

Baseline Avian Studies for the Windy Flats Wind Energy Project, Klickitat County, Washington

Prepared for:

Windy Point Partners, LLC

Prepared by:

Greg Johnson
Jay Jeffrey
Jerry Baker
Kimberly Bay

WEST Inc.
2003 Central Avenue
Cheyenne, WY 82001



May 29, 2007

IMPACT ASSESSMENT

The most probable impact to birds resulting from the project is direct mortality or injury due to collisions with the turbines or guy wires of temporary or permanent meteorological towers. Collisions may occur with resident birds foraging and flying within the project area, or with birds migrating through the project area. Other impacts could include abandonment of the area due to disturbance caused by project construction or operation, and mortality or injury due to collisions with construction vehicles or other equipment.

Project construction could affect birds through loss of habitat, potential fatalities from construction equipment, and disturbance/displacement effects from construction activities. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance and equipment. Potential mortality from construction equipment is expected to be very low. Equipment used in wind facility construction generally moves at slow rates (e.g., cranes) or is stationary for long periods. The risk of direct mortality from construction to birds is most likely limited to potential destruction of a nest for ground- and shrub-nesting species. Disturbance-type impacts can be expected if construction activity occurs near an active nest or a primary foraging area. Birds displaced from these areas might move to areas with fewer disturbances, depending on the stage of nesting; however, breeding effort and fledging success could be affected, and foraging opportunities might be altered during the construction period. Constructing outside the breeding season or limiting construction within predefined buffers around special status bird nests during the breeding season may be effective in minimizing direct and indirect impacts to special status bird species.

The assessment of operational impacts to birds from wind projects is based on the site-specific measures of bird utilization, bird behavior, nesting, habitat, and topography in combination with existing information on these same metrics in addition to direct measures of impact (e.g., mortality and displacement). Fortunately, this particular site is located in a region where several wind projects have been developed and studied. Baseline and/or monitoring studies have been conducted at most of these locations providing an existing comprehensive data source for predicting impacts to wildlife.

Measured bird use of the Windy Flats site in addition to measured use and mortality estimates from other existing wind farms were used to predict mortality of birds for the project. Primary regional data used from other projects include pre-construction avian use and post-construction fatality monitoring data from (1) the Klondike I wind project in Sherman County, Oregon, (2) the Condon Wind Project in Gilliam County, Oregon, (3) the Stateline Wind Project in Walla Walla County, Washington and Umatilla County, Oregon, (4) the Vansycle Wind Project in Umatilla County, Oregon, (5) the Combine Hills Wind Project in Umatilla County, Oregon, (6) the Hopkins Ridge Project in Columbia County, Washington, and (7) the Nine Canyon Wind Project in Benton County, Washington.

Substantial data on avian mortality at wind facilities are currently available. Of 841 avian fatalities reported from California studies (>70% from Altamont Pass, CA), 39% were diurnal raptors, 19% were passerines (excluding house sparrows and European starlings), and 12% were owls. Non-protected birds including house sparrows, European starlings, and rock doves comprised 15% of the fatalities. Other avian groups generally made up <10% of the fatalities (Erickson et al. 2002). During 12 fatality monitoring studies conducted outside of California, diurnal raptor fatalities comprised only 2% of the wind project-related fatalities and raptor mortality averaged 0.03/turbine/year. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising 82% of the 225 fatalities documented. No other group (e.g., raptors, waterfowl) comprised more than 5% of the

fatalities. Many of these projects that were studied are small in scale and have more modern turbines than the California projects.

For all avian species combined, estimates of the number of bird fatalities per turbine per year from individual studies have ranged from 0 at the Searsburg, Vermont (Kerlinger 1997) and Algona, Iowa sites (Demastes and Trainer 2000) to 7.7 at the Buffalo Mountain, Tennessee site (Nicholson 2003). Using updated mortality data from wind projects throughout the entire U.S., the average number of avian collision fatalities is 3.1 per megawatt per year or 2.3 per turbine per year (NWCC 2004).

