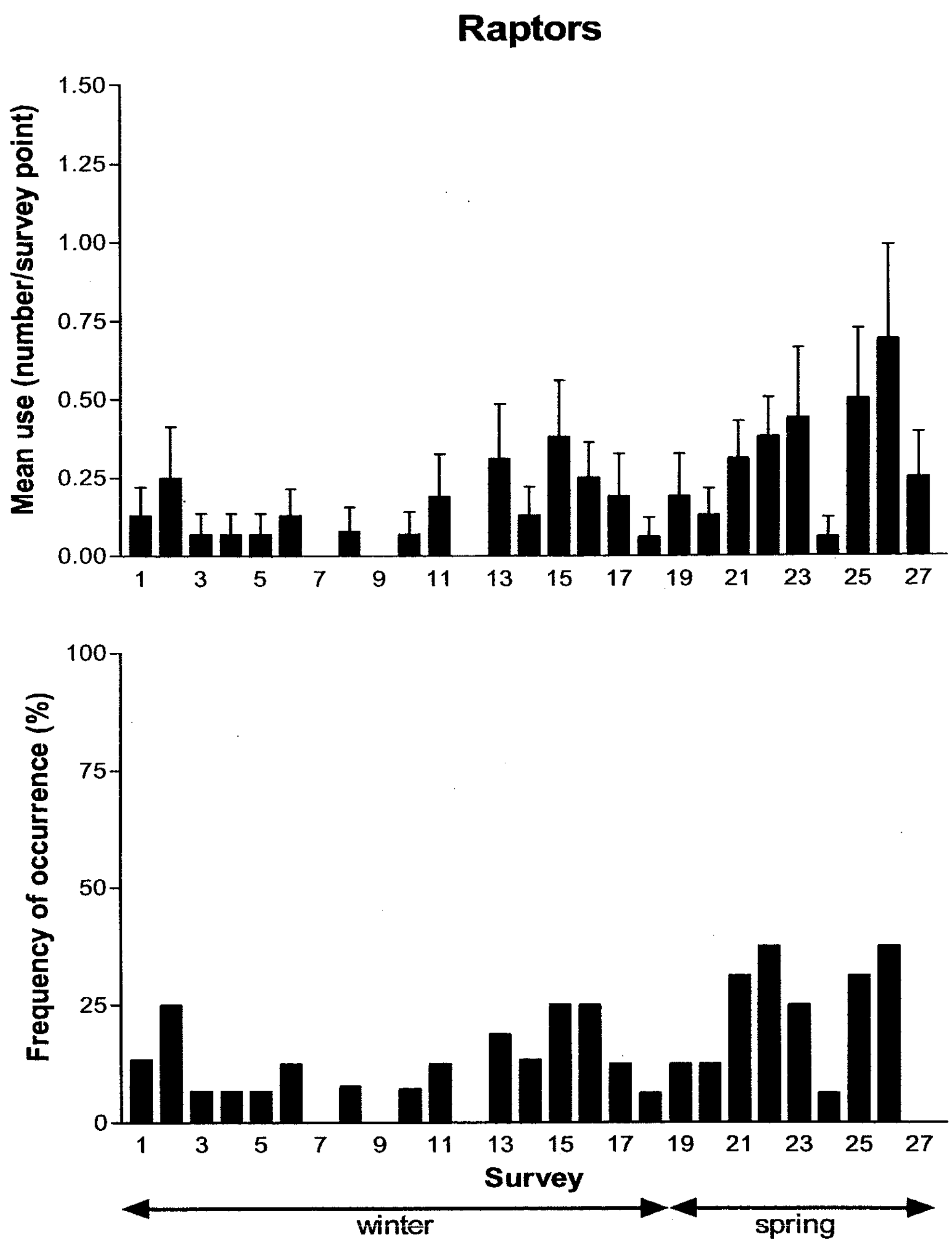

Figure 2. Raptor mean use (number/survey point ± SE) and frequency of occurrence (%) by survey number on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005). Survey numbers correspond to approximately weekly intervals.

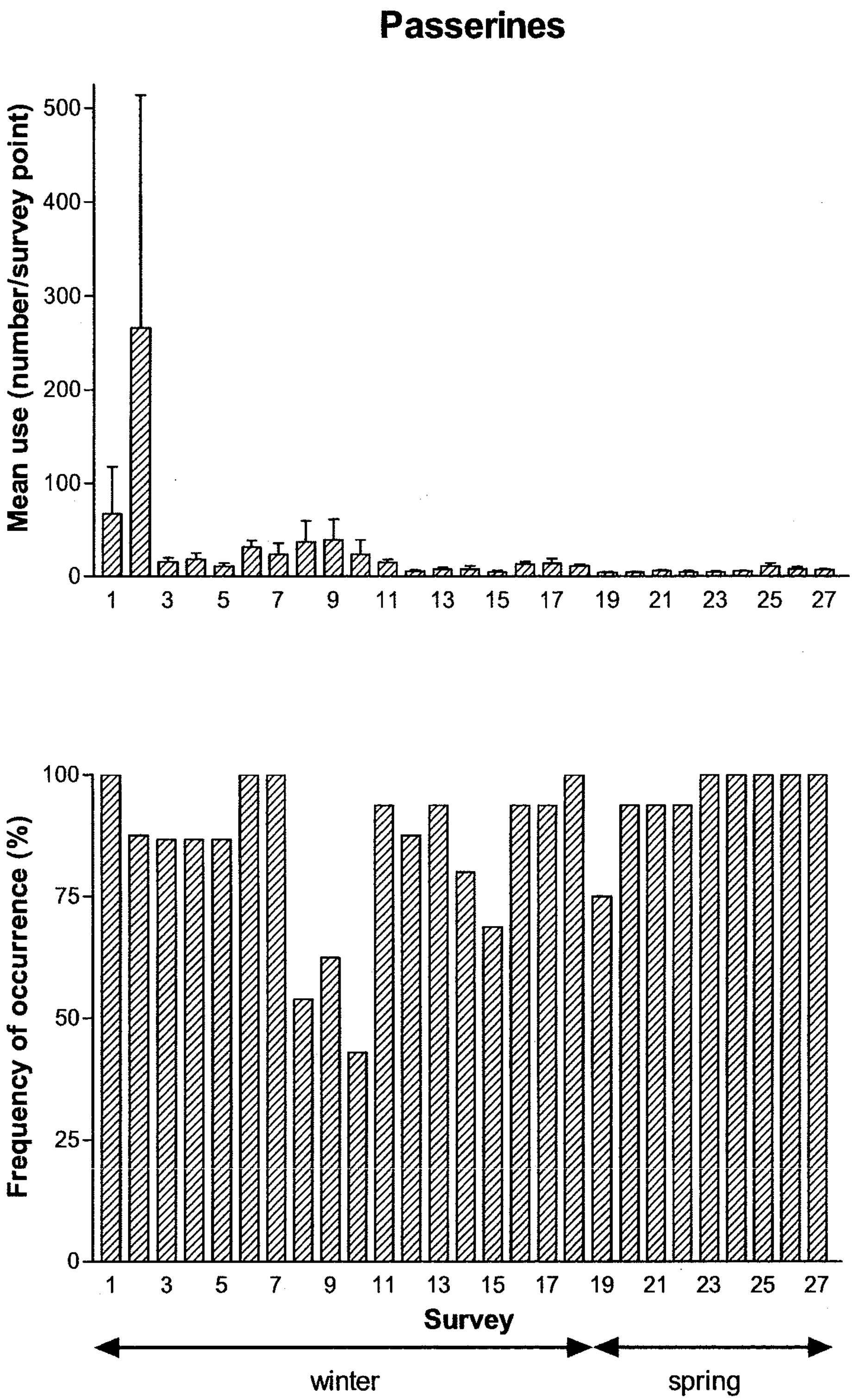

Figure 3. Passerine mean use (number/survey point ± SE) and frequency of occurrence (%) by survey number on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005). Survey numbers correspond to approximately weekly intervals.

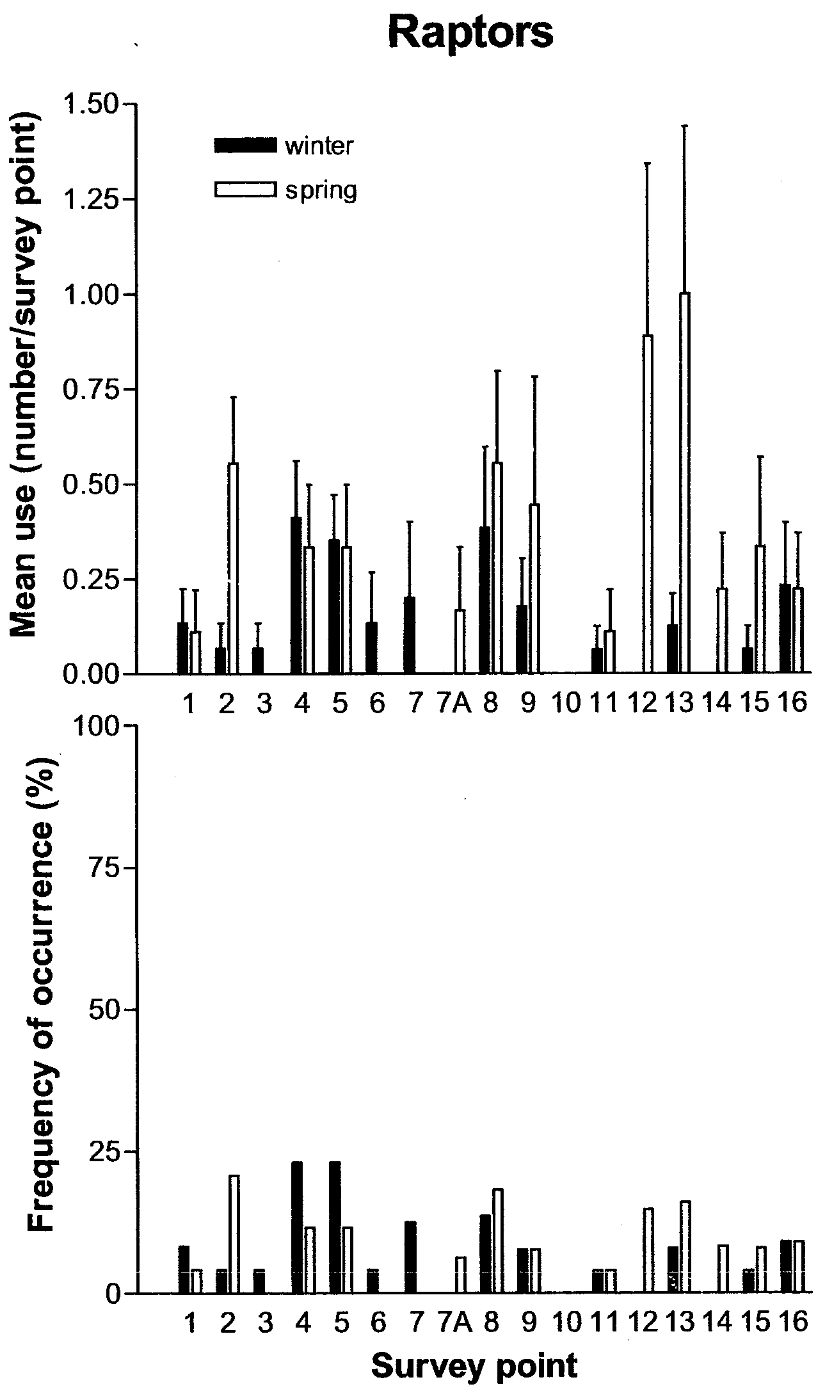

Figure 4. Raptor mean use (number/survey point ± SE) and frequency of occurrence (%) by Avian Survey Point on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

