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February 1, 2010

Re: Comments on "Recommendations for Wind Energy Development in Crucial and Important Wildlife Habitats**."**

Dear Mr. Gamo,

The Wyoming Outdoor Council, Wyoming's largest statewide conservation organization and a leading advocate for the protection of Wyoming's public lands and wildlife, is grateful for the opportunity to provide comments on the above-referenced document. We support the development of alternative renewable energy sources to reduce emissions that contribute to global climate change and air pollution. In addition, we recognize that Wyoming has high-quality wind resources that can provide a domestic source of renewable energy to the nation and revenues to the state, local communities, and private landowners. However, we also recognize that wind farms have site-specific footprints that can harm Wyoming's wildlife and alter its iconic landscapes. As the Wyoming Game and Fish Department (WGFD) comprehensively outlined in its *Recommendations for Wind Energy Development in Crucial and Important Wildlife Habitats* (hereafter Wind Recommendations), the potential adverse impacts of wind energy development include collision-related mortality of birds and bats, habitat destruction and fragmentation, increased anthropogenic disturbance, and site avoidance by wildlife. Because of these threats, the Wyoming Outdoor Council believes that certain areas are inappropriate for wind development. Where it is appropriate, wind development should follow "best management practices" that minimize the impact of wind development on wildlife and wild lands. We appreciate the WGFD's attempts to develop such best management practices and, with these comments, respectfully offer some modifications and some suggested additions to ensure that wildlife impacts are minimized as the pace of wind energy leasing, permitting, and development continues to escalate in Wyoming.

Currently, the Wyoming Industrial Siting Council (WISC) reviews and approves permit applications for the majority of the state's wind projects [all of those over the current cost threshold of 178.9 million dollars (W.S. 35-12-102(vii))]. The BLM approves Right of Way permits to wind projects on federal lands. Both the WISC and the BLM look to the WGFD to provide them with the necessary mitigation measures that individual companies should adopt to minimize their project's impact on wildlife. As a result, it is critical that the WGFD's Wind Recommendations be comprehensive, specific, and prescriptive, and that they achieve the goal of protecting Wyoming's treasured wildlife resources.

Wind energy representatives frequently have expressed concern (at legislative hearings, the Governor's wind conference, and other gatherings), that Wyoming's lack of regulatory clarity makes it difficult for them to operate successfully in the state. As a result, we encourage the WGFD to be as prescriptive and specific as possible in its recommendations to provide clarity on how best to protect wildlife resources to the wind energy industry, as well as to permitting entities such as the WISC and the BLM. Furthermore, we urge the WGFD to carefully review each individual project on a case-by-case basis and use the expertise of its local biologists and other experts to highlight and address site specific problems early in the permitting process so that any additional site-based mitigation measures are instituted as needed.

We sincerely appreciate that the WGFD considers its Wind Recommendations to be a "living" document that will be subject to continual review and amendment. Given how much we still have to learn about wind energy impacts on wildlife in general, and on sage-grouse and big game in particular, we believe that it is essential to view this document as reflecting only current knowledge and to incorporate new findings and associated mitigation measures as they become known. We also urge the WGFD to move forward judiciously with the process of approving these Wind Recommendations. Wind energy development has been proceeding at an incredible pace in Wyoming. Having a clear understanding of its potential impacts on wildlife as well as having a comprehensive suite of mitigation measures available to protect wildlife will ensure that future wind development proceeds responsibly.

In addition to the recommendations already outlined by the WGFD, we also would like to see prescriptive recommendations with regards to meteorological towers, lighting, and fencing, all of which either were not addressed in the current document or were addressed only superficially. We also would like pre-construction surveys to be more comprehensive, post-construction surveys not to be waived, and adequate buffers and stipulations to help safeguard the species they are designed to protect.

General Comments

We commend the WGFD for its comprehensive analysis of wildlife impacts, which comprises the bulk of the Wind Recommendations document. The cumulative impact framework not only provides valuable information to those who are unaware of the site-specific impacts of wind energy development on Wyoming's wildlife and critical wildlife habitats, but also provides important validation for the WGFD's recommended best management practices. In addition, the WGFD highlights important research needs which ultimately will inform more refined best management practices that will enable Wyoming to better site and develop wind energy with fewer negative consequences to wildlife.

Given the potential for wind energy development to eliminate, fragment, and disturb wildlife habitat, we particularly appreciate the WGFD's recommendations regarding developing wind energy preferentially on already-disturbed lands. We similarly support developing wind first and foremost in areas that have the fewest environmental conflicts. As a result, we concur with the views expressed by the Governor's office that wind development is best suited for areas east of the I-25 corridor, where there are fewer wildlife resources and therefore fewer potential conflicts, perhaps most significantly and importantly, with regard to the greater sage-grouse.

Unless otherwise noted, we support the WGFD's proposed best management practices as outlined in Appendix A, particularly its recommendations for avoiding wildlife habitat management areas; federal wildlife refuges; big game migration corridors; wetlands; forested habitats; perennial streams, reservoirs and riparian areas; topographical features that attract raptors, and significant raptor migration corridors. These recommendations generally conform to recommendations made by the USFWS (for example, USFWS 2003) and by other state wildlife agencies and other interested entities (National Wind Coordinating Collaborative 2007). These mitigation measures are inherent to the more refined siting of wind energy farms that has led to decreased avian and bat fatalities at newer wind energy sites. Maintaining low levels of bird and bat fatalities is essential not only to maintaining populations of these animals, but also to maintaining public support of wind energy.

Some may object to the WGFD's setback recommendations with the argument that oil and gas development is not subject to such recommendations. However, birds and bats do not typically die from colliding with oil and gas infrastructure and these setbacks are solely designed to keep wind turbines, which *do* kill birds and bats, away from areas that are known wildlife attractants (water sources, treed areas, etc.), so as to minimize avian and bat collision fatalities. Recognizing that the high levels of avian and bat fatalities at early wind farms alarmed the public and were a blight on the industry's reputation, wind energy companies have emphasized that better siting of wind farms has resulted in lower bird and bat fatalities. The WGFD's setback recommendations are exactly the type of appropriate siting measures that have resulted in these "better-sited" wind farms that have lower wildlife fatality rates. Birds and bats are attracted to water sources and forested habitats in Wyoming. Raptors are attracted to certain types of

topography. Therefore, the WGFD is right to recommend that certain landscape features be avoided and that turbines be set two miles from known attractants, so that wildlife losses are minimized, and the public remains supportive of wind energy as a climate-friendly source of energy.

The WGFD Should Recommend the Use of Bird Diverters on Meteorological Tower Guy Wires

Bird species throughout the U.S have experienced significant declines [North American Bird Conservation Initiative (NABCI) 2009]. Almost one quarter of U.S. bird species are considered to be species of conservation concern and about eight percent are federally listed as endangered (NABCI 2009). Grassland and arid-land birds have experienced the most rapid declines over the last four decades (NABCI 2009). Sagebrush lands, in particular, face wide-ranging threats and are considered to be one of the most threatened types of ecosystems. Approximately 45% of potential sagebrush habitat has been converted to other habitat types, as a result of agriculture, urbanization, and other pressures (NABCI 2009).

Birds face significant cumulative impacts from habitat loss; predation by cats; collisions with communication towers, windows, vehicles, and power lines; agricultural pesticides; and increasingly, wind farms (Erickson et al. 2005). Several species that breed in Wyoming are showing population declines of 68–91%, including the mountain plover and McCown's longspur (NABCI 2009).

The Bureau of Land Management in Wyoming has received approximately 99 wind energy site testing and monitoring applications since 2002 (personal communication with Janelle Wrigley, Realty Specialist, BLM, Cheyenne, November 25, 2009). Testing the wind energy resource at each proposed project site involves the deployment of numerous meteorological towers which, in Wyoming, typically are anchored to the ground with a multitude of guy wires.

