



United States Department of the Interior
FISH AND WILDLIFE SERVICE
OKLAHOMA ECOLOGICAL SERVICES FIELD OFFICE



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**STANDARD RECOMMENDATIONS TO AVOID, MINIMIZE AND MITIGATE
POTENTIAL IMPACTS OF WIND ENERGY PROJECTS IN OKLAHOMA**

The Service supports the development of non-polluting, renewable, sustainable energy sources (e.g. wind power). However, wind energy developments do pose risks to wildlife and their habitats. Although most issues concerning wildlife and wind energy development initially focused on the direct effects of mortality from wildlife collisions with turbines and their associated infrastructure (power lines, guy wires, substation buildings, etc.), such collisions are no longer the sole focus of concern. Equal concern is now focused on the indirect effects caused by habitat fragmentation and the disruption of species' life cycles (e.g. reproduction, brood rearing) due to behavioral tendencies of many wildlife species to avoid vertical structures, including wind turbines, resulting in potential displacement from otherwise suitable habitat.

Recently published studies indicate that wildlife may be negatively affected by wind energy development (e.g., when birds or bats collide with wind turbine rotors or distribution lines). Another example of a negative impact, albeit less direct or obvious, is displacement of sensitive wildlife species by altering or removing key components of their habitat. Such impacts likely can be reduced or avoided by strategic placement of turbines and associated infrastructure (e.g., access roads and distribution and transmission lines), as well as other management practices.

Details of a site specific analysis may warrant additional site specific recommendations or quantify a lack of impact, negating the need to implement any of the following recommendations. For the most current recommendations and information, visit the Service's, Oklahoma Ecological Services Field Office wind energy website at <<http://www.fws.gov/southwest/es/oklahoma/windpower.htm>>.

WIND PROJECT ENVIRONMENTAL REVIEW COORDINATION

The U.S. Department of the Interior released voluntary Land-Based Wind Energy Guidelines (guidelines) on March 23, 2012. The guidelines were designed to help wind energy project developers avoid and minimize impacts of land-based wind projects on wildlife and their habitat.

These voluntary Guidelines provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development. They also promote effective communication among wind energy developers and federal, state, tribal, and local conservation agencies. In addition, the Guidelines provide Best Management Practices for site development, construction, retrofitting, repowering, and decommissioning. They take immediate effect and replace interim guidance published by the Service in 2003.

The most important thing a developer can do is to consult with the Service early in the development of a wind energy project. Early consultation offers the greatest opportunity for avoiding areas where development is precluded or where wildlife impacts are likely to be high and difficult or costly to remedy or mitigate at a later stage. By consulting early, project developers can also incorporate appropriate

wildlife conservation measures and monitoring into their decisions about project siting, design, and operation.

The Guidelines assist developers in identifying species of concern that may potentially be affected by their proposed project, including migratory birds; bats; bald and golden eagles and other birds of prey; prairie and sage grouse; and listed, proposed, or candidate endangered and threatened species.

These impacts may include:

- Collisions with wind turbines and associated infrastructure; loss and degradation of habitat from turbines and infrastructure;
- Fragmentation of large habitat blocks into smaller segments that may not support sensitive species;
- Displacement and behavioral changes; and
- Indirect effects such as increased predator populations or introduction of invasive plants.

Tiered Approach

The Guidelines use a “tiered approach” for assessing potential adverse effects to species of concern and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail; quantifying the possible risks of proposed wind energy projects to species of concern and habitats; and evaluating those risks to make siting, construction, and operation decisions.

During the pre-construction tiers (Tiers 1, 2, and 3), developers will work with the Service to identify and avoid and minimize risks to species of concern. During post-construction tiers (Tiers 4 and 5), developers will assess whether actions taken in earlier tiers to avoid and minimize impacts are successfully achieving the goals and, when necessary, taking additional steps to reduce impacts. Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers. Each tier offers a set of questions to help the developer evaluate the potential risk associated with developing a project at the given location.

