APPENDIX O:
POTENTIAL WIND FARM MITIGATION MEASURES ADAPTED FROM PROGRAMMATIC EIS - BLM WIND ENERGY DEVELOPMENT ON BLM LANDS IN THE WESTERN U.S.

Potential Wind Farm Mitigation Measures
Adapted from the BLM Programmatic EIS for
BLM Wind Energy Development on BLM Lands in the Western U.S.

The previous evaluations identified a number of potential impacts that could occur during the construction, operation, and decommissioning of a wind energy facility. A variety of mitigation measures could be implemented at wind energy projects to reduce potential impacts, and these are described in the following sections. In addition, monitoring during the various phases of wind energy development could be utilized to identify potential concerns and actions to address those concerns. Monitoring data could be used to track the condition of resources, to identify the onset of impacts, and to direct responses to address those impacts. The following sections identify measures that may be appropriate for mitigating potential impacts associated with new wind energy projects.

The discussion of potential measures to reduce impacts is heavily adapted from the final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-administered lands in the Western United States located at http://windeis.anl.gov/documents/fpeis/. Potential measures have been refined to address conditions found in the vicinity of the MATL line. Because this discussion is general in nature due to the lack of detailed plans on the wind farms, site-specific and species-specific issues associated with individual wind energy development projects are not assessed in detail. Rather, the range of possible impacts on resources present in the study area is identified. This section considers only indirect cumulative impacts of the transmission line that could be associated with wind farm development.

1.0 Land Use and Infrastructure

A variety of mitigation measures could be implemented to reduce potential land use impacts. These measures include:

- Wind energy projects could be planned to mitigate or minimize impacts to other land uses.

- Federal and state agencies, properties owners, and other stakeholders could be contacted as early as possible in the planning process to identify potentially sensitive land uses and issues;

- The U.S. Department of Defense would be consulted regarding the potential impact of a proposed wind energy project on military operations in order to identify and address any concerns;

- The FAA required notice of proposed construction would be made as early as possible to identify any air safety measures that would be required;

- To plan for efficient land use, necessary infrastructure requirements could be consolidated whenever possible, and current transmission and market access could be evaluated;

- Restoration plans could be developed to ensure that all temporary use areas are restored.

- Wind farm developers could work with affected landowners to reduce interference with existing land uses.

1.1 Land Use and Infrastructure - Transportation

Potential impacts from transportation activities related to site monitoring and testing, construction, operation, and decommissioning of typical wind energy development projects are expected to be low, provided appropriate planning and implementation actions are taken. The following measures to mitigate transportation impacts address the expected major activities associated with future wind energy development projects and general safety standards.

- Generally, roads could be required to follow natural contours and be reclaimed. Roads could be designed to an appropriate standard no higher than necessary to accommodate their intended functions.

- Existing roads could be used to the maximum extent possible, but only if in safe and environmentally sound locations. If new access roads are necessary, they could be designed and constructed to the appropriate standard no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Abandoned roads and roads that are no longer needed could be recontoured and revegetated.

- A transportation plan could be developed by project sponsors, particularly for the transport of turbine components, main assembly cranes, and other large pieces of equipment. The plan could consider specific object sizes, weights, origin, destination, and unique handling requirements and could evaluate alternative transportation approaches (e.g., barge or rail). In addition, the process to be used to comply with unique state requirements and to obtain all necessary permits could be clearly identified.

- A traffic management plan could be prepared by the project sponsors for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan could incorporate measures such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any necessary changes in temporary lane configuration. Signs could be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local commuters, consideration could be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.

- Project personnel and contractors could be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow.

- During construction and operation, traffic could be restricted to the roads developed for the project. Use of other unimproved roads could be restricted to emergency situations.

2.0 Geology and Soils

The potential for impacts to geologic resources and soils would occur primarily during construction and decommissioning. The following mitigation measures could reduce impacts:

- The size of disturbed land could be minimized as much as possible. Existing roads and borrow pits could be used as much as possible.

- Topsoil removed during construction could be salvaged and reapplied during reclamation. Disturbed soils could be reclaimed as quickly as possible or protective covers could be applied.

- Erosion controls that comply with state standards could be applied. Practices such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- On-site surface runoff control features could be designed to minimize the potential for increased localized soil erosion. Drainage ditches could be constructed where necessary but held to a minimum. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, drainage ditches, and culverts could be cleaned and maintained regularly.