Guyed meteorological (met) towers may pose an even greater threat to birds than associated wind turbines since met tower guy wires often are invisible to flying birds. An early 1980s study of two experimental turbines and a met tower in Wyoming found 25 avian fatalities in a one-year period, "most of them involving passerines that had collided with guy wires on the meteorological tower" (U.S. Bureau of Reclamation 1984, referenced in Erickson et al. 2005). A post-construction study at Foote Creek Rim in Wyoming directly compared fatality rates at wind turbines and associated met towers. Researchers found an estimated 8.1 bird fatalities per met tower per year, compared to an estimated 1.5 bird fatalities per wind turbine per year (Young, et al. 2003). Based on these findings, guyed met towers were five times more likely to kill birds than were wind turbines at the Foote Creek Rim site. The highest known bird fatality rate for any wind farm is 7.3 birds per turbine per year at Buffalo Mountain Tennessee, where only three wind turbines were in use (Nicholson et al. 2005). A met tower at this location had a mortality

rate of 5.8 birds per year (Nicholson et al. 2005). In comparison, based on studies prior to 2003 of avian wind energy-related collision fatalities nationwide, an average of 2.11 birds were killed per wind turbine per year (Erickson et al. 2005). [Nevertheless, it should be noted that existing fatality estimates at wind farms are highly imprecise and potentially biased low (Smallwood 2007)].

Although little research has been conducted on the population or site-specific impacts of met tower guy wires on birds, bird fatalities resulting from collisions with power lines and guyed communication towers are well documented (for example, Faanes 1987, Manville 2005). Power lines and guyed communication towers kill millions of birds annually (Manville 2005, Longcore et al. 2008). Guy wires associated with communication towers have been particularly dangerous to birds (Kruse 1996, Manville 2005, Gehring and Kerlinger 2007a, Longcore et al. 2008). As a result, the U. S. Fish and Wildlife Service has recommended the use of bird diverters, markers that are attached to the wires to make them more visible to birds, for communication tower guy wires (USFWS 2000). Such diverters also have significantly reduced avian collisions with powerlines (Brown and Drewien 1995, Savareno et al. 1996) and have been recommended by the Avian Powerline Interaction Committee (APLIC), a consortium of electric utilities, utility organizations, and federal agencies involved in bird and powerline interaction issues (APLIC 2006).

Recognizing the similarity between the avian collision threat posed by guy wires on met towers, and the threat of communication tower guy wires and powerlines, the USFWS recommended that all existing met tower guy wires be marked with recommended bird deterrent devices to help prevent avian collisions and allow wind energy companies to remain in compliance with the Migratory Bird Treaty Act (16 U.S.C. 703-712) in its 2003 *Interim guidelines to avoid and minimize wildlife impacts from wind turbines* (USFWS 2003).

In its latest draft recommendations (October 2009), the USFWS's Wind Turbine Guidelines Advisory Committee, recommends "Avoid[ing] guyed communication towers and permanent meteorological towers at wind energy project sites" and states: "If guy wires are necessary, bird flight diverters or high visibility marking devices should be used" (p.43). Elsewhere in the same document the USFWS again recommends that: "Guyed structures should be avoided unless guy wires are treated with bird flight diverters or high visibility marking devices, or are located where known low bird use will occur" (p.62).

Although the use of bird diverters has been particularly important in raptor and waterfowl concentration areas, such devices also are useful in preventing songbird (passerine) collisions. Given that 92% of the avian fatalities documented at Wyoming's Foote Creek Rim wind site were passerines (Young 2003), mitigation measures that protect these birds are of paramount importance.

Marking met tower guy wires may also help to reduce potential greater sage-grouse collisions with guy wires. Thus far, collision fatality rates of sage-grouse with wind turbines have been low compared to those of raptors, waterfowl, and passerines (Erickson et al. 2001), although this may be an artifact of few wind sites having been built in sage-grouse habitat until recently rather than a real indication of the threat that wind turbines pose to grouse. Nevertheless, research has shown that wire fences pose a significant collision threat to sage-grouse. Rangeland fences accounted for 18 percent of sage-grouse deaths in a Utah study (Danvir 2002). More recently, research by the WGFD documented 170 bird strikes, 146 (86%) of which were by sage-grouse, along a 4.7-mile stretch of fence in southwestern Wyoming (Christiansen 2009). Based on these findings and their typical flight height, sage-grouse may be more likely to strike met tower guy wires than wind turbine blades. The use of bird diverters on met towers guy wires would reduce the likelihood of sage-grouse colliding with guy wires. The use of bird diverters on portions of the fence in the Wyoming study reduced bird-fence collisions by 70% over unmarked sections (Christiansen 2009). Only seven bird strikes (all sage-grouse) were recorded along fence segments that were marked with bird diverters, compared to 47 bird strikes, including 36 sage-grouse, recorded in the unmarked section (Christiansen 2009).

Given the vulnerability of sage-grouse and the continued decline of Wyoming's sagebrush obligates and grassland birds, the Wyoming Outdoor Council feels that recommending the use of bird diverters on met tower guy wires will not only reduce collision-related fatality rates of raptors, waterfowl, passerines, and other small birds, but could also reduce possible grouse collisions with met tower guy wires. Indeed, in December 2009, the BLM issued an Internal Memorandum (IM 2010-022), recommending the following:

- To reduce the risk of collisions, avoid the use of guy wires for turbine or MET tower supports. All existing guy wires should be marked with recommended bird deterrent devices. (Emphasis added).
- The siting of new temporary MET towers must be avoided within 2 miles of active sage-grouse leks, unless they are out of the direct line of sight of the active lek.

A number of companies currently produce bird diverters that clip on to met tower guy wires and function well in extremely windy conditions. Most of the bird diverter models have reflective tape that glows in the dark, thereby illuminating the wires for night-flying as well as diurnal birds (see for example, P & R Technologies, Inc.'s Firefly Model FF-Met that is designed specifically for met towers: http://www.pr-tech.com/product/birds/birds_main.htm. Different attachments can be purchased for these diverters so that they function well in high-wind conditions). The use of bird diverters on met towers is a low-cost means of mitigating the impacts of wind energy development on birds and avoiding easily preventable fatalities.

Most birds in Wyoming are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712). In addition, eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). We believe that wind energy companies should institute best available technologies

to reduce avian fatalities at their wind sites and remain in compliance with these federal mandates. Given that the U.S. Fish and Wildlife Service and the Bureau of Land Management currently recommend the use of bird deterrent devices (bird diverters) on met tower guy wires, we believe that the WGFD should do so as well. In addition, using bird diverters to make met tower guy wires more visible to birds would also make the towers more visible to pilots. While the straight met tower pole and guy wires can be virtually invisible to pilots, posing a substantial threat to low-flying aircraft, the reflective surface of the bird diverters spaced approximately 30 feet apart along the guy wires will help highlight the structures for pilots, thereby providing an invaluable human-safety benefit. This issue has obvious and direct significant implications for the WGFD, given its extensive use of small airplanes flying at low altitudes in support of its management efforts.

We believe that the WGFD should recommend tubular, non-latticed met towers first and foremost. Latticed structures have been known to attract birds and latticed turbines are believed to have been a causal factor in the high levels of raptors killed at the Altamont wind farm in California (Howell and DiDonato 1991, Orloff and Flannery 1992). The wind energy industry responded to the high levels of raptor fatalities at Altamont by developing tubular turbines that did not provide perching surfaces for birds. As a result, the WGFD should not support the use of latticed met towers at wind energy sites in Wyoming that could attract raptors and other birds, and increase their likelihood of colliding with turbine blades. In addition, the WGFD should qualify its recommendation (Wind Recommendations, Appendix A, BMP 22) that unguyed met towers be used, by adding that *if wind or other conditions necessitate the use of guy wires, bird diverters should be used on met tower guy wires*. Although the WGFD recommended the use of non-guyed met towers in its recommendations, the reality is that the vast majority (if not all) of the met towers currently deployed in Wyoming are guyed. Recommending the use of bird diverters on the guy wires of the many hundreds of met towers that are currently in place in Wyoming as well as those that may be deployed in the future is a vital and cost-effective protective measure for conserving Wyoming's declining bird populations.

