

**Klondike IIIa (Phase 2) Wind Power Project
Wildlife Monitoring Study
August 2008–August 2010**

Prepared for:

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1.0 INTRODUCTION

1.1 Wind Project Description

Klondike III Wind Project, located in Sherman County, Oregon is a wind-powered electric generating plant with an average electric generating capacity of approximately 125 megawatts (MW) and a peak generating capacity of not more than 375 MW (OEFSC, 2007). It was developed and is operated by Klondike Wind Power III LLC (Iberdrola Renewables, originally PPM Energy) of Portland, Oregon. There are two phases, referred to simply as Klondike III (Phase 1) and Klondike IIIa (Phase 2), both permitted by the State of Oregon through the Energy Facility Siting Council (EFSC) process. Klondike Wind Power III LLC received a Site Certificate from the EFSC through the Oregon Department of Energy on June 30, 2006 and a Site Certificate for Klondike IIIa (KIIIa) on November 16, 2007. Klondike III Phase 1 (KIII) was commissioned and fully operational in October 2007 and consists of 125 turbines. Of these 125 turbines, 80 are 1.5 MW GE turbines and 44 are Siemens 2.3 MW turbines and there is one Mitsubishi 2.4 MW turbine. Phase 2 consists of 51, 1.5 MW turbines and was commissioned and fully operational June 21, 2008. The MW listed is a nameplate capacity and does not reflect actual production. Wildlife monitoring is required for each phase. KIIIa (Phase 2 or “the Project”) is the subject of this final wildlife monitoring report. The results of year one of the two-year study were previously submitted (Gritski et al. 2009a).

1.2 Post-construction Wildlife Monitoring Study

This final report summarizes methods and results of the two-year avian and bat monitoring study for the Klondike IIIa Wind Project (Phase 2) since the Project was constructed in late June 2008 including:

- Wildlife fatality monitoring including reporting of all casualties found, results of Carcass Removal and Searcher Efficiency Trials, and estimated fatalities per MW in eight categories (7 avian, 1 bat) as well as four primary groups, as described in the Klondike III Wind Project Wildlife Monitoring and Mitigation Plan (WMMP, pages A-5 and A-10) filed under the EFSC Site Certificate (OEFSC, 2007).
- Raptor nest monitoring surveys in 2008
- Post-construction avian use surveys, 2008–2010

Wildlife fatality monitoring results include all casualties found at the Project from August 11, 2008 through August 18, 2010, including all incidental finds, and casualties found during the “clean-up searches” conducted each year prior to formal monitoring. Monitoring year one (or year one) is defined as the period from August 11, 2008 through August 15, 2009; monitoring year two (or year two) is defined as the period from August 16, 2009 through August 18, 2010. Previously unidentified or unconfirmed specimens were examined after the end of the first and second years of monitoring to determine species where possible. If it was not possible to identify to species, the fatality was classified to genus or taxonomic group based on available evidence. Wildlife fatality estimates included in this report were summarized from data collected during the two-year monitoring study. Preliminary results of the first year of wildlife fatality monitoring, post-construction avian use surveys, and raptor nest surveys were previously reported in Gritski et al., 2009a; however, results presented in this final wildlife fatality report supersede all previously reported information.

2.0 METHODS

Wildlife monitoring study protocol methods are available in detail in the Klondike III Wind Project Wildlife Monitoring and Mitigation Plan (Attachment A of the Final Order on Amendment #3 of the Site Certificate for the Klondike III Wind Project, dated November 16, 2007; OEFSC, 2007). Those methods are summarized in this section.

2.1 Study Design

The study design consists of a sampling of the 51 Phase 2 turbines searched during each of the two years of monitoring (Figure 1). Of the 51 1.5 MW turbines, 17 of these turbines were searched during year one (33.3%) and another 17 were sampled in year two, resulting in 34 of the 51 turbines (66.7%) sampled during the monitoring study. The 1.5 MW turbines had a square search plot of approximately 240 meters (m) on each side centered on the turbine (120 m from the turbine base in all directions; Figure 2). The “effective” number of turbines searched was greater than the actual number of turbines searched due to the overlapping of the search plots with adjacent non-searched turbine plots. The effective area searched was calculated using ArcView 9.2 and the sample size of the total searched area was adjusted to reflect the effective search area. For year one turbines, the effective area searched for the 1.5 MW turbines was 39.13% of the total searchable area for the project (or 19.96 turbines). During year two 39.03% of the total searchable area was searched (or 19.91 turbines). Thus, the total effective searched area for the study was 78% of the total searchable area (or 39.87 turbines). Fatality estimates used this correction factor and discussion of observed fatalities per turbine also used this correction factor.

Personnel trained in proper search techniques (“the searchers”) conducted the carcass searches by walking parallel transects within the search plots. Transects were set at six-meter intervals. The searchers walked at a rate of approximately 45 to 60 meters per minute along each transect, searching both sides out to three meters for casualties. Search pace varied by searcher and in different habitat types.

2.1.1 Search Schedule

Search periods were divided into two primary intervals—searches were conducted twice a month during spring and fall migration periods, and once a month during summer and winter seasons. Dates for these search periods are shown in Table 1. Due to inclement weather or other schedule conflicts during some seasons, actual search intervals were slightly different than planned search intervals. A clean-up search was conducted each year prior to the beginning of formal searches. Year one clean-up search was conducted on August 11, 2008 and year two clean-up search was conducted on August 18, 2009. Clean-up searches are designed to clear the plot of previous fatalities and allow for standardized metrics involved in formal carcass searches.

Table 1. Standardized carcass search periods at Klondike IIIa Wind Project, 2008–2010.

Season	Search Period	# of Searches (includes both years)
Fall	August 16–October 31	9
Winter	November 1–March 15	9
Spring	March 16–May 15	7
Summer	May 16– August 15	7

2.1.2 *Search Protocol, Data Collection, and Incidentals*

Definitions

The following definitions for casualty age, condition, taxonomic group, and status are applied in this report. Incidentals and State of Oregon Special Status Species are also defined.

Age

Bird and bat fatalities were aged and sexed. The terms adult and immature are used in this report. The following definitions are applied to any mention of adult, juvenile, or immature for avian or bat fatalities:

- Birds: Birds were classified as immature if they were found as fatalities during the year of birth, but older than in nestling plumage. The exception to this rule is for taxa groups such as raptors that take multiple years to obtain adult status. Raptors classified as sub-adult birds (more than one year old but not an adult) were also classified as immature birds. All birds that were in juvenile plumage (nestling plumage) were classified as such if they had not molted into an immature plumage. Some birds in the fall and winter are not able to be aged and were left as unknown. Birds were aged by a combination of techniques including molt limits, feather wear and other characteristics (Pyle, 1997).
- Bats: Bats were aged using ossification of wing joints. Bats were classified as immature if they were found during the year of birth. The term juvenile and immature is inter-changeable and both refer to individuals born during the year of strike. Aging of bats during the fall can be difficult because during that time period bats born in that year are in a transition period between juvenile and adult status and therefore age cannot always be determined with certainty.

Condition

For all searches, the field staff recorded the condition of each carcass found, using the following condition categories:

- Intact – A carcass that is entire, 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 a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin).
- Feather Spot – Ten or more feathers or three or more primaries (the outermost 9–12 wing feathers) at one location indicating predation or scavenging.
- Dismembered – A carcass in two or more pieces, not readily attributed to scavengers. May not include all parts of the carcass.

Taxonomic group

Casualties were assigned to a taxonomic group. The basic definitions of the taxonomic groups that were found are as follows:

- Dove – Any member of the order of Columbiformes. This group is represented by rock pigeon in this report.
- Galliformes – Any gallinaceous bird. Included chukar and ring-necked pheasant in this report.
- Passerine – Any member of the order of Passeriformes, or perching birds.
- Raptor – Any diurnal or nocturnal bird of prey belonging to the orders of Falconiformes or Strigiformes. This includes falcons, hawks and owls (USFWS, 2002).
- Waterfowl – Any member of the order Anseriformes. This group is represented by northern pintail in this report.

State of Oregon Sensitive Species status:

At Klondike IIIa, several species that are classified as State Sensitive-Vulnerable were found as fatalities; a partial status definition is listed below. Full definitions of Oregon Sensitive statuses and lists of State Sensitive species can be found at on the Oregon Department of Fish and Wildlife (ODFW) web site:

http://www.dfw.state.or.us/wildlife/diversity/species/docs/SSL_by_category.pdf

- State Sensitive-Vulnerable: species facing one or more threats to their populations and/or habitat. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the State, but could become so with continued or increased threats to populations and/or threats.

All carcasses found were labeled with a unique number, bagged, and frozen for future reference and possible necropsy. A freezer tag with pertinent information for each carcass was inserted with the bagged specimen. All casualties located were photographed as found and plotted on a detailed map of the study area. For each carcass found, searchers recorded species, sex, and age when possible, date and time collected, location (distance and direction from turbine), condition (as detailed above), and any comments relevant to cause of death. All carcasses were collected and stored in accordance with appropriate Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service (USFWS) collection and salvage permits obtained by NWC prior to field activities.

Incidentals

"Incidentals" are defined as bird and bat casualties found in non-search areas (e.g., near a turbine but not included in the search area) or not during scheduled searches at turbine plots.

Avian or bat casualties found in search plots by Iberdrola Renewables (IBR) maintenance personnel and others not conducting the formal searches were left undisturbed, recorded using the incident report form, and reported to the Project biologist. These casualties were left on-site, unless the animal was found alive and injured. By leaving the casualty on a search plot, researchers could determine if that casualty was found by searchers during the next scheduled search or had been removed by scavengers or not detected during searcher efforts on the plot. ODFW and USFWS permits included allowances for the collection and transport of injured animals discovered during Project activities. The specific permit compliance protocol for the handling and reporting of injured or dead birds and bats is included in the Klondike III Wildlife Monitoring and Mitigation Plan. Further details on IBR Klondike III Wind Project Wildlife Reporting and Handling System can be found in the Klondike III Wildlife Monitoring and Mitigation Plan (OEFSC, 2007).

2.2 Carcass Removal Trials

The objective of the carcass removal (or "persistence") trials were to estimate the average length of time avian and bat carcasses remain in the search area before being removed by scavengers or reach a deteriorated condition in which detection of the animal is not possible, and is inclusive of other influences on carcass persistence. Estimates of carcass removal rates are used to adjust carcass counts for removal bias. "Carcass removal" is the disappearance of a carcass from the search area. "Carcass persistence" is the mirror image of this, the persistence of a carcass in the search area in spite of potential scavenging. For consistency with terminology used for regional wind project wildlife fatality monitoring studies, collectively these are referred to as "removal" or removal/persistence trials in this report; analysis of each was not conducted separately.

The trials were conducted within each of the seasons defined above (Table 1) during the study. Trials were spread throughout the year to incorporate the effects of varying weather, farming practices, and scavenger densities. Each trial used 20 carcasses. For each trial, 10 small bird carcasses and 10 large bird carcasses were distributed spatially throughout the Project. One trial was placed each season, for a total of 80 trials for each year (40 small and 40 large). For the study duration a total of 80 small and 80 large trials were placed. The WMMP (page A-3) states that for each season one trial will be conducted resulting in at least 10 small and 10 large placed.

Trial carcasses were marked discreetly for recognition by searchers and other personnel to ensure that these carcasses would not be confused with actual turbine mortalities. Trial carcasses were left at the location until the end of the carcass removal trial. Trials lasted for 35 days and were checked every day for the first four days and again on day 7, day 10, day 14, day 21, day 28, and day 35. At the end of the 35-day trial period, any remaining birds and feathers were removed. Birds were placed in all available habitat groups and in three different exposure classes; fully exposed, partially hidden, and fully hidden. These data were used to determine scavenging rates based on statistical methods presented below.

Two size classes, "large" (raptor size) and "small" (songbird size) were used to simulate fatalities. Native species were used whenever possible, but due to their limited availability, non-native species were also used. Small brown game bird chicks were used as surrogates for bat fatalities.

2.3 Searcher Efficiency Trials

Searcher efficiency (SEEF) trials were conducted during turbine plot searches to determine the probability of a searcher detecting a carcass known to be present. A Project biologist placed carcasses at random times and locations on search plots for searchers to detect. These were blind trials, meaning that the searcher did not know of the trial prior to searching that plot and each searcher was independent of other searchers, due to the fact that searchers did not discuss their results while the trial was on-going, but waited until searches were completed. A trial is considered a single animal and the result is either a find or a miss by the searcher. Treatment of these data is discussed below in statistical methods. The Project biologist removed the SEEF carcasses immediately following each day's trials to prevent attracting scavengers to the site.

Searcher efficiency trials were conducted on the fatality monitoring search plots in both grassland/shrub-steppe and cultivated agriculture habitat types. Searcher efficiency was estimated by season and carcass size. Estimates of searcher efficiency were used to adjust observed fatalities for detection bias.

Searcher efficiency trials were conducted in each season as defined above (Table 1) during the fatality monitoring year. Trials were spread throughout the year to incorporate the effects of seasonal variations in weather, farming practices, and vegetative cover. At least two sets of trials were conducted in each season. Each set consisted of a variable number of carcasses so that the searchers did not know the total number of trial carcasses being used in any given trial. For each trial set, both small bird and large bird carcasses were used.

On the day of a fatality monitoring search but before the beginning of the search, efficiency trial carcasses were placed at random locations within areas to be searched. Carcasses were randomly placed in a variety of postures to simulate a range of conditions. For example, birds were: 1) placed in an exposed posture (thrown over the shoulder), 2) hidden to simulate a crippled bird, and 3) partially hidden.

In order to ensure that SEEF trial carcasses were not mistaken for actual turbine casualties, each trial bird used as a SEEF carcass was discreetly marked so that it could be correctly identified as an efficiency trial carcass after it was found. The number and location of the efficiency trial carcasses found during the carcass search was recorded. The number of efficiency trial carcasses available for detection during each trial (e.g., not removed by scavengers), was determined immediately after the trial by the person responsible for distributing the carcasses. If a scavenger removed the carcass, the trial was not used, as it was not possible to determine if the bird was available for detection or not.

SEEF was estimated separately for two sizes classes, large and small. Native species were used whenever possible, but due to their limited availability, non-native species were also used. Small carcasses (e.g. non-native species like quail, juvenile ringed-necked pheasants, and native passerine species) were used to represent small birds such as passerines. Large carcasses (e.g. adult ring-necked pheasants, rock doves, chukars, and mallards) were used to simulate large birds such as raptors, game birds, and waterfowl. Due to lack of available bat carcasses, small brown game bird chicks were used as surrogates for bats.

2.4 Statistical Methods for Estimating Fatalities

2.4.1 *Removal Trials*

Estimates of the probability that a carcass will not be removed in the interval between searches are used to adjust carcass counts for removal bias. Removal includes removal by predation, scavenging, wind, or decomposition. In most fatality monitoring efforts, it is assumed that carcass removal occurs at a constant rate that is not dependent on the time since death. This simplifying assumption allows estimation of fatalities when search intervals exceed one day.

The length of time a carcass remains in the study area before it is removed is typically modeled as an exponentially distributed random variable. The probability that a carcass is not removed during an interval of length I can be roughly approximated as

$\hat{r} \cong \sum_{d=1}^I \exp(-(d - 0.5)/t)/I$, the average probability of persisting given its death might have

occurred on any day (d) in the interval (Huso, 2010). If carcass removal rates are rapid and the search interval is long enough, then I is the length of the effective interval at the turbine, i.e. the length of time when 99% of carcasses can be expected to be removed.

Data from carcass persistence trials were fit to an interval censored parametric failure time model, carcass persistence time modeled as a function of size and season and their interaction. Using $\alpha=0.15$, there was a strong effect of the interaction of size with season ($\chi^2_3 = 11.21$, $p=0.01$), indicating that carcass persistence varied both with size of the carcass and season. Bootstrapped samples were fit to failure time models with size, season, and their interaction as explanatory variables.

2.4.2 *Searcher Efficiency Trials*

Estimates of the probability that a carcass will be detected by an observer during a search (searcher efficiency) are used to adjust carcass counts for observer bias. The failure of an observer to detect a carcass that is on the search plot may be due to its size or color, or time since death, as well as conditions in its immediate vicinity, such as vegetation density, shade, weather, etc. In most mortality monitoring efforts, because time since death cannot be measured, it is assumed that a carcass' observability is constant over the period of the search interval.