- Operators could identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and dip angles of geologic strata). Operators also could avoid creating excessive slopes during excavation and blasting operations. Special construction techniques could be used where applicable in areas of steep slopes, erodible soil, and stream channel/wash crossings.

- Borrow material could be obtained only from authorized and permitted sites.

- Access roads could be located to follow natural contours of the topography and minimize side hill cuts.

- Foundations and trenches could be backfilled with originally excavated materials as much as possible. Excavation material could be disposed of only in approved areas to control soil erosion and to minimize leaching of hazardous constituents. If suitable, excess excavation materials may be stockpiled for use in reclamation activities.

3.0 Engineering and Hazardous Materials (Safety also)

The following mitigation measures could be used to deal with hazardous materials during all activities associated with a wind energy project:

- The project sponsor could keep a comprehensive listing of the hazardous materials that would be used, stored, transported, or disposed of during activities associated with site monitoring and testing, construction, operation, and decommissioning of a wind energy project.

- Project sponsors could develop a hazardous materials management plan addressing storage, use, transportation, and disposal of each hazardous material anticipated to be used at the site. The plan could identify all hazardous materials that would be used, stored, or transported at the site. It could establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan could also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.

- Project sponsors could develop a waste management plan identifying the waste streams that are expected to be generated at the site and addressing hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements, inspection procedures, and waste minimization procedures. This plan could address all solid and liquid waste that may be generated at the site.

- Project sponsors could develop a spill prevention and response plan identifying where hazardous materials and wastes are stored on site, spill prevention measures to be implemented, training requirements, appropriate spill response actions for each material or waste, the locations of spill response kits on site, a procedure for ensuring that the spill response kits are adequately stocked at all times, and procedures for making timely notifications to authorities.

- Project sponsors must develop a storm water management plan under Montana DEQ regulation for the site to ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion.

- If pesticides are to be used on the site, an integrated pest management plan could be developed to ensure that applications will be conducted in accordance with state and federal regulations. Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Secondary containment could be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) could be a temporary activity occurring only for as long as is needed to support construction and decommissioning activities. Fuel storage facilities could be removed from the site after these activities are completed.

- Wastes could be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.

- In the event of an accidental release to the environment, the operator could document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event could be provided to DEQ as required.

- Any wastewater generated in association with temporary, portable sanitary facilities could be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews could be adequate to support expected on-site personnel and could be removed at the completion of construction activities.

The following mitigation measures dealing with health and safety could be implemented where appropriate during all phases associated with a wind energy project:

- All construction, operation, and decommissioning activities could be conducted in compliance with applicable federal and state occupational safety and health standards (e.g., OSHA's Occupational Health and Safety Standards, 29 CFR Parts 1910 and 1926, respectively (DOL 2001, 2003).

- A safety assessment could be conducted to describe potential safety issues and the means that would be taken to mitigate them, including issues such as site access, construction, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.

- A health and safety program could be developed to protect workers during construction, operation, and decommissioning of a wind energy project. The program could identify all applicable federal and state occupational safety standards, establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses; OSHA standard practices for safe use of explosives and blasting agents; and measures for reducing occupational EMF exposures), establish fire safety evacuation procedures, and define safety performance standards (e.g., electrical system standards and lighting protection standards). The program could include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies could be established.

- Electrical systems could be designed to meet all applicable safety standards (e.g., National Electrical Code [NEC] and IEC and National Electric Safety Code).

- For the mitigation of explosive hazards, workers could be required to comply with the OSHA standard (1910.109) for the safe use of explosives and blasting agents (DOL 1998).

- Measures could be considered to reduce occupational EMF exposures, such as backing the generator with iron to block the electric field, shutting down the generator when working in the vicinity, and/or limiting exposure time while the generator is running (Robichaud 2004).

- The project health and safety program could also address protection of public health and safety during construction, operation, and decommissioning of a wind energy project. The program could establish a safety zone or setback for wind turbine generators from residences and occupied buildings, roads, ROWs, and other public access areas that is sufficient to prevent accidents resulting from hazards such as blade failure and ice throw during the operation of wind turbine generators. It could identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or decommissioning activities. It could also identify measures to be taken during the operations phase to limit public access to facilities (e.g., permanent fencing could be installed around electrical substations, and turbine tower access doors could be locked to limit public access).