The WGFD Should Include More Prescriptive Recommendations Regarding Lighting

The WGFD makes no recommendations about lighting in its list of best management practices for wind sites. Nevertheless, certain lights can attract night-flying birds and have been known to increase the avian hazards posed by communication towers and other structures (Longcore et al. 2008). For turbines, the WGFD should recommend the minimum amount of lighting required by the Federal Aviation Administration (FAA). In addition, the WGFD should recommend the use of flashing red or white lights on turbines and on communication towers. Solid red lights have been shown to attract night-migrating birds (Gauthreaux and Belser 2006, Gehring and Kerlinger 2007b – Exhibit 1). Furthermore, studies have shown that the *combination* of a solid red light

and a flashing red light on communication towers is most likely to attract night-flying birds and therefore is particularly dangerous to them (Gehring and Kerlinger 2007b). Therefore, the WGFD should recommend that solid red lights NOT be used in combination with blinking red lights on communication towers (some wind energy companies [for example Rocky Mountain Power in its Dunlap Project] are including communication towers as part of their wind farm infrastructure).

If lights on auxiliary buildings, such as operations and maintenance buildings are deemed necessary, they should be motion-activated and downcast to reduce light pollution and to prevent disturbing or attracting wildlife. According to Kerlinger et al. (unpubl. data referenced in Longcore et al. 2008), studies have shown greater rates of bird kills at turbines near lighted structures. Reducing night lighting on accessory buildings at wind farms also would reduce adverse effects on other taxa (Longcore and Rich 2004, Rich and Longcore 2006). Finally, we believe that the WGFD should recommend the strict avoidance of sodium vapor lights at wind energy sites. Sodium vapor lights, widely used for streetlights and security lighting, should not be used at or near wind energy facilities because they have been shown to attract night-flying birds (Kerlinger 2004, Kerns and Kerlinger 2004).

While not endorsing any particular mitigation measures, the U.S. Government Accounting Office noted in its discussion of possible mitigation measures for reducing the impact of wind energy on birds that:

> "some experts argue that, regardless, it is best to use low lighting to avoid attracting birds that migrate at night. In addition, researchers recommended that sodium vapor lights should never be used at or near wind power facilities because they have commonly been shown to attract birds to other structures. They noted that the largest number of birds killed at one time near wind turbines was found adjacent to sodium lights after a night of dense fog. No fatalities have been discovered near these turbines since the lights were subsequently turned off" (USGAO 2005).

In addition, in its latest draft recommendations (October 2009), the USFWS's Wind Turbine Guidelines Advisory Committee, recommends the following with regards to lighting at wind energy sites:

> Employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights to meet FAA requirements for visibility lighting of wind turbines, permanent met towers, and communication towers. Only a portion of the turbines within the wind project should be lighted, and all pilot warning lights should fire synchronously.
>
> Keep lighting at both operation and maintenance facilities and substations located within half a mile of the turbines to the minimum required.
>
> a. Use lights with motion or heat sensors and switches to keep lights off when not required.
> b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.
> c. Minimize use of high-intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.

Additional study on the potential attractants posed by wind farm lighting is warranted. In the meantime, though, it seems prudent for the WGFD to add the abovementioned lighting best management practices to its Wind Recommendations to minimize the potential impacts of wind energy development in Wyoming on the state's migratory birds.

The WGFD Should Recommend Wildlife-Friendly Fencing and Sage-Grouse Diverters on Fences

We concur with the WGFD's recommendation that the construction of fences be minimized in wind energy projects (Wind Recommendations, Appendix A, BMP 24). We also recommend that the WGFD provide more specific recommendations with regard to any fencing that will be constructed or remain in wind energy sites. Fences should be "wildlife friendly" with smooth top and bottom wires and of a height and line spacing that minimizes the threat of ungulate entanglement.

In addition, we believe that the WGFD should recommend that any fencing within two miles of active sage-grouse leks be fitted with sage-grouse diverters to prevent grouse from colliding with fences. As mentioned above, a recent WGFD study documented the severity of the threat posed to sage-grouse by certain fences and the success of sage-grouse diverters in reducing fence-collision fatality rates (Christiansen 2009). Sage-grouse diverters clip onto the top line of fences, flap in the wind reflecting sunlight, and glow in the dark for 10-12 hours to highlight fence lines for flying grouse. Requiring the use of these low-cost (approximately $1.75 each) deterrent devices in the vicinity of active sage-grouse leks is a prudent measure that will help reduce unnecessary grouse fatalities. Wyoming has enacted a number of important conservation measures to reduce threats to sage-grouse and maintain stable grouse-populations in the face of energy development. We believe the WGFD should recommend the use of sage-grouse diverters in its Wind Recommendations as a proactive means of reducing a highly preventable threat to local sage-grouse populations.

The 0.25 mi Buffer for Sage-grouse Leks in Non-core Areas is Inadequate to Protect Sage-grouse Populations from Wind Energy Development

Thus far, research has not specifically examined the impact of wind turbines on greater sage-grouse. Nevertheless, the impacts of oil and gas development on sage-grouse have received extensive study and involve many infrastructure components and disturbance factors (roads, structures, power lines, human disturbance) that are comparable to the anticipated disturbances of wind energy development. As the WGFD notes in its comments,

> "studies examining the impacts of roads, powerlines, communication towers, and noise in natural gas fields are relevant in ascertaining how native prairie grouse are likely to respond to wind energy development. Movement and noise associated with turbines and access and maintenance roads, in particular, are expected to cause avoidance effects similar to those associated with large-scale oil and gas fields" (WGFD Wind Recommendations at 9).

The USFWS concurs with this assessment, stating in a July 2009 letter to the WGFD (Exhibit 2).

> "In assessing the threats to sage-grouse to determine whether the species warrants listing under ESA, we view the science on the impacts of wind development on sage-grouse as being clearer than is being conveyed by some in the wind industry. While there is no doubt that we have more to learn, there exists a large body of empirical, peer-reviewed, and published science on the negative impacts of road-and-pad based development on the behavior, movements, survival and productivity of this species." (USFWS July 2009 letter to the WGFD at 2).

In addition to sharing many of the infrastructure components of oil and gas fields, wind energy development has an added vertical component (wind turbines) that is anticipated to be particularly problematic for sage-grouse, which evolved in treeless, open landscapes that provide few perches for the raptors that prey on grouse. Greater sage-grouse are displaced when junipers (vertical structures that serve as raptor perches) encroach on sagebrush habitat (Doherty 2008, Miller et al. *In press*). Research also suggests that habitat use by sage-grouse is negatively impacted by power lines (another type of vertical structure) up to a distance of at least 600 m (Braun 1998). Studies on two species of prairie chickens, which are open-country species like sage-grouse, in Oklahoma showed that the birds avoided transmission lines (Pruett et al. 2009). In addition, the birds crossed power lines less often than expected if birds moved randomly, and the home ranges of lesser prairie-chickens overlapped transmission lines less than would be expected by the chance placement of home ranges (Pruett et al. 2009).

Not only do wind energy sites contain vertical structures that might displace grouse, but they also contain higher *densities* of vertical structures than do oil and gas fields. Research has shown that oil and gas development in excess of one well pad per square mile causes sage-grouse populations to decline (Holloran 2005, Naugle et al. 2006). Wind farms may have densities of more than 13 turbines (with pads) per square mile. Furthermore, the motion, shadow flicker, and noise of turbine blades, are likely to be additional disturbance factors to grouse.

Given the anticipated impacts that wind energy development will have on sage-grouse populations, we concur with the WGFD's recommendation that wind turbines NOT be sited in core areas (Wind Recommendations, Appendix A, BMP 1). Developing wind in core areas would pose a significant threat to Wyoming's healthiest remaining sage-grouse populations. In addition, as the USFWS stated in its July 2009 letter to the WGFD (Exhibit 2), building wind farms in core areas, even for research purposes "would negate the usefulness of the core area concept," thereby undermining the key regulatory mechanism that Wyoming has instituted to protect its sage-grouse and forestall a listing of the species under the Endangered Species Act.