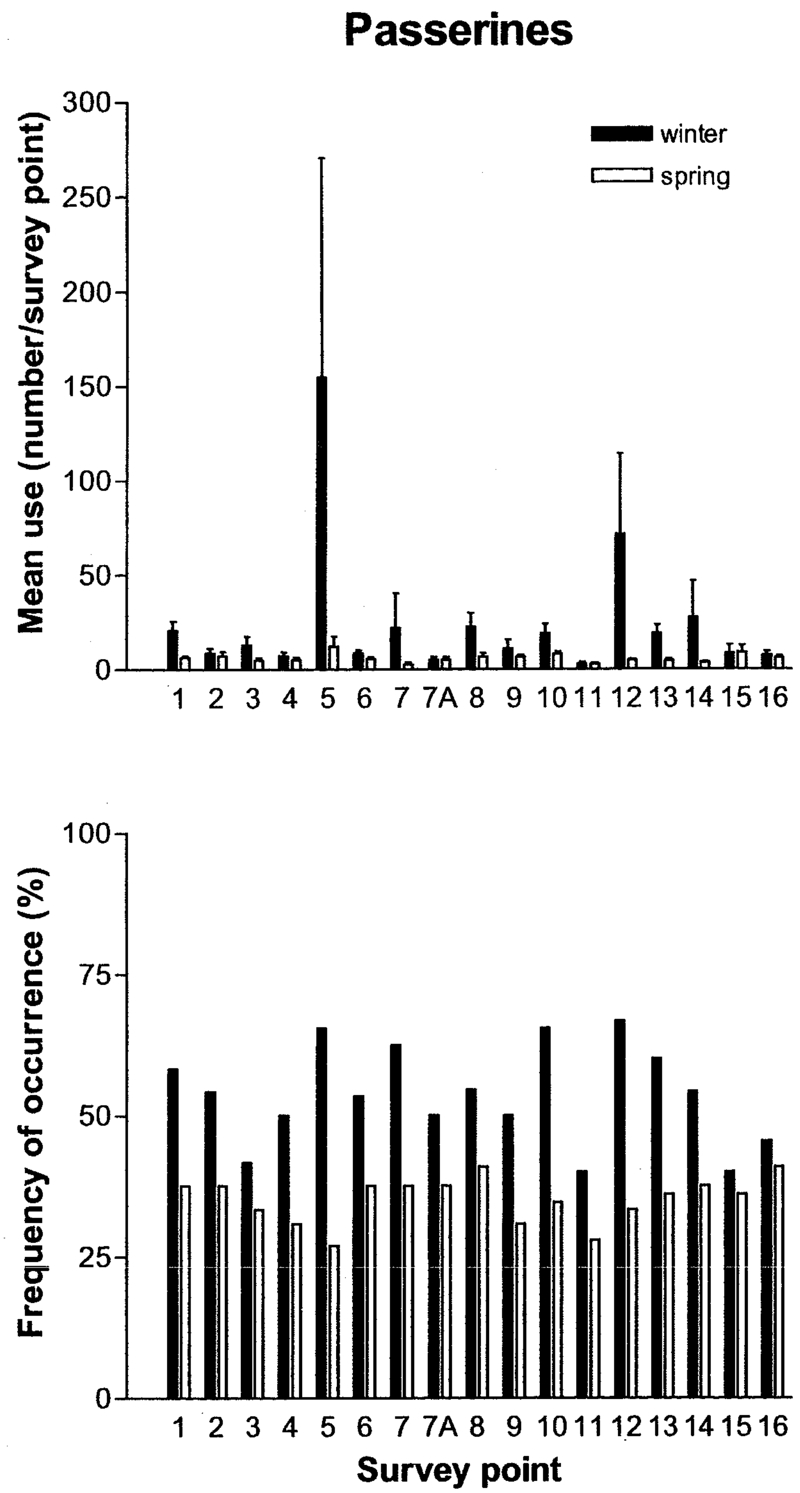

Figure 5. Passerine mean use (number/survey point ± SE) and frequency of occurrence (%) by Avian Survey Point on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

spring, mean use of raptors was substantially lower than that for passerines (note the difference in scale between figures). During winter, raptor use was low throughout all survey points and they were absent from points 7A, 10, 12, and 14 (locations dominated by dry agriculture fields; Fig. 4). Raptor use during spring was also low (relative to passerine use) and was highest at points 12 and 13, whereas they were absent at points 3, 6, and 10 (locations dominated by dry agriculture fields; Fig. 4). The increased use at point 12 was caused by a nesting pair of Swainson's Hawks at this survey point. Mean use of raptors varied significantly across the survey dates during winter (χ^2 = 27.26, P = 0.015) but not during spring (χ^2 = 22.22, P = 0.074; Fig. 4).

Mean use by passerines during winter was highest at Avian Survey Point 5, because of the observation of a large flock of Horned Larks (1,000 individuals) and unidentified Blackbirds (1,000 individuals), and second highest at Point 12, driven by the observation of a large flock of Horned Larks (700 individuals; Fig. 5). Mean use of passerines varied significantly across the survey dates during winter (χ^2 = 4.76, P < 0.001) but not during spring (χ^2 = 15.83, P = 0.324; Fig. 5).

PERCENT COMPOSITION

SPECIES

Percent composition (mean use for a species/total use across all species, multiplied by 100) provides an estimate of the relative use of any particular species, relative to the use by all other species. This metric is particularly useful for identifying whether any one species has a dominant presence in the study area. During winter, waterfowl percent composition values (primarily Canada Goose, 11.82%) were greater than raptors whose values ranged from 0.01% for Red-tailed Hawk to 0.16% for Rough-legged Hawk (Table 3). Passerines, however, were dominant over all other species groups during winter (Table 3). Horned Lark were dominant within passerines, with a percent composition value of 67.42%, followed by unidentified Blackbird (13.65%), with all remaining species (<1%; Table 3).

During spring, waterfowl were absent from the project area, and raptor percent composition values ranged from 1.58% for Swainson's Hawk to 0.21% for Rough-legged Hawk (Table 3). Passerines dominated once again, with Horned Lark (54.94%) followed by Western Meadowlark (15.65%), Brewer's Blackbird (9.03%), and unidentified Swallow (4.20%), with all remaining species (<2%; Table 3).

FREQUENCY OF OCCURRENCE

SPECIES

Frequency of occurrence (percentage of 20-min point counts in which a species was observed) provides an index of how often a species occurs in the project area. In combination with mean use, it allows one to understand the basis of mean-use values. For example, if one large flock of Canada Geese is observed one time, its mean use can be high because it is based on the number of individuals, even though its frequency of occurrence is low. To understand the risks of birds near proposed structures, it is important to understand both how many birds are using the study area (mean use) and how frequently they are using it (frequency of occurrence).

In winter, both waterfowl (primarily Canada Goose; 3.2%) and raptors (0.40%–4.80%, respectively, for Red-tailed Hawk and Rough-legged Hawk) were observed at low frequencies. Passerines were observed at much higher frequencies, with Horned Lark observed on 82.4% of all point counts, followed by Western Meadowlark (13.2%), and Common Raven (10.4%), with all remaining species observed < 4% (Table 4).

In spring, waterfowl were not observed at all, and raptor frequencies varied from 1.39% for Rough-legged Hawk to 6.25% for Swainson's Hawk (Table 4). Passerines were observed at much higher frequencies, with Horned Lark observed on 87.5% of all point counts, followed by Western Meadowlark (48.61%), Common Raven (11.1%), Ring-necked Pheasant (6.9%), Grasshopper Sparrow (3.47%), and Savanna Sparrow (3.47%), with all remaining species observed <3% (Table 4).

The frequency of occurrence of raptors (a group of interest) and passerines (the numerically

Table 3. Estimated percent composition (mean use/total use for all species x 100) of avian species and species groups observed within 800 m of survey points on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

Species-group/species	Winter	Spring
Wading birds	0	0.11
Great Blue Heron	0	0.11
Vultures	0	0.21
Turkey Vulture	0	0.21
Waterfowl	11.89	0
Trumpeter Swan	0.06	0
Canada Goose	11.82	0
Raptors	0.45	4.94
Northern Harrier	0.05	1.05
Eagles	0.05	0.11
Golden Eagle	0.03	0
Unidentified eagle	0.03	0.11
Buteos	0.23	2.73
Red-tailed Hawk	0.01	0.95
Swainson's Hawk[1]	0	1.58
Rough-legged Hawk	0.16	0.21
Unidentified buteo	0.06	0
Small falcons	0.04	0.32
American Kestrel	0.04	0.32
Large falcons	0.01	0.42
Prairie Falcon	0	0.42
Unidentified falcon	0.01	0
Unidentified raptor	0.06	0.11
Upland game birds	0.16	1.68
Chukar	0.09	0.42
Ring-necked Pheasant	0.06	1.26
Shorebirds	0.04	0.42
Killdeer	0.04	0.42
Woodpeckers	0.01	0
Northern Flicker	0.01	0
Doves	0	0.11
Mourning Dove	0	0.11

Species-group/species	Winter	Spring
Passerines	87.45	92.75
Songbirds	86.85	90.76
Say's Phoebe	0.08	0.32
Western Kingbird	0	0.21
Loggerhead Shrike[1]	0.01	0
Unidentified shrike	0.01	0
Horned Lark	67.42	54.94
Violet-green Swallow	0	0.11
Northern Rough-winged Swallow	0	0.21
Barn Swallow	0	0.32
Unidentified swallow	0	4.20
American Robin	0.06	0
European Starling	0.96	0.11
Spotted Towhee	0.01	0
Grasshopper Sparrow[1]	0	0.63
Savanna Sparrow	0	0.74
Vesper Sparrow	0	0.11
Dark-eyed Junco	0.01	0
Western Meadowlark	1.20	15.65
Red-winged Blackbird	0.01	0
Brewer's Blackbird	0.71	9.03
Unidentified blackbird	13.65	0.11
Brown-headed Cowbird	0.04	0
House Finch	0	0.21
Common Redpoll	0.09	0
Unidentified finch	0.16	0.11
Unidentified songbirds	2.42	3.78
Corvids	0.61	2.00
American Crow	0.01	0
Common Raven	0.59	2.00

[1] ODFW sensitive species list (vulnerable)

Table 4. Estimated frequency of occurrence (percentage of surveys on which the species was recorded) of avian species and species groups observed within 800 m of survey points on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