Briefly, the tiers address:

- Tier 1 – Preliminary site evaluation (landscape-scale screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife and habitat and predict project impacts
- Tier 4 – Post-construction studies to estimate impacts
- Tier 5 – Other post-construction studies and research

The tiered approach provides the opportunity for evaluation and decision-making at each stage, enabling a developer to abandon or proceed with project development, or to collect additional information if required. This approach does not require that every tier, or every element within each tier, be implemented for every project.

If sufficient data are available at a particular tier, the following outcomes are possible:

- The project proceeds to the next tier in the development process without additional data collection.
- The project proceeds to the next tier in the development process with additional data collection.
- An action or combination of actions, such as project modification, mitigation, or specific post-construction monitoring, is indicated.
- The project site is abandoned because the risk is considered unacceptable.

Adherence to the Guidelines is voluntary and does not relieve any individual, company, or agency of the responsibility to comply with laws and regulations. However, if a violation occurs the Service can consider a developer’s documented efforts to communicate with the Service and adhere to the Guidelines.

The final Guidelines and all associated materials are available at <www.fws.gov/windenergy>.

ENDANGERED SPECIES ACT

Pursuant to section 9 of the Endangered Species Act (ESA), it is unlawful for any person subject to the jurisdiction of the United States to take any federally-listed threatened or endangered fish or wildlife species, without special exemption. The ESA defines take as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Consequently, it is a violation of federal law to take endangered species' or their habitat without the appropriate permits, even if that take is accidental and a result of the species collision with a manmade object (e.g., wind turbine, distribution line, and building).

Take incidental to a lawful activity may be authorized through formal consultation under section 7(a)(2), if a Federal agency, funding, or a permit is involved. Otherwise, an incidental take permit pursuant to section 10(a)(1)(B) may be obtained upon completion of a satisfactory habitat conservation plan (HCP) for listed species. There is no mechanism for authorizing incidental take "after-the-fact." Should the development of an HCP be necessary for the proposed project, the Service would work with the project proponent to complete the HCP process as expeditiously as possible. However, it is important to note for your planning purposes that the HCP process can be a complex task that often takes years to complete. For more information regarding formal consultation, please see the *Endangered Species Consultation Handbook*, < http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf >. For more information regarding HCPs, please see the Service's HCP website, < <http://www.fws.gov/endangered/what-we-do/hcp-overview.html> >.

MIGRATORY BIRDS

The Service is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species (e.g., waterfowl, shorebirds, birds of prey, songbirds) that spend all or part of their lives in the United States. The MBTA prohibits take of migratory birds except when specifically authorized by the Department of the Interior by permit, depredation order, or other vehicle. Under the MBTA, "take" means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect. Federal law enforcement officers and the Department of Justice need not prove that a taking was intentional to substantiate a violation.

The MBTA and its implementing regulations (50 CFR 21) do not provide for issuance of permits that authorize take of migratory birds that may be killed or injured by otherwise lawful activities, such as wind energy generation. The MBTA provides for significant criminal penalties. Thus, it is important for companies and their managers to ensure that their proposed activities have been fully coordinated in advance with the Service. Such coordination should occur as early in facility development as possible but certainly before final siting of facility components is determined and wind turbines and associated infrastructure are constructed.

The Service's Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement as well as through fostering relationships with individuals, companies and industries who have taken effective steps to avoid or minimize their negative impacts on migratory birds and through encouraging others to enact such programs. It is not possible to absolve individuals, corporations, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. There is no threshold as to the number of birds or other animals taken at wind energy sites beyond which the Service will initiate enforcement action. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take

migratory birds without regard for their actions or without taking effective steps to avoid or minimize take.

The Service's *Birds of Conservation Concern 2008* (USFWS 2008) is a valuable resource for considering species potentially impacted by development and is located at <<http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf>>. A list of all birds protected under the MBTA can be found at <<http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtintro.html>>.