However, despite our support for the WGFD's recommendation for core areas, we feel that the agency's recommendations for sage-grouse in *non-core* areas are inadequate and risk the loss of those non-core grouse populations that occur in wind development areas. Given that approximately one third of Wyoming's grouse occur in non-core areas, offering these birds some level of protection may be essential to sustaining Wyoming's overall grouse population.

The WGFD has recommended that "turbines and all related infrastructure (including roads) should occur outside a 0.25 mile distance from the perimeter of leks in non-core habitat" (Wind Recommendations, Appendix A, BMP 8). Nevertheless, research has shown that this 0.25 mile buffer, widely used by the Bureau of Land Management (BLM) in coal-bed natural gas (CBNG) development areas, has been inadequate in preventing local sage-grouse populations from declining in energy fields (Holloran 2005, Walker et al. 2007). A 0.25 mile buffer typically leaves 98% of a landscape within two miles of a lek open to full-field energy development (Walker et al. 2007). In the Powder River Basin, 98% CBNG development within two miles of leks was projected to reduce the average probability of lek persistence from 87% to 5% (Walker et al. 2007) and the impacts of full-scale wind energy development are anticipated to be worse for grouse than those of oil and gas development. Moreover, research in Wyoming and Montana has shown that the impacts to leks from energy development are discernable out to a minimum of four miles (Holloran 2005, Walker et al. 2007). In its own Wind Recommendation, the WGFD admits that:

> "Based on the available literature and set-back recommendations, wind energy facilities have the potential to impact habitat suitability for prairie grouse if they are sited within 3-5 miles of occupied leks and within 0.5-1 mile from nesting and brood-rearing habitats situated outside the 3-5 mile zone" (WGFD Wind Recommendations at 11).

Research has shown that a four-mile buffer around leks encompasses 74-80% of sage-grouse nests (Moynahan 2004, Holloran and Anderson 2005). No-surface-occupancy buffers around leks therefore protect not only sage-grouse leks (and breeding males), but also nesting sage-grouse and their broods. Given that the success of these broods will reflect future recruitment to the adult population, protecting broods is of paramount importance to maintaining viable sage-grouse populations. A 0.25 mile buffer is unlikely to provide adequate protection for breeding females and their broods even if it were to provide a modicum of protection for breeding males. Recognizing the importance of protecting female sage-grouse that are likely to nest within four to five miles of leks, the USFWS recommends "avoid[ing] placing turbines within 5 miles of known leks" in "known prairie grouse habitat" (USFWS 2003).

We understand that the WGFD faces many constraints in making its recommendations regarding sage-grouse and wind energy, not the least of which is the Governor's Executive Order 2008-2, which states that:

> Incentives to enable development of all types outside Core Population Areas should be established (these should include stipulation waivers, enhanced permitting processes, density

> bonuses, and other incentives). However, such development scenarios should be designed and managed to maintain populations, habitats and essential migration routes outside Core Population Areas. (Emphasis added).

We feel that there is a clear distinction between *incentivizing* and *sacrificing*. Given that scientific research shows that a 0.25 mile buffer is inadequate to protect sage-grouse in the face of oil and gas development, recommending a 0.25 mile buffer from wind energy development, which is universally believed to pose a greater threat to grouse than oil and gas development, gives the appearance that the state is willing to sacrifice certain grouse populations in exchange for protecting others. Considering that we still have a limited understanding of which non-core populations may be important for maintaining the genetic connectivity of core populations, it seems unwise to adopt such a non-precautionary course in managing this high-profile, highly-regarded species. As the WGFD expressed in its Wind Recommendations,

> "Although maintenance or improvement of habitat function is paramount in crucial habitats (crucial big game ranges, core sage grouse areas), the future health of these crucial habitats and the wildlife they support is dependant [sic] on maintaining adequate connectivity across the state by ensuring crucial habitat components within the state are not isolated from other crucial habitats through habitat fragmentation and construction of barriers" (Wind Recommendations at 3-4).

Furthermore, the Governor's EO emphasizes the importance of maintaining "populations, habitats and essential migration routes outside Core Population Areas." (Emphasis added). Since essential migration routes and connectivity corridors have not yet been identified and are still poorly understood, we feel that the WGFD should be more conservative in its approach, and should incorporate the current best available science in making its no-surface occupancy recommendations for non-core areas.

Although we recognize that the WGFD must work within a framework of constraints in making recommendations for protecting wildlife in the face of energy development, we feel that the agency must, at a minimum, recommend *science-based* prescriptions that will protect wildlife to some degree. Scientific research has shown that the 0.25 mile buffer is inadequate at preventing sage-grouse population declines, and it is therefore inappropriate for the WGFD to recommend such a stipulation in the face of such science. Even if the WGFD compromised by recommending a 0.6 mile or 1.0 mile buffer that is unlikely to wholly protect grouse, but has a better chance of doing so than the scientifically-maligned 0.25-mile buffer, the agency would at least be making some sort of protective recommendation rather than making a recommendation that its top sage-grouse biologists *know* and have communicated to the Department to be inadequate. (Exhibit 3). In a memorandum to the former WGFD Director and current Deputy Director, the WGFD's Sage-grouse Coordinator and sage-grouse biologist state that: "It is our recommendation that WGFD acknowledge this document as the correct interpretation of the recently published sage-grouse research and use this information to update and augment department documents and policies" (Exhibit 3). The document in question is the "latest and final document capturing the multi-state interpretation of the recent science related to sage-

grouse conservation and oil and gas development" (Exhibit 3). Page 3 of this document states "Walker et al. (2007) indicates that the current 0.25-mile buffer lease stipulation is insufficient to adequately conserve breeding sage-grouse populations in areas having full CBNG development."

Recommending a no-surface-occupancy buffer that is *known* to be inadequate to prevent sage-grouse population declines is an inappropriate management strategy for a state agency that is entrusted with the conservation and management of our state's wildlife. Given the nation's energy needs and the hefty contribution Wyoming will continue to make to meet those needs, we understand that Wyoming's wildlife faces ongoing pressures and populations of certain species of wildlife are unlikely to thrive. However, the WGFD should always strive to make recommendations that maintain viable, healthy populations of Wyoming's wildlife species, rather than making recommendations that are known to be inadequate. Since one third of Wyoming's grouse occur in non-core areas, we urge the WGFD to commit to achieving a greater probability of persistence for these populations than is likely to occur under the current recommendations.

If the WGFD were to recommend a 1.0 mile buffer between wind turbines and infrastructure and occupied sage-grouse leks, future studies of grouse in wind farms in non-core areas could then inform us if such a buffer were adequate to prevent local sage-grouse populations from declining. We are unlikely to learn anything from a 0.25-mile buffer other than that it is as inadequate to protect grouse from wind energy development as it is to protect grouse from oil and gas development. Furthermore, if the WGFD fails to increase its 0.25 mile buffer stipulation, concerned entities are likely to feel compelled to provide testimony and scientific evidence supporting their contention that such a buffer is inadequate to protect grouse populations at future wind energy project permit application hearings. The WGFD would then be in the uncomfortable position of repeatedly having to defend a no-surface-occupancy buffer that has been unequivocally shown to be inadequate.

Finally, we would like to note that anecdotal information about sage-grouse nesting under or near turbines is not a reliable indicator of how turbines ultimately will affect grouse populations. Sage-grouse show tremendous lek site and nest site fidelity and will return to traditional sites even if they have been fragmented by energy development. Studies on the impacts of oil and gas development on grouse showed an average lag time of approximately four years between CBNG development and the disappearance of leks (Walker et al. 2007). We believe that it is important for the WGFD to include specific information regarding the current scientific knowledge about the lag time between energy development and population impacts on grouse to complement its comprehensive analysis about the potential wildlife impacts of wind energy development. Scientific studies have documented this lag effect, and the delayed effects of wind energy development on grouse should be given far more credence in the WGFD's Wind Recommendations than anecdotal stories of grouse nesting near wind turbines. Mule deer continue to frequent habitat in the Pinedale Anticline and yet Sawyer et al. documented significant population declines (27%) as a result of energy development over a five-year period

(Sawyer et al. 2006). It is too early in our experience with wind energy development in Wyoming to be reassured by stories of a few grouse remaining in the vicinity of newly constructed wind turbines in other states.