Species-group/species	Winter[1]	Spring[1]
Wading birds	0	0.69
Great Blue Heron	0	0.69
Vultures	0	0.69
Turkey Vulture	0	0.69
Waterfowl	3.60	0
Trumpeter Swan	0.40	0
Canada Goose	3.20	0
Raptors	11.60	23.61
Northern Harrier	1.60	5.56
Eagles	1.60	0.69
Golden Eagle	0.80	0
Unidentified eagle	0.80	0.69
Buteos	6.80	13.19
Red-tailed Hawk	0.40	5.56
Swainson's Hawk[2]	0	6.25
Rough-legged Hawk	4.80	1.39
Unidentified buteo	1.60	0
Small falcons	0.80	2.08
American Kestrel	0.80	2.08
Large falcons	0.40	2.78
Prairie Falcon	0	2.78
Unidentified falcon	0.40	0.69
Unidentified raptor	1.60	0.69
Upland game birds	2.00	8.33
Chukar	1.20	1.39
Ring-necked Pheasant	0.80	6.94
Shorebirds	1.20	2.08
Killdeer	1.20	2.08
Woodpeckers	0.40	0
Northern Flicker	0.40	0
Doves	0	0.69
Mourning Dove	0	0.69
Passerines	84.80	95.14
Songbirds	84.80	94.44
Say's Phoebe	1.60	1.39
Western Kingbird	0	0.69
Loggerhead Shrike[2]	0.40	0
Unidentified shrike	0.40	0
Horned Lark	82.40	87.50
Violet-green Swallow	0	0.69
Northern Rough-winged Swallow	0	0.69
Barn Swallow	0	2.08
Unidentified swallow	0	1.39
American Robin	0.80	0
European Starling	3.20	0.69
Spotted Towhee	0.40	0
Grasshopper Sparrow[2]	0	3.47
Savanna Sparrow	0	3.47
Vesper Sparrow	0	0.69
Dark-eyed Junco	0.40	0
Western Meadowlark	13.20	48.61
Red-winged Blackbird	0.40	0
Brewer's Blackbird	0.80	2.78
Unidentified blackbird	2.00	0.69
Brown-headed Cowbird	0.40	0
House Finch	0	0.69
Common Redpoll	0.40	0
Unidentified finch	0.40	0.69
Corvids	10.80	11.11
American Crow	0.40	0
Common Raven	10.40	11.11

[1] Frequency of occurrence values can not be added within, or acros surveys where passerines were also observed).

[2] ODFW sensitive species list (vulnerable)

dominant species-group) was presented graphically to illustrate the seasonal variation in their occurrence (Figs. 2 and 3). Raptors always occurred much less often than passerines, ranging from ~0–35% occurrence (Fig. 2), whereas passerines occurred from ~ 45–100% occurrence (Fig. 3).

The frequency of occurrence of raptors and passerines also was presented graphically to illustrate the spatial variation in their occurrence among Avian Survey Points (Figs. 4 and 5). Raptors occurred at low frequencies during both winter and spring, and were absent at certain survey points during winter, spring, or both (Fig. 4). Passerines occurred at all survey points during winter and spring, with frequencies generally lower at survey points during spring (Fig. 5).

AVIAN USE, FREQUENCY OF OCCURRENCE, AND PERCENT COMPOSITION

SPECIES GROUPS

Species were aggregated into larger taxonomic groups (when possible) to make them comparable to other studies in the region (Young et al. 2002, Mabee and Cooper 2004a). Mean use during winter was highest for passerines (27.072 individuals within 800 m/20-min count), followed by waterfowl (3.680), upland game birds (0.048), and raptors (0.140; Table 2). Mean use during spring was highest for passerines (6.132), followed by raptors (0.326), and upland game birds (0.111; Table 2).

The percent composition during winter was highest for passerines (87.45%), followed by waterfowl (11.89%), and raptors (0.45%; Table 3). Percent composition during spring was highest for passerines (92.75%), followed by raptors (4.94%), and upland game birds (1.68%; Table 3).

During winter, frequency of occurrence was highest for passerines (84.80%), followed by raptors (11.60%), waterfowl (3.60%), and upland game birds (2.00%; Table 4). During spring, frequency of occurrence was highest for passerines (95.14%), followed by raptors (23.61%), and upland game birds (8.33%; Table 4).

FLIGHT CHARACTERISTICS

The percentage of birds flying within the turbine rotor swept area (RSA) provides an estimate of the likelihood that a species will fly through this area. Because the exact turbine sizes have yet to be selected for this project, we identified the RSA or, zone of potential risk, [i.e., 38–121 m above ground level (agl)] based on the worst-case scenario of turbine dimensions (i.e., the smallest turbine towers coupled with the largest turbine blades).

Numbers and groups of birds flying, percent of birds flying, and flight-altitude categories (in m [agl]) are presented for species and species groups observed within 800 m of Avian Survey Points in Table 5. Flight altitudes were divided into three categories: 37 m agl (below turbine blades), 38–121 m agl (RSA of the turbine—the potential collision zone) and 122 m agl (above turbine blades). Flight height characteristics were generally similar across seasons for all species, hence general statements across both seasons are made below.

In general, most waterfowl flew within (~58%) or above (~33%) the RSA (Table 5). Raptors appeared to be flying mainly below the RSA (~42%), but substantial proportions also were observed within the RSA (~29%) and above the RSA (~29%; Table 5). Species differences were strong, with Northern Harrier, American Kestrel, and Prairie Falcon generally flying below the RSA, Golden Eagle (n = 1) always flying within the RSA, and the buteos (Red-tailed Hawk, Swainson's Hawk, Rough-legged Hawk) generally flying below or within the RSA (Table 5). Passerines flew primarily (>84%) below the RSA, with smaller percentages within the RSA (Table 5). Patterns generally were similar for the two major types of passerines observed during this study, songbirds and corvids (Table 5).

EXPOSURE INDEX

The Exposure Index is a relative measure of the risk that each species will come into contact with a turbine blade. The Exposure Index is the product of a species' mean use, the percentage of time spent flying, and the percentage of time that a bird will fly within the RSA and is presented for

Table 5. Flight height characteristics and percent of avian species and species groups observed flying within 800 m of survey points on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005). Values represent percentages of birds flying below the rotor swept area (RSA < 37 m), within RSA (38–121 m), and above RSA (> 122 m).

	Groups flying		Birds flying		% individual flying		Flight altitude (%)					
							Winter			Spring		
Species-group/species	W	S	W	S	W	S	<RSA	RSA	>RSA	<RSA	RSA	>RSA
Wading birds	0	1	0	1	0	100.0	0	0	0	0	100.0	0
Great Blue Heron	0	1	0	1	0	100.0	0	0	0	0	100.0	0
Vultures	0	2	0	2	0	100.0	0	0	0	100.0	0	0
Turkey Vulture	0	2	0	2	0	100.0	0	0	0	100	0	0
Waterfowl	10	0	556	0	60.4	0	9.0	58.1	32.9	0	0	0
Trumpeter Swan	1	0	5	0	100.0	0	0	100.0	0	0	0	0
Canada Goose	9	0	551	0	75.4	0	9.1	57.7	33.2	0	0	0
Raptors	34	45	35	47	68.6	87.2	41.7	29.2	29.2	61.0	29.3	9.8
Northern Harrier	3	10	3	10	75.0	100.0	100.0	0	0	90	10	0
Eagles	4	1	4	1	100.0	100.0	0	75.0	25.0	0	100.0	0
Golden Eagle	2	0	2	0	100.0	0	0	100.0	0	0	0	0
Unidentified eagle	2	1	2	1	100.0	100.0	0	50.0	50.0	0	100.0	0
Buteos	10	19	10	21	55.6	80.8	50.0	30.0	20.0	47.6	33.3	19.0
Red-tailed Hawk	0	8	0	9	0	100.0	0	0	0	55.6	33.3	11.1
Swainson's Hawk[1]	0	11	0	12	0	85.7	0	0	0	41.7	33.3	25.0
Rough-legged Hawk	9	0	9	0	100.0	0	55.6	33.3	11.1	0	0	0
Unidentified buteo	1	0	1	0	100.0	0	0	0	100.0	0	0	0
Small falcons	1	3	1	3	33.3	100.0	100.0	0	0	66.7	33.3	0
American Kestrel	1	3	1	3	100.0	100.0	100.0	0	0	66.7	33.3	0
Large falcons	1	3	1	3	100.0	75.0	100.0	0	0	66.7	33.3	0
Prairie Falcon	0	3	0	3	0	100.0	0	0	0	66.7	33.3	0
Unidentified falcon	1	0	1	0	100.0	0	100.0	0	0	0	0	0
Unidentified raptor	5	1	5	1	100.0	100.0	0	20.0	80.0	0	100	0

Table 5. Continued.

Species-group/species	Groups flying		Birds flying		% individual flying		Flight altitude (%)					
							Winter			Spring		
	W	S	W	S	W	S	<RSA	RSA	>RSA	<RSA	RSA	>RSA
Upland game birds	2	1	5	2	41.7	12.5	100.0	0	0	0	0	100
Chukar	1	1	3	2	100.0	100.0	100.0	0	0	100.0	0	0
Ring-necked Pheasant	1	0	2	0	100.0	0	100.0	0	0	0	0	0
Shorebirds	2	2	2	3	66.7	75.0	100.0	0	0	100.0	0	0
Killdeer	2	2	2	3	66.7	100.0	100.0	0	0	100.0	0	0
Doves	0	1	0	1	0	100.0	0	0	0	100.0	0	0
Mourning Dove	0	1	0	1	0	100.0	0	0	0	100.0	0	0
Passerines	424	496	6768	883	83.5	64.6	84.2	15.6	0.2	89.0	10.8	0.2
Songbirds	274	316	5607	551	83.4	63.8	84.3	15.6	0.1	89.7	10.3	0
Say's Phoebe	0	1	0	1	0	100.0	0	0	0	100.0	0	0
Western Kingbird	0	1	0	1	0	50.0	0	0	0	100.0	0	0
Horned Lark	253	256	4477	397	97.4	82.0	79.4	20.6	0	92.3	7.7	0
Violet-green Swallow	0	1	0	1	0	100.0	0	0	0	100.0	0	0
Northern Rough-winged Swallow	0	2	0	2	0	100.0	0	0	0	50.0	50.0	0
Barn Swallow	0	3	0	3	0	100.0	0	0	0	100.0	0	0
Unidentified swallow	0	2	0	40	0	100.0	0	0	0	97.5	2.5	0
European Starling	2	1	2	1	100.0	100.0	100.0	0	0	100.0	0	0
Savanna Sparrow	0	3	0	5	0	100.0	0	0	0	100.0	0	0
Western Meadowlark	6	28	22	38	100.0	62.3	100.0	0	0	100.0	0	0
Brewer's Blackbird	2	3	38	22	100.0	28.6	100.0	0	0	22.7	77.3	0
Unidentified blackbird	3	1	1010	1	97.7	100.0	100.0	0	0	100.0	0	0
Brown-headed Cowbird	1	0	3	0	100.0	0	100.0	0	0	0	0	0
House Finch	0	1	0	2	0	100.0	0	0	0	100.0	0	0
Unidentified finch	0	1	0	1	0	100.0	0	0	0	100.0	0	0
Unidentified songbirds	7	12	55	36	76.39	100.0	81.8	7.3	10.9	80.6	19.4	0
Corvids	28	17	44	19	93.62	100	77.3	20.5	2.3	68.4	26.3	5.3
American Crow	1	0	1	0	100.0	0	0	0	100.0	0	0	0
Common Raven	27	17	43	19	97.7	100.0	79.1	20.9	0	68.4	26.3	5.3

[1] ODFW sensitive species list (vulnerable)

species and species groups in Table 6. The Exposure Index assumes that birds in the RSA will not attempt to avoid the turbine blades or be able to pass through the turbine blades. Although both of these assumptions are unrealistic, few data are available to be able to model these avoidance variables—hence they are currently not part of the exposure index.