Data from searcher efficiency trials were fit to a logistic regression model, with odds of observing a carcass modeled as a function of size and season and their interaction. Using $\alpha=0.2$ (increased due to smaller sample sizes relative to year 1), there was no effect of the interaction of size with season ($\chi^2_3=1.69$, $p=0.64$), nor of size alone ($\chi^2_1=0.57$, $p=0.45$). The effect of season alone was marginal ($\chi^2_3=4.57$, $p=0.20$), and it was retained in the model. Bootstrapped samples were fit to logistic regression models with only season as an explanatory variable.

2.4.3 *Fatality Estimates*

The annual estimated fatality rate is reported as an estimate of (assumed wind project related) bird and bat fatalities in eight primary categories as defined under the monitoring plan (OEFSC, 2007; page A-5): 1) all birds, 2) small birds, 3) large birds, 4) raptors, 5) grassland birds, 6) nocturnal migrants, 7) State Sensitive species listed under OAR 635-100-0040, and 8) bats. Grassland birds are defined as all native bird species that rely on grassland habitat and are either resident species, occurring year round, or species that nest in the area, excluding horned lark, burrowing owl, and northern harrier (OEFSC, 2007; page A-10). Small birds are defined as any bird under nine inches in total length and large birds are defined as any bird greater than or equal to nine inches in total length. This measurement is consistent with previous reports (Kronner et al., 2008, Gritski et al., 2008a).

All carcasses located within areas surveyed, regardless of species, were recorded, and if a different cause of death was not apparent, the fatality was attributed to Project operation, consistent with the approach commonly used at other regional fatality studies. The total number of avian and bat carcasses found were adjusted with removal and searcher efficiency bias trial data to determine the fatality estimate.

As specified in the monitoring and mitigation plan (OEFSC, 2007; page A-7) estimates were calculated using the Schoenfeld method. The Schoenfeld estimator was used in analyses for the Klondike II wind project (NWC and WEST, 2007) and the Stateline wind project (Erickson et al., 2004). For comparison, an estimator used by Huso was also calculated. The estimator proposed by Huso (Huso, 2010) has been used in the Big Horn (Kronner et al., 2008) and Leaning Juniper (Gritski et al., 2008a) wildlife monitoring post-construction studies. Huso has shown the Schoenfeld estimator to be strongly biased under some conditions, but to have relatively little bias under others. In general, the Schoenfeld estimator is comparable to the Huso estimator when search intervals are long and carcass persistence times are short, conditions that generally prevailed in this study. Where differences in the two estimators occurred, the Schoenfeld estimator was used for comparisons to thresholds set forth in OEFSC, 2007. For methods on how the Schoenfeld estimator is calculated, refer to OEFSC, 2007. Huso methods are outlined below.

In this analysis, a bootstrap sample of carcass persistence data for each size and season combination was drawn and average carcass persistence time for each size in each season was estimated from it. A bootstrap sample of the searcher efficiency data for each size and season was drawn and searcher efficiency for each size in each season was estimated from it. These estimates were merged with the casualty data and adjusted estimates of fatality

calculated for each animal using the following equation:
$$\frac{C_{ijk}}{\hat{p}_{jk} * \hat{r}_{jk} * \hat{e}_{jk}} = \hat{f}_{ijk}$$

where c_{ijk} is the observed number of carcasses in the k^{th} size class at the i^{th} turbine during the j^{th} search, \hat{f}_{ijk} is the estimated fatality in the k^{th} size class that occurred at the i^{th} turbine during the j^{th} search, \hat{p}_{jk} is the estimated probability that a carcass in the k^{th} size class that is on the ground during the j^{th} search will actually be seen by the observer, \hat{r}_{jk} is the probability that an individual bird or bat that died during the interval preceding the j^{th} search will not be removed by scavengers and \hat{e}_{jk} is the effective interval, i.e. the ratio of the length of time before 99% of carcasses can be expected to be removed to the search interval. \hat{p}_{jk} was estimated through searcher efficiency trials with estimates given above. \hat{r}_{jk} is a function of the average carcass persistence time, estimated through carcass persistence trials, and the length of the interval preceding the j^{th} search. \hat{r}_{jk} , \hat{e}_{jk} and \hat{p}_{jk} are assumed not to differ among turbines, but differ with season (i.e. search j) and carcass size (k).

For each turbine size, the estimate of the annual per turbine fatality were calculated as

$$\hat{f} = \frac{\sum_{i=1}^{23} \sum_{j=1}^{n_i} \sum_{k=1}^2 \hat{f}_{ijk}}{t}$$

where n_i is the number of searches carried out at turbine i , $i = 1, \dots, 23$,

and t is the effective number of turbines searched. The per turbine estimate and confidence limits were multiplied by 80 and 44, respectively, to give total annual fatality estimates (Cochran, 1977). No closed form solution is available for the variance of this estimator, so 90% confidence intervals of this estimate were calculated by bootstrapping (Manly, 1997) as described above.

These estimates were summed across all turbines, then divided by the effective number of turbines searched to give annual per turbine fatality rate. Refer to Section 2.1 for number of effective turbines searched during each year of the study. Per turbine estimates were multiplied by the total number of turbines in the respective size class to give total site fatality and divided by their respective megawatt label to give per MW fatality. A bootstrapped 90% confidence interval on annual per turbine fatality was achieved by repeating this process 1000 times and reporting the central 90% limits of the resulting distribution.

2.4.4 **Observed Fatality Rates of Nocturnal Migrants at Lit and Unlit Turbines**

As specified in the WMMP (page A-9), differences in observed nocturnal migrant fatality rates for the lit and unlit turbines were reviewed. Comparisons were made between lit turbines plus turbines directly adjacent to lit turbines, and turbines that were neither lit nor directly adjacent to lit turbines. A difference of means test was used, with a significance value of 0.05 to determine if there was a significant difference among groups. The turbine was the sample unit and numbers of observed nocturnal avian fatalities were counted for each turbine. All analysis was completed using SPSS Version 16.0 (SPSS, 2007).

2.5 **Raptor Nest Monitoring**

Raptor nest surveys were conducted in spring/summer 2008, the first nesting season after construction. The objective of this study is to estimate the size of the local breeding populations of tree or other above-ground-nesting raptor species in the vicinity of the facility, and to determine whether operation of the facility ultimately results in a reduction of nesting activity or nesting success in the local populations of the following raptor species:

Swainson's hawk, golden eagle, and ferruginous hawk. These were the primary target species for the 2008 aerial and ground-based surveys; other species observed nesting or assumed nesting (such as America kestrel) were also recorded as encountered incidentally while searching for nests of the three target species. As specified on page A-11 of the WMMP, data from the 2008 survey year will be combined with data from the 2012 survey year, and analysis conducted to determine whether a reduction in either nesting success or nest use has occurred in the vicinity of Klondike III facility (this is inclusive of Phase I and Phase II (Klondike III and IIIa)).

The 2007 nest survey year data and supplemental notes for the 2006 or earlier nesting years were reviewed and used for planning the 2008 monitoring. Only one nest site surveyed in 2007 was not part of the 2008 aerial survey buffer; this was due to a slight change in the two-mile survey buffer of planned vs. actual turbine locations.

On May 9, 2008, an aerial survey was conducted within the Klondike III site boundary and a 2-mile (3.2 km) buffer around turbines to determine nest occupancy (Figure 3), as per the WMMP, page A-11. The survey was conducted by an experienced helicopter pilot and wildlife biologist. All appropriate nesting areas including trees, rock formations, and power lines were investigated by air to provide complete coverage of the Project areas to the extent possible. Areas immediately surrounding houses were not surveyed to avoid human or livestock disturbances and areas near operating wind turbines were not flown due to safety reasons. In addition to the aerial survey, while biologists were on site conducting other wildlife monitoring, several nests were checked for raptors in flight or incubating.

All potential and confirmed raptor or other large bird nests were recorded, regardless of activity status. Determination of nest status (active, inactive, unknown) was made using a combination of visual clues such as adult behavior, presence of eggs or young, presence or absence of whitewash (excrement), or supplemental observational data from the ground-based surveys. A nest was determined to be active if behaviors consistent with a nesting attempt such as nest building/repair, egg laying, incubation or presence of young were noted (Steenhoff and Newton, 2007). A nest was considered to be inactive if none of these behaviors were noted over two nest checks. Presence of birds alone in the nesting territory did not constitute activity of the nest according to this report. A nest was considered to be not-present if the nest structure in the original nest location (tree or cliff) was missing and had not been re-built in the same location. If the nest was re-built in a new location close by, it was given a new unique NWC nest number. Inactive nests (without sign of current year's use) were assessed as to the type of bird that may have used the nest previously. Large stick nests, potentially used by golden eagles or ferruginous hawk were recorded and noted as such because these species are target species for monitoring in future years. Stick nests that appeared to have been constructed, and may have been used by common ravens, were conservatively included in "Inactive" status as these structures may be used by buteo raptors in future years. All nest locations were recorded using a hand-held Global Positioning System (GPS) receiver, typically with an accuracy of 8 meters (26 feet) while stationary.

Follow-up surveys to determine nesting success were conducted from the ground within the leased land boundary during the period from May 31 through June 18, 2008. All active or unknown status nests recorded during the aerial survey were checked, where feasible. For areas not leased by Iberdrola and where access permission was not likely (due to other wind lease arrangements or feasibility), nests were checked with spotting scopes and binoculars from public roads. In addition, a second aerial survey was conducted on July 23, 2008 to assess the final status of nests that could not be checked through ground surveys.

Data were managed in an Excel spreadsheet and in ArcMap version 9.3 GIS. Analysis for potential impacts from operating Klondike III and IIIa turbines will be conducted after the second year of monitoring in 2012.

2.6 Avian Use Surveys

In addition to standardized fatality searches, avian use surveys were conducted during each fatality monitoring search throughout the two years of study. The purpose of recording avian use while conducting the fatality monitoring, as specified in the WMMP (page A-12), is to identify additional avian species that may not have been listed in the original baseline survey report for the pre-construction avian use study. In addition, these point count surveys may provide a basis on which to evaluate, in general terms, whether the species with the highest fatality numbers are also the most common species at the site during the monitoring study year.

Observers recorded birds detected in a ten-minute period at approximately one-third of the turbines per year (six plots per year), using standard variable circular-plot point count survey methods (Reynolds et al., 1980). An experienced avian ecologist was positioned at the center of the plot and collected data on all wildlife seen or heard during a 10-minute observation period. A full set of surveys (six plots) was completed on the same survey day, and plots were surveyed equally during different times of day (morning, mid-day, and afternoon), to the extent feasible, to reduce temporal bias. The six, year one plots corresponded to locations of year one turbines and the six, year two plots corresponded to locations of year two turbines. All individuals regardless of distance were counted, thus there may have been some double counting for species such as ravens and groups such as waterfowl and raptors that cover large areas of ground.

General data recorded included date, time, weather, and wildlife observed. For birds detected, data collected included species, number of individuals, habitat association, and behavior, including flight height and direction. Whenever special status species and species of interest were observed while in-transit near the study plots, within the general Project area, these observations were also recorded. Data were entered into a Microsoft Access database.

In all, there were 102 avian surveys conducted in year one and 96 in year two at a total of 12 different plots (198 plot surveys total). A spring visit on May 27, 2010 fell outside of the definition of spring season as defined in the WMMP. However, the date was closer to existing data for spring season than summer season data collected in June, and was grouped with spring season data. Plot dates for each season and number of surveys are summarized as follows:

- Fall season:
Year 1 – August 14, 2008–October 13, 2008; 5 visits to 6 plots=30 surveys
Year 2 – September 10, 2009–October 26, 2009; 4 visits to 6 plots=24 surveys
- Winter season:
Year 1 – November 12, 2008–March 12, 2009; 5 visits to 6 plots=30 surveys
Year 2 – November 11, 2009–March 11, 2010; 5 visits to 6 plots=30 surveys
- Spring season:
Year 1 – March 31, 2009–May 18, 2009; 4 visits to 6 plots=24 surveys
Year 2 – March 24, 2010–May 27, 2010; 4 visits to 6 plots=24 surveys
- Summer season:
Year 1 – June 16, 2009–August 6, 2009; 3 visits to 6 plots=18 surveys
Year 2 – June 27, 2010–August 5, 2010; 3 visits to 6 plots=18 surveys

2.6.1 *Avian Use Data Analysis*

The same avian-use metrics found in other studies in the region were used for this analysis (Johnson et al., 2002; Kronner et al., 2005a and b; Mabee et al., 2005 and 2007). Standardized metrics were computed for avian species or species-groups on mean use, percent composition, and frequency of occurrence.

- *Mean use* for a species equals the mean number of individuals/10-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 10-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.

3.0 RESULTS

This section summarizes the results of Klondike IIIa Wind Project wildlife monitoring for the two years of monitoring. Preliminary results of the first year of monitoring were previously reported in Gritski et al., 2009a; however, results presented in this final wildlife fatality report supersede all previously reported information.

3.1 Summary of Findings Prior to Formal Monitoring and Incidentals

3.1.1 *Incidentals*

No incidental fatalities were found prior to the beginning of the monitoring study. One incidental, an American kestrel (raptor) found on August 31, 2009 during year two of the monitoring period.

3.1.2 *Clean-up Searches*

As stated above, the clean-up search was performed to clear the search plot area of casualties before formal monitoring was initiated during each year of monitoring.

2008–2009 Monitoring Year One

During the year one clean-up search, one fatality was found: a hoary bat. Further details are available in Appendix A.

2008–2009 Monitoring Year Two

During year two of monitoring, three fatalities were found during the clean-up search: 1 bird and 2 bats. The bird species found was an American kestrel. Both bats were hoary bats. Further details are available in Appendix A.

3.2 Standardized Scheduled Searches

3.2.1 Scheduled Searches

For the two years of monitoring a total of 24 birds and 3 bats were found during scheduled searches (Table 2). Horned larks were the most frequent avian species found during scheduled searches (25.0 %). A total of 15 species of birds were found during scheduled searches, with an additional two avian fatalities that could not be identified to species as of this report: one unidentified kinglet species and one unidentified sparrow species.

All bats were of one species, hoary bat (Table 2). Details of all casualties are found in Appendix A.

Table 2. Summary of avian and bat species and percent composition of all fatalities found at the Klondike IIIa Wind Project, August 2008–August 2010.

Species Found as Fatalities Listed by highest to lowest % search composition (fourth column)	Total Found During Scheduled Searches				Total Including Incidentals*	
	Year 1 2008– 2009	Year 2 2009– 2010	Grand Total 2008– 2009	% Composition	Total 2008– 2009	% Composition Including Incidentals
Avian Species						
horned lark	3	3	6	25.0	6	23.1
rock pigeon (<i>n</i>)	1	1	2	8.3	2	7.7
savannah sparrow	0	2	2	8.3	2	7.7
chipping sparrow	0	1	1	4.2	1	3.8
chukar	1	0	1	4.2	1	3.8
Hammond's flycatcher	0	1	1	4.2	1	3.8
northern pintail	1	0	1	4.2	1	3.8
pacific-slope flycatcher	0	1	1	4.2	1	3.8
red-tailed hawk	0	1	1	4.2	1	3.8
ring-necked pheasant (<i>n</i>)	1	0	1	4.2	1	3.8
unidentified kinglet	0	1	1	4.2	1	3.8
unidentified sparrow	1	0	1	4.2	1	3.8
western meadowlark	0	1	1	4.2	1	3.8
western tanager	1	0	1	4.2	1	3.8
white-crowned sparrow	1	0	1	4.2	1	3.8
Wilson's warbler	0	1	1	4.2	1	3.8
yellow-rumped warbler	0	1	1	4.2	1	3.8
American kestrel	0	0	0	0.0	2	7.7
Avian Subtotal	10	14	24	100.0	26	100.0
Bat Species						
hoary bat	2	1	3		6	100.00
Bat Subtotal	2	1	3	100.0	6	100.0

*Includes both scheduled search findings and incidental observations (including clean-up searches conducted in 2008 and 2009)

n = a non-native species

3.2.2 Timing and Composition of Observed Fatalities

Passerines comprised the majority of observed avian fatalities during the 2008–2010 monitoring period on scheduled searches (75%), followed by galliformes (8.3%), doves (8.3%), raptors (4.2%), waterfowl (4.2%; Table 3; Figure 4). All avian casualties were fatalities (no live, injured birds).