The No-construction Timing Stipulation Should Be Increased to Protect Sage-grouse Hens and Broods

The WGFD has recommended that "Any construction/development activities within 2 miles of the perimeter of occupied leks in non-core habitat should be suspended from Mar 15 – June 30" (Wind Recommendations, Appendix A, BMP 7). While we appreciate any protective measures provided to sage-grouse in non-core areas, we feel that construction/development activities within the stated period should be suspended in grouse nesting habitat within four miles of the perimeter of occupied leks. Given the importance of juvenile recruitment in maintaining viable populations of sage-grouse, we believe that it is essential to target protective measures to sage-grouse hens, the majority of which typically nest within four miles of leks, and their broods (Moynahan 2004, Holloran and Anderson 2005).

Additional Suggested Prescriptions Regarding Transmission Lines for Core and Non-core Areas

We concur with the WGFD's recommendation (Wind Recommendations, Appendix A, BMP 16) regarding the avoidance of overhead power transmission lines within 0.6 miles of the perimeter of occupied leks within core habitats (although we would advocate a greater distance). In order to protect nesting female sage-grouse and their broods, we also suggest that the WGFD recommend the use of raptor perch deterrents on power poles (see APLIC 1996) within four miles of occupied leks within *both* core and non-core areas. Approximately 74-80% of sage-grouse females nest within four miles of leks (Moynahan 2004, Holloran and Anderson 2005). Sage-grouse chicks may be particularly vulnerable to predation in the days immediately following hatching (Hagen, *In press*) and measures to reduce potential raptor predation (which is artificially facilitated by the presence of transmission poles on which raptors can perch) on sage-grouse broods are likely to benefit Wyoming's sage-grouse populations.

The 0.25 mi Buffer for Columbian sharp-tailed Grouse Leks is Inadequate to Protect This Species from Wind Energy Development

The Columbian sharp-tailed grouse is one of Wyoming's Species of Greatest Conservation Need. The subspecies has a limited distribution in the state, occurring in low numbers in certain mountain-foothills shrub communities, sagebrush-grasslands, and willow-riparian habitats

primarily in south-central Wyoming (WGFD 2005). Although the south-central Wyoming population of the Columbian sharp-tailed grouse has been increasing or stable since the 1990s (personal communication with Tim Woolley, Wyoming Game and Fish Department, January 27, 2010), this subspecies currently occupies less than 10 percent of its historic range (Hoffman and Thomas 2007). The subspecies once occupied portions of 11 counties in west-central, southwestern, and south-central Wyoming (Hoffman and Thomas 2007), but Wyoming's only viable population now occurs in only one county (Hoffman and Thomas 2007). The subspecies has been petitioned twice for listing under the Endangered Species Act. It was determined that listing was not warranted both times. However, given the Columbian sharp-tailed grouse's tenuous status, it is quite probable that it will again be petitioned for listing in the future. As a result, measures should be taken now to ensure that this subspecies does not face increased threats that might qualify it for listing. As of 2008, only 13 Columbian sharp-tailed grouse leks existed in Wyoming (personal communication with Tim Woolley, WGFD). Therefore, offering these leks a meaningful level of protection is unlikely to significantly impair the development of wind energy in Wyoming. We suggest that the WGFD increase the 0.25 mile buffer that it is currently recommending between turbines and the perimeter of occupied Columbian sharp-tailed grouse leks (Wind Recommendations, Appendix A, BMP 15). Given that a 0.25 mile buffer has been inadequate to prevent population declines of greater sage-grouse in the face of energy development (Holloran 2005, Walker et al. 2007), such a buffer is unlikely to provide adequate protection for already-vulnerable Columbian sharp-tailed grouse populations in wind energy development areas.

Additional Recommendations for Reducing Raptor Fatalities

We support the WGFD's recommendation to avoid siting turbines near ridges, bluffs, or other features that are significant raptor migration corridors (the latter may be identified through pre-construction surveys) (Wind Recommendations, Appendix A, BMP 23). The USFWS has made similar recommendations (USFWS 2003) and such recommendations are an essential component of the careful siting efforts post-Altamont (the Wind Resource Area in California where high levels of raptor fatalities seriously alarmed the public and blighted the wind energy industry's fledgling reputation) that have led to reduced raptor fatalities at wind farms.

In addition to the above recommendation, we suggest that the WGFD also recommend avoiding siting turbines near established raptor communal roost sites. Bald eagles and rough-legged hawks, are known to roost communally, often at traditional roost sites that can number in the hundreds of birds (Keister et al. 1987, Olson 2006). Such aggregations of raptors may be particularly vulnerable to collisions with wind turbines, particularly if turbines are sited between roost sites and foraging areas.

The WGFD Should Recommend Against Siting Turbines in Prairie Dog Colonies

The WGFD recommends that prairie dog colonies be "left in the condition in which they [are] found" "to the extent practicable" to provide herptile habitat (Wind Recommendations, Appendix 1, BMP 13). Given that raptors are attracted to prairie dog colonies as foraging areas and that such colonies provide important habitat for burrowing owl, mountain plover, black-footed ferret, and other species of concern, we believe the WGFD should provide stronger recommendations with regards to wind energy development and prairie dog towns. The WGFD should recommend that siting wind turbines in prairie dog towns be avoided.

In their summary of existing studies of avian collisions with wind turbines, Erickson et al. (2001) caution that:

> … raptor collisions with wind turbines may be more likely to occur while the raptor is concentrating on foraging, or stooping towards a prey item. A dense or abundant prey base within a wind resource area may attract a greater number of raptors within the vicinity of wind turbines, and subsequently increase the potential for collision fatalities among raptor species.

Indeed, dense concentrations of ground squirrels are often cited as a reason for the high raptor fatalities documented at the Altamont Wind Resource Area in California (Orloff and Flannery 1996, Smallwood and Thelander 2005).

In its 2003 wind energy guidelines, the U.S. Fish and Wildlife Service recommends that turbine locations be configured so as to avoid "areas or features of the landscape known to attract raptors" (USFWS at 3). More specifically, they recommend not locating turbines "in or near prairie dog colonies" (USFWS 2003 at 3). Although the WGFD, recommends "adopt[ing] appropriate turbine design and siting standards to minimize bird and bat collisions (see U.S. Fish and Wildlife Service 2003)," we believe that the WGFD should be more specific in its guidance document with regards to its recommendations regarding avoiding prairie dog towns when siting turbines.

Presumably because of the USFWS's recommendations and a desire to minimize raptor fatalities, many wind companies already avoid siting turbines in prairie dog colonies as a matter of course. As a result, it should not be unduly disruptive for wind companies to abide by a recommendation to avoid siting turbines in prairie dog towns to reduce the potential for raptor fatalities.

In general, it is unclear if the WGFD is recommending the adoption of *all* the turbine design and siting standards recommended by the USFWS or merely a portion of them (Wind Recommendations, Appendix A, BMP 27). This issue merits clarification. We support adopting all USFWS recommendations regarding turbine design and siting standards to minimize bird and bat collisions and believe that most wind energy companies already have been operating under this guidance framework.