BALD EAGLE & GOLDEN EAGLE

The bald eagle recently was delisted under the ESA, but remains a protected species under the MBTA and the BGEPA. The Bald and Golden Eagle Projection Act provides for very limited issuance of permits that authorize take of eagles when such take is associated with otherwise lawful activities, cannot practicably be avoided, and is compatible with the goal of stable or increasing eagle breeding populations. This law also affords eagles additional protections beyond those provided by the MBTA, in particular, by making it unlawful to disturb eagles. Disturb under BGEPA means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. The BGEPA provides for significant criminal and civil penalties. Thus, it is important for companies and their managers to ensure that their proposed activities have been fully coordinated in advance with the Service. Such coordination should occur as early in facility development as possible, but certainly before final siting of facility components is determined and wind turbines and associated infrastructure are constructed.

Further information regarding actions to avoid and minimize impacts to the bald eagle can be found in: 1) the Draft Eagle Conservation Plan Guidance (January 2011; <<http://www.fws.gov/windenergy/>>); 2) the National Bald Eagle Management Guidelines (May 2007; <<http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf>>); and 3) the final rule addressing “Eagle Permits; Take Necessary To Protect Interests in Particular Localities” (September 11, 2009) at <<http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/Final%20Disturbance%20Rule%209%20Sept%202009.pdf>>.

If additional site specific wildlife surveys indicate presence of eagles, the Service recommends that you initiate discussion with the Service's Migratory Bird Program in the Regional Office in Albuquerque, New Mexico regarding next steps for evaluating the need for, and as appropriate, applying for a permit for take of bald eagles from the construction and operation of the proposed unnamed wind energy project.

For additional discussions, in regards to pursuing an application for a take permit for bald or golden eagles, please contact Robert Murphy.

Robert Murphy, Non-Game Biologist
Division of Migratory Birds
P. O. Box 1306
Albuquerque, NM 87103
(505) 248-6879, robert_murphy@fws.gov

For more information regarding bald eagle nesting locations in Oklahoma, please contact Alan Jenkins of the George M. Sutton Avian Research Center.

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P. O. Box 2007
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BATS

There are 24 species of bats in Oklahoma, of which 3 are federally- and state-listed as endangered, and 7 are state species of concern. Bats have shown an unexplained tendency to collide with wind turbines. Although much is still unknown about bats susceptibility to colliding with wind turbines (Johnson *et al.* 2002), there is increasing information on behavioral interactions with wind turbines, and monitoring techniques (Energetics 2004). The interaction between wind turbines and bats is well documented, but ultimate understanding of the cause of effects is still unclear, especially for bat populations outside of eastern North America.

As wind energy development has expanded in North America, mortality of bats has increasingly become an issue of concern. Many post construction monitoring studies conducted to date indicate a peak in mortality during the typical migratory period of late summer and fall (Arnett *et al.* 2008). Barotrauma (*i.e.*, tissue damage to air-containing structures caused by rapid or excessive air pressure change) also recently has been suggested as a potential cause of bat mortality at wind power facilities (Baerwald *et al.* 2008). Although much is still to be learned about bat mortality at wind power facilities (Johnson *et al.* 2002), there is increasing information on relevant behavioral interactions, predictors of bat activity and fatality, and monitoring techniques (Arnett *et al.* 2008; Energetics 2004; Kunz *et al.* 2007).

Because wind energy developments currently operating in Oklahoma and other states have confirmed bat mortality and the proximity to known bat concentrations, we recommend that you complete pre- and post construction bat monitoring. Information from these efforts should be used to avoid and/or minimize documented impacts to bats. Additional information pertaining to bats and wind energy development can be found at <<http://www.nationalwind.org/>> and <<http://www.batsandwind.org/>>. Additional information on bat species can be found online at Bat Conservation International's website, <<http://www.batcon.org/>>.

WETLANDS

The Service recommends impacts to wetland areas be avoided or minimized to the greatest extent practicable. Information on the occurrence of wetlands within your project area may be obtained from the relevant National Wetlands Inventory (NWI) map. We encourage you to utilize the National Wetland Inventory maps in conjunction with ground truthing to identify wetlands occurring within your proposed project area. Steps should be taken in determining the final location, extent, construction, and operation of project features to avoid any wetland impacts or loss, and provide for mitigation of any unavoidable wetland impacts. The Service's NWI provides many wetland resources on their website, <<http://www.fws.gov/wetlands/>>.