Raptors

Based on site specific avian use data collected for the Windy Flats site over a one-year period, mean annual raptor use (defined as number of raptors observed per 20 minute period at a station with an 800-m radius) is 0.83/survey (Table 2). Based on studies of 31 other WRAs using similar protocols, mean annual raptor/vulture use (defined as number of raptors and vultures observed per 20-minute period at a station with an 800-m radius) typically ranges from 0.10/survey to 1.3/survey (Figure 6). The only areas studied with higher than typical raptor use are Altamont Pass, California, where annual use averaged 2.4/survey, and the High Winds site in Solano County, California, where annual raptor use averaged 3.5/survey. Raptor/vulture use at the Windy Flats site is 24% of that observed at High Winds and 35% of that observed at Altamont. Raptor use at Windy Flats is moderate compared to other WRAs, as 9 had higher use and 22 had lower use (Figure 6).

The Altamont Pass, California WRA contains 5,400 turbines, most of which are small, obsolete, lattice tower, Kenetech turbines. The latest raptor fatality estimates at Altamont based on searches using 30 – 90 day search intervals indicate that annual mortality averages 1.5 to 2.2 raptor fatalities per megawatt (MW) per year when adjusted for searcher efficiency and scavenging bias. The High Winds Project is a modern wind farm with 1.8 MW turbines, and estimated mortality was 0.30 raptors per MW per year (unadjusted for scavenger removal or searcher efficiency) with searches conducted every 14 days. Most of the raptor mortality at the High Winds Project involved American kestrels, and the relative use of the High Winds site by kestrels was approximately 6 times higher than at the Altamont Pass. With the exception of American kestrels at the High Winds Project in California, raptor mortality at new-generation wind projects both within and outside California has been relatively low (Table 9).

We conducted a regression analysis of raptor use and raptor collision mortality for several new-generation wind farms where similar methods were used to obtain raptor use estimates and found that the correlation between raptor use and raptor collision mortality is highly significant ($r^2 = 87.5\%$; Figure 7). The data are from the High Winds project in Solano County, California, Diablo Winds repowering project in Altamont Pass, Buffalo Ridge project in Minnesota, Foote Creek Rim project in Wyoming, and six projects in the Pacific Northwest, including the Stateline project on the Washington/Oregon border, the Combine Hills, Vansycle, and Klondike projects in Oregon, and the Nine Canyon and Hopkins Ridge Projects in Washington. Using this regression to predict raptor collision mortality at Windy Flats based on mean raptor use of 0.83/survey yields an estimated fatality rate of 0.09/MW/year, or 17 raptors per year for a 190-MW project. A 90% prediction interval around this estimate is 0 to 0.21 raptor fatalities/MW/year.

These estimates should be considered tentative. Although mortality data do exist for wind farms in the Pacific Northwest with turbines up to 1.5 MW in size, no fatality data exist for 2 or 2.5-MW turbines. These estimates assume raptor mortality for a 2.5-MW turbine would be 2.5 times higher than a 1-MW turbine, which may not be accurate. Turbines larger than 1.5 MW have a larger rotor diameter, which

may increase risk to raptors, the rotor-swept area is higher off the ground and the turbine rotates at slower speeds, which may actually reduce risk to some raptors. Based on an analysis of avian fatality data at wind farms with turbines ranging in size from 0.04–1.8 MW, tower heights ranging from 24–94 m and rotor diameters ranging from 15–80 m, Barclay et al. (2007) concluded that avian fatality rates were not affected by any of these parameters. Therefore, inflating our estimates to account for larger turbines may lead to over-estimates of avian mortality at Windy Flats.

Based on species composition of the most common raptor fatalities at other western wind farms and species composition of raptors observed in the Columbia Hills during baseline studies, the majority of the fatalities of diurnal raptors will likely consist of buteos (especially red-tailed hawk) and American kestrels. Small numbers of other raptors observed during the surveys, including accipiters, harriers, and eagles, may also occur as fatalities over the life of the project. Species of raptor fatalities documented at other WRA in the Pacific Northwest include red-tailed hawk (9), American kestrel (9), short-eared owl (2), rough-legged hawk (2), ferruginous hawk (1), Swainson's hawk (1), Cooper's hawk (1) and northern harrier (1) (Table 10).

Other Birds

Passerines (songbirds) have been the most abundant avian fatality at wind farms outside California, often comprising more than 80% of total avian fatalities (Erickson et al. 2001a). Passerines are also the most commonly observed birds during pre-construction avian use point count surveys at all of these sites. Both migrant and resident passerine fatalities have been observed.