The WGFD Should Expand its Recommendations for Maintaining Hunter Access in Wind Energy Development Sites

Hunter access is an issue that is of paramount importance to Wyomingites in general and to many Wyoming Outdoor Council members in particular. Maintaining hunter access to formerly available lands that are developed for wind energy is vital to enable the WGFD to successfully manage ungulate populations and the habitats upon which they depend, to maintain the quality of the hunting experience in Wyoming, and to reduce subsequent overcrowding of remaining "wild" areas used by hunters. We support the WGFD recommendation that "Access for hunting should continue within wind farms on public lands and on private lands with landowner permission" (Wind Recommendations, Appendix A, BMP 26). In addition, we believe that the WGFD should incorporate resolutions made by the Wyoming Game and Fish Commission (WGFC) (Exhibit 4) by recommending to the WISC that wind farm development permits be conditioned to prevent project applicants from requiring indemnification from landowners who are willing to provide public access for hunting and fishing. We also believe that a discussion regarding the WGFD's commitment to work with local law enforcement, land management agencies, wind energy companies, and private landowners to minimize and report damage to wind turbines by vandals with firearms merits inclusion in the Wind Recommendation section that focuses on management concerns.

Traditional hunting areas, which typically consist of high quality habitats that have significant aesthetic values for hunters, can play an important role in the management of big game species in Wyoming. Many of these areas have been compromised by the loss of public access, energy development, and the abandonment of county roads that access public lands. The protection of important hunting areas may help the WGFD effectively manage local herds and quality habitat, and retain wild and scenic landscapes for quality hunting experiences and other recreational activities. As a result, we encourage the WGFD to consider the value of adjacent traditional hunting areas when making recommendations for wind energy development in crucial and important wildlife habitat.

Avian Pre-construction Surveys Should Consist of Weekly Migration Surveys

We support the WGFD's recommendation to conduct two years of pre-construction monitoring surveys for birds and bats (Wind Recommendations, Appendix B). This is generally accepted protocol and most wind energy companies conduct one to two years of pre-construction wildlife studies as a matter of course. We support the two-years-of-study recommendation to adequately document wildlife presence, distribution, and movements in the face of potential inter-year variations in climate and weather.

It is generally agreed that siting is a key factor in reducing avian and bat fatalities. As a result pre-construction surveys that document the presence and abundance of these organisms in a proposed wind site, as well as their potential *use* of the area are paramount in reducing bird and bat fatalities (USFWS 2009). We concur that project proponents should consult with the WGFD to properly site turbines to avoid avian and bat high-use areas based on the findings of pre-construction studies. [However, we do NOT concur with the recommendation of waiving vital post-construction mortality surveys if project proponents do so (see below)].

We agree that pre-construction baseline data collection and monitoring should consist of risk-assessment reconnaissance surveys, before-after control-impact (BACI) studies, and pre-construction surveys. However, we are very concerned about the WGFD's suggested protocols for the avian pre-construction surveys. The WGFD recommends: "Spring and autumn migration surveys at dawn and dusk for passerines. A minimum of 3 surveys should be conducted each season to detect early, mid, and late migrants" (Wind Recommendations, Appendix B, 3a; emphasis added). Passerine monitoring at proposed wind energy sites typically consists of *weekly* morning point counts to determine the species composition and use of the project area (personal experience conducting avian pre-construction surveys for wind energy companies and reviewing/evaluating/summarizing pre-construction surveys conducted by environmental consulting companies in Wyoming, Colorado, and Texas). We suggest that the WGFD recommend *weekly* fixed-radius point counts using standard point-count methodologies (for example, Hutto et al. 1987, Reynolds et al. 1980, Ralph et al. 1995, Hussell and Ralph 2005). Avian species migrate at different times throughout the migration season and three surveys during the migration season are inadequate to document either the migratory movements or the species composition of birds that pass through a project area. Most importantly, conducting only three surveys over a multi-month period is woefully inadequate for documenting avian spatial and temporal *use* of a project area, which is the primary reason for conducting avian pre-construction surveys. Without determining which portions of the project area (if any) birds are preferentially using, where and when they might be flying in the rotor sweep area, and where avian concentrations may be occurring as the migration season unfolds, the purpose of the pre-construction surveys will not be fulfilled and turbines may not be sited appropriately to avoid avian concentrations and subsequent high fatality rates.

In addition to missing the sequential migratory movements of different species, conducting only three surveys is likely to miss the migratory peak in both numbers of birds and species diversity of birds. Point-count surveys during the migration period often reveal a distinct peak in bird and species numbers, and missing such information (which is quite likely when conducting only three surveys) means that project proponents are likely to underestimate avian use of the project area. A biologist of my acquaintance who was doing pre-construction avian studies for a proposed wind energy site counted over 1,400 sandhill cranes passing over the project area on only one day during weekly migration counts and much additional time in the project area. Conducting only three surveys in a migration period is likely to miss such movement pulses.

Siting turbines so as to avoid avian concentrations is only as successful as the data on which such decisions are based. As a result, we suggest that the WGFD recommend *weekly* morning point counts during fall and spring avian migration periods. We believe it is more important to conduct weekly point counts during the migration season than it is during the breeding season. Fewer surveys might suffice to document avian use of the project area during the breeding season, but they will not suffice for the migration season.

We suggest that the WGFD recommend using point-count radii of no more than 100 meters (328 feet) since it is difficult to make accurate observations of passerines/small birds beyond this distance (Reynolds et al. 1980). We do not advise doing raptor point counts (which typically have a radius of 800-m) and passerine point counts simultaneously as some environmental consulting companies do, since raptors are more active later in the day than passerines and passerines are not always visible or identifiable at distances of greater than 100 meters. Passerine and raptor point counts should be done separately and point-count radii should differ for these two groups of birds.

We do not think that dusk surveys are comparable to dawn surveys for determining avian use of a project area, although they may provide additional information about the use of a project area by crepuscular species like the common nighthawk. In general, we think it would be preferable for the WGFD to recommend weekly morning point counts rather than three dawn and dusk surveys per migration season. We also think that night migration surveys warrant some consideration by the WGFD given how many avian species are nocturnal migrants. Point-counts often document an area's importance as a stopover site, rather than documenting the actual passage of migrants. Nocturnal surveys would provide valuable information regarding the potential threat of turbines to night-migrating birds. Nocturnal migrants can be identified based on their call notes when in flight or the passage of migrants can be documented using radar (for methodologies for documenting nocturnally active birds and bats see Kunz et al. 2007).

We are similarly concerned about the survey protocols for raptors. The WGFD recommends: "Spring and autumn migration surveys at mid-day for raptors. A minimum of 3 surveys should be conducted each season to detect early, mid, and late migrants" (Wind Recommendations, Appendix B, Birds 3b). As with passerines, we feel that conducting only three surveys per migration season rather than conducting *weekly* point count surveys will not provide adequate information about raptor use of the project area. Such a strategy is likely to miss migratory pulses and peaks, underestimate the numbers of raptors and the different species that are using the project area, and will not provide adequate information to properly site turbines to avoid raptor fatalities. Conducting weekly point-count monitoring is standard procedure for assessing raptor spatial and temporal use of potential wind energy sites (personal experience with conducting and reporting on such studies in Wyoming and Colorado).

In addition, we have concerns regarding the methodologies that the WGFD has outlined for conducting raptor nest searches. The WGFD makes no mention of using helicopters for aerial

nest searches. The use of helicopters to conduct raptor nest searches should be mentioned since helicopter surveys often provide more accurate information than fixed-wing aircraft surveys. "Driving along public roads and accessible private roads" (Wind Recommendations Appendix B, Birds 3d) is an inadequate survey method for successfully locating all of the raptor nests in a proposed wind energy project area. Many areas do not have sufficient accessible roads to provide adequate survey coverage of a proposed project site. Driving surveys can supplement aerial surveys for large project areas, but should not be depended on exclusively since they will result in unrecorded raptor nests (as they did in Duke Energy's Top of the World wind project).

The WGFD's table for recommended disturbance-free dates and buffers also should include Swainson's hawk, red-tailed hawk, northern harrier, American kestrel, sharp-shinned hawk, Cooper's hawk, and osprey, all of which were omitted from the species list and were not provided with necessary disturbance-free dates and disturbance-free buffers. In addition, this table and the WGFD's recommended raptor survey dates table should include owl species (see below) since these species' nests also receive protective measures. Finally, we recommend making some slight adjustments to the raptor survey date table. We believe that northern harrier nests with young should be monitored into early August, osprey nests/young should be monitored until mid-August, red-tailed hawk nests/young should be monitored until early July, and prairie falcons with young in the nest should be monitored beginning in early to mid-June through July as opposed to through mid-August.