RECOMMEDED PROTOCOLS FOR DEAD OR INJURED WILDLIFE

Any dead wildlife found should be documented using the Bird Mortality form in Morrison (1998), found at <<http://www.nrel.gov/wind/pdfs/24997.pdf>>, and a copy of the report provided to this office within 30 days. This may require preservation of the carcass by freezing to allow identification by a biologist at a later time. Proper disposition may be determined by contacting our Law Enforcement Division,

405-715-0617.

Permits may be required for handling dead or injured wildlife. Please contact the Service's Migratory Birds permit division at 505-248-7882 (<<http://www.fws.gov/migratorybirds/mbpermits.html>>) and the ODFW's Wildlife Division, at 405-521-2739, for the appropriate federal and state permits. If any species protected under the ESA are discovered killed or injured, our office should be contacted immediately to develop appropriate measures to prevent future mortalities.

SITE DEVELOPMENT RECOMMENDATIONS

- Avoid impacts by locating projects as far from occupied and suitable habitat of federally-listed and candidate species, species of concern and other important fish and wildlife resources based on buffer zones identified in the scientific literature for the species of concern. These should include, but are not limited to, existing conservation lands (e.g., National Wildlife Refuges, Wildlife Management Areas, Preserves, National Forests, and National Grasslands), large landscapes with intact native plant communities, or unique geologic or topographic features. Should there be any questions concerning the importance of a particular site to fish and wildlife resources, please contact this office.
- Avoid fragmenting large, contiguous tracts of wildlife habitat; select fragmented or degraded habitats over intact areas. Where practical, place turbines on lands already altered (e.g., dominant vegetation converted to non-native species, cultivated, intensively developed) and away from areas of intact native habitats. Minimize habitat fragmenting features, such as roads, fences, construction staging areas, other infrastructure, and wind turbine foundation construction sites. All infrastructure should be capable of withstanding periodic burning of vegetation, as natural fires or prescribed burns are necessary for maintaining many fire adapted habitats.
- A number of native wildlife species exhibit avoidance behavior relative to vertical structures. To minimize the avoidance footprint of any wind project, place turbines as close together as is allowed (i.e., maximum relative density). Additionally, use the largest MW per turbine currently available to reduce the overall number of turbines at a site (e.g., 210 MW of 2.1 MW turbines = 100 turbines, whereas 210 MW of 3.6 MW turbines = approximately 58 turbines).
- For every acre of habitat unavoidably impacted by the construction and operation of wind turbines and associated infrastructure, the Service recommends that provisions be made for habitat mitigation following the Service's Mitigation Policy (Federal Register V.46, No. 15, January 23, 1981).
- Concurrent with the design and construction of wind energy facilities and associated electrical infrastructure, develop and implement an Avian and Bat Protection Plan. The Edison Electric Institute's Avian Power Line Interaction Committee (APLIC) and the Service's joint publication, *Avian Protection Plan Guidelines*, provide another toolbox for selecting and tailoring avoidance and minimization components applicable to specific projects. A copy of this document may be obtained from the APLIC website at <<http://www.aplic.org/>>.
- Place all electrical lines underground to the maximum extent possible. If burial is not possible, construct electrical lines and associated infrastructure in a manner consistent with guidance in the APLIC document, *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2012*. A copy of this document may be obtained from the APLIC website at <<http://www.aplic.org/>>.