Timing of observed avian fatalities showed a peak of fatalities during August and September, consistent with fall migration (Figure 5). However, searches were more frequent during this period and the low total number of observed avian fatalities should be factored into conclusions from this data. There were not enough observed fatalities to break taxonomic groups apart for analysis. As passerines had 75% of total observed composition, this figure is strongly based on passerine fatalities. Raptor fatalities (1) occurred in March. The single observed waterfowl fatality was found in September.

The bats were found in the fall months of August–September (Figure 6), particularly August; however, as with avian data, low sample sizes prevent definitive conclusions from being stated. To increase sample sizes for timing of fatalities, incidentals were included for Figure 6; however, due to bias of finding incidental large birds over small birds, incidentals were not included in percent composition for Figure 4.

Past studies (Kronner et al., 2008; Gritski et al., 2008a) have found that percentages of passerines are lower for observed fatalities versus estimated fatalities, while larger birds such as raptors and galliforms usually show higher percentages of observed fatalities versus estimated fatalities due to searcher detection rate and carcass persistence rate differences for these small and large birds.

Table 3. Wildlife casualties found during two years of formal monitoring (2008–2010) at the Klondike IIIa Wind Project, listed by taxonomic group.

Taxa Group	# of Fatalities Monitoring Year 1 2008–2009*	# of Fatalities Monitoring Year 2 2009–2010*	Total # of Fatalities 2008–2010*
Raptor	0	1 + 1 incidental	1 + 1 incidental
Galliform	2	0	2
Passerine	6	12	18
Dove	1	1	2
Waterfowl	1	0	1
Total Birds	10	14 + 1 incidental	24 + 1 incidental
Bats	2	1	3
Total Birds and Bats	12	15+ 1 incidental	27 + 1 incidental

*This table does not include fatalities found incidentally prior to the start of formal monitoring on August 16, 2008, or during clean-up searches (August 11, 2008; August 18, 2009).

3.2.3 *Distance from Turbine for Observed Fatalities*

Small birds, large birds, and bats were grouped into distance categories as expressed in meters from the base of the turbine (Figure 7). Distances were grouped to reflect 30 meter intervals. While search plots only extended out to 120 meters (394 feet), because search plots were square, distances in the corner of the plot could be greater than 126 meters (414 feet). Thus the maximum distance a fatality could be found from the turbine is 170 meters (557 feet) as shown in Figure 2. Figure 7 includes findings on scheduled searches as well as incidentals. The majority of bats were found 0–60 meters from the turbine base (5 of 6). There was not a strong trend for either avian category (small or large birds), although more small birds were found in the 60–120-meter range. Again, these are based on relatively small sample sizes. No fatalities had distances greater than 120 meters from the turbine base.

3.2.4 *Nocturnal Migrants*

Species that were found during the spring and fall migration season scheduled searches that do not breed or winter on the Project were classified as nocturnal migrants. A total of 9 avian fatalities were classified as nocturnal migrants, comprising 8 species and 1 unidentified kinglet. Species included in the nocturnal migrant category were chipping sparrow, Hammond's flycatcher, pacific-slope flycatcher, savannah sparrow, western tanager, white-crowned sparrow, Wilson's warbler, yellow-rumped warbler and the above mentioned unidentified kinglet species. This list does not include fatalities found as incidentals or during clean-up searches, as those fatalities are not included in the estimated annual fatality calculations.

3.2.5 *Avian Groups of Concern*

In the monitoring plan established for Klondike III (OEFSC 2007, page 10), thresholds were set for several groups of avian species. These groups included raptors, raptor species of special concern, and State Sensitive species listed under OAR 635-100-0040 (not including raptors that are covered under the raptor species of special concern). In addition to these categories, thresholds were also set for grassland avian species. This category includes all native species breeding in the area or residing year-round, that rely on grasslands but excludes horned lark, burrowing owl, and northern harrier. Numbers of fatalities found in each of the groups of concern are summarized below. Refer to Appendix A for further details such as turbine number where the fatality occurred and date when the fatality was found.

Grassland Birds

Birds included in this category found during the monitoring included 2 savannah sparrows and 1 western meadowlark. No grassland birds were found as incidentals.

Raptors

One raptor was found during scheduled searches, a red-tailed hawk. Two American kestrels were found, 1 during clean-up searches and 1 as an incidental.

Raptor species of special concern

No raptor species of special concern were found.

State Sensitive Species

No Oregon State Sensitive avian species were found as fatalities. One species of State Sensitive mammals was found, hoary bat. Hoary bat is listed as a Sensitive-Vulnerable species. There were 3 hoary bats found as fatalities during clean-up searches and 3 found during scheduled searches.

3.2.6 *Review of Findings at Lit and Unlit Turbines*

Observed nocturnal avian fatality rates were compared between lit (n=10) and unlit turbines (n=24). Observed nocturnal avian fatality rates were also compared for lit turbines and adjacent to lit turbines (n=19) against turbines that were neither lit nor adjacent to lit turbines (n=15). At lit turbines there were a total of one nocturnal migrant observed as a fatality at 10 turbines, and at unlit turbines there were a total of eight fatalities at 24 turbines. Only the lit vs. unlit analysis were significant at the P=0.05 level. Thus, there were significantly more nocturnal migrants found at unlit turbines than lit turbines, however small sample sizes (nine total nocturnal migrant fatalities) preclude any meaningful conclusions.

3.3 Carcass Removal Trials

Data from carcass removal trials were fit to an interval-censored parametric failure time model, with carcass persistence time modeled as a function of year, size and season and their interaction. Using $\alpha=0.15$, the effect of size and season were found to significantly affect average persistence time but differed between years ($\chi^2_3=7.94$, $p=0.047$).

Both size classes had considerable range of carcass removal rates between seasons and years. Large birds had an average removal time ranging from slightly less than eight days in fall season of year two to just over 19 days in spring season of year one. Small birds did not mirror the large bird category in terms of seasonal differences. The longest period that small birds remained was over 22 days in summer season of year one while the shortest period was just under three days in summer season of year two.

Average removal times and 90% confidence limits for the two size classes in each season of each year are given in Table 4. Bootstrapped samples were fit to an interval-censored parametric failure time model, with year, size and season and their interaction as explanatory variables. These estimates were factored into estimated fatalities presented in Section 3.5 along with searcher efficiency estimates presented in Section 3.4.

Table 4. Bootstrapped average Carcass Removal times and 90% confidence limits during the two years of wildlife fatality monitoring (combined) at Klondike IIIa Wind Project, 2008–2010.

Season	2008–2009 Monitoring Year 1				2009–2010 Monitoring Year 2			
	Number	Carcass Removal	Lower CI ¹	Upper CI	Number	Carcass Removal	Lower CI ¹	Upper CI
Large Size								
Spring	10	19.04	12.00	31.90	10	13.26	8.63	19.43
Summer	10	13.73	6.25	26.55	10	8.98	4.83	15.74
Fall	10	11.47	6.38	19.65	10	7.55	2.95	14.87
Winter	10	16.52	7.91	35.01	10	12.89	6.77	24.12
Small Size								
Spring	10	2.92	1.93	4.29	10	5.07	2.54	9.18
Summer	10	22.26	9.24	50.72	10	2.56	1.91	3.47
Fall	10	13.52	5.29	30.06	10	13.55	6.95	25.47
Winter	10	7.26	3.53	14.77	10	4.48	2.79	6.86

¹lower and upper limits of the 90% confidence interval (CI)

3.4 Searcher Efficiency Trials

Data from 288 searcher efficiency trials were fit to a logistic regression model, with odds of observing a carcass modeled as a function of size and season and their interaction. Using $\alpha=0.15$, the effect of size and season were found to significantly affect average searcher efficiency, but their effect differed between years ($\chi^2_3 > 7.57$, $p < 0.0558$). Average probability of a searcher finding a carcass and 90% confidence limits for the two size classes in each season of each year are given in Table 5. Bootstrapped samples were fit to logistic regression models with year, size, season and their interaction as explanatory variables. Because division by 0 is undefined, when estimated SE was 0, it was replaced with a value equal to $1/(2 \times \text{number of carcasses placed in the trial})$.

Searcher efficiency rates for large birds and small birds varied considerably between season and year as stated above, particularly for large birds. For large birds searcher efficiency was the highest in the winter of year one with an average probability of detection of 82% and the lowest in the spring of year one at 20%. For small birds, the season with the highest average detection rate was spring of year one at 65% and the season with the lowest average detection rate was winter of year two at an average searcher efficiency of 45%. Bootstrapped average probability of a searcher finding a carcass and 90% confidence limits for the two size classes in each season are given in Table 5.

Table 5. Bootstrapped Searcher Efficiency (SE) and 90% confidence limits during the two years of wildlife fatality monitoring (combined) at Klondike IIIa Wind Project, 2008–2010.

Season	2008-2009 Monitoring Year 1				2009–2010 Monitoring Year 2			
	Number Found/Placed	Searcher Efficiency	Lower CI ¹	Upper CI	Number Found/Placed	Searcher Efficiency	Lower CI ¹	Upper CI
Large Size								
Spring	11/17	0.65	0.47	0.82	16/20	0.80	0.65	0.95
Summer	4/15	0.27	0.07	0.47	11/20	0.55	0.35	0.70
Fall	2/10	0.20	0.05	0.40	14/19	0.74	0.58	0.89
Winter	18/22	0.82	0.68	0.95	15/20	0.75	0.60	0.90
Small Size								
Spring	11/17	0.65	0.47	0.82	11/19	0.58	0.37	0.74
Summer	8/16	0.50	0.31	0.69	10/18	0.56	0.33	0.72
Fall	7/13	0.54	0.31	0.77	10/18	0.56	0.39	0.72
Winter	14/24	0.61	0.42	0.75	9/20	0.45	0.25	0.65

¹lower and upper limits of the 90% confidence interval (CI)

3.5 Estimated Annual Fatality Rates

Average per turbine and total site fatality over the two years and 90% confidence limits are presented in Table 6a and 6b. Estimated per turbine fatality and estimated total site fatalities in each year and 90% confidence limits are presented in Table 7a and 7b. As described in the methods, both the Huso and Schoenfeld estimators were calculated. In the discussion, for comparison to other projects the Schoenfeld estimator is used, as that is the estimator defined in the WMMP (OEFSC, 2007, Page A-7 through A-9). While fatality estimates for each year calculated separately are presented here (Table 7a, 7b) to show annual variation, the focus of this report is on the estimated fatality rates for the two-year study period combined (Table 6a, 6b). While means are presented below, the estimate should include the 90% confidence interval (CI) and those are presented along with means (estimates) in Tables 6a, 6b, 7a, and 7b.

Because in this study, the search interval was long and carcass persistence times generally two weeks or less (except for small carcasses in summer and large carcasses in spring of 2009) estimates from the Huso and Schoenfeld estimators are similar. The particular combination of search interval and average carcass persistence times at this site generally satisfied the conditions under which the two estimators show little difference from one another. However, with such low numbers of found fatalities, neither estimator is likely very accurate. As there was only one raptor found during standardized scheduled searches, it complicates calculation of an accurate estimate of raptor fatality at the site.

During the 2008–2010 study period (during standardized scheduled searches), 27 carcasses whose deaths were attributable to the turbines were found in the search plots, 24 birds and three bats. These represented only a small fraction of actual estimated fatality, i.e. only 6%

of birds (12/199.7) and 14% of bats (1.5/10.5). The all birds category had an estimate of 2.61 (90%CI: 0.77, 6.93) birds/MW/year, with an overall site fatality estimate of 199.7 (90%CI: 58.7, 530.1) birds/year (Table 6a). Year two results showed slightly higher mean estimates for all birds and small birds while year one had higher mean estimates for bats and large birds (Table 7a). However, there was significant overlap between years for all groups, suggesting any differences are within natural variation.

Due to search interval, a low number of fatalities were found in all groups. Estimated fatality rates for groups with fewer than 10 carcasses found have questionable accuracy and precision. The estimated annual fatality rate per MW for grassland birds was 0.37 (90%CI: 0.03, 1.16) and for raptors was 0.06 (90%CI: 0.04, 0.19). However, because only three grassland birds and one raptor were found, these estimates may not be accurate.

Table 6a. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Schoenfeld Estimator*, for two years of wildlife fatality monitoring at Klondike IIIa Wind Project, 2008–2010 (combined).

Categories ¹	Avg. # Found Per Year	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	12	199.7	58.7–530.1	3.92	1.15–10.39	2.61	0.77–6.93
Small Birds	9	146.8	42.1–332.3	2.88	0.83–6.51	1.92	0.55–4.34
Large Birds	3	52.9	16.6–197.8	1.04	0.33–3.88	0.69	0.22–2.59
Grassland Birds	1.5	28.4	2.5–88.9	0.56	0.05–1.74	0.37	0.03–1.16
Raptors	0.5	4.6	3.3–14.8	0.09	0.07–0.29	0.06	0.04–0.19
Bats	1.5	10.7	4.8–37.7	0.21	0.10–0.74	0.14	0.07–0.49

¹As defined in OEFSC, 2007.

Table 6b. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Huso Estimator*, for two years of wildlife fatality monitoring at Klondike IIIa Wind Project, 2008–2010 (combined).

Categories ¹	Avg. # Found Per Year	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	12	214.2	66.5–571.4	4.20	1.30–11.20	2.80	0.87–7.47
Small Birds	9	153.3	47.0–340.3	3.01	0.92–6.67	2.00	4.45–1.92
Large Birds	3	60.9	19.4–231.1	1.19	0.38–4.53	0.80	0.25–3.02
Grassland Birds	1.5	29.8	3.1–93.2	0.59	0.06–1.83	0.39	0.04–1.22
Raptors	0.5	4.6	3.3–14.8	0.09	0.07–0.29	0.06	0.04–0.19
Bats	1.5	12.2	5.6–42.3	0.24	0.11–0.83	0.16	0.07–0.55

¹As defined in OEFSC, 2007.

Table 7a. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Schoenfeld Estimator*, for each year of wildlife fatality monitoring at Klondike IIIa Wind Project, 2008–2010 (calculated separately).

2008–2009 Monitoring Year 1							
Categories ¹	# Found	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	10	177.0	134.4–381.2	3.47	2.64–7.47	2.31	1.76–4.98
Small Birds	6	82.4	68.5–156.5	1.61	1.34–3.07	1.07	0.89–2.05
Large Birds	4	94.6	44.7–275.7	1.86	0.88–5.41	1.24	0.59–3.61
Grassland Birds	0	0	0.0–0.0	0	0.0–0.0	0	0.0–0.0
Raptors	0	0	0.0–0.0	0	0.0–0.0	0	0.0–0.0
Bats	2	15.0	5.0–53.0	0.30	0.10–1.03	0.20	0.07–0.69
2009–2010 Monitoring Year 2							
All Birds	14	222.4	53.6–539.1	4.36	1.05–10.57	2.91	0.70–7.05
Small Birds	12	199.0	45.3–466.9	3.90	0.89–9.15	2.60	0.59–6.10
Large Birds	2	23.4	8.3–72.2	0.46	0.16–1.42	0.31	0.11–0.94
Grassland Bird	3	57.0	5.0–178.0	1.11	0.10–3.49	0.74	0.07–2.33
Raptors	1	9.0	7.0–30.0	0.18	0.13–0.58	0.12	0.09–0.39
Bats	1	6.0	5.0–23.0	0.12	0.09–0.45	0.08	0.06–0.30

¹As defined in OEFSC, 2007.

Table 7b. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Huso Estimator*, for each year of wildlife fatality monitoring at Klondike IIIa Wind Project, 2008–2010 (calculated separately).

2008–2009 Monitoring Year 1							
Categories ¹	# Found	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	10	194.3	147.4–445.7	3.81	2.89–8.74	2.54	1.93–5.83
Small Birds	6	98.0	70.7–159.2	1.92	1.39–3.12	1.28	0.93–2.08
Large Birds	4	96.3	53.4–327.2	1.89	1.05–6.41	1.26	0.70–4.27
Grassland Birds	0	0	0.0–0.0	0	0.0–0.0	0	0.0–0.0
Raptors	0	0	0.0–0.0	0	0.0–0.0	0	0.0–0.0
Bats	2	17.0	6.0–57.0	0.34	0.12–1.11	0.08	0.13–0.74
2009–2010 Monitoring Year 2							
All Birds	14	234.1	62.4–553.4	4.59	1.22–10.85	3.06	0.82–7.23
Small Birds	12	210.3	53.9–480.3	0.47	0.17–1.43	2.75	0.70–6.28
Large Birds ²	2	23.8	8.5–73.0	4.12	1.06–9.42	0.31	0.11–0.95
Grassland Birds	3	60.0	6.0–186.0	1.17	0.12–3.66	0.78	0.08–2.44
Raptors	1	9.0	7.0–30.0	0.18	0.13–0.58	0.12	0.07–0.29
Bats	1	7.0	5.0–28.0	0.14	0.10–0.55	0.09	0.07–0.37

¹As defined in OEFSC, 2007.