The WGFD Should Include Information about Owls in Its Prescriptions for Raptors

Owls appear to have been omitted from the WGFD's raptor recommendations (Appendix B). Given that owl nests receive protective stipulations in oil and gas development sites, we believe that great-horned owl, burrowing owl, long-eared owl, and short-eared owl, at a minimum, merit inclusion in the WGFD's prescriptions for raptors at wind energy sites. Recommended survey dates, timing stipulations, and disturbance-free buffers should be included for owls. Burrowing owls warrant particular attention as they are considered a Species of Greatest Conservation Need in Wyoming and have been shown to be particularly vulnerable to collisions with wind turbines (Smallwood et al. 2007, Smallwood and Karas 2009). Wind turbines in the Altamont Pass Wind Resource Area are estimated to kill hundreds (and in some years thousands) of burrowing owls annually (Smallwood et al. 2007, Smallwood and Karas 2009). To protect burrowing owls, the WGFD should recommend against siting wind turbines in prairie dog colonies (see above).

Post-construction Surveys to Evaluate Avian and Bat Fatalities Should NOT Be Waived

We are concerned with the WGFD's statement that post-construction "Carcass surveys can be waived if siting of turbine strings is demonstrated to avoid migration corridors and bat [and bird]

concentration areas" (Appendix B, Bat and Birds sections). Post-construction carcass searches are a critical means of determining whether the locations of wind turbines in a wind farm are dangerous to birds and bats. Furthermore, they are a critical means of determining whether a wind energy project is complying with the Migratory Bird Treaty Act. Given the limitations of collecting reliable data on nocturnal animals and animals that migrate at night, siting wind turbines is not yet infallible and our grasp on what constitutes "good" siting is still very tenuous. We often do not know if particular wind turbines are sited in "bad" areas that will result in avian and bat fatalities until post-construction studies inform us of this. Post-construction studies of wind energy sites sometimes reveal that particular turbines are more dangerous to birds and/or bats than it was anticipated they would be. Sometimes an entire wind farm is determined to be more dangerous to bats than it was anticipated it would be.

Given the extreme paucity of knowledge in Wyoming about avian and bat migration routes and the limited information about avian and bat concentration areas, we feel that it is too risky to waive post-construction fatality studies at this early juncture in wind development in Wyoming. Finding dead birds and bats at wind farms can tell us tremendous amounts about when and where these organisms migrate through Wyoming and how they use their habitats. More importantly, mitigation for bird and bat fatalities can occur *only* if we know when and where these fatalities are occurring. One or two turbines often are responsible for the majority of bird and bat fatalities. In such situations, individual turbines could be temporarily shut down during the migration period, thereby reducing bird and bat fatalities and helping to address the public's concern regarding the negative impacts of wind energy on wildlife. In addition, several recent studies have shown that changing the turbine "cut-in" speed, the speed at which wind generated electricity enters the power grid (i.e., programming wind turbine blades to beginning turning at higher wind speeds) has drastically reduced bat fatalities at wind farms, since bats tend to be more active at lower wind speeds (Arnett et al. 2009, Baerwald et al. 2009). If post-construction studies show us that bats are being killed during migration at a particular wind farm, cut-in speeds can be changed during the bat migration period, reducing bat fatalities with a very limited and temporary reduction in energy output. For example, one study showed nightly reductions in bat fatality rates ranging from 53–87% with marginal annual power losses (Arnett et al. 2009). Given the magnitude and extent of bat fatalities worldwide, such measures may be critically important (Arnett et al. 2009). Without the information provided by bird and bat fatality information (obtained through post-construction carcass surveys), such mitigation measures are not possible and wind farms will continue to kill birds and bats at levels that are unacceptable to many people. These types of mitigation measures also are critical for allowing wind energy companies to stay in compliance with the Migratory Bird Treaty Act and for assessing liability in enforcement pursuant to this Act (Smallwood 2007).

Requiring post-construction avian and bat fatality studies only for those projects that do not site their turbines to avoid migration corridors and bird concentration areas is also counterproductive in that it would result in a data bias since only "bad" areas would be monitored. It is highly

likely that all wind companies will take very general measures to avoid obvious bird concentration areas, so would be allowed under the WGFD's current recommendations to forego post-construction studies. However, if wind companies did not avoid these areas and consequently had to do post-construction studies, they would be likely to have high avian and/or bat fatalities (as expected) because of inappropriate siting, which could cause a backlash against wind energy because of the unnecessary (and newsworthy) killing of wildlife.

We feel that the WGFD should NOT waive post-construction studies at those wind energy sites that avoid known migration corridors and bird/bat concentration areas for the above stated reasons. If the WGFD is absolutely committed to maintaining this provision, it should, at the very least say that "carcass surveys MAY be waived" as opposed to "carcass surveys CAN be waived" so that wind energy projects in areas where little is known about important bird and bat concentration areas may still be adequately studied and mitigated as needed.

Three types of surveys/studies are necessary to develop an accurate estimate of avian and bat fatality rates at wind energy sites: carcass surveys (discussed above), scavenger removal trials, and searcher efficiency trials. Without determining the rate at which scavengers are removing dead birds and bats from the project area, one cannot accurately estimate bird/bat fatality rates (Morrison 2002). If carcass surveys are conducted once a week and scavengers have keyed into a high numbers of carcasses in the project area and are removing them within a few days, the fatality rate will be underestimated. Scavenger removal trials consist of placing different-sized carcasses out on a project area and monitoring them to determine the length of time it takes scavengers to find and remove them (for protocols, see Smallwood 2007). This rate can then be factored into statistical estimations of fatality rates to provide a more accurate estimate of actual fatality rates at a particular wind site.

In addition, individual searchers vary widely in their abilities at finding carcasses (Morrison 2002; personal experience). Habitat variation also contributes to large differences in the detectability of carcasses, as do variations in topography, weather, lighting, and the size and condition of carcasses (Morrison 2002, Kunz et al. 2007). If certain searchers are not very successful at finding tiny dead bats in long grass, they will underestimate the numbers of carcasses actually found at a particular site leading to an underestimate in fatality rates. Therefore, searcher efficiency trials also must be conducted (for protocols, see Kunz et al 2007). Generally, different-sized carcasses are placed out on a project area and the success rate that a searcher (who is not informed that a searcher efficiency trial is ongoing) has in locating small, medium, and large carcasses is documented. The searcher's "efficiency" rate at finding carcasses is then factored into statistical estimations of fatality rates to provide a more accurate estimate of actual fatality rates at a particular wind site. Estimates of bird and bat fatality rates that have not factored in scavenger removal and searcher efficiency rates are essentially meaningless. The lack of reliable correction factors (results of scavenger removal and searcher

efficiency trials) for the biases inherent in carcass survey findings not only make it impossible to reliably estimate fatality rates for a given site or season, but also undermine attempts to compare results from different regions and years so that cumulative impacts to birds and bats can be properly evaluated (Morrison 2002, Kunz et al. 2007). Scavenger removal and searcher efficiency trials can themselves be prone to biases, but these can be reduced by using recommended methodologies (Smallwood 2007).

The WGFD is unclear in its recommendations regarding scavenger removal and searcher efficiency trials, recommending only that with regards to carcass surveys, "Search effort should be recorded, and observer efficiency, scavenging rate, and an annual kill rate per turbine should be estimated " (Wind Recommendations, Appendix B, Birds 4). This statement seems to imply that some standardized scavenging and observer efficiency rates may be used, but actual scavenger trials and searcher efficiency trials do not need to be conducted at each site. We hope that we are misinterpreting this recommendation and that the WGFD is recommending actual trials to accompany post-construction carcass surveys. Scavenger removal and searcher efficiency rates vary widely depending on scavenger communities and habitat variation at different project sites, as well as different observer abilities (Morrison 2002). As a result, applying a pre-determined estimator to carcass surveys at a particular site is liable to result in inaccurate fatality estimates (Morrison 2002). Such estimators have been suggested for instances when such trials have not been or cannot be conducted (e.g., Smallwood 2007), but they are based on questionable assumptions and should not be used in place of actual trials under most circumstances. We suggest that the WGFD provide more information about the critical value of scavenger removal and searcher efficiency trials in providing estimated avian and bat fatality rates at wind sites and recommend that these trials be conducted along with carcass surveys at each project site.