- Operators could consult with local authorities regarding increased traffic during the construction phase, including an assessment of the number of vehicles per day, their size, and type. Specific issues of concern (e.g., location of school bus routes and stops) could be identified and addressed in the traffic management plan.

- If operation of the wind turbines is expected to cause significant adverse impacts to nearby residences and occupied buildings from shadow flicker, low-frequency sound, or EMF, site-specific recommendations for addressing these concerns could be incorporated into the project design (e.g., establishing a sufficient setback from turbines).

- The project could be planned to minimize EMI (e.g., impacts to radar, microwave, television, and radio transmissions) and comply with FCC regulations. Signal strength studies could be conducted when proposed locations have the potential to impact transmissions. Potential interference with public safety communication systems (e.g., radio traffic related to emergency activities) could be avoided.

- In the event an installed wind energy development project results in EMI, the operator could work with the owner of the impacted communications system to resolve the problem. Potential mitigation may include realigning the existing antenna or installing relays to transmit the signal around the wind energy project. Additional warning information may also need to be conveyed to aircraft with onboard radar systems so that echoes from wind turbines can be quickly recognized.

- The project could be planned to comply with FAA regulations, including lighting requirements, and to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.

- Operators could develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.

4.0 Electric and Magnetic Fields – no measures.

5.0 Water Resources

Potential water resource impacts would mostly occur during the site construction and decommissioning phases. Mitigation measures that could reduce such impacts include:

- The amount of cleared and disturbed lands could be minimized as much as possible. Existing roads and borrow pits could be used as much as possible.

Topsoil removed during construction could be salvaged and reapplied during reclamation. Disturbed soils could be reclaimed as quickly as possible or protective covers could be applied.

- Operators could identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquakes, slope angles, and dip angles of geologic strata). Operators also could avoid creating excessive slopes during excavation and blasting operations. Special construction techniques could be used where applicable in areas of steep slopes, erodible soil, and stream channel/wash crossings.

- Erosion controls that comply with state standards could be applied. Controls such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- Operators could gain a clear understanding of the local hydrogeology. Areas of groundwater discharge and recharge and their potential relationships with surface water bodies could be identified.

- Operators could avoid creating hydrologic conduits between two aquifers during foundation excavation and other activities.

- Proposed construction near aquifer recharge areas could be closely monitored to reduce the potential for contamination of the aquifer. This may require a study to determine localized aquifer recharge areas.

- Foundations and trenches could be backfilled with originally excavated material as much as possible. Excess excavated material could be disposed of only in approved areas.

- Existing drainage systems could not be altered, especially in sensitive areas such as erodible soils or steep slopes. When constructing stream or wash crossings, culverts or water conveyances for temporary and permanent roads could be designed to comply with county standards, or if there are no county standards, to accommodate the runoff of a 10-year storm. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts could be cleaned and maintained regularly.

- On-site surface runoff control features could be designed to minimize the potential for increased localized soil erosion. Drainage ditches could be constructed where necessary but held to a minimum. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, drainage ditches, and culverts could be cleaned and maintained regularly.

- Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

6.0 Wetlands and Floodplains

Wind energy development typically occurs on ridges and other elevated land where wetlands and surface bodies are not likely to occur; however, access roads and transmission lines may cross lands where these features may be more common. As a result, wetland and aquatic biota could be affected during construction of the wind energy project and its associated facilities.

- Construction activities may adversely affect wetlands and aquatic biota through (1) habitat disturbance, (2) mortality or injury of biota, (3) erosion and runoff, (4) exposure to contaminants, and (5) interference with migratory movements. Except for the construction of stream crossings for access routes or the unavoidable location of a transmission line support tower in a wetland, construction within wetlands or other aquatic habitats would be largely prohibited.

- The overall impact of construction activities on wetlands and aquatic resources would depend on the type and amount of aquatic habitat that would be disturbed, the nature of the disturbance (e.g., grading and filling, or erosion in construction support areas), and the aquatic biota that occupy the project site and surrounding areas.

- Avoid construction of stream crossings could directly impact aquatic habitat and biota within the crossing footprint.