3.6 Raptor Nest Monitoring

On May 9, 2008, an aerial survey was conducted within the Klondike III and IIIa site boundary and a 2-mile buffer (3.2 km) around turbines (total survey area of 98.04 square miles or 253.02 square kilometers) to determine nest occupancy. Within the nest survey area, there were a total of 14 active nests, 19 inactive nests, and 1 nest not present in 2008 (Figure 3 and Appendix B). In addition, one active long-eared owl nest and four active American kestrel nests (exact location unknown) were observed incidentally, but not monitored. Nine inactive common raven or buteo species nests in the 2007 database that are not within the Klondike III or IIIa project boundaries were not relocated in 2008 for various reasons (nest was likely too obstructed for viewing, was blown out of tree or was missed by surveyor). The number of active nests of each species within the survey area is listed as follows:

Nests of Target Raptor Species

- 6 Swainson's hawk
- 1 golden eagle
- 1 ferruginous hawk

Nests of Other Raptor Species or Inactive Nests

- 4 American kestrel (exact location unknown)
- 5 red-tailed hawk
- 1 unknown buteo
- 1 long-eared owl
- 17 inactive stick nests
- 2 inactive large stick nests – i.e. golden eagle

As previously described in the Methods section (2.5), nests of target species were checked during a second aerial survey where additional information to determine success was needed. The following summarizes the success for the target species. Distances to turbines reflect only Klondike III and IIIa turbines, not Klondike I and II turbines. Refer to Appendix B for number of young likely fledged and additional details. There is not a sufficient sample size of nests where nesting success was determined to analyze for any trends or patterns.

Swainson's hawk (Record #s)

6 active nests –

Three were onsite within the Klondike III or IIIa facility boundaries (42, 49, and 52), 42 and 52 were successful, and the success of nest 49 was unconfirmed. Nests 42 and 52 were within 0.5 miles of KIII turbines.

Three were offsite (48, 55, 66), two successful, and one with unconfirmed success status.

Golden eagle

1 active nest (89), but not onsite and not within 0.50 mile of turbines.

Ferruginous hawk

1 active nest (50) onsite, but not within 0.50 mile of turbines.

3.7 General Wildlife Observations

Observations of State and Federal special status wildlife species were recorded as incidental observations during monitoring surveys. Three species were recorded; peregrine falcon (State Sensitive-Vulnerable), golden eagle (Eagle Protection Act), and white-tailed jackrabbit (State Sensitive-Vulnerable). Full details can be found in Appendix C.

3.8 Avian Use Surveys

As stated in the methods, the primary objectives of the avian use surveys were to identify additional species that may not have been present during the original baseline report and to evaluate whether species with the highest fatality numbers are also the most common species at the site. During pre-construction baseline site-specific studies for Klondike IIIa there was one season of avian use surveys conducted (spring; Mabee et al., 2007). Due to only one season of data collected for baseline surveys, only spring season post-construction monitoring data is compared to spring season baseline point count data in Table 8. Refer to Appendix D for details of the four seasons of post-construction avian use surveys. Also included in Table 8 is the percent composition for two years of species observed on post-construction surveys and the percent composition for two years of fatality monitoring. This comparison allows for brief analysis of the second objective, "to evaluate whether species with the highest fatality numbers are also the most common species at the site".

Comparison of spring avian use surveys between baseline and monitoring shows some variation in detections. There were seven species or groups not recorded during spring baseline surveys that were recorded during spring monitoring surveys; Cooper's hawk, Swainson's hawk, prairie falcon, European starling, rock wren, rock pigeon and swallow species. All of these species were observed only once or twice during the operations phase monitoring surveys indicating they are generally present in low numbers and this may explain why they were not observed during baseline surveys. Six species were observed during baseline surveys that were not found during monitoring surveys; golden eagle, turkey vulture, chukar, American pipit, grasshopper sparrow, blackbird species. All species were either infrequent in baseline studies or are known to be cryptic in their detection frequencies compared to their occurrence as fatalities (Downes et al., 2008).

Examining post-construction avian use survey data and post-construction observed fatalities show several trends. Passerines comprised the highest percent composition of all taxonomic groups during both pre- and post-construction avian use surveys and post-construction fatality monitoring. Specifically, horned lark was the most common species in all comparison groups. In general, taxonomic groups were similar between pre- and post-construction spring avian use surveys. There were also similar composition results across all comparisons groups (Table 8) for most groups. Two exceptions were raptors being lower in observed fatalities than avian use estimates (pre- and post-) and game birds being found as fatalities in a higher composition than avian use surveys showed.

There were 17 species observed during post-construction avian use surveys that were not found as fatalities at KIIIa searched turbines during the two years of study (Table 8). Species that had combined (4 seasons of post-construction point counts combined) composition levels of greater than 1% but were not found as fatalities (including incidentals) included northern harrier, rough-legged hawk, Brewer's blackbird, European starling, black-billed magpie and common raven. Eleven species were found as fatalities but not recorded during pre- or post-construction avian use surveys. Nine of these eleven species were classified as nocturnal migrants and were previously reported in Section 3.2.4. The other two species were northern pintail and chukar. Based on the timing of the northern pintail fatality (September) it was likely a migrant as well and chukars are often detected in less frequencies on avian use surveys than their occurrence as fatalities (Downes et al., 2008).

Table 8. Percent composition for avian groups observed during post-construction avian use surveys in monitoring year 1 and monitoring year 2 in spring season (2009 and 2010) and all four seasons combined, pre-construction avian use surveys in and spring season (2007), and for fatalities found on scheduled searches 2008–2010, Klondike IIIa Wind Project.

Group and Species	Estimated % Composition of Avian Species			
	Spring Season		Monitoring Year 1 and 2 Combined (2008–2010, All Seasons Combined)	
	Pre-Construction Point Counts ¹	Post-Construction Point Counts ²	Post-construction Point Counts ³	Fatalities Found on Scheduled Searches ⁴
Waterfowl	0	0	0	4.17
northern pintail	0	0	0	4.17
Raptors	11.14	10.50	8.19	4.17
<i>northern harrier</i>	2.54	3.00	1.69	0
<i>Accipiters</i>	0	0.50	0.36	0
Cooper's hawk	0	0.50	0.24	0
unidentified accipiter	0	0	0.12	0
<i>Buteos</i>	4.57	4.50	3.13	4.17
Swainson's hawk	0	1.50	0.36	0
red-tailed hawk	2.03	2.00	1.33	4.17
rough-legged hawk	1.02	1.00	1.69	0
unidentified buteo	1.52	0	0	0
<i>Eagles</i>	1.52	0	0.60	0
golden eagle	1.52	0	0.60	0
<i>Falcons</i>	2.03	2.50	2.17	0
American kestrel	1.52	1.50	1.81	0
prairie falcon	0	1.00	0.36	0
unidentified falcon	0.51	0	0	0
<i>Vultures</i>	0.51	0	0	0
turkey vulture	0.51	0	0	0
Shorebirds	0.51	1.50	0.36	0
long-billed curlew	0.51	1.50	0.36	0
Game birds	3.05	0.50	0.12	8.33
chukar	1.02	0	0	4.17
ring-necked pheasant	2.03	0.50	0.12	4.17
Passerines	85.32	78.50	88.31	75.00
<i>Songbirds</i>	50.76	71.00	79.76	75.00
American pipit	1.02	0	0	0
Brewer's blackbird	0	0	3.49	0
chipping sparrow	0	0	0	4.17
European starling	0	2.50	2.41	0
grasshopper sparrow	0.51	0	0	0
Hammond's flycatcher	0	0	0	4.17
horned lark	50.76	38.50	60.12	25.00

Group and Species	Estimated % Composition of Avian Species			
	Spring Season		Monitoring Year 1 and 2 Combined (2008–2010, All Seasons Combined)	
	Pre-Construction Point Counts ¹	Post-Construction Point Counts ²	Post-construction Point Counts ³	Fatalities Found on Scheduled Searches ⁴
house finch	0	0	0.24	0
loggerhead shrike	0	0	0.12	0
pacific-slope flycatcher	0	0	0	4.17
rock wren	0	0.50	0.12	0
savannah sparrow	0	0	0	8.33
unidentified blackbird	8.12	0	0.12	0
unidentified kinglet	0	0	0	4.17
unidentified passerine	1.02	0.50	1.08	0
unidentified sparrow	2.03	0	0.12	4.17
unidentified swallow	0	10.00	2.41	0
western kingbird	0	0	0.60	0
western meadowlark	18.27	19.00	5.30	4.17
western tanager	0	0	0	4.17
white-crowned sparrow	0	0	0	4.17
Wilson's warbler	0	0	0	4.17
yellow-rumped warbler	0	0	0	4.17
<i>Corvids</i>	3.55	7.50	8.55	0
black-billed magpie	0	0	1.08	0
common raven	3.55	7.50	7.47	0
Doves	0	9.00	3.01	8.33
mourning dove	0	0	0.24	0
rock pigeon	0	9.00	2.77	8.33
Total	100.00	100.00	100.00	100.00

¹ Klondike IIIa pre-construction avian use surveys were conducted in one season, spring (March 21–May 10, 2007). For detailed methods see Mabee et al., 2007.

² Post-construction year one and year two spring data combined. 10-min. point counts (methods in Section 2.6 of this report). Year one – March 31, 2009–May 18, 2009; 4 visits to 6 plots=24 surveys; Year two – March 24, 2010–May 27, 2010; 4 visits to 6 plots=24 surveys

³ Post-construction four seasons for year one and year two combined. 10-min. counts (methods in Section 2.6 of this report); August 14, 2008–August 5, 2010

⁴ Percent composition of observed avian fatalities on scheduled searches. Four seasons of year one and year two combined due to small sample size.

4.0 DISCUSSION

4.1 Birds

4.1.1 *Comparison of Avian Fatality Estimates to Other CPE Wind Projects*

Annual fatality estimates for all birds and raptors are presented in Table 9 for wind projects in the Columbia Plateau Ecoregion (CPE) where fatality monitoring has been reported for at least one full year. Numbers presented are only mean estimates; refer to the source documents (listed in citations) for each monitoring study for complete confidence intervals. Mean fatality rates for the two groups (all birds and raptors) for Klondike IIIa are also included in Table 9. Raptors are included in their own category, due to increased focus on that taxonomic group regarding wind power fatality monitoring studies. Both per MW and per turbine estimates are shown in Table 9. For turbine sizes and specifications for the different wind projects discussed, refer to Table 10.

The range of mean fatality estimates for all birds on a per MW basis to date for the CPE is 0.9 to 6.7 birds/MW/year with an average of 2.46 birds/MW/year. On a per/MW basis, Klondike IIIa (3.02 birds/MW/year) is slightly above the mean, although examination of the 90% CI reported in this report (2.39–4.25 birds/MW/year; Table 6a) shows that there is a wide overlap with the 90% CI and the regional mean. Klondike II also reported very similar estimated fatality rates to Klondike IIIa despite multiple years lapsing between monitoring efforts at the two neighboring projects (Table 9).

The range of mean fatality estimates for raptors on a per MW basis (Table 9) for the CPE is 0.0 to 0.29 raptors/MW/year. The estimated fatality rate for raptors at Klondike IIIa is 0.06 raptors/MW/year and its related confidence interval of 0.07–0.29 raptors/MW/year is within the CPE range of estimates. This estimate lacks a high degree of precision and accuracy due to the low sample size of one.

Table 9. Annual fatality estimates on a per turbine and per MW nameplate basis for all birds and for all raptors in the Columbia Plateau Ecoregion where fatality monitoring studies have been completed.

Columbia Plateau Ecoregion Wind Project ¹	All Bird Fatality Rates		Raptor Fatality Rates ²	
	#/ MW	#/ Turbine	#/ MW	#/ Turbine
Listed in order of highest to lowest All Bird Fatality Rate per MW/Year				
Leaning Juniper I, OR ⁵	6.7	10.0	0.21	0.32
Tuolumne, WA	3.2	7.1	0.29	0.63
Klondike II, OR	3.1	4.7	0.11	0.17
Klondike III, OR (Phase 1) ⁵	3.0	5.3	0.15	0.26
Hopkins Ridge I, WA (2008)	3.0	5.4	0.07	0.12
Stateline I and II, WA/OR	2.9	1.9	0.09	0.06
Nine Canyon I, WA ³	2.8	3.6	0.05	0.07
Combine Hills, OR	2.6	2.3	0.00	0.00
Klondike IIIa, OR (Phase 2)⁵	2.6	3.9	0.06	0.09
Big Horn, WA ⁵	2.5	3.8	0.15	0.23
Biglow Canyon, OR (2009)	2.5	4.1	0.04	0.06
Hay Canyon, OR	2.2	4.7	0.00	0.00
Pebble Springs, OR	1.9	4.1	0.04	0.08
Biglow Canyon, OR (2008)	1.8	2.9	0.03	0.06
Wild Horse, WA ⁴	1.6	2.8	0.09	0.17
Goodnoe Hills, WA	1.4	2.8	0.17	0.34
Hopkins Ridge I, WA (2006)	1.2	2.2	0.14	0.25
Vansycle, OR	1.0	0.6	0.00	0.00
Klondike I, OR	0.9	1.4	0.00	0.00

Projects listed may have used different methods and/or analysis so some rates are not comparable.

¹ References for projects: Big Horn (Kronner et al., 2008), Biglow Canyon Phase I (Jeffrey et al., 2009; Enk et al., 2010), Combine Hills (Young et al., 2006), Goodnoe Hills (URS, 2010); Hay Canyon (Gritski and Kronner, 2010b); Hopkins Ridge I (Young et al., 2007, 2009), Klondike I (Johnson et al., 2003), Klondike II (NWC and West, 2007), Klondike IIIa (this report); Klondike III (Gritski et al., 2010), Leaning Juniper I (Gritski et al., 2008a), Nine Canyon (Erickson et al., 2003), Pebble Springs (Gritski and Kronner, 2010a), Stateline I and II-partial (Erickson et al., 2004), Tuolumne (Enz and Bay, 2010), Vansycle (Erickson et al., 2000), Wild Horse (Erickson et al., 2008).

² Raptor estimates include diurnal raptors and owls.

³ Nine Canyon II monitored only part-year.

⁴ Wild Horse estimates include only data for the first year of the respective 2-year studies.

⁵ Estimates shown here for KIIIa and KIII were calculated using the Shoenfeld estimator. For rates calculated using Huso estimator for KIIIa, see Table 6b of this report, and for KIII see Gritski et al., 2010. Huso estimator was used to determine estimated fatality rates for Leaning Juniper I and Big Horn wind projects (Gritski et al., 2008a; Kronner et al., 2008).

Table 10. Project and turbine characteristics of regional wind energy facilities where fatality monitoring studies have been completed*.

Columbia Plateau Ecoregion Wind Project**	Project Size		Turbine Characteristics		
	# Turbines	MW	RD*** (meters)	Tip Height (max. meters)	MW
Tuolumne, WA (2 turbine types)	42/20	136.6	93/92.5	126.5/135	2.3/2.0
Hay Canyon, OR	48	100.8	97	124	2.1
Pebble Springs, OR	47	98.7	97	124	2.1
Goodnoe Hills, WA	47	94	92.5	135	2.0
Hopkins Ridge I, WA	83	150	80	107	1.80
Wild Horse, WA	127	229	80	107	1.80
Biglow Canyon, OR (Phase I)	76	125.4	90	121	1.65
Big Horn, WA	133	199.5	77	118.5	1.50
Klondike I, OR	16	24	65	100	1.50
Klondike II, OR	50	75	77	118.5	1.50
Klondike III, OR (Phase 1) (2 turbine types)	80/42	120/96.6	77/93	118.5/126.5	1.50/2.30
Klondike IIIa, OR (Phase 2)	51	77	77	118.5	1.50
Leaning Juniper I, OR	67	100.5	77	118.5	1.50
Nine Canyon I, WA	37	48	62	91	1.30
Combine Hills I, OR	41	41	61	84	1.00
Stateline, OR/WA	454	300	47	74	0.66
Vansycle, OR	38	25	47	74	0.66

* Similar study methods. Condon Wind Project Carcass Study omitted due to differences in study methods. Wild Horse estimates include only data for the first year of the respective 2-year studies.