During winter, Horned Lark had the highest exposure index of any species (4.188), followed by Canada Goose (1.592), with the remaining species having very low exposure indices relative to these species (Table 6). Species groups showed the same pattern, with passerines (3.526) and waterfowl (1.291) having the highest exposure indices, followed by raptors (0.028; Table 6). During spring, Horned Lark had the highest exposure index of any species (0.229), followed by Red-winged Blackbird (0.132), with the remaining species having very low exposure indices relative to these species (Table 6). Species groups showed the same pattern, with passerines (0.428) having the highest exposure indices, followed by raptors (0.083; Table 6).

AERIAL RAPTOR NEST SURVEYS

We conducted aerial surveys for nests of large raptors on 6 May 2005 and 31 May 2005. Across both surveys we located 20 active (including Red-tailed Hawk, Swainson's Hawk, Great Horned Owl, and Common Raven), 10 inactive, and 4 unknown status nests (Fig. 6; Table 7). Although the survey was designed primarily to determine nest status (active or inactive), we also noted nest substrate and nest fate when possible. Most nests (29 of 34) were located in deciduous trees. Of the 20 active nests observed during the surveys, 14 nests contained nestlings or fledglings (Table 7).

AVIAN FLIGHT PATHS

Flight paths of waterfowl or raptors did not appear concentrated (or overlapping) during winter (Fig. 7) or spring (Fig. 8) at any of the Avian Survey Points (1–5) located in the southwestern section of the project. Flight paths of raptors also did not appear concentrated during winter (Fig. 9) or spring (Fig. 10) at Avian Survey Points 6–11 in the southeastern section of the project. Flight paths of Canada Geese, however, appeared concentrated during winter near avian survey points 13 and 15 (Fig. 11) in the northern section of the project, but waterfowl were absent during spring (Fig. 12). Raptor flight paths appeared more concentrated during spring near points 13 and 15 (Fig. 12) and flight paths of Swainson's Hawk appeared more numerous near point 12 because of their nest site at this point. ODFW sensitive species such as Loggerhead Shrike were only observed once at Point 12 (Fig. 13), whereas Grasshopper Sparrows were observed several times in shrub-steppe or CRP habitat at points 4, 10, and 16 (Fig. 13).

DISCUSSION

Baseline avian-use studies, coupled with an avian risk-assessment protocol, are important tools to assess the likelihood of bird–turbine collisions at proposed wind power projects. Proper interpretation of these studies is vital to making appropriate siting recommendations for wind power projects, so that avian collisions with wind turbines may be minimized (Nelson and Curry 1995). Crucial to this interpretation is an understanding of a species' natural history throughout the annual cycle. Overall, we have compared the results of this study with other studies at wind projects to make general assessments of avian collision risk with turbines. Our comparison of the avian use statistics and assessments of the potential collision risk are made using general terms (i.e., low, moderate, high) and are relative to the avian use statistics and collision fatalities found at other projects in the Western United States.

In this study, the avian use metrics were combined with flight-altitude characteristics (percent of time birds fly, percent of time birds fly within the RSA of a turbine) to produce an exposure index—a relative measure of the risk of each species' coming into contact with a turbine blade. Although this combination of metrics is a logical one that may help determine a species relative risk of collision, it does not account for avoidance behavior (the ability of birds to detect and avoid wind turbines), the probability of birds to pass through the rotor swept area, or other facets of a species' natural history and behavior that may

Table 6. Exposure indices (mean use x percent flying percent flying within the rotor-swept area [RSA]) calculated for avian species and species groups observed within 800 m of survey points on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005).

Species-group/species	Winter				Spring			
	Mean use	Percent individual flying	Percent flying in RSA	Exposure index	Mean use	Percent flying	Percent flying in RSA	Exposure index
Wading birds	0	0	0	0.000	0.007	100.0	100.0	0.007
Great Blue Heron	0	0	0	0.000	0.007	100.0	100.0	0.007
Vultures	0	0	0	0.000	0.014	100.0	0	0.000
Turkey Vulture	0	0	0	0.000	0.014	100.0	0	0.000
Waterfowl	3.680	60.4	58.1	1.291	0	0	0	0.000
Trumpeter Swan	0.020	100.0	100.0	0.020	0	0	0	0.000
Canada Goose	3.660	75.4	57.7	1.592	0	0	0	0.000
Raptors	0.140	68.6	29.2	0.028	0.326	87.2	29.3	0.083
Northern Harrier	0.016	75.0	0	0.000	0.069	100.0	10.0	0.007
Eagles	0.016	100.0	75.0	0.012	0.007	100.0	100.0	0.007
Golden Eagle	0.008	100.0	100.0	0.008	0	0	0	0.000
Unidentified Eagle	0.008	100.0	50.0	0.004	0.007	100.0	10.0	0.001
Buteos	0.072	55.6	30.0	0.012	0.181	80.8	33.3	0.049
Red-tailed Hawk	0.004	0	0	0.000	0.063	100.0	33.3	0.021
Swainson's Hawk[1]	0	0	0	0.000	0.104	85.7	33.3	0.030
Rough-legged Hawk	0.048	100.0	33.3	0.016	0.014	0	0	0.000
Unidentified Buteo	0.020	100.0	0	0.000	0	0	0	0.000
Small falcons	0.012	33.3	0	0.000	0.021	100.0	33.3	0.007
American Kestrel	0.012	100.0	0	0.000	0.021	100.0	33.3	0.007

Table 6. Continued.

Species-group/species	Winter Mean use	Winter Percent individual flying	Winter Percent flying in RSA	Winter Exposure index	Spring Mean use	Spring Percent flying	Spring Percent flying in RSA	Spring Exposure index
Large falcons	0.004	100.0	0	0.000	0.028	75.0	33.3	0.007
Prairie Falcon	0	0	0	0.000	0.028	100.0	33.3	0.009
Unidentified falcon	0.004	100.0	0	0.000	0	0	0	0.000
Unidentified raptor	0.020	100.0	20.0	0.004	0.007	100.0	100.0	0.007
Upland game birds	0.048	41.7	0	0.000	0.111	12.5	0	0.000
Chukar	0.028	100.0	0	0.000	0.028	100.0	0	0.000
Ring-necked Pheasant	0.020	100.0	0	0.000	0.083	0	0	0.000
Shorebirds	0.012	66.7	0	0.000	0.028	75.0	0	0.000
Killdeer	0.012	66.7	0	0.000	0.028	100.0	0	0.000
Doves	0	0	0	0.000	0.007	100.0	0	0.000
Mourning Dove	0	0	0	0.000	0.007	100.0	0	0.000
Passerines	27.072	83.5	15.6	3.526	6.132	64.6	10.8	0.428
Songbirds	26.884	83.4	15.6	3.498	6.0	63.8	10.3	0.394
Say's Phoebe	0.024	0	0	0.000	0.021	100.0	0	0.000
Western Kingbird	0	0	0	0.000	0.014	50.0	0	0.000
Loggerhead Shrike[1]	0.004	0	0	0.000	0	0	0	0.000
Unidentified shrike	0.004	0	0	0.000	0	0	0	0.000
Horned Lark	20.872	97.4	20.6	4.188	3.632	82.0	7.7	0.229
Violet-green Swallow	0	0	0	0.000	0.007	100.0	0	0.000
Northern Rough-winged Swallow	0	0	0	0.000	0.014	100.0	50.0	0.007
Barn Swallow	0	0	0	0.000	0.021	100.0	0	0.000
Unidentified swallow	0	0	0	0.000	0.278	100.0	2.5	0.007
American Robin	0.020	0	0	0.000	0	0	0	0.000
European Starling	0.296	100.0	0	0.000	0.007	100.0	0	0.000

Table 6. Continued.

Species-group/species	Winter				Spring			
	Mean use	Percent individual flying	Percent flying in RSA	Exposure index	Mean use	Percent flying	Percent flying in RSA	Exposure index
Spotted Towhee	0.004	0	0	0.000	0	0	0	0.000
Grasshopper Sparrow[1]	0	0	0	0.000	0.042	0	0	0.000
Savanna Sparrow	0	0	0	0.000	0.049	100.0	0	0.000
Vesper Sparrow	0	0	0	0.000	0.007	0	0	0.000
Dark-eyed Junco	0.004	0	0	0.000	0	0	0	0.000
Western Meadowlark	0.372	100.0	0	0.000	1.035	62.3	0	0.000
Red-winged Blackbird	0.004	0	0	0.000	0	0	0	0.000
Brewer's Blackbird	0.220	100.0	0	0.000	0.597	28.6	77.3	0.132
Unidentified blackbird	4.224	97.7	0	0.000	0.007	100.0	0	0.000
Brown-headed Cowbird	0.012	100.0	0	0.000	0	0	0	0.000
House Finch	0	0	0	0.000	0.014	100.0	0	0.000
Common Redpoll	0.028	0	0	0.000	0	0	0	0.000
Unidentified finch	0.048	0	0	0.000	0.007	100.0	0	0.000
Unidentified songbirds	0.748	76.39	7.3	0.042	0.250	100.0	19.4	0.049
Corvids	0.188	93.62	20.5	0.036	0.132	100.0	26.3	0.035
American Crow	0.004	100.0	0	0.000	0	0	0	0.000
Common Raven	0.184	97.7	20.9	0.038	0.132	100.0	26.3	0.035

[1] ODFW sensitive species list (vulnerable)

Table 7. Characteristics of raptor nests observed during aerial surveys of the proposed Klondike III Wind Power Project, Oregon, on 6 May 2005 and 31 May 2005. Values represent number of nests.