- Increase, when indicated, the visibility of overhead transmission lines by using line marking devices (e.g., flapper devices, Fireflies, spiral vibration dampers, and bird flight diverters). For guidance on markers, see APLIC 1994. *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*. A copy of this document may be obtained from the Edison Electric Institute website at <
http://www2.eei.org/products_and_services/descriptions_and_access/mitigating_birds.htm >.
- Include provisions for pre- and post-construction wildlife research and monitoring, when potential impacts to federally-protected species and other important fish and wildlife resources are identified. Provide completed copies of all work to the Service and other cooperating wildlife conservation entities. In coordination with wildlife conservation entities, analyze collected data to determine if any patterns of collision mortality exist for any wildlife species and attempt to devise and implement appropriate avoidance, minimization and mitigation measures.
- Avoid locating turbines in known local and migratory bird flight pathways (e.g., between roosting and feeding areas) or in areas where birds are highly concentrated, unless direct mortality risk is low (e.g., birds present rarely enter the rotor-swept area). Examples of high concentration areas for birds are wetlands, State or Federal refuges and management areas, staging areas, rookeries, leks, roosts, and riparian areas along streams.
- Time construction activities that will potentially result in temporary or permanent loss of local and migratory bird habitat to periods outside the avian nesting season relative to a particular project site. Breeding seasons vary greatly among bird species in Oklahoma. The time frame for avoidance will depend upon the location of the proposed project, the type and quality of habitat and the associated breeding bird species.
- Include avian mortality search protocols in all post-construction monitoring plans. All birds collected during mortality searches should be offered as a donation to a local university. A permit from the Service and the Oklahoma Department of Wildlife Conservation likely will be required to collect collision injury/mortality birds and transfer them to an educational institution. Provide completed copies of all work to the Service and other wildlife conservation entities.
- Configure turbine locations to avoid areas or features of the landscape known to attract raptors (i.e., hawks, falcons, eagles, owls). For example, many hawks and falcons use cliff or rim edges extensively; setbacks from these edges may reduce mortality. Other landscape features to avoid include a dip or pass in a ridge, or in or near prairie dog colonies.
- Configure turbine arrays to avoid potential avian mortality where feasible. Implement appropriate storm water management practices that do not create attractions for birds. Maintain contiguous habitat for area-sensitive species (e.g., lesser and greater prairie chickens).
- Avoid placing turbines in habitat known to be occupied by prairie grouse or other species that exhibit avoidance of vertical features and structural habitat fragmentation. Utilize the Oklahoma Lesser Prairie-Chicken Spatial Planning Tool in evaluating prospective development sites, <
www.wildlifedepartment.com/lepcdevelopmentplanning.htm>.
- Avoid placing turbines near known bat hibernation, breeding, and maternity or nursery colonies, in migration corridors, or in flight paths between colonies and feeding areas. We recommend that

you complete site appropriate pre-construction bat monitoring (e.g., acoustic and radar detection, mist netting, etc.). A post construction monitoring plan should include bat mortality search protocols. A permit from the Oklahoma Department of Wildlife Conservation may be required to collect bats and transfer them to an educational institution. Provide completed copies of all work to the Service and other wildlife conservation entities. A representative sample of bats collected as a result of mist netting or other surveys, and all bats collected during mortality searches, should be offered as a donation to the American Museum of Natural History for their ongoing North American Bat Samples for Genomic and Stable Isotope Studies, <<http://research.amnh.org/vz/mammalogy/batdonation>>.

TURBINE DESIGN RECOMMENDATIONS

- Wind turbines should be designed to prevent perching by avian species. Rounded and sloped surfaces that are too large in circumference for birds to grasp or too angled for birds to perch on are best. Tubular tower designs that eliminate perching sites on towers should be used. Do not use lattice towers, as these attract birds to perch on the structures. Avoid use of guy wires for turbine or meteorological tower supports, as birds are more likely to strike guy wires during migration. If guy wires must be used, ensure adequate high visibility marking to reduce the likelihood of collisions.
- Use the minimum amount of pilot warning and obstruction avoidance lighting required by the Federal Aviation Administration (FAA). The FAA typically requires lights for aviation safety on all structures over 199 feet above ground level, which includes most modern wind turbines. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be set to the minimum number, minimum intensity, and minimum number of flashes per minute (i.e., longest duration between flashes) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract nocturnally-migrating birds at much higher rates than white or red strobe lights.
- When upgrading or retrofitting turbines, follow the above guidelines as closely as possible. If data indicate high mortality at specific older turbines, retrofitting or relocating is strongly recommended. Decommissioned turbines and associated infrastructure should be taken down and sites restored to appropriate native vegetation within 12 months.

Questions should be addressed to:

Field Supervisor
U.S. Fish and Wildlife Service
Oklahoma Ecological Services Field Office
9014 East 21st Street North
Tulsa, Oklahoma 74129-1428
918/581.7458

LITERATURE CITED

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