Songbird mortality at wind projects in eastern Oregon and Washington has been reasonably consistent among sites. Songbirds have comprised 69% of the mortality. Horned larks have been the most commonly observed songbird fatality at agriculture and grassland projects in the Pacific Northwest, comprising 35% of all fatalities (Table 10), and have been the most abundant songbird observed during pre-construction point count surveys at these sites. Based on long term Breeding Bird Survey data, horned larks are likely one of the most common birds in the Columbia Plateau. Otherwise, no other resident songbird species has comprised a large proportion of the fatalities observed at the sites in the Pacific Northwest. The two apparent migrants with the highest number of fatalities include golden-crowned kinglet and white-crowned sparrow.

Studies of nocturnal migration at several wind projects suggest that the mortality compared to the number of birds passing through the area appears low (Johnson et al. 2002a; Mabee and Cooper 2002; McCrary et al. 1984). In much of the West, songbirds appear to migrate across a broad front, except in unique topographic situations such as coastlines and large river valleys or riparian corridors. In the Pacific Northwest, nocturnal migration has been studied at the Stateline Wind Project on the Oregon/Washington border (Mabee and Cooper 2002), as well as some small sampling effort at the Nine Canyon Wind Project in Washington. The Stateline radar study was designed to monitor waterfowl, shorebird, and passerine movements during 2001 spring and fall migrations. Marine radar was used to study nocturnal bird migration at two stations; one near the existing Vansycle Wind Project near the southeastern end of the Stateline project area, and one to the north of the project area in Washington. The northern and southern monitoring stations had very similar passage rates, suggesting broad front movements throughout the project site.

Turbines on taller towers may kill more nocturnal migrating birds that typically fly at altitudes much higher than the heights of small older-generation turbines. While there have been numerous fatality events recorded at communication structures that involved up to several hundred avian fatalities in one

night, there have been only two events reported, both reasonably small, at U.S. wind generation facilities (includes sites with modern turbines). Fourteen nocturnal migrating passerine fatalities were observed at two turbines during a single night at the Buffalo Ridge wind project in Minnesota, during spring migration (Johnson *et al.* 2002a). Thirty-three nocturnal migrating passerine fatalities were observed at three turbines and a well lit substation at the Backbone Mountain, West Virginia facility during one or two nights of foggy weather (Kerns and Kerlinger 2004). The data suggest that sodium vapor lamps at the substation were the primary attractant, since fatality locations were correlated with the location of the substation, and the turbines away from the substation had few fatalities documented the morning after the event. After the lights were turned off at the substation, no events occurred. Tall, lighted structures are suspected of attracting nocturnal migrating birds, especially during inclement weather (Kerlinger 2000). Lighting at communication towers, where larger mortality events have been documented, is typically different than lighting at wind turbines. Communication towers commonly have more than one light location on a tower, while wind turbines have only one location for the light (on top of the nacelle, see FAA circular on lighting). Communication towers often have one red pulsating or flashing light on the top of the tower, and several solid red lights at various heights. Communication tower lighting may be more of an attractant than wind turbine lighting (Kerlinger 2003), but research and data are limited.

No large measured differences in nocturnal migrant fatality rates have been documented between wind turbines that are lit with aircraft obstruction lighting and unlit turbines. At the Stateline Wind Project, observed fatality rates at lit turbines were slightly higher than at unlit turbines, although none of the differences were statistically significant ($p > 0.10$) (Erickson *et al.* 2004). Similar results were found at the Nine Canyon wind project, which has the same lighting characteristics (red-flashing at night) but on larger and taller turbines than Stateline turbines (Erickson *et al.* 2003). The Buffalo Ridge, Minnesota wind project showed a similar result for turbines similar in size to Stateline, although lighting types differ (i.e., steady-burning red incandescent; Johnson *et al.* 2002a). Buffalo Ridge wind project Phase I turbines were not lit, whereas Phase III turbines had approximately every other turbine lit with solid red lights (approximately 70 of 143 turbines). Six of the 138 Phase II turbines along the outer boundary of the site were lit with solid red lights. No statistical differences were found between lit and unlit turbines.

Most mortality at communication towers involves towers greater than 500 feet in height (Longcore *et al.* 2005). In addition, much of the avian mortality at communication towers involves birds colliding with guy wires rather than the tower itself. One study showed that mortality at guyed communication towers was ten times higher than unguyed towers (Longcore *et al.* 2005). The Windy Flats wind turbines are <500 feet in height and will not have guy wires, which should greatly reduce the potential for impacts to nocturnal migrants.