		Nest substrate				
Nest status/species	Total nests	Deciduous tree	Evergreen tree	Cliff	Building	Nestling/fledgling
Active[1]						
Red-tailed Hawk	11	9	2	0	0	8
Swainson's Hawk[2]	4	4	0	0	0	1
Unidentified buteo	1	1	0	0	0	0
Great-horned Owl	4	3	0	0	1	4
Common Raven	1	0	0	0	1	1
Inactive[3]	10	9	0	1	0	0
Unknown[4]						
Red-tailed Hawk	3	3	0	0	0	0
Unidentified buteo	1	1	0	0	0	0
Total	34	29	2	1	2	14

[1] Active nest= presence of incubating adult, eggs, chicks, or fledglings
[2] ODFW sensitive species list (vulnerable)
[3] Inactive nest=absence of adults near nest with no eggs
[4] Unknown=presence of adults near nest with no eggs

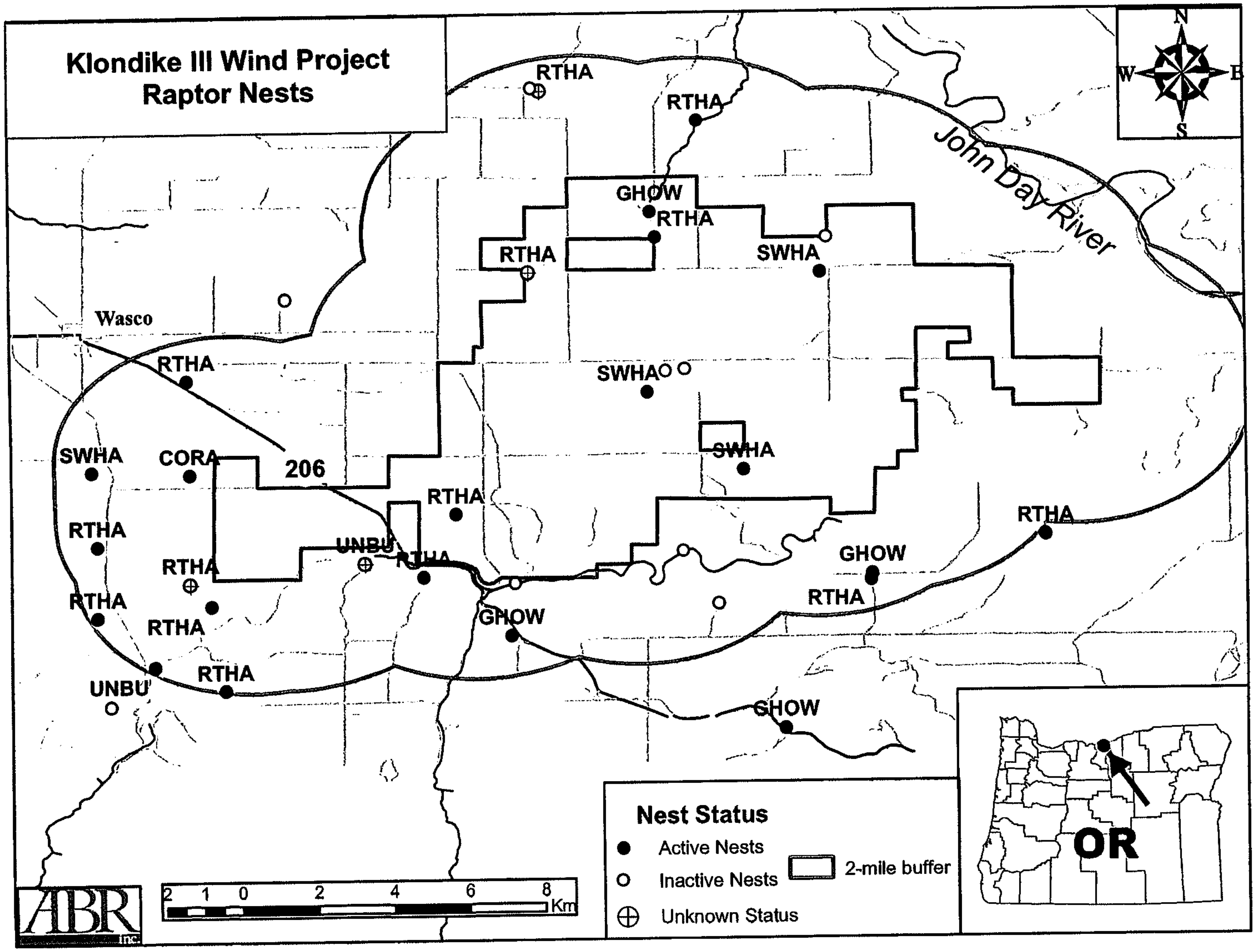

Figure 6. Locations of raptor nests observed during aerial surveys of the proposed Klondike III Wind Power Project, Oregon, on 6 May 2005 and 31 May 2005. Species alpha codes are as follows: RTHA = Red-tailed Hawk, SWHA = Swainson's Hawk, UNBU = Unidentified buteo, GHOW = Great-horned Owl, CORA = Common Raven. Active nest equals presence of incubating adult, eggs, chicks, or fledglings. Inactive nest equals absence of adults near nest with no eggs.

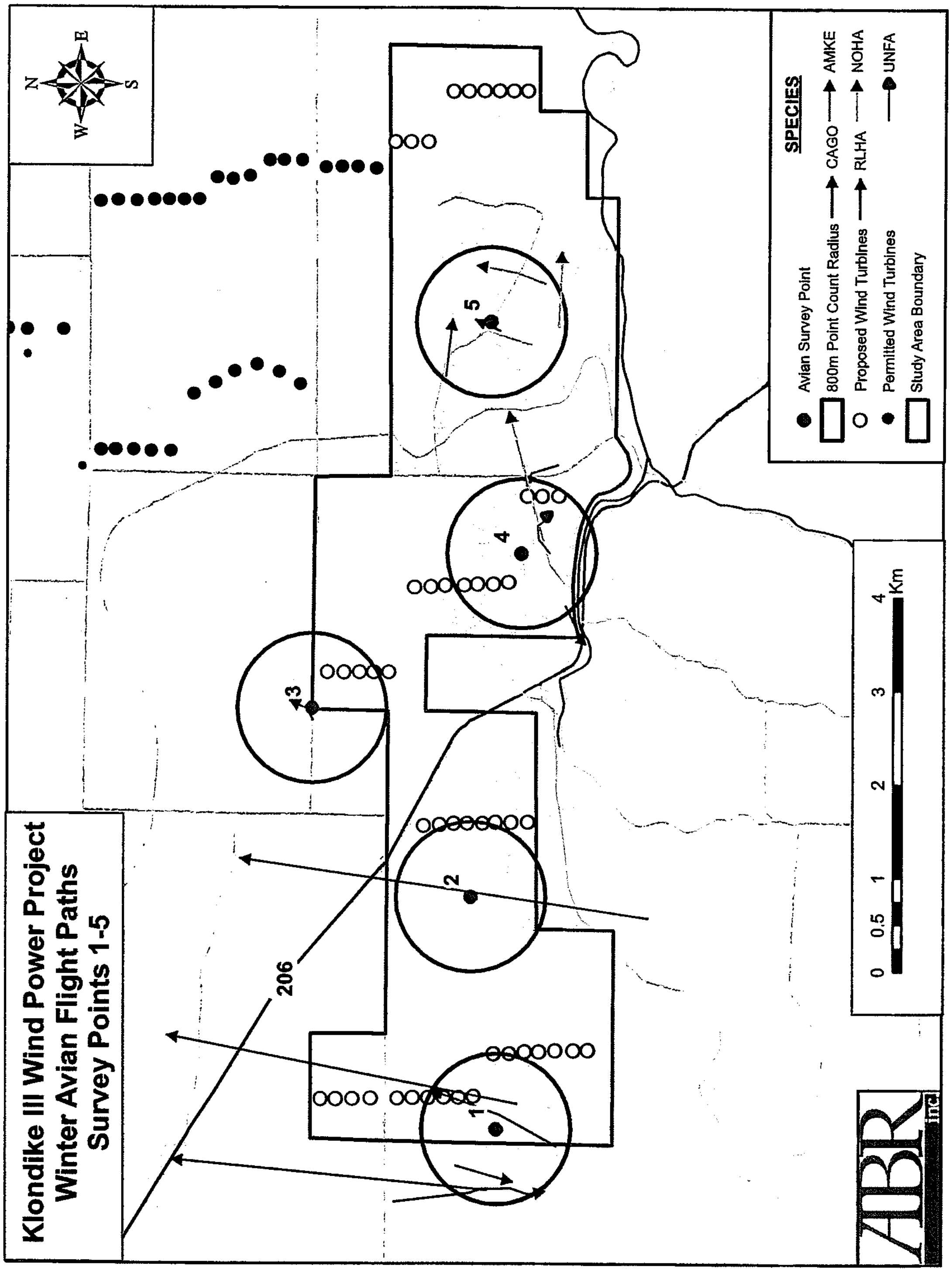

Figure 7. Avian flight paths observed on Avian Survey Points 1–5 of the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005). Species alpha codes are as follows: CAGO = Canada Goose, AMKE = American Kestrel, RLHA = Rough-legged Hawk, NOHA = Northern Harrier, UNFA = Unidentified falcon.

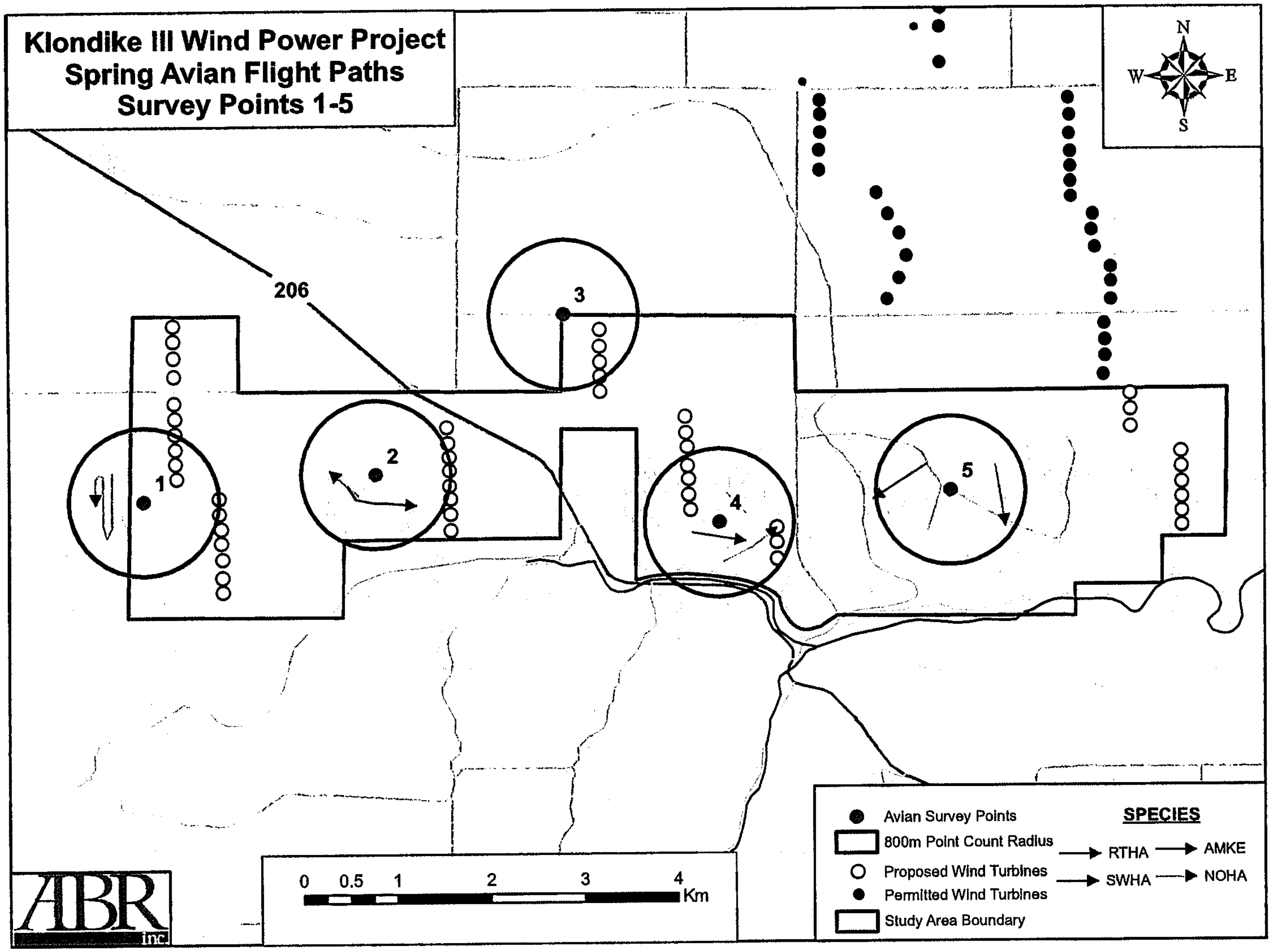

Figure 8. Avian flight paths observed on Avian Survey Points 1–5 of the proposed Klondike III Wind Power Project, Oregon, during spring (15 March 2005–15 May 2005). Species alpha codes are as follows: RTHA = Red-tailed Hawk, AMKE = American Kestrel, SWHA = Swainson's Hawk, NOHA = Northern Harrier.