** Projects are sorted by MW of turbine type.

*** RD= rotor diameter

4.1.2 *Comparison of Avian Fatality Composition to Other CPE Wind Projects*

Estimated fatality rates are the primary focus of most fatality monitoring studies completed to date in the CPE. However, anecdotal comparison of species found as fatalities (observed not estimated) at Klondike IIIa and other Columbia Plateau Ecoregion wind projects studied gives some indication as to how species found as fatalities at one wind project may be different or similar to other projects. Table 11 compares all CPE wind related avian fatalities found on scheduled searches (at wind projects with publicly available annual or final reports) to fatalities found during scheduled searches at Klondike IIIa. Only fatalities found on scheduled searches were included because some species are more easily detected incidentally than others.

For birds, horned lark was the most common observed fatality. Percent composition at KIIIa (25%) was lower than the CPE average composition of 31.5% (Table 11). Since, only 6% of estimated fatalities were found, no definitive conclusions can be derived from this data; however, this pattern is similar to other projects in the area including Klondike II (NWC and WEST 2007), Klondike III (Gritski et al., 2010) and Hay Canyon (Gritski and Kronner 2010b). Based on observed fatality data, lower than average horned lark composition is due to higher than average nocturnal migrant fatality composition. Only two species had not previously been identified as a fatality in CPE studied projects, northern pintail and pacific-slope flycatcher. However, there have been unidentified ducks (3) and unidentified flycatcher (1) found previously that may have been these species.

Table 11. Number, species and composition of observed bird fatalities found at Columbia Plateau Ecoregion wind projects where fatality monitoring studies have been completed* or are in progress (data obtained from public files).

Species	CPE Wind Projects ¹ (Excludes Klondike IIIa for comparison) (Includes scheduled searches only)		Klondike IIIa (Year 1 and 2 combined) (Includes scheduled searches only)	
	% Composition Found	Number of Fatalities Found	% Composition Found	Number of Fatalities Found
horned lark	31.5	335	25.0	6
golden-crowned kinglet	5.9	63	0.0	0
ring-necked pheasant	4.8	51	4.2	1
gray partridge (n)	4.5	48	0.0	0
western meadowlark	3.2	34	4.2	1
chukar (n)	2.9	31	4.2	1
European starling (n)	2.7	29	0.0	0
American kestrel	2.6	28	0.0	0
dark-eyed junco	2.5	27	0.0	0
mourning dove	2.4	26	0.0	0
unidentified passerine	2.3	25	0.0	0
white-crowned sparrow	2.0	21	4.2	1
unidentified bird	2.0	21	0.0	0
Townsend's warbler	1.9	20	0.0	0
yellow-rumped warbler	1.6	17	4.2	1
red-tailed hawk	1.4	15	4.2	1
rock pigeon (n)	1.2	13	8.3	2
winter wren	1.3	14	0.0	0
ruby-crowned kinglet	1.2	13	0.0	0
northern flicker	1.0	11	0.0	0
American robin	0.8	9	0.0	0
savannah sparrow	0.8	9	8.3	2
red-breasted nuthatch	0.8	8	0.0	0
short-eared owl	0.8	8	0.0	0
unidentified kinglet	0.8	8	4.2	1
warbling vireo	0.7	7	0.0	0
Canada goose	0.6	6	0.0	0
black-billed magpie	0.6	6	0.0	0
house wren	0.6	6	0.0	0
Brewer's sparrow	0.5	5	0.0	0
common nighthawk	0.5	5	0.0	0
golden-crowned sparrow	0.5	5	0.0	0
unidentified sparrow	0.5	5	4.2	1
Cassin's vireo	0.4	4	0.0	0
common raven	0.4	4	0.0	0
great-horned owl	0.4	4	0.0	0
Swainson's hawk	0.4	4	0.0	0
American coot	0.3	3	0.0	0
great blue heron	0.3	3	0.0	0
house sparrow (n)	0.3	3	0.0	0
Lincoln's sparrow	0.3	3	0.0	0
Mallard	0.3	3	0.0	0
orange-crowned warbler	0.3	3	0.0	0
song sparrow	0.3	3	0.0	0
spotted towhee	0.3	3	0.0	0
unidentified buteo	0.3	3	0.0	0
unidentified duck	0.3	3	0.0	0
unidentified vireo	0.3	3	0.0	0
unidentified warbler	0.3	3	0.0	0
Vaux's swift	0.3	3	0.0	0

Species	CPE Wind Projects ¹ (Excludes Klondike IIIa for comparison) (Includes scheduled searches only)		Klondike IIIa (Year 1 and 2 combined) (Includes scheduled searches only)	
	% Composition Found	Number of Fatalities Found	% Composition Found	Number of Fatalities Found
vesper sparrow	0.3	3	0.0	0
western tanager	0.2	2	4.2	1
American goldfinch	0.2	2	0.0	0
barn owl	0.2	2	0.0	0
chipping sparrow	0.2	2	4.2	1
common yellowthroat	0.2	2	0.0	0
downy woodpecker	0.2	2	0.0	0
ferruginous hawk	0.2	2	0.0	0
house finch	0.2	2	0.0	0
long-eared owl	0.2	2	0.0	0
MacGillivray's warbler	0.2	2	0.0	0
northern harrier	0.2	2	0.0	0
northern rough-winged	0.2	2	0.0	0
pine siskin	0.2	2	0.0	0
rough-legged hawk	0.2	2	0.0	0
sage thrasher	0.2	2	0.0	0
sharp-shinned hawk	0.2	2	0.0	0
Virginia rail	0.2	2	0.0	0
white-throated swift	0.2	2	0.0	0
Wilson's warbler	0.2	2	4.2	1
American pipit	0.1	1	0.0	0
ash-throated flycatcher	0.1	1	0.0	0
black-throated sparrow	0.1	1	0.0	0
Brewer's blackbird	0.1	1	0.0	0
brown-headed cowbird	0.1	1	0.0	0
California quail	0.1	1	0.0	0
common poorwill	0.1	1	0.0	0
Cooper's hawk	0.1	1	0.0	0
golden eagle	0.1	1	0.0	0
grasshopper sparrow	0.1	1	0.0	0
gray flycatcher	0.1	1	0.0	0
hairy woodpecker	0.1	1	0.0	0
Hammond's flycatcher	0.1	1	4.2	1
hermit thrush	0.1	1	0.0	0
horned grebe	0.1	1	0.0	0
killdeer	0.1	1	0.0	0
Lewis's woodpecker	0.1	1	0.0	0
long-billed curlew	0.1	1	0.0	0
Merlin	0.1	1	0.0	0
mountain bluebird	0.1	1	0.0	0
purple finch	0.1	1	0.0	0
red-winged blackbird	0.1	1	0.0	0
Swainson's thrush	0.1	1	0.0	0
Townsend's solitaire	0.1	1	0.0	0
tree swallow	0.1	1	0.0	0
unidentified accipiter	0.1	1	0.0	0
unidentified flycatcher	0.1	1	0.0	0
unidentified thrush	0.1	1	0.0	0
varied thrush	0.1	1	0.0	0
western grebe	0.1	1	0.0	0
western kingbird	0.1	1	0.0	0
western wood-pewee	0.1	1	0.0	0
white-breasted nuthatch	0.1	1	0.0	0
yellow warbler	0.1	1	0.0	0

Species	CPE Wind Projects ¹ (Excludes Klondike IIIa for comparison) (Includes scheduled searches only)		Klondike IIIa (Year 1 and 2 combined) (Includes scheduled searches only)	
	% Composition Found	Number of Fatalities Found	% Composition Found	Number of Fatalities Found
American crow	0.0	0	0.0	0
Bufflehead	0.0	0	0.0	0
gray catbird	0.0	0	0.0	0
northern pintail	0.0	0	4.2	1
pacific-slope flycatcher	0.0	0	4.2	1
prairie falcon	0.0	0	0.0	0
sage sparrow	0.0	0	0.0	0
turkey vulture	0.0	0	0.0	0
Williamson's sapsucker	0.0	0	0.0	0
Totals	100.0	1,065	100.00	24

n = non-native species

* with similar study protocols

¹ Data from the following formal monitoring studies during the monitoring periods stated below. For full reference, see reference Section 6.0. These are observed fatalities and not final estimates of fatalities, which are higher.

Enk et al., 2010. Portland General Electric, Biglow Canyon Wind Farm Phase I, post-construction avian and bat monitoring, second annual report, January–December 2009.

Enz, T. and K. Bay. 2010. Post-construction avian and bat fatality monitoring study, Tuolumne Wind Project, Klickitat County, Washington. Final report: April 20, 2009 to April 7, 2010.

Erickson et al., 2000. Avian and bat mortality associated with the Vansycle Wind Plant, Umatilla County Oregon. 1999 study year.

Erickson et al., 2003. Nine Canyon Wind Power Project avian and bat monitoring report, September 2002–August 2003.

Erickson et al., 2004. Stateline Wind Project wildlife monitoring final report, July 2001–December 2003.

Erickson et al., 2007. Stateline Wind Project wildlife monitoring annual report, January–December 2006.

Erickson et al., 2008. Wild Horse Wind Facility construction avian and bat monitoring first annual report, January–December, 2007.

Gritski B., 2010a. Rattlesnake Road Wind Farm – first annual wildlife monitoring study (Jan. 2009–Jan. 2010).

Gritski B., 2010b. Wheat Field Wind Farm – first annual wildlife monitoring study (May 2009–May 2010).

Gritski B., 2010c. Willow Creek Wind Project, results of the first year of wildlife fatality monitoring for the periods January 7, 2009 through February 9, 2010.

Gritski, B. and K. Kronner. 2010a. Pebble Springs Wind Power Project wildlife monitoring study, January 2009–January 2010.

Gritski and Kronner, 2010b. Hay Canyon Wind Power Project wildlife monitoring study, May 2009–May 2010.

Gritski et al., 2008a. Leaning Juniper Wind Power Project, 2006–2008. Wildlife monitoring final report.

Gritski et al., 2008b. White Creek Wind I wildlife monitoring annual summary, winter 2007–2008 through fall 2008.

Gritski et al., 2009b. White Creek Wind I wildlife monitoring second annual summary, winter 2008–2009 through fall 2009.

Gritski et al., 2010. Klondike III (Phase 1) Wind Power Project wildlife fatality monitoring study, October 2007–October 2009.

Jeffrey et al., 2009. Biglow Canyon Wind Farm Phase I post-construction avian and bat monitoring first annual report, January 2008–December 2008

Johnson et al., 2003. Avian and bat mortality at the Klondike, Oregon Phase I Wind Plant, Sherman County, Oregon. February 2002–February 2003.

Kronner et al., 2008. Big Horn Wind Power Project wildlife monitoring study, 2006–2007.

NWC and WEST. 2007. Avian and bat monitoring report for the Klondike II Wind Power Project, Sherman County, Oregon. August 2005–August 2006.

URS, 2010. Final Goodnoe Hills Wind Project avian mortality monitoring report. February 2009–January 2010.

Young et al., 2006. Eurus Combine Hills Turbine Ranch Phase 1 Post Construction Wildlife Monitoring First Annual Report February 2004–February 2005.

Young et al., 2007. Puget Sound Energy, Hopkins Ridge Wind Project Phase 1, post-construction avian and bat monitoring first annual report. January–December 2006.

Young et al., 2009. Puget Sound Energy, Hopkins Ridge Wind Project Phase 1, post-construction avian and bat monitoring, second annual report, January–December 2008.

4.1.3 *OEFSC Avian Thresholds of Concern*

The WMMP enumerates thresholds of concern for four avian groups (OEFSC, 2007). The groups are: raptors, raptor species of special concern, grassland species, and State-Sensitive avian species listed under OAR 635-100-0040. No raptor species of special concern or special status avian species were found during monitoring, consequentially these groups were below threshold levels. The estimated mean fatality rates for raptors (0.06 birds/MW/year) and grassland birds (0.37 birds/MW/year) were below the threshold levels as stated in the WMMP (0.09 raptors/MW/year and 0.59 grassland birds/MW/year). However, due to wide confidence intervals (0.04–0.19 raptors/MW/year and 0.03–1.16 grassland birds/MW/year), both groups had an area of overlap with their respective thresholds and lacked a level of accuracy and precision due to the low sample sizes.

4.1.4 *Migrants*

Nocturnal migrants comprised approximately 38% of observed annual small bird fatalities. As described in Section 3.2.4, there was a high diversity of observed nocturnal migrant fatalities at Klondike IIIa, and the percent composition for many of the nocturnal passerine species was higher at Klondike IIIa than at other CPE projects listed in Table 11 as well as at some individual projects (Kronner et al., 2008; Gritski et al., 2008a). Nocturnal migrant observed fatality composition, however, was roughly comparable to higher observed fatality rates of nocturnal migrants found as fatalities during monitoring at Klondike II (NWC and WEST, 2007), Klondike III (Gritski et al., 2010) and Biglow Canyon (Enk et al., 2010) though higher than other projects in the CPE monitored to date. Hay Canyon (Gritski and Kronner, 2010b) had lower observed nocturnal migrant fatality rates (17%), though total sample size for all birds were low (12), thus possibly influencing any conclusions. As Klondike II, III and Biglow Canyon are adjacent projects to Klondike IIIa monitored in different years, this pattern suggests that the immediate area may have a higher nocturnal migrant fatality rate than other projects in the CPE.

4.2 **Bats**

4.2.1 *Comparison of Bat Fatality Estimates to Other CPE Wind Projects*

Estimated annual bat fatalities at Klondike IIIa (0.14/MW/Yr) were substantially below the CPE average of 1.79/MW/Year (Table 12). Other nearby projects (Klondike II, Hay Canyon) have also had lower than average bat fatality rates. However, Klondike III (Phase 1) had bat fatality rates near the CPE regional mean and Biglow Canyon had annual estimates above the regional mean. Biglow Canyon is closer to the Columbia and John Day Rivers and this may explain some of the higher estimates. While there is certainly some annual variation in numbers, higher bat fatality estimates at KIII than KIIIa despite the year of overlap in study (2009), suggests that there may be micro-scale differences in bat fatalities in the Project area. There was, however, some overlap in 90% confidence intervals (KIII: 0.77 MW/Year 0.38–1.39; KIIIa: 0.14 MW/Year 0.06–0.49). Hay Canyon was also studied during this period and had a wide confidence interval that overlapped both phases of Klondike III (0.57 MW/Year 0.14–1.46).

4.2.2 *Comparison of Bat Fatality Composition to Other CPE Wind Projects*

Hoary and silver-haired bats have comprised over 90% of all observed bat fatalities in CPE studied projects. The only observed bat fatality species found at Klondike IIIa was hoary bat, although since observed fatalities only contained approximately 14% of the estimated fatalities, other species such as silver-haired bat would likely be found as fatalities if the observed percent composition was higher. At the adjacent Klondike III project, hoary and

silver-haired bats comprised 95% of the total observed composition, with silver-haired bats having 54.1% and hoary bat 40.5% (Gritski et al., 2010) of the composition.

Table 12. Annual bat mortality estimates at existing wind projects in the Columbia Plateau Ecoregion with completed fatality monitoring studies.