Use of the Windy Flats project by waterbirds, primarily gulls and Canada geese, was fairly high compared to many other WRA. Wind projects with year-round waterfowl use have shown the highest waterfowl mortality, although levels of waterfowl/waterbird mortality appear insignificant compared to use of the sites by these groups. Waterfowl and other waterbirds have comprised only 2.5% of the fatalities found at existing wind farms in Oregon and Washington, and include 4 Canada geese, 2 great blue herons, 1 mallard, 1 Virginia rail and 1 American coot. Mortality compared to use by these groups is very low. For example, only 2 Canada goose fatalities were documented at the Klondike, Oregon wind project, even though 43 flocks totaling 4845 individual Canada geese were observed during pre-construction surveys (Johnson *et al.* 2003). The recently constructed Top of Iowa Wind Project is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use,

including migrant and resident waterfowl. During a recent study, approximately 1 million total goose-use days and 120,000 total duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during concurrent and standardized wind project fatality studies (Koford et al. 2004). Similar findings were observed at the Buffalo Ridge Wind Project in southwestern Minnesota, which is located in an area with relatively high waterfowl/waterbird use and some shorebird use. Snow geese, Canada geese and mallards were the most common waterfowl observed. Three of the 55 fatalities observed during the fatality monitoring studies were waterfowl, including 2 mallards and 1 blue-winged teal. Two American coots, one grebe, and one shorebird fatality were also found. Some waterfowl, shorebird and other waterbird mortality may occur from the project, but based on all available data from other projects, the numbers are expected to be low relative to the waterfowl/waterbird use of the general area.

Upland game birds documented during surveys of the Windy Flats project included California quail, ring-necked pheasant, gray partridge and chukar. Some upland game bird mortality has been documented at many wind projects (Erickson et al. 2001a, Erickson et al. 2002). In the Pacific Northwest, upland game birds are one of the most common fatalities, comprising 18% of all identified fatalities. Based on habitat present, results from other regional wind projects, and the presence of upland game birds during baseline surveys, there is potential for mortality of some upland game birds to occur. However, it is expected to be below any levels that would cause population declines.

Total avian use at Windy Flats from site-specific surveys averaged 19.8 per survey. Similar data are available for 25 other WRA in eastern Washington and Oregon, where total avian use ranged from 5–23.6/survey and averaged 12.4/survey (Figure 8). Total avian use at the 7 wind farms in eastern Washington and Oregon with post-construction fatality data ranged from 5.6 at Hopkins Ridge, Washington to 17.5 at Klondike, Oregon. Fatality estimates for all bird species combined at the six existing eastern Washington and Oregon projects with standardized mortality data have ranged from 0.6 to 3.6 fatalities/turbine/year or 0.9 to 2.9 fatalities/MW/year (Table 11). The only species represented by more than 10% of the fatalities has been horned lark, the most commonly observed species at all of these facilities during daytime use surveys (Table 10). Compared with raptors, there is less correlation between total numbers of birds (all species) observed during pre-construction surveys (most of which are song birds) and post-construction mortality, presumably because many of the collision fatalities are nocturnal migrants, which are not accounted for during diurnal surveys. For example, of the 7 existing wind farms in eastern Washington and Oregon with fatality data, the wind farm with the highest avian use (Klondike – 17.5/survey) had the lowest fatality rate (0.9/MW). Therefore, because total avian use at Windy Flats is within the range of similar avian use values for other regional wind farms, it is reasonable to assume that mortality of all birds combined at Windy Flats would be similar to that observed at the other regional wind energy projects. Based on the range of 0.9–2.9 fatalities/MW/year, we estimate that total avian mortality at Windy Flats would range from 171–551 per year. As is the case at other wind farms, most of the total avian mortality would likely be composed of song birds. The largest number of fatalities will likely be horned larks, a common grassland songbird detected during the surveys. No other species (migrant or resident) is anticipated to make up a large proportion of the fatalities, based on the patterns of results of other regional studies. As was the case with raptor fatality estimates, there are no mortality data for 2.5-MW turbines, and total avian mortality may differ (i.e., be lower or higher) than that observed at the smaller turbines.

Indirect Effects

The presence of wind turbines may alter the landscape so that wildlife habitat use patterns are altered,