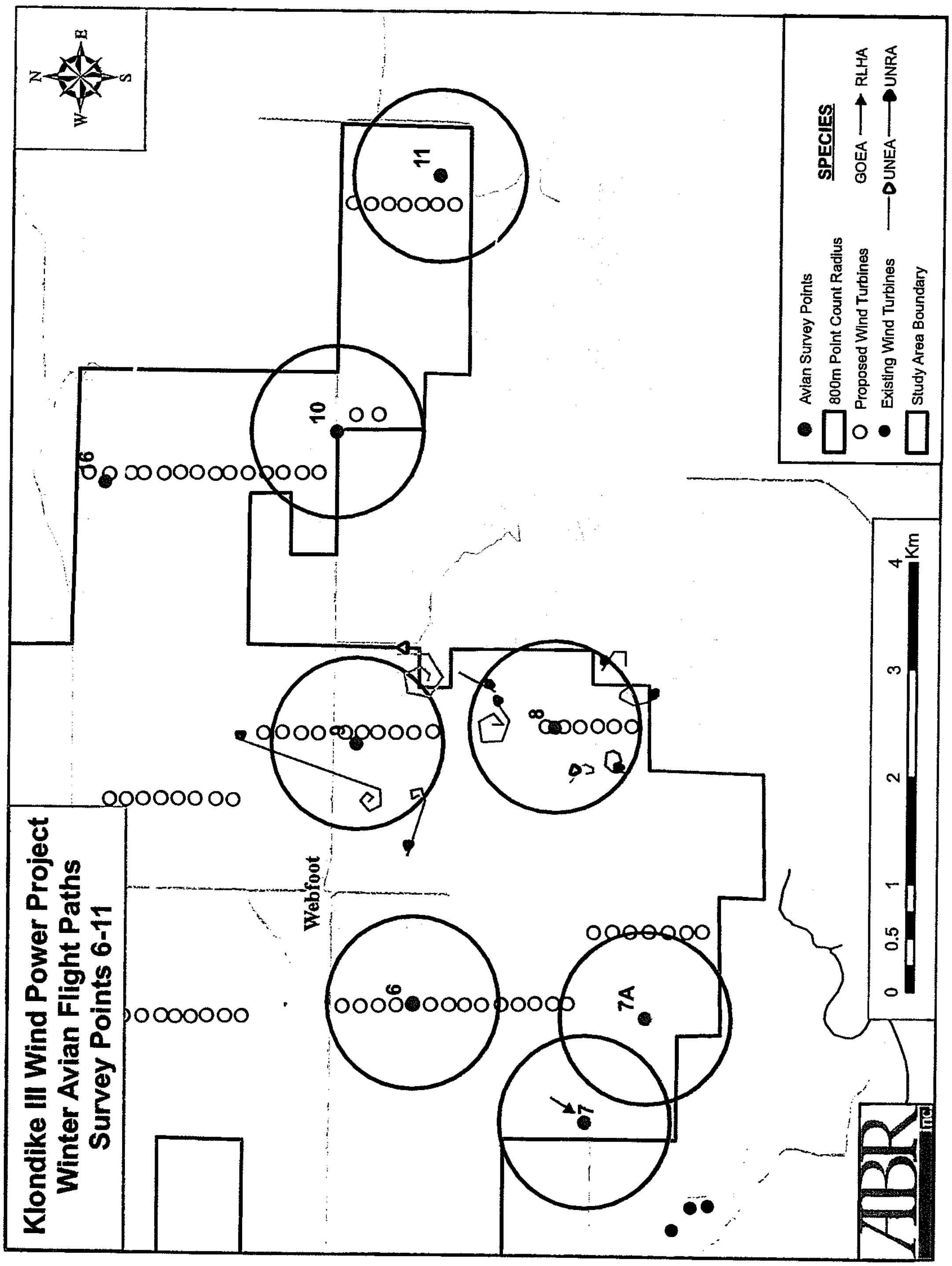

Figure 9. Avian flight paths observed on Avian Survey Points 6–11 of the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005). Species alpha codes are as follows: GOEA = Golden Eagle, RLHA = Rough-legged Hawk, UNEA = Unidentified eagle, UNRA = Unidentified raptor.

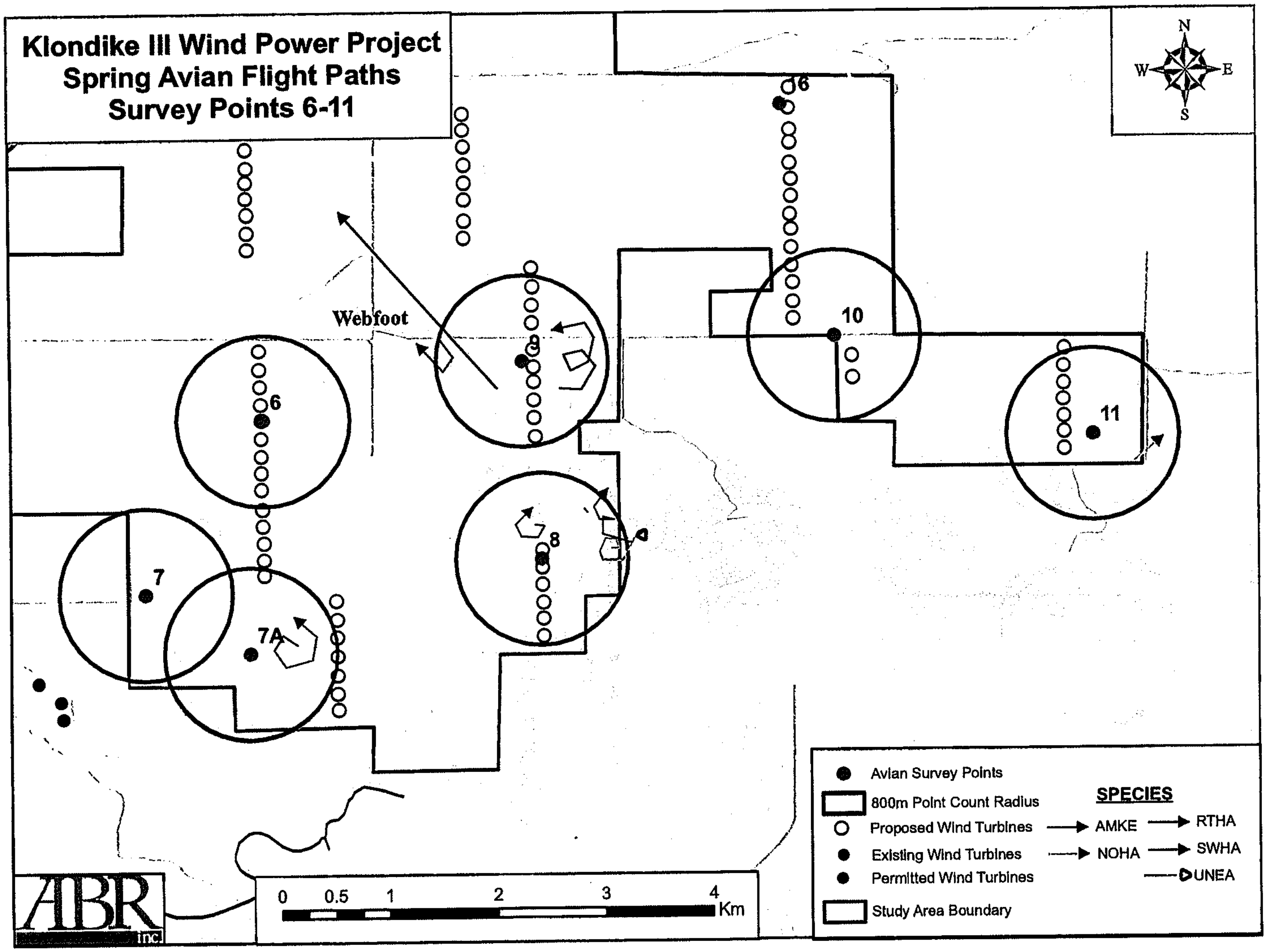

Figure 10. Avian flight paths observed on Avian Survey Points 6–11 of the proposed Klondike III Wind Power Project, Oregon, during spring (15 March 2005–15 May 2005). Species alpha codes are as follows: AMKE = American Kestrel, RTHA = Red-tailed Hawk, NOHA = Northern Harrier, SWHA = Swainson's Hawk, UNEA = Unidentified eagle.