Wind Project¹ Listed in order of highest to lowest bat fatality rate per MW/year (last column)	Number of Bat Fatalities Found	Annual Fatality Estimate (number of bats)	Number of Bat Fatalities per Turbine per Year (mean)	Number of Bat Fatalities per MW per Year (mean)
Nine Canyon I, WA ²	27	119	3.21	2.47
Biglow Canyon, OR (2008)	39	250	3.29	1.99
Leaning Juniper I, OR ⁴	20	199	2.97	1.98
Big Horn, WA ⁴	59	380	2.86	1.90
Combine Hills, OR	21	77	1.88	1.88
Stateline I and II, WA/OR	128	500	1.12	1.70
Pebble Springs, OR	10	153	3.25	1.55
Hopkins Ridge I, WA (2008)	23	208	2.50	1.39
Vansycle, OR	10	28	0.74	1.12
Klondike III, OR (Phase 1) ⁴	37	240	1.96	1.11
Tuolumne, WA	15	128	2.07	0.94
Klondike I, OR	6	19	1.16	0.77
Hopkins Ridge I, WA (2006)	19	94	1.13	0.63
Biglow Canyon, OR (2009)	17	73	0.96	0.58
Hay Canyon, OR	2	54	1.12	0.53
Klondike II, OR	5	31	0.63	0.41
Wild Horse, WA ³	17	89	0.70	0.39
Goodnoe Hills, WA	8	32	0.68	0.34
Klondike IIIa, OR (Phase 2)⁴	3	11	0.21	0.14
Mean (without KIIIa)			1.79	1.20

¹ Projects are sorted by cumulative bat per MW rates. Big Horn (Kronner et al., 2008), Biglow Canyon Phase I (Jeffrey et al., 2009; Enk et al., 2010), Combine Hills (Young et al., 2006), Goodnoe Hills (URS, 2010); Hay Canyon (Gritski and Kronner, 2010b); Hopkins Ridge I (Young et al., 2007, 2009), Klondike I (Johnson et al., 2003), Klondike II (NWC and West, 2007), Klondike IIIa (this report); Klondike III (Gritski et al., 2010), Leaning Juniper I (Gritski et al., 2008a), Nine Canyon (Erickson et al., 2003), Pebble Springs (Gritski and Kronner, 2010a), Stateline I and II-partial (Erickson et al., 2004), Tuolumne (Enz and Bay, 2010), Vansycle (Erickson et al., 2000), Wild Horse (Erickson et al., 2008).

² Nine Canyon II monitored only part-year (July 25 through November 2, 2004).

³ Wild Horse estimates include only data for the first year of the respective 2-year studies.

⁴ Estimates shown here for KIIIa and KIII were calculated using the Shoenfeld estimator. For rates calculated using Huso estimator for KIIIa, see Table 6b of this report, and for KIII see Gritski et al., 2010. Huso estimator was used to determine estimated fatality rates for Leaning Juniper I and Big Horn wind projects (Gritski et al., 2008a; Kronner et al., 2008).

4.3 Distribution of Fatalities within the KIIIa Project Area

Only 6% of estimated avian fatalities and 14% of estimated bat fatalities were found by searchers (observed fatalities), thus no conclusions regarding the distribution of fatalities within the Project area can be made from observed fatalities. Observed fatalities can be viewed as anecdotal observations in terms of distribution of fatalities with the Project area. Sixteen of the 34 searched turbines had at least one avian fatality, with only one turbine having more than two observed avian fatalities, turbine BB3 (3). Examining trends in terms of turbine strings, all turbine strings had at least one observed avian fatalities. Turbine strings X and Z had the lowest observed per turbine avian fatality rates (both were 0.25 observed avian fatalities/turbine/year). All other turbine strings had similar observed fatality rates.

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7.0 APPENDICES

Appendix A. Summary of wildlife casualties* found at Klondike IIIa Wind Project from August 11, 2008–August 18, 2010.

Date Found	Season	Species ¹	Taxa Group	Sex ²	Age ³	Habitat	Condition	Found During ⁴	Turbine	Distance to Turbine (meters)
Casualties Found Prior To Scheduled Searches in Monitoring Year 1										
Birds (<i>none found</i>)										
Bats										
08/11/08	N/A	hoary bat	Bat	U	A	Road	Intact	Clean-up search	X3	17
Casualties Found Prior To Scheduled Searches in Monitoring Year 2										
Birds										
08/18/09	Fall	American kestrel	Raptor	M	U	CRP	Feather Spot	Clean-up search	BB3	72
Bats										
08/18/09	Fall	hoary bat	Bat	M	A	Agriculture	Intact	Clean-up search	Z10	37
08/18/09	Fall	hoary bat	Bat	U	A	Agriculture	Scavenged	Clean-up search	Z9	87
Monitoring Year 1 Casualties - Birds										
09/15/08	Fall	chukar	Galliform	U	U	Disturbed	Feather spot	Scheduled search	BB4	93
09/29/08	Fall	western tanager	Passerine	F	A	Agriculture	Scavenged	Scheduled search	X3	83
09/30/08	Fall	northern pintail	Waterfowl	U	U	Agriculture	Feather spot	Scheduled search	N4	54
10/14/08	Fall	rock pigeon	Dove	U	U	Agriculture	Feather spot	Scheduled search	AA6	45
11/12/08	Winter	unidentified sparrow	Passerine	U	U	Agriculture	Feather spot	Scheduled search	U4	31
02/17/09	Winter	horned lark	Passerine	F	A	Disturbed	Intact	Scheduled search	AA7	51
04/15/09	Spring	white-crowned sparrow	Passerine	F	A	Agriculture	Scavenged	Scheduled search	AA6	117
05/15/09	Spring	horned lark	Passerine	F	A	Agriculture	Feather Spot	Scheduled search	BB1	117
05/15/09	Spring	horned lark	Passerine	U	A	CRP	Scavenged	Scheduled search	N5	93
08/10/09	Summer	ring-necked pheasant	Galliform	U	A	Grassland	Scavenged	Scheduled search	N5	117
Monitoring Year 2 Casualties - Birds										
08/31/09	Fall	American kestrel	Raptor	M	A	Road	Feather Spot	Incidental	N/A	N/A
08/31/09	Fall	Wilson's warbler	Passerine	M	I	Disturbed	Scavenged	Scheduled Search	AA9	89
08/31/09	Fall	chipping sparrow	Passerine	U	I	Disturbed	Scavenged	Scheduled Search	AA8	93

Date Found	Season	Species ¹	Taxa Group	Sex ²	Age ³	Habitat	Condition	Found During ⁴	Turbine	Distance to Turbine (meters)
08/31/09	Fall	savannah sparrow	Passerine	U	I	Agriculture	Scavenged	Scheduled Search	Z2	79
08/31/09	Fall	Hammond's flycatcher	Passerine	U	U	Agriculture	Scavenged	Scheduled Search	Z2	88
09/28/09	Fall	horned lark	Passerine	M	U	Agriculture	Feather Spot	Scheduled Search	U1	72
09/28/09	Fall	unidentified kinglet	Passerine	U	U	Agriculture	Dismembered	Scheduled Search	AA4	54
10/13/09	Fall	western meadowlark	Passerine	U	U	CRP	Feather Spot	Scheduled Search	BB3	94
10/13/09	Fall	yellow-rumped warbler	Passerine	U	I	CRP	Scavenged	Scheduled Search	BB3	91
02/12/10	Winter	savannah sparrow	Passerine	U	A	CRP	Feather Spot	Scheduled Search	BB3	103
02/12/10	Winter	horned lark	Passerine	U	A	CRP	Feather Spot	Scheduled Search	BB3	67
03/19/10	Spring	red-tailed hawk	Raptor	U	A	CRP	Scavenged	Scheduled Search	BB8	51
06/17/10	Summer	horned lark	Passerine	U	A	Agriculture	Feather Spot	Scheduled Search	U2	28
06/17/10	Summer	rock pigeon	Dove	U	U	Agriculture	Feather Spot	Scheduled Search	U2	59
08/18/10	Fall	pacific-slope flycatcher	Passerine	U	U	Agriculture	Scavenged	Scheduled Search	AA5	107
Monitoring Year 1 Casualties - Bats										
09/12/08	Fall	hoary bat	Bat	U	A	Agriculture	Scavenged	Scheduled search	X4	47
09/30/08	Fall	hoary bat	Bat	M	A	Disturbed	Scavenged	Scheduled search	BB2	10
Monitoring Year 2 Casualties - Bats										
08/31/09	Fall	hoary bat	Bat	U	A	Disturbed	Scavenged	Scheduled Search	AA4	43

* Includes all casualties found. All are attributable to the wind project operations in the absence of sufficient information to determine causes of death.

¹ Includes those identified to species and for those where species identification could not be confirmed, taxonomic group or other is used. Previously unidentified specimens were examined to determine species when possible. Changes have been incorporated into this table and supersede any species identification in previous reports.

² Sex: U = Unknown, M = Male, F = Female

³ Age: U = Unknown, A = Adult, I = Immature, J = Juvenile

⁴ Types are scheduled carcass search (search), incidental, or clean-up search

⁵ N/A: Season not-applicable, found during clean-up search.

Appendix B. Results of Klondike III 2008 raptor nest monitoring* and distance to nearest Klondike III or IIIa turbine.

Nest Record¹ (Bold = within ½ mi of Klondike III or IIIa Turbines)	Inside Klondike III or Klondike IIIa Boundary	2008 Status, Species, Number Fledged², Other Notes (Bold = Successful nests of the three target species)	Distance to Nearest Turbine (Turbine # and Feet)	Likely Associated Nests (Nest Record #)
41	III	Inactive	L8 1,948 ft.	-
42	III	SWHA 1 fledged	P5 1,811 ft.	43, 295
43	III	Inactive	P5 2,085 ft.	42, 295
45	III	Inactive	J7 1,837 ft.	-
46	III	RTHA 3 fledged	K2 994 ft.	-
49	IIIa	SWHA Success unconfirmed. nest gone at last visit 7/19, may have blown out	G1 1,864 ft.	-
50	IIIa	FEHA 1 fledged	M8 2,925 ft.	-
52	III	SWHA 2 fledged	D10 879 ft.	-
84	IIIa	RTHA Unknown number fledged	BB6 2,081 ft.	-
86	III	Unknown buteo Success unconfirmed	AA1 2,598 ft.	-
99	III	Inactive SWHAs observed near nest	H1 700 ft.	-
295	III	2007 nest but not present in 2008	P6 910 ft.	42, 43, 294
Nests Not In Klondike III or IIIa Boundary				
37	No	Inactive	P1 10,174 ft.	-
38	No	Inactive	V1 8,451 ft.	-
39	No	Inactive	V1 6,599 ft.	40
40	No	Inactive	V1 6,625 ft.	39
44	No	RTHA Success unconfirmed	J2 6,695 ft.	-
47	No	RTHA	K4 3,205 ft.	-
48	No	SWHA 1 fledged	K4 5,502 ft.	-
55	No	SWHA Success unconfirmed, no whitewash present	Z1 10,472 ft.	-
56	No	Inactive	Z1 8,712 ft.	-
57	No	Inactive	Z1 5,771 ft.	-
58	No	Inactive ³	Z1 1,276 ft.	59
59	No	Inactive ⁴	Z1 1,411 ft.	58
61	No	Inactive	D13 3,807 ft.	60, 62, 63
62	No	Inactive	D13 4,252 ft.	60, 61, 63

Nest Record¹ (Bold = within ½ mi of Klondike III or IIIa Turbines)	Inside Klondike III or Klondike IIIa Boundary	2008 Status, Species, Number Fledged², Other Notes (Bold = Successful nests of the three target species)	Distance to Nearest Turbine (Turbine # and Feet)	Likely Associated Nests (Nest Record #)
63	No	Inactive	D13 3,742 ft.	60, 61, 62
65	No	Inactive	B17 7,473 ft.	-
66	No	SWHA 1 fledged	B17 3,908 ft.	-
67	No	RTHA 2 fledged	B3 7,639 ft.	-
81	No	Inactive	BB5 8,157 ft.	-
85	No	Inactive	G9 1,823 ft.	-
89	No	GOEA 2 fledged	X7 4,906 ft.	133, 134
91	No	Inactive	AA1 6,472 ft.	263
2007 Nest Sites Not within K-III or K-IIIa Boundaries and Not Relocated During 2008 Surveys⁵				
		2007 and 2008 Notes		
129	No	CORA in 2007	P1 7,956 ft.	-
131	No	CORA in 2007	X7 4,207 ft.	-
134	No	GOEA in 2007 Associated with 2008 active GOEA #89 nest	X7 5,182 ft.	89
253	No	Inactive in 2007 May not be raptor or raven but magpie	B17 4,141 ft.	-
255	No	Inactive in 2007	C8 2,118 ft.	-
267	No	Inactive in 2007	AA1 4,878 ft	-
269	No	2007 notes indicate "old" nest (may have blown out by 2008)	AA1 1,867 ft.	-
277	No	RTHA in 2007	B10 8,356 ft.	-
278	No	Inactive in 2007	B5 1,709 ft.	-

* Does not include some species such as American kestrel and long-eared owl

¹ Some nests are very near others and are considered one traditional nest "site" with two or more tree nests or cliff shelf platforms used alternatively through the years. These side-by-side nests are not likely to be used by multiple birds in the same year.

² Number of young likely fledged successfully based on final nest check

³ SWHA flying

⁴ Unknown activity status - appeared to have had some activity, no whitewash present, likely not used, close to #58

⁵ For some nests not relocated, nest was likely too obstructed for viewing, was blown out of tree or was missed by surveyor. This list does not include 2007 American kestrel assumed nesting sites.

Species Codes (where shown, nest was determined to be Active)

SWHA – Swainson's hawk

GOEA – Golden Eagle

RTHA – Red-Tailed Hawk

FEHA – Ferruginous Hawk

CORA – Common Raven

Active = observed perched on nest, repairing nest, incubating, etc.

Inactive = no sign of use

Not present = no nest present

Unsuccessful = bird confirmed incubating and/or young present but no young documented fledged

Appendix C. Special status wildlife observed (live) during wildlife monitoring at the Klondike IIIa Wind Power Project 2008–2010.

Date	Species	Status¹	Number	Location (nearest turbine)
Birds				
08/31/09	peregrine falcon	SV, BoCC	1	N1
08/31/09	golden eagle	EPA, BoCC	2	BB- String
Mammals				
10/14/08	white-tailed jackrabbit	SV	1	BB1
01/13/09	white-tailed jackrabbit	SV	1	BB1
02/17/09	white-tailed jackrabbit	SV	1	BB4
03/16/09	white-tailed jackrabbit	SV	2	BB4
08/31/09	white-tailed jackrabbit	SV	2	U1
09/28/09	white-tailed jackrabbit	SV	1	U2
05/07/10	white-tailed jackrabbit	SV	1	BB6

¹ Status:

SV = State of Oregon Sensitive Vulnerable

BoCC = USFWS Bird of Conservation Concern

EPA= Eagle Protection Act

Scientific names available upon request

Appendix D. Results of post-construction avian use surveys in four seasons in monitoring year 1 and monitoring year 2, August 14, 2008–August 5, 2010, Klondike IIIa Wind Project (data presented in four tables, pgs. 41–44).