Currently scavenger removal and searcher efficiency trials are not even mentioned in the bat recommendations. Searcher efficiency trials in particular are an essential component of estimating bat fatality rates, since bat carcasses can be so difficult to find. Searcher efficiency and scavenger removal trials should accompany both bat and bird carcass searches, to help correct for the bias in carcass survey results and to ensure that bird and bat fatality rates can be accurately determined for each wind energy project site (Morrison 2002).

We support the WGFD recommendation to conduct three-years of post-construction data. Since population declines of certain species may occur several years after the initiation of energy development (Walker et al. 2007), the longer the time period that post-construction studies can continue the better (Parker and Wiens 2005, Erickson et al. 2007). Certain birds exhibit site fidelity to their breeding areas and will return in a subsequent year to a site, even though it has become unsuitable for them (Wiens et al. 1986, Walker et al. 2007). Longer survey periods post-construction also allow enough time for habitat impacted by construction to regenerate, allow for possible habituation of some wildlife species to wind turbines, and allows survey results to incorporate unusual climatic or weather events (Erickson et al. 2007). Nevertheless, we would

rather have wind companies conduct only two years of post-construction data if these were comprehensive wildlife surveys that included carcass surveys, coupled with scavenger removal and searcher efficiency trials based on accepted protocols. We believe that acquiring two years of valuable, accurate data is worth more than doing only carcass surveys for three years and applying some standardized estimator to calculations of fatality rates.

The WGFD Should Provide a Caution That Buffers and Timing Stipulations May Be Applied to Species of Greatest Conservation Need at a Later Date

The WGFD includes a recommendation regarding the monitoring of Wyoming Species of Greatest Conservation Need (Wind Recommendations, Appendix B, Birds 5), but does not discuss nationwide declines and possible mitigation measures for species such as mountain plover, McCown's longspur, ferruginous hawk, burrowing owl, and pygmy rabbit. Given the potential threat of wind energy to these and other species of concern in Wyoming, we suggest that the WGFD provide more discussion about such species. McCown's longspur, for example, is a declining species that is locally abundant within a restricted breeding range in the northwestern fringe of the Great Plains and the southern edge of the Canadian Prairie Provinces, and has a breeding aerial flight display that may make it particularly vulnerable to collisions with wind turbines (With 1994). In addition, we believe that it would be prudent for the WGFD to include a caution in its recommendations that the WGFD may recommend future no-occupancy and no-construction buffers, timing stipulations, and other mitigation measures as needed to protect Wyoming Species of Greatest Conservation Need that may be negatively impacted by wind energy development.

The WGFD Should Recommend Baseline Data Collection and Monitoring Recommendations for Small Mammals

We commend the WGFD for its inclusion of baseline data collection, monitoring prescriptions, and mitigation measures for amphibians and reptiles. These taxa often do not receive the attention they merit given the vulnerability of many herpetofauna populations and the general paucity of information about many of Wyoming's herpetofauna species. Prescriptive monitoring and mitigation measures were not provided for these taxa in the WGFD's "*Recommendations for development of oil and gas resources within crucial and important wildlife habitats*" and we remain hopeful that the WGFD will remedy this oversight in the near future. We support all of the prescriptions outlined by the WGFD for amphibian and reptiles at wind energy sites. In addition, we support the WGFD in its stated desire to request that biologists and environmental consultants additionally record opportunistic sightings of these often-elusive taxa while conducting other baseline monitoring studies.

In addition to providing guidance for baseline data collection, monitoring, and mitigation for amphibians and reptiles, we believe that the WGFD should provide similar guidance for small mammals. Given the paucity of information on many of Wyoming's small mammal species and the threat that wind energy development may pose for these species by eliminating and fragmenting habitat and creating barriers to dispersal and other movements, wind companies should also be cognizant of their potential impacts on Wyoming's small mammal populations and take measures to mitigate such impacts. Having a general understanding about how wind energy might impact small mammal populations may provide us with a better understanding of how to protect species like the Wyoming pocket gopher (*Thomomys clusius*), which is currently being reviewed for listing under the Endangered Species Act, in the face of future wind development. We believe that the WGFD should model recommendations for small mammals after its recommendations for amphibians and reptiles. Recommendations should consist of habitat mapping, determining whether sensitive habitats or species occur in the development area, trapping to determine species occurrence and relative abundance pre- and post-construction, and mitigation measures to minimize potential impacts.

Providing Guidance for Monitoring Culverts, Roads and Creeks is Essential to Maintaining Wildlife Habitat Integrity in the Face of Energy Development

We commend the WGFD for providing guidance for monitoring culvert slopes, roads with slopes of five percent or greater, and creek conditions to determine the potential cumulative impacts of wind energy development on an area's upland surface hydrology and its erosion and deposition potential. We believe that these are important ways to monitor potential changes to wildlife habitat so that necessary mitigation measures can be implemented if needed to prevent continued habitat deterioration. We encourage the WGFD to amend its "*Recommendations for development of oil and gas resources within crucial and important wildlife habitats*" to include similar habitat alteration monitoring.

For recommendation number 10 under *Culverts* and recommendation number 11 under *Roads with 5% or greater slope*, we suspect that the inclusion of PacifiCorp as an entity that would reevaluate the necessity for future monitoring was an oversight. These recommendations should be amended to state that either the WGFD exclusively or the WGFD in conjunction with the "relevant project proponent" be responsible for evaluating the need for additional monitoring.

Additional Needs that Could Facilitate the WGFD's Management of Wildlife and Wildlife Habitats in Wind Energy Development Areas

In order to ensure that the WGFD has the relevant information that it needs to properly manage wildlife and wildlife habitats within wind energy development areas, we believe that the WISC

should require project applicant's to supply the agency with an "as built" drawing upon completion of project construction. In addition, we believe that the WISC should require wind companies to provide the WGFD with GIS files that include information such as project boundaries, newly constructed roads, project fences, and other associated infrastructure to ensure that the agency has access to all relevant habitat modifications that might affect the project area's wildlife. Without such information, it will be difficult for the WGFD to manage wildlife appropriately in developed landscapes, as well as to evaluate cumulative impacts on Wyoming's wildlife and critical habitats, and to ensure that appropriate mitigation measures are in place to mitigate such impacts in the face of ongoing energy development.

In addition, we believe that the WISC should require companies to submit complete reclamation plans to ensure that critical wildlife habitats ultimately are restored to their pre-development condition.

In conclusion, we believe that recommending the use of bird diverters on meteorological towers, providing prescriptive recommendations for lighting and fencing, providing adequate no-disturbance buffers for those species that require them, ensuring that pre-construction and post-construction surveys are comprehensive and achieve their stated purposes, and supplementing the WGFD Wind Recommendations with the other measures that we have suggested will help to ensure that Wyoming's wildlife is adequately protected in the face of expanding wind energy development.

Sincerely,

Sophie Osborn

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Cc: Governor Freudenthal
Steve Black, Department of Interior
Steve Ferrell, Wyoming Game and Fish Department
Mary Flanderka, Wyoming Game and Fish Department
Clifford Kirk, Wyoming Game and Fish Commission
Ed Mignery, Wyoming Game and Fish Commission
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Jerry Galles, Wyoming Game and Fish Commission
Aaron Clark, Wyoming Game and Fish Commission
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Michael Healy, Wyoming Game and Fish Commission
Senator Anderson
Senator Perkins
Representative Steward
Representative Carson
Representative Lockhart
Brian Kelly, U.S. Fish and Wildlife Service
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