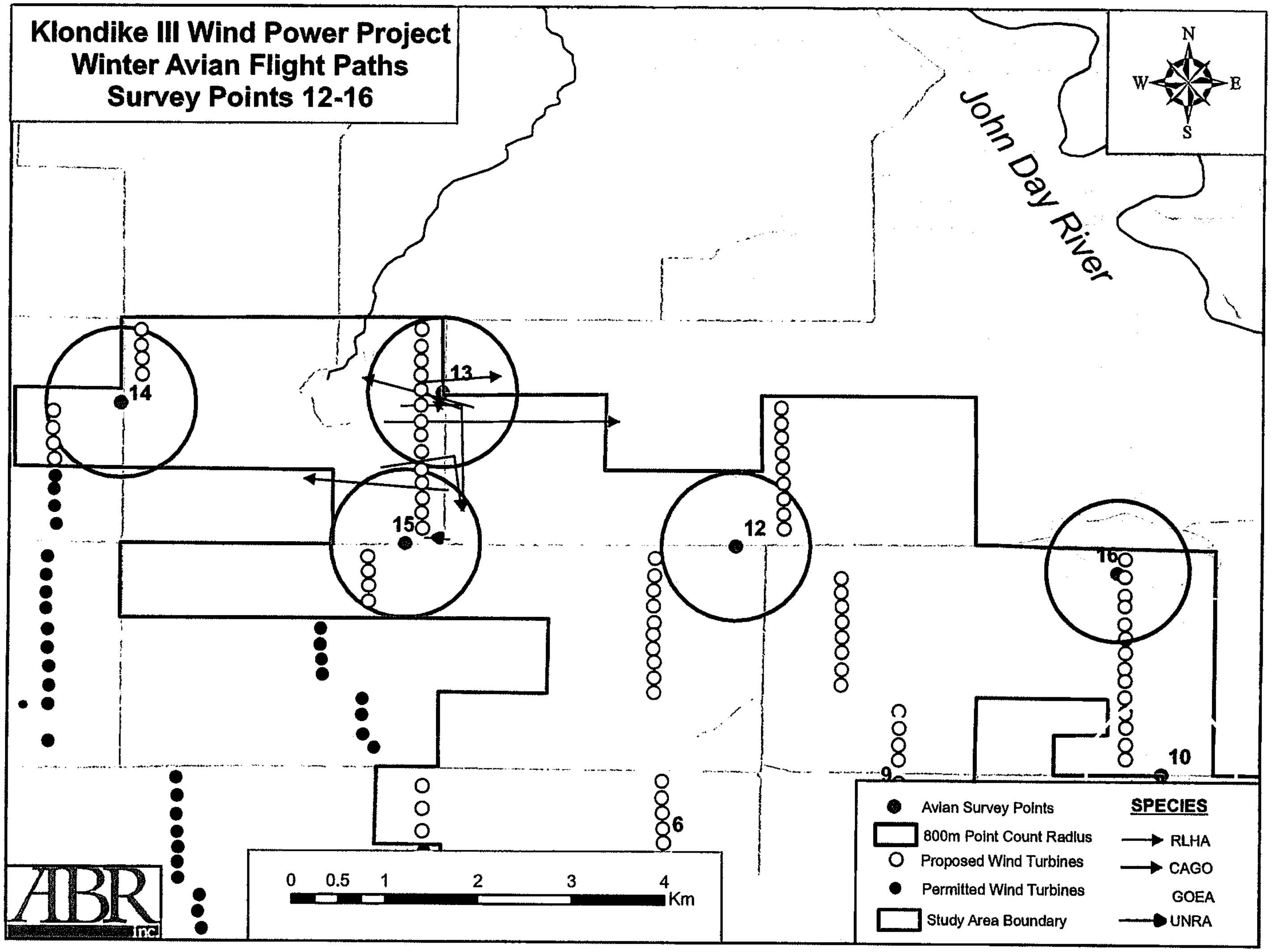

Figure 11. Avian flight paths observed on Avian Survey Points 12–16 of the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005). Species alpha codes are as follows: RLHA = Rough-legged Hawk, CAGO = Canada Goose, GOEA = Golden Eagle, UNRA = Unidentified raptor.

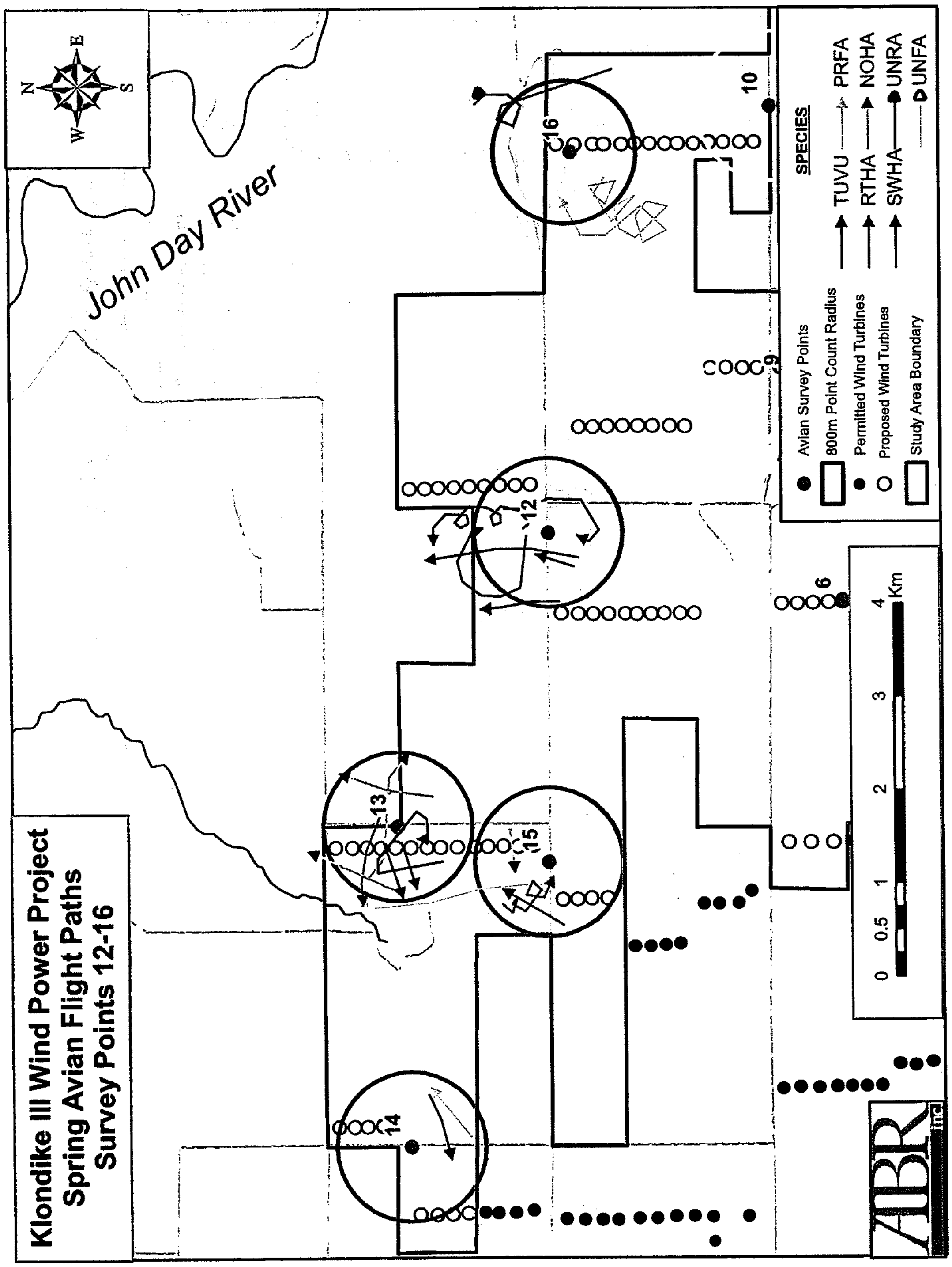

Figure 12. Avian flight paths observed on Avian Survey Points 12–16 of the proposed Klondike III Wind Power Project, Oregon, during spring (15 March 2005–15 May 2005). Species alpha codes are as follows: TUVU = Turkey Vulture, PRFA = Prairie Falcon, RTHA = Red-tailed Hawk, NOHA = Northern Harrier, SWHA = Swainson's Hawk, UNRA = Unidentified raptor, UNFA = Unidentified falcon.

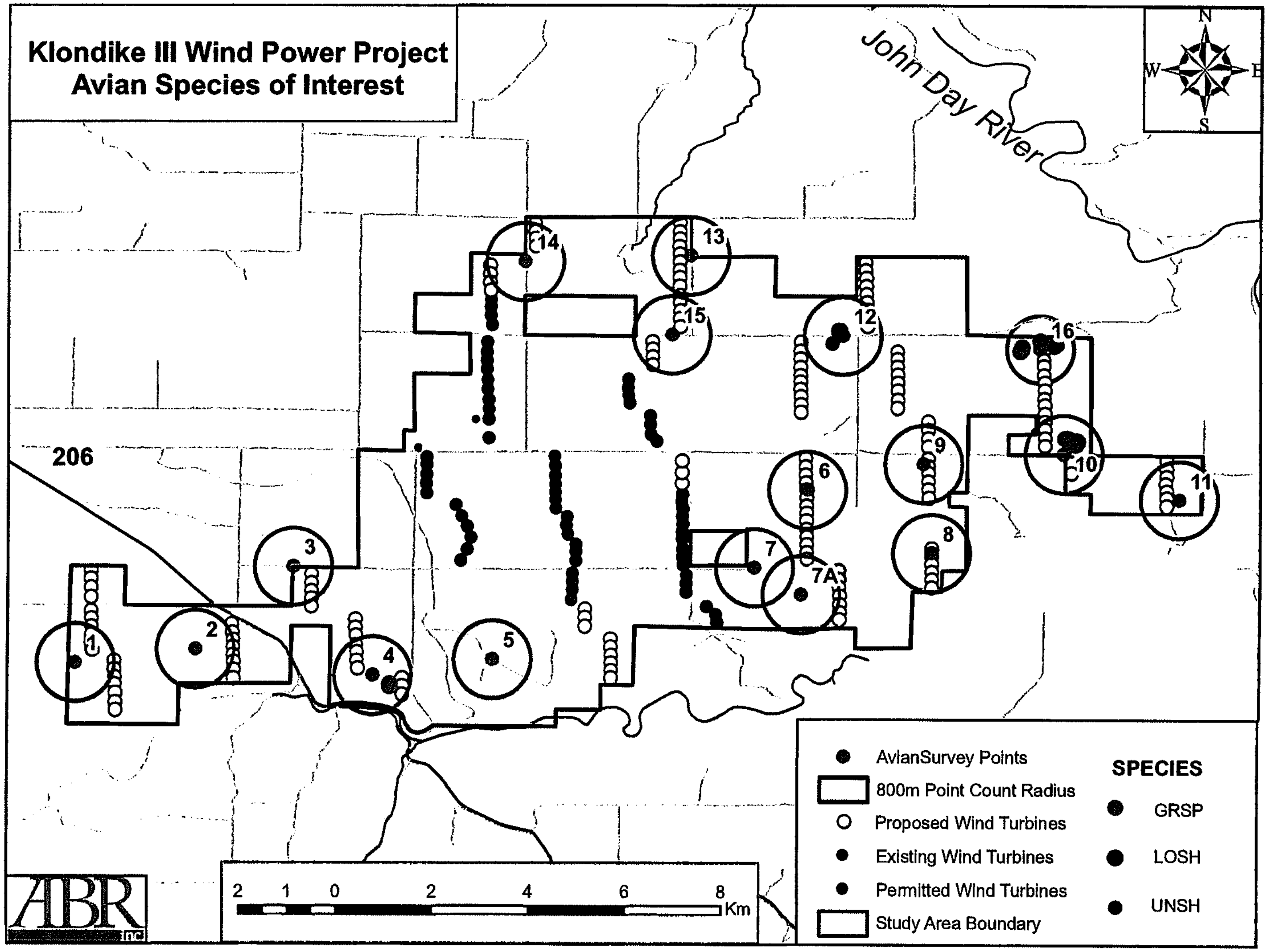

Figure 13. Oregon Department of Fish and Wildlife Sensitive Species observed on the proposed Klondike III Wind Power Project, Oregon, during winter (04 November 2004–14 March 2005) and spring (15 March 2005–15 May 2005). Species alpha codes are as follows: GRSP = Grasshopper Sparrow, LOSH = Loggerhead Shrike, UNSH = Unidentified shrike.

influence its probability of collision (e.g., whether it is a diurnal or nocturnal migrant, *see* Mabee and Cooper 2004b). It is important to consider all these behavioral facets of a species and its general biology before determining its propensity to collide with wind turbines.

WATERFOWL

Waterfowl fatalities have occurred at several newer generation wind projects, but apparently in very low numbers relative to the use at those sites (Erickson et al. 2002). Waterfowl carcasses composed 11% of the total fatalities (n = 9 total carcasses found) at Ponnequim, CO; 10% of the total fatalities (n = 21) at Wisconsin; 9% of the total fatalities (n = 55) at Buffalo Ridge, MN (Erickson et al. 2002), and 25% of the total fatalities (n = 2) at Klondike I (Johnson et al. 2002).