Species observed for avian groups recorded during post-construction avian use surveys

Species/Groups	Fall				Winter				Spring				Summer			
	Year 1		Year 2		Year 1		Year 2		Year 1		Year 2		Year 1		Year 2	
	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind
Raptors		5		3		15		10		13		8		6		8
<i>northern harrier</i>	1	1	2	2	1	1	2	2	2	4	2	2	1	1	1	1
<i>Accipiters</i>		1		0		0		0		1		0		0		1
Cooper's hawk	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
unidentified accipiter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
<i>Buteos</i>		0		0		10		6		7		0		2		1
Swainson's hawk	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0
red-tailed hawk	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	1
rough-legged hawk	0	0	0	0	6	8	3	4	2	2	0	0	0	0	0	0
<i>Eagles</i>		1		0		2		1		0		0		1		0
golden eagle	1	1	0	0	1	2	1	1	0	0	0	0	1	1	0	0
<i>Falcons</i>		2		1		2		1		1		4		2		5
American kestrel	2	2	1	1	1	1	1	1	1	1	2	2	2	2	2	5
prairie falcon	0	0	0	0	1	1	0	0	0	0	2	2	0	0	0	0
Shorebirds		0		0		0		0		3		0		0		0
long-billed curlew	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0
Game birds		0		0		0		0		0		1		0		0
ring-necked pheasant	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Passerines		52		88		204		106		70		87		30		96
<i>Songbirds</i>		45		72		193		87		60		82		29		94
Brewer's blackbird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	29
European starling	0	0	2	9	0	0	1	6	1	2	1	3	0	0	0	0
horned lark	13	39	15	51	22	191	21	64	16	31	23	46	14	27	15	50
house finch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
loggerhead shrike	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
rock wren	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
unidentified blackbird	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
unidentified passerine	0	0	1	8	0	0	0	0	0	0	1	1	0	0	0	0

Species/Groups	Fall				Winter				Spring				Summer				
	Year 1		Year 2		Year 1		Year 2		Year 1		Year 2		Year 1		Year 2		
	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	
unidentified sparrow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
unidentified swallow	0	0	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0
western kingbird	1	3	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
western meadowlark	2	3	3	4	1	2	7	16	4	7	1	1	1	1	1	7	10
<i>Corvids</i>		7		16		11		19		10		5		1		2	
black-billed magpie	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0
common raven	5	7	10	16	6	11	7	10	6	10	4	5	1	1	2	2	
Doves		0		0		0		0		0		18		0		7	
mourning dove	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
rock pigeon	0	0	0	0	0	0	0	0	0	0	2	18	0	0	1	5	
Total		57		91		219		116		86		114		36		111	

*Survey dates in each season, number of surveys, and number of plots surveyed in each monitoring year:

Fall season:

Year 1 – August 14, 2008–October 13, 2008; 5 visits to 6 plots=30 surveys

Year 2 – September 10, 2009–October 26, 2009; 4 visits to 6 plots=24 surveys

Winter season:

Year 1 – November 12, 2008–March 12, 2009; 5 visits to 6 plots=30 surveys

Year 2 – November 11, 2009–March 11, 2010; 5 visits to 6 plots=30 surveys

Spring season:

Year 1 – March 31, 2009–May 18, 2009; 4 visits to 6 plots=24 surveys

Year 2 – March 24, 2010–May 27, 2010; 4 visits to 6 plots=24 surveys

Summer season:

Year 1 – June 16, 2009–August 6, 2009; 3 visits to 6 plots=18 surveys

Year 2 – June 27, 2010–August 5, 2010; 3 visits to 6 plots=18 surveys

Mean use for avian groups recorded during post-construction avian use surveys

Group and Species	Fall*		Winter		Spring		Summer	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
	Mean Use**							
Raptors	0.167	0.125	0.500	0.333	0.542	0.333	0.333	0.444
<i>northern harrier</i>	0.033	0.083	0.033	0.067	0.167	0.083	0.056	0.056
<i>Accipiters</i>	0.033	0.000	0.000	0.000	0.042	0.000	0.000	0.056
Cooper's hawk	0.033	0.000	0.000	0.000	0.042	0.000	0.000	0.000
unidentified accipiter	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056
<i>Buteos</i>	0.000	0.000	0.333	0.200	0.292	0.083	0.111	0.056
Swainson's hawk	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000
red-tailed hawk	0.000	0.000	0.067	0.067	0.083	0.083	0.111	0.056
rough-legged hawk	0.000	0.000	0.267	0.133	0.083	0.000	0.000	0.000
<i>Eagles</i>	0.033	0.000	0.067	0.033	0.000	0.000	0.056	0.000
golden eagle	0.033	0.000	0.067	0.033	0.000	0.000	0.056	0.000
<i>Falcons</i>	0.067	0.000	0.067	0.033	0.042	0.167	0.111	0.278
American kestrel	0.067	0.042	0.033	0.033	0.042	0.083	0.111	0.278
prairie falcon	0.000	0.000	0.033	0.000	0.000	0.083	0.000	0.000
Shorebirds	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000
long-billed curlew	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000
Game birds	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.000
ring-necked pheasant	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.000
Passerines	1.733	3.667	6.800	3.533	2.917	3.625	1.667	5.333
<i>Songbirds</i>	1.500	3.000	6.433	2.900	2.500	3.417	1.611	5.222
Brewer's blackbird	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.611
European starling	0.000	0.375	0.000	0.200	0.083	0.125	0.000	0.000
horned lark	1.300	2.125	6.367	2.133	1.292	1.917	1.500	2.778
house finch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111
loggerhead shrike	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056
rock wren	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.000
unidentified blackbird	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.000
unidentified passerine	0.000	0.333	0.000	0.000	0.000	0.042	0.000	0.000
unidentified sparrow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056
unidentified swallow	0.000	0.000	0.000	0.000	0.833	0.000	0.000	0.000
western kingbird	0.100	0.000	0.000	0.000	0.000	0.000	0.056	0.000
western meadowlark	0.100	0.167	0.067	0.533	0.292	1.292	0.056	0.056
<i>Corvids</i>	0.233	0.667	0.367	0.633	0.417	0.208	0.056	0.556
black-billed magpie	0.000	0.000	0.000	0.300	0.000	0.000	0.000	0.111
common raven	0.233	0.667	0.367	0.333	0.417	0.208	0.056	0.111
Doves	0.000	0.000	0.000	0.000	0.000	0.750	0.000	0.389
mourning dove	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111
rock pigeon	0.000	0.000	0.000	0.000	0.000	0.750	0.000	0.278
Total	1.900	3.792	7.300	3.867	3.583	4.750	2.000	6.167

* Survey dates in each season and plots surveyed described in footnotes of Table 8.

** Mean Use: mean number of individuals within 800m plot/20-minute point count for each species or group provides an index of the magnitude of avian use, but it does not describe density.

Percent composition for avian groups recorded during post-construction avian use surveys

Group and Species	Fall		Winter		Spring		Summer	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
% Composition*								
Raptors	8.77	3.30	6.85	8.62	15.12	7.02	16.67	7.21
<i>northern harrier</i>	1.75	2.20	0.46	1.72	4.65	1.75	2.78	0.90
<i>Accipiters</i>	1.75	0.00	0.00	0.00	1.16	0.00	0.00	0.90
Cooper's hawk	1.75	0.00	0.00	0.00	1.16	0.00	0.00	0.00
unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
<i>Buteos</i>	0.00	0.00	4.57	5.17	8.14	1.75	5.56	0.90
Swainson's hawk	0.00	0.00	0.00	0.00	3.49	0.00	0.00	0.00
red-tailed hawk	0.00	0.00	0.91	1.72	2.33	1.75	5.56	0.90
rough-legged hawk	0.00	0.00	3.65	3.45	2.33	0.00	0.00	0.00
<i>Eagles</i>	1.75	0.00	0.91	0.86	0.00	0.00	2.78	0.00
golden eagle	1.75	0.00	0.91	0.86	0.00	0.00	2.78	0.00
<i>Falcons</i>	3.51	1.10	0.91	0.86	1.16	3.51	5.56	4.50
American kestrel	3.51	1.10	0.46	0.89	1.16	1.75	5.56	4.50
prairie falcon	0.00	0.00	0.46	0.00	0.00	1.75	0.00	0.00
Shorebirds	0.00	0.00	0.00	0.00	3.49	0.00	0.00	0.00
long-billed curlew	0.00	0.00	0.00	0.00	3.49	0.00	0.00	0.00
Game birds	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
ring-necked	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
Passerines	91.23	96.70	93.15	91.38	81.40	76.32	83.33	86.49
<i>Songbirds</i>	78.95	79.12	88.13	75.00	69.77	71.93	80.56	84.68
Brewer's blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.13
European starling	0.00	9.89	0.00	5.17	2.33	2.63	0.00	0.00
horned lark	68.42	56.04	87.21	55.17	36.05	40.35	75.00	45.05
house finch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
loggerhead shrike	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
rock wren	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
unidentified	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00
unidentified	0.00	8.79	0.00	0.00	0.00	0.88	0.00	0.00
unidentified sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
unidentified swallow	0.00	0.00	0.00	0.00	23.26	0.00	0.00	0.00
western kingbird	5.26	0.00	0.00	0.00	0.00	0.00	2.78	0.90
western	5.26	4.40	0.91	13.79	8.14	27.19	2.78	9.01
<i>Corvids</i>	12.28	17.58	5.02	16.38	11.63	4.39	2.78	1.80
black-billed magpie	0.00	0.00	0.00	7.76	0.00	0.00	0.00	0.00
common raven	12.28	17.58	5.02	8.62	11.63	4.39	2.78	1.80
Doves	0.00	0.00	0.00	0.00	0.00	15.79	0.00	6.31
mourning dove	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
rock pigeon	0.00	0.00	0.00	0.00	0.00	15.79	0.00	4.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Percent Composition: mean use for a species/total use across all species, multiplied by 100, providing an estimate of the relative use of any particular species, compared to the use by all other species combined.

Percent frequency of occurrence for avian groups recorded during post-construction avian use surveys

Group and Species	Fall		Winter		Spring		Summer	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
	% Frequency of Occurrence*							
Raptors	16.67	12.50	30.00	33.33	33.33	33.33	27.78	27.78
<i>northern harrier</i>	3.33	8.33	3.33	6.67	8.33	8.33	5.56	5.56
<i>Accipiters</i>	3.33	0.00	0.00	0.00	4.17	0.00	0.00	5.56
Cooper's hawk	3.33	0.00	0.00	0.00	4.17	0.00	0.00	0.00
unidentified accipiter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56
<i>Buteos</i>	0.00	0.00	20.00	20.00	25.00	8.33	11.11	5.56
Swainson's hawk	0.00	0.00	0.00	0.00	8.33	0.00	0.00	0.00
red-tailed hawk	0.00	0.00	3.33	6.67	8.33	8.33	11.11	5.56
rough-legged hawk	0.00	0.00	16.67	13.33	8.33	0.00	0.00	0.00
Eagles	3.33	0.00	6.67	3.33	0.00	0.00	5.56	0.00
golden eagle	3.33	0.00	6.67	3.33	0.00	0.00	5.56	0.00
<i>Falcons</i>	6.67	4.17	3.33	3.33	4.17	16.67	11.11	11.11
American kestrel	6.67	4.17	3.33	3.33	4.17	8.33	11.11	11.11
prairie falcon	0.00	0.00	3.33	0.00	0.00	8.33	0.00	0.00
Shorebirds	0.00	0.00	0.00	0.00	4.17	0.00	0.00	0.00
long-billed curlew	0.00	0.00	0.00	0.00	4.17	0.00	0.00	0.00
Game birds	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.00
ring-necked pheasant	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.00
Passerines	63.33	91.67	73.33	90.00	83.33	95.83	83.33	100.00
<i>Songbirds</i>	50.00	70.83	73.33	79.67	70.83	95.83	77.78	100.00
Brewer's blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.22
European starling	0.00	8.33	0.00	3.33	4.17	4.17	0.00	0.00
horned lark	43.33	62.50	73.33	70.00	66.67	95.83	77.78	83.33
house finch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56
loggerhead shrike	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56
rock wren	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.00
unidentified blackbird	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00
unidentified passerine	0.00	4.17	0.00	0.00	0.00	4.17	0.00	0.00
unidentified sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56
unidentified swallow	0.00	0.00	0.00	0.00	4.17	0.00	0.00	0.00
western kingbird	3.33	0.00	0.00	0.00	0.00	0.00	5.56	5.56
western meadowlark	6.67	12.50	3.33	23.33	16.67	54.17	5.56	38.89
<i>Corvids</i>	16.67	41.67	20.00	23.33	25.00	16.67	5.56	11.11
black-billed magpie	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00
common raven	16.67	41.67	20.00	23.33	25.00	16.67	5.56	11.11
Doves	0.00	0.00	0.00	0.00	0.00	8.33	0.00	11.11
mourning dove	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56
rock pigeon	0.00	0.00	0.00	0.00	0.00	8.33	0.00	5.56
Total	63.33	91.67	83.33	93.33	91.67	95.83	88.89	100.00

* Frequency of Occurrence: percentage of surveys in which a species was observed with the survey plot providing an index of how often a species occurs in the project area.

8.0 FIGURES

Figure 1. Turbine search plots at Klondike IIIa Wind Project, 2008–2010.

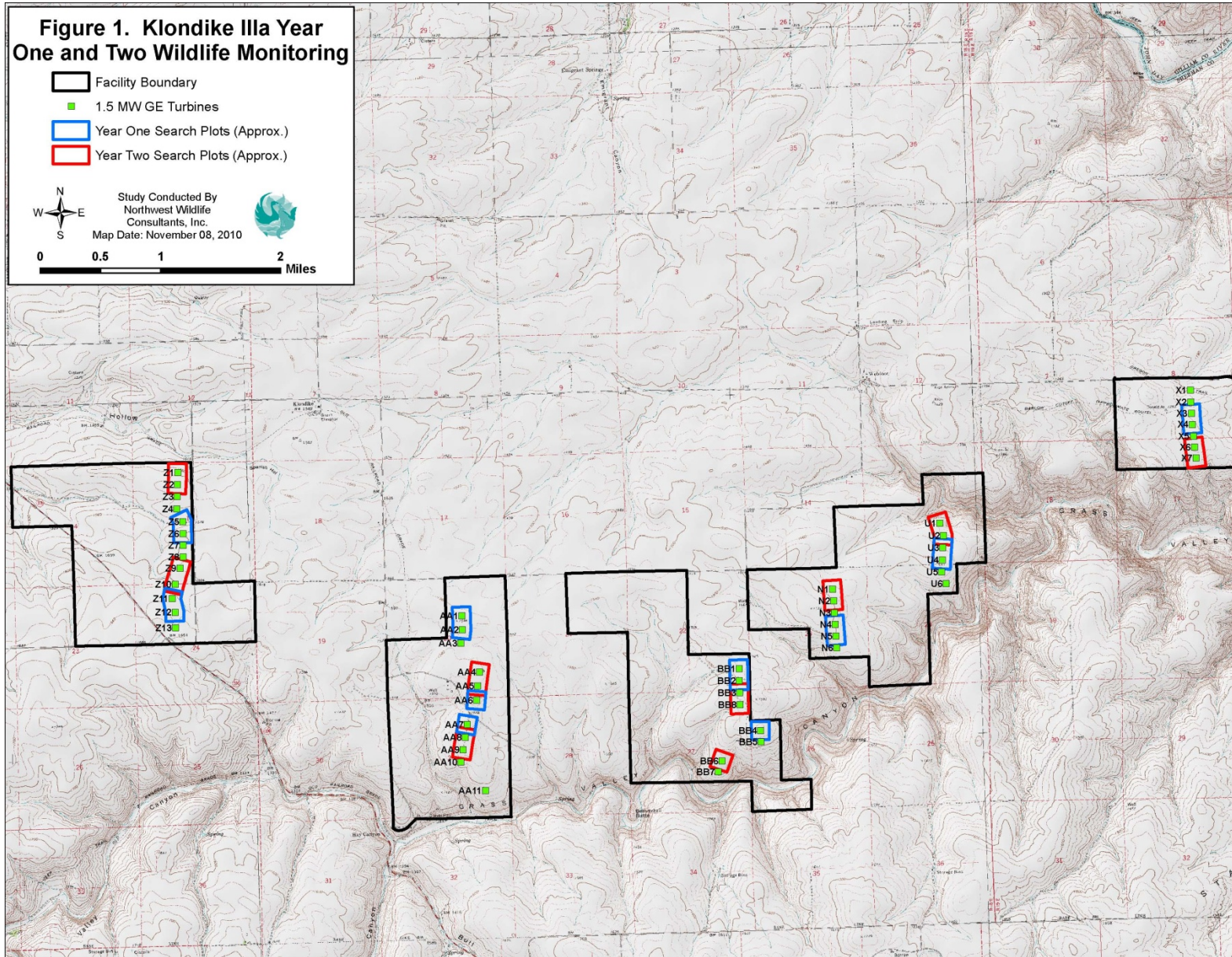


Figure 2. Graphical depiction of 120 meter search plots conducted during monitoring at Klondike IIIa Wind Project, 2008–2010.

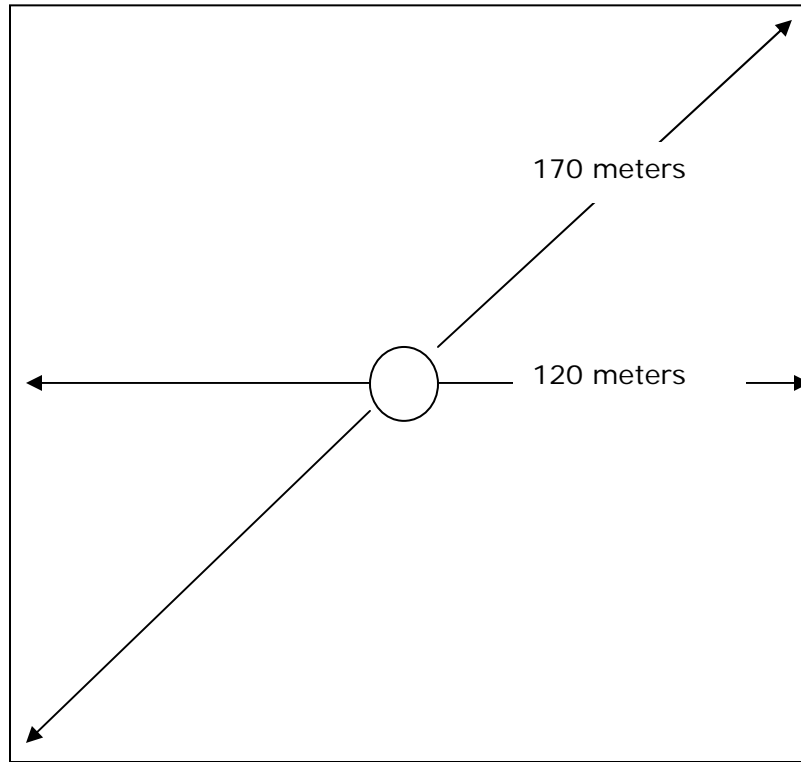
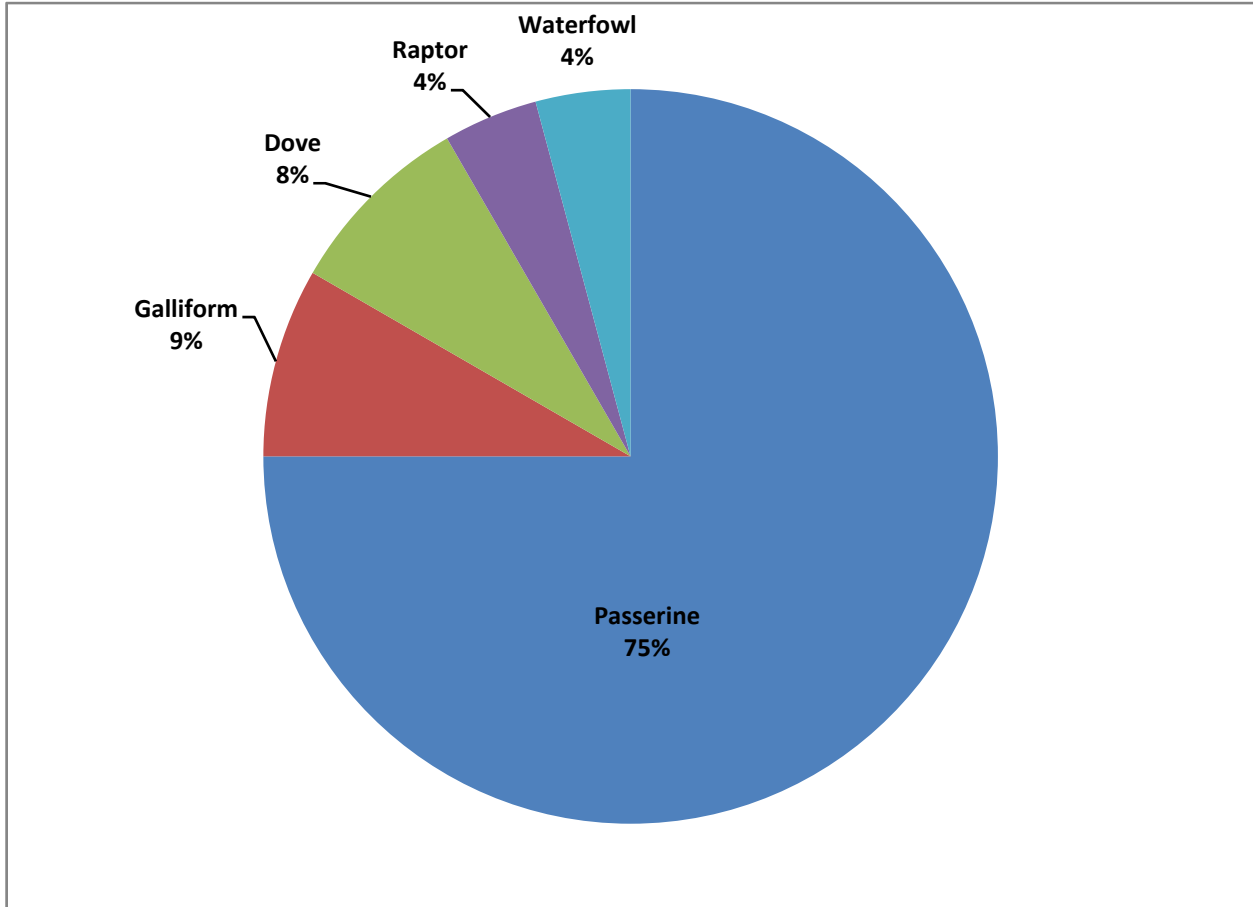


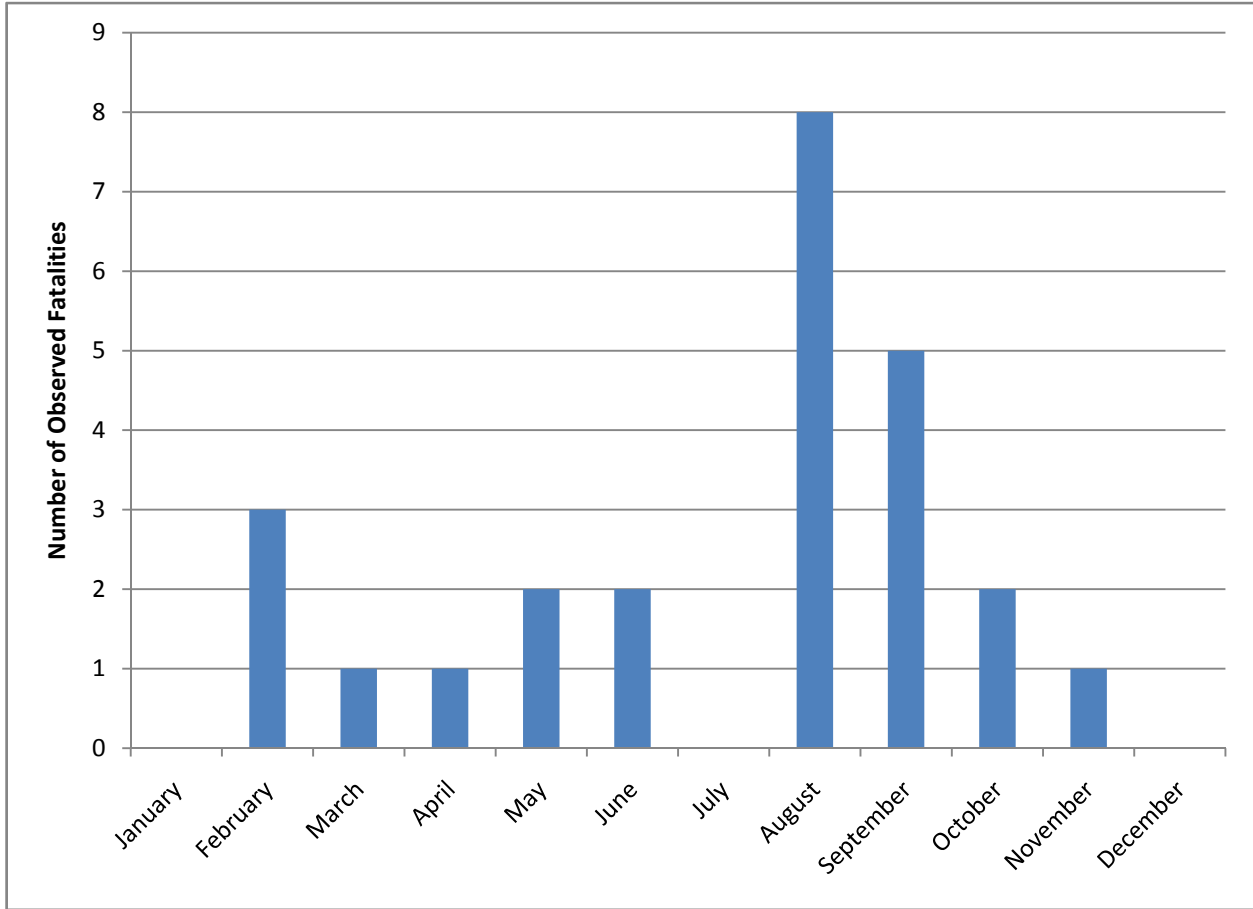
Figure 3. Klondike III and IIIa Raptor and Other Large Bird Nest Monitoring.
(*Confidential - submitted under separate cover*)

Figure 4. Composition of observed (documented) avian fatalities¹ by taxonomic group at Klondike IIIa Wind Project, 2008–2010 during scheduled searches.



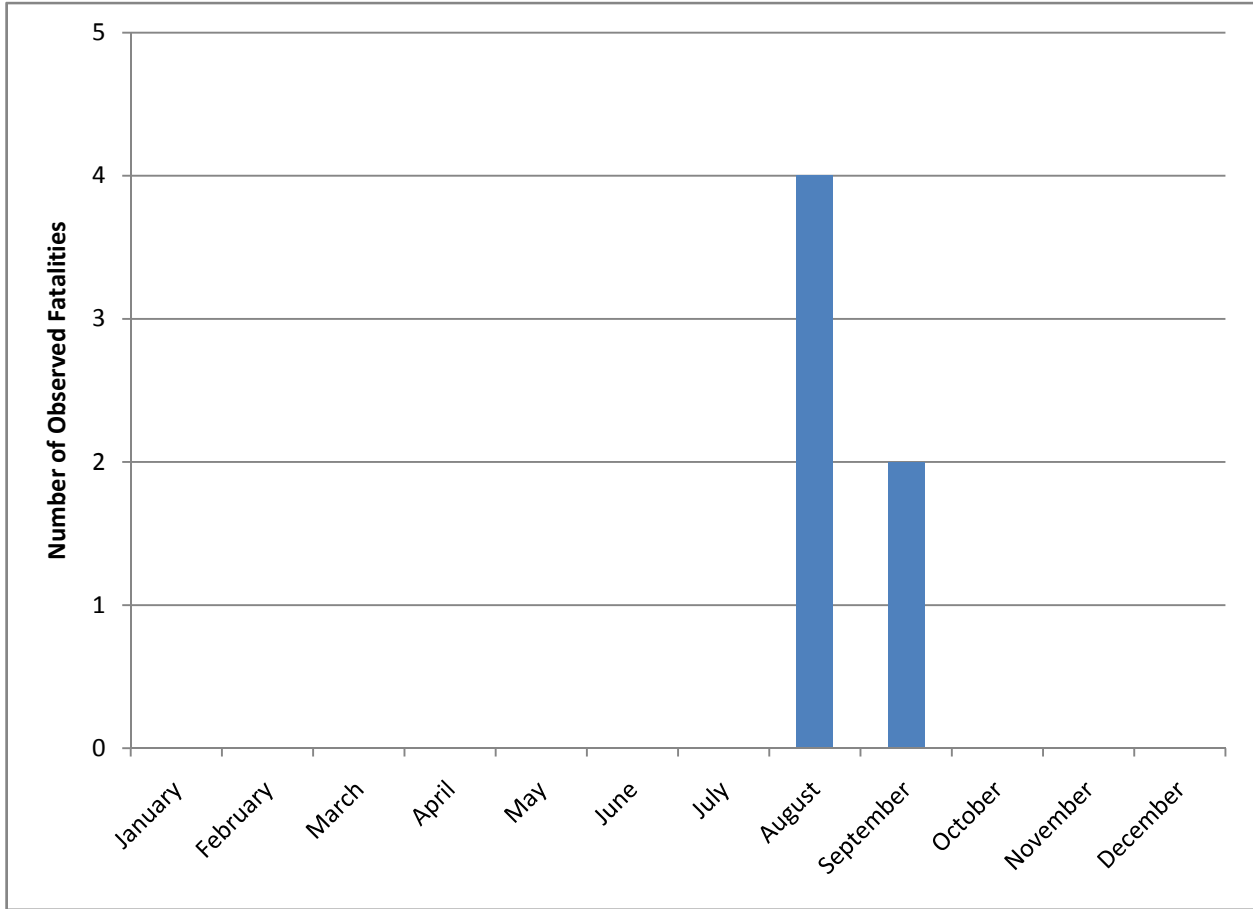
¹ Does not include incidentals

Figure 5. Observed avian fatalities¹ found by month at Klondike IIIa Wind Project, 2008–2010.



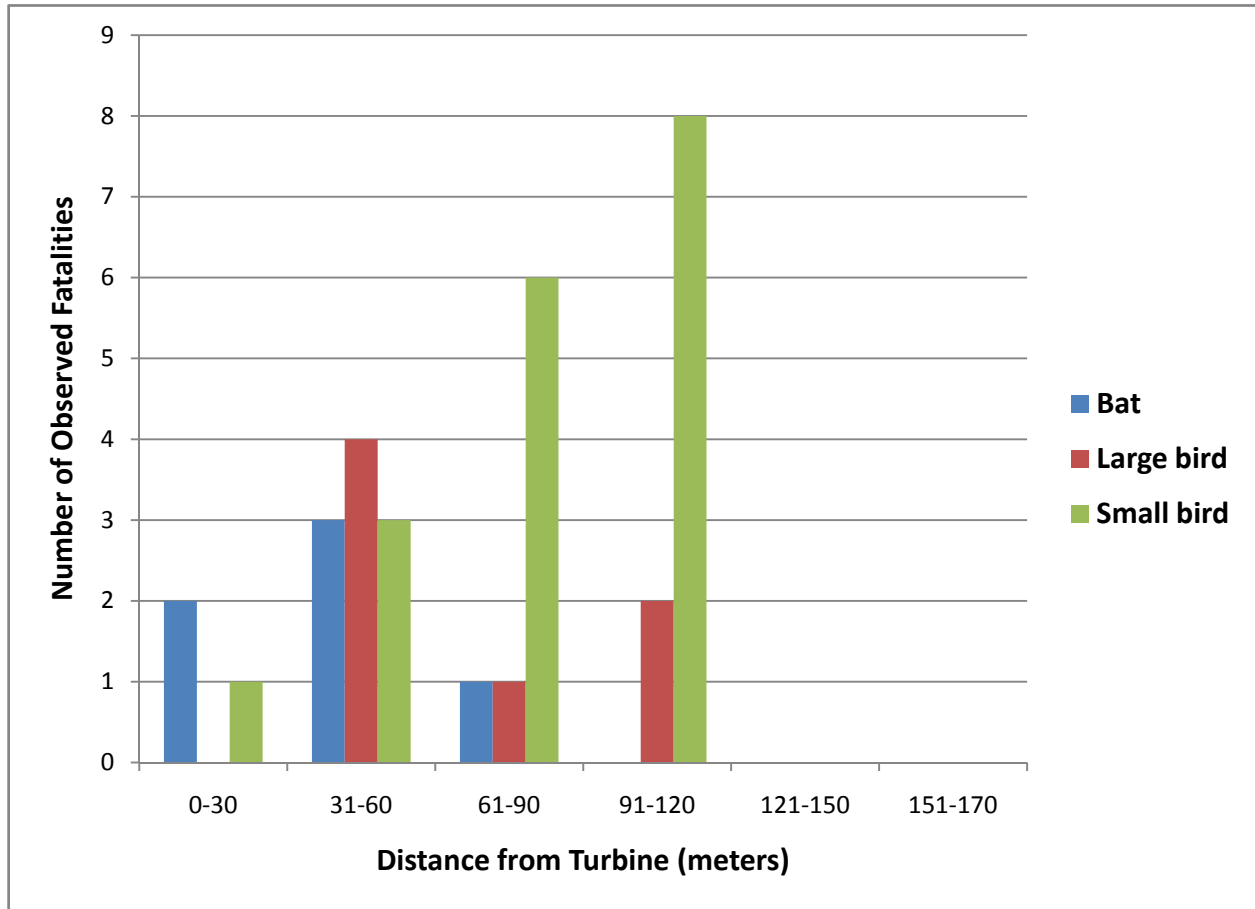
¹ Includes incidentals

Figure 6. Observed bat fatalities¹ found by month at Klondike IIIa Wind Project, 2008–2010.



¹ Includes incidentals

Figure 7. Observed fatalities¹ for large birds, small birds, and bats, grouped by distance from turbine at Klondike IIIa Wind Project, 2008–2010.



¹ Includes incidentals