Canada Goose was the dominant species of waterfowl observed in the study area, although numbers were lower than during previous studies. For example, mean winter use was 3.66 birds/ 20 min point count, compared to 17.41 birds/30 min point count from studies at Klondike I (Johnson et al. 2002). Canada Geese were often observed flying within the RSA (58%), leading to a relatively high exposure index (relative to all species besides Horned Lark). Two Canada Geese carcasses were found during winter 2002 at Klondike I (as part of a year-long study; Johnson et al. 2002), and two carcasses were found during three years of fatality monitoring at Stateline Wind Project (Erickson et al. 2004). The relatively high exposure index for Canada Geese and history of goose mortality at this project and other regional wind projects suggest that small numbers of collisions of Canada Geese could occur at the Klondike III Wind Power Project.

RAPTORS

The concern for raptor collisions at some existing wind projects is warranted, because Turkey Vulture, Red-tailed Hawk, Swainson's Hawk, Northern Harrier, Golden Eagle, American Kestrel, and Prairie Falcon have all collided with wind turbines at Altamont, California (Erickson et al. 2001). A few raptor fatalities also have been reported for the more local wind projects in Washington and Oregon (Erickson et al. 2004). The average fatality rate at newer generation wind projects is 0.04 raptor fatalities/MW/yr compared to up to ~1 raptor fatality/MW/yr at older generation wind projects such as Altamont (Erickson et al. 2004).

Mean use across all raptor species at the Klondike III Wind Power Project ranged from 0.140–0.326 birds/point count, respectively, during winter and spring. Examination of the use values for individual raptor species shows that Rough-legged Hawk contributed a large amount (34%) to the overall use for raptors during winter. Rough-legged Hawk were present at higher numbers during winter, a time when they are considered an uncommon to common winter resident in the open country of Oregon (Marshall et al. 2003). Residents such as Northern Harrier and American Kestrel had low mean use during winter, a time when some individuals may migrate south. Golden Eagle (a resident east of the Cascades; Marshall et al. 2003) were observed infrequently during winter. During spring, Swainson's Hawk contributed a large amount (32%) to the overall use for raptors. Swainson's Hawk were present only during spring, as would be expected for a migrant that over winters in Argentina and returns to the U.S. only during the breeding season (England et. al. 1997).

Raptor use during winter at the Klondike III Wind Power Project was low relative to winter use documented at other regional projects. Johnson et al. (2002) standardized several regional studies for 20 min point counts during the winter season, and our estimate (0.14) is low relative to other studies: Vansycle, OR (0.78); Klondike I, OR (0.49; 2002 data); Stateline, WA/OR (0.42); Nine Canyon, WA (0.31); and Foote Creek Rim, WY (0.21). Exposure indices also were low for all raptors, and even though Rough-legged Hawks had the highest value (0.016), they may have lower than expected levels of fatalities because only one fatality has occurred at a large new generation wind project where Rough-legged Hawks are known to occur (Condon Wind Project, OR; Fishman 2003).

Raptor use during spring at the Klondike III Wind Power Project was low relative to spring use documented at other regional projects. Our estimate (0.33) is low relative to other studies found in Johnson et al. (2002): Vansycle, OR

(0.67); Stateline, WA/OR (0.59); Foote Creek Rim, WY (0.49); Klondike I, OR (0.40; 2002 data); and Nine Canyon, WA (0.36). Exposure indices were low for all raptors, and even though Swainson's Hawks had the highest value (0.030), it is unclear what level of fatalities to expect because only one fatality of that species has occurred nearby at the large Stateline Wind Project during 2 ½ years of operational monitoring (Erickson et al. 2004).

PASSERINES

Potential for passerine collisions also should be assessed at wind power projects, because as a whole, passerines have incurred the most fatalities at several wind plants, often comprising > 80% of the fatalities (Johnson et al. 2002, Erickson et al. 2001). A review of avian fatalities at eight new generation projects in the West and Midwest (Stateline, OR/WA; Vansycle, OR; Klondike I, OR; Nine Canyon, WA; Foote Creek, WY; Ponnequin, CO; Buffalo Ridge, MN; Wisconsin) showed that most fatalities were of Horned Lark (29.6%), followed by sparrows (13.8%), warblers (9.2%), upland game birds (8.8%), and smaller percentages for other groups of birds (Erickson 2004). Overall fatality rates for birds (most presumably passerines) in the U.S. were ~ 3 fatalities/MW/yr (excluding older generation sites in CA; Erickson et al. 2004). One eastern US site (Buffalo Mountain, TN) has had unusually high fatality rates, however (~11 fatalities/MW/yr; Erickson et al. 2004).

Passerines numerically dominated avian use at the Klondike III Wind Power Project, and Horned Lark was the dominant species among passerines. Horned Lark were numerous during winter—a time of the year when they aggregate into mobile flocks of foraging birds. During winter, mean use was 20.87 birds/point count compared to 13.63 birds/30 min point count from studies at Klondike I (Johnson et al. 2002). Mean use by passerines was strongly influenced by two surveys during November where observations of a few large flocks of Horned Larks and unidentified Blackbirds (700–1,000 individuals/flock) inflated the mean use values. Western Meadowlarks (and most other passerine species) either occurred at low densities or did not occur at all—a typical pattern for migratory species that were not expected to overwinter in eastern Oregon in any large numbers. As expected during winter, most (84.2%) passerines flew below the RSA, whereas a much smaller proportion flew within (15.6%) or above (0.2%) the RSA. Exposure indices were highest for Horned Lark (4.188) during winter and therefore may put this species at the highest risk of collision with proposed wind turbines during this time of year.

Horned Larks were also numerous (relative to other passerines) during spring—a time of the year when this grassland-nesting species disperses into suitable breeding habitat. Although seemingly common, Horned Lark populations now appear to be declining slightly on a continent-wide scale (Beason 1995, Lanyon 1994) and in the Columbia Plateau Breeding Bird Survey Physiographic Region (Sauer et al. 1999). During spring, mean use was 3.632 birds/point count compared to 1.92 birds/30 min point count from studies at Klondike I (Johnson et al. 2002). As expected during spring, most (89.7%) passerines flew below the RSA, whereas a much smaller proportion flew within (10.8%) or above (0.2%) the RSA. In contrast, aerial courtship displays by Horned Larks often occur within the RSA, putting this species in the potential collision zone. This behavior plus its high mean use are the reasons that the exposure index was higher for Horned Lark (0.229) than other passerines during spring.

SENSITIVE SPECIES

Less common grassland-breeding species (e.g., Grasshopper Sparrow) occurred at the low densities during the breeding season (see Table 2) that are typical for these species in Oregon (Marshall et al. 2003). Grasshopper Sparrows are an erratic breeder in Oregon, with populations coming and going from localized areas (Marshall et al. 2003), probably because Oregon is on the edge of the species' overall breeding range (Vickery 1996). Populations of Grasshopper Sparrows in the Columbia Plateau Breeding Bird Survey Physiographic Region have declined significantly between 1966 and 1998 (Sauer et al. 1999), although the species has been present consistently in suitable habitat at the Vansycle (URS and WEST 1997) and Stateline (URS and WEST 2001) wind projects of eastern Oregon.

Grasshopper Sparrows were found almost exclusively in the CRP and shrub-steppe habitats within the Klondike III Wind Power Project study area and generally were not observed in the more intensively managed agricultural habitats.

The Loggerhead Shrike is another uncommon and declining passerine on the ODFW sensitive species list that breeds in open habitats east of the Cascades. In Oregon, BBS data show a significant 3.4%/yr declining trend during 1966–98 (Sauer et al. 1999). During winter it is a rare but regular inhabitant (Marshall et al. 2003). Loggerhead Shrikes were only observed once during winter in a tree at an abandoned homestead (Table 2).

Lastly, although not observed within our 800 m point count radius, we did observe Long-billed Curlews on two occasions (6 birds on 19 March and 1 bird on 11 April) flying between Avian Survey Points 11 and 10. The bird observed on 11 April was conducting an aerial display, indicating at least the potential for Curlews to have nested in this remote section of shrub-steppe and CRP habitat. Long-billed curlews are designated as a Highly Imperiled species by the U.S. and Canadian Shorebird Conservation plans and a Sensitive-Vulnerable species in Oregon by the Oregon Department of Fish and Wildlife.

AERIAL RAPTOR NEST SURVEYS

The overall number of active (20), inactive (10) and unknown status (4) raptor nests located within 2 miles of the proposed project during aerial surveys of the Klondike III Wind Power Project during spring 2005 was lower than that recorded during surveys within a 5 mi buffer of the Klondike I Wind Power Project during spring 2001 (Johnson et al. 2002). Johnson et al. (2002) discovered active nests of Golden Eagle (1), Red-tailed Hawk (16), Swainson's Hawk (11), Great-horned Owl (6), American Kestrel (1), and Common Raven (1) during their aerial surveys in May and June of 2001. They also discovered 23 large, inactive stick nests. We did not observe any Golden Eagle nest sites (active or inactive) but we did observe two active American Kestrel nest sites (i.e., adults flew out of the tree cavity). These nest sites were not mapped because American Kestrels were not one of the target species and because aerial surveys are inadequate to properly assess the number of nests of this species.

The density (#/mi^2) of buteo nests within 2 mi of the project were slightly higher (Red-tailed Hawk) or similar (Swainson's Hawk) at the Klondike III Wind Power Project when compared to other projects in the West located in agricultural landscapes. Red-tailed Hawk nest density at the Klondike III Wind Power Project was 0.112, higher than that reported for other projects including the following: Klondike I, OR = 0.083, Stateline, OR/WA = 0.079; Condon, OR = 0.040; Zintel Canyon, WA = 0.020; Erickson et al. 2002). Swainson's Hawk nest density at the Klondike III Wind Power Project was 0.041, similar to that reported for other projects including the following: (Klondike I, OR = 0.042; Zintel Canyon, WA = 0.040; Stateline, OR/WA = 0.034; Nine Canyon = 0.033; Erickson et al. 2002). At the Klondike III Wind Power Project seven active nests were located within ~1 km of proposed turbine strings, including Red-tailed Hawk (n = 3), Swainson's Hawk (n = 2), Great-horned Owl (n = 1), and Common Raven (n = 1).

CONCLUSIONS

Ultimately, the avian use metrics presented in this report should help determine whether certain species are at a high risk of collision. However, other facets of a species' behavior also may influence its susceptibility to collision (e.g., its ability to see and avoid wind turbine blades, whether it is a diurnal or nocturnal migrant). Therefore, all behavioral facets of a species should be considered before determining its propensity to collide with wind turbines. Although nocturnal bird migration was not examined at this proposed development, there are data available from the nearby Stateline and Vansycle wind power projects in Oregon. At those sites, it appeared that low numbers of birds migrated through these areas during fall and moderate numbers passed through during spring, with < ~10% of the nocturnal migrants within the RSA of wind turbines (Mabee and Cooper 2004b). Ongoing fatality monitoring at these and other facilities in the Pacific Northwest will continue to provide useful information on the relationship between pre-construction avian use data and actual avian fatalities at wind power projects.

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