7.0 Vegetation

The following measures could be implemented through weed control plans required by county weed boards to minimize the potential establishment of invasive vegetation at a wind energy development site and its associated facilities:

- Operators would develop a plan for control of noxious weeds and invasive plants acceptable to the county weed board, which could occur as a result of new surface disturbance activities at the site. The plan could address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. The use of certified weed-free mulching could be required.

- If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area could be established to visually inspect construction equipment arriving at the project area and to remove and collect seeds that may be adhering to tires and other equipment surfaces.

- Access roads and newly established power lines could be monitored regularly for invasive species establishment, and weed control measures could be initiated immediately upon evidence of invasive species introduction.

- Fill materials that originate from areas with known invasive vegetation problems could not be used.

- Certified weed-free mulch could be used when stabilizing areas of disturbed soil.

- Habitat restoration activities and invasive vegetation monitoring and control activities could be initiated as soon as possible after construction activities are completed.

- All areas of disturbed soil could be reclaimed using weed-free native shrubs, grasses, and forbs.

- Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Access roads, utility and transmission line corridors, and tower site areas could be monitored regularly for invasive species establishment, and weed control measures could be initiated immediately upon evidence of invasive species introduction.

8.0 Wildlife

Mitigation measures that could minimize raptor fatalities at wind energy development projects include:

- Raptor use of the project area could be evaluated, and the project could be designed to minimize or mitigate the potential for raptor strikes. Scientifically rigorous raptor surveys could be conducted; the amount and extent of baseline data required could be determined on a project-specific basis.

- Areas with a high incidence of fog, mist, low cloud ceilings, and low visibility could be avoided.

- Turbine locations could be configured in order to avoid landscape features (including prairie dog colonies and other high-prey potential sites) known to attract raptors.

- Turbine arrays could be configured to minimize avian mortality (e.g., orient rows of turbines parallel to known bird movements).

- Underground or raptor-safe transmission lines could be used to reduce collision and electrocution potential.

- A habitat restoration plan could be developed that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species (e.g., avoid the establishment of habitat that attracts high densities of prey animals used by raptors).

- Road cuts, which are favored by pocket gophers and ground squirrels, could be minimized.

- Either no vegetation or native plant species that do not attract small mammals could be maintained around the turbines.

- Tubular supports rather than lattice supports could be used, with no external ladders and platforms.

- The minimum amount of pilot warning and obstruction avoidance lighting specified by the FAA could be used, and the FAA could be consulted.

- Operators could determine if active raptor nests (i.e., raptor nests used during the breeding season) are present. Buffers could be provided to avoid disturbance of nesting raptors.

- Areas with high bird use could be avoided through micro-siting alternatives (e.g., at the Foote Creek Rim project, turbines were located slightly away from the rim edge of a flat top mesa [Strickland et al. 2001a]).

Measures that have been suggested for management of sage grouse and their habitats may apply to sharp-tailed grouse (e.g., Paige and Ritter 1999; Connelly et al. 2000; Montana Sage-Grouse Work Group 2003). The measures that have pertinence to wind energy development projects include:

- Identify and avoid both local (daily) and seasonal migration routes.

- Consider grouse and sage habitat when designing, constructing, and utilizing project access roads and trails.

- Avoid, when possible, siting energy developments in breeding habitats.

- Adjust the timing of activities to minimize disturbance to grouse during critical periods.

- When possible, locate energy-related facilities away from active leks or near grouse habitat.

- When possible, restrict noise levels to 10 dB above background noise levels at the lek sites.

- Minimize nearby human activities when birds are near or on leks.

- As practicable, do not conduct surface-use activities within crucial sage-grouse wintering areas from December 1 through March 15.

- Maintain sagebrush communities on a landscape scale.

- Provide compensatory habitat restoration for impacted sagebrush habitat.

- Avoid the use of pesticides at grouse breeding habitat during the brood-rearing season.

- Develop and implement appropriate measures to prevent the introduction or dispersal of noxious weeds.

- Avoid creating attractions for raptors and mammalian predators in grouse habitat.

- Consider measures to mitigate impacts at off-site locations to offset unavoidable grouse habitat alteration and reduction at the project site.

9.0 Fish – no measures.

10.0 Threatened, Endangered, and Candidate for Listing Species

If federally listed species are present in the project vicinity, the project sponsor is encouraged to contact the USFWS.

A variety of site-specific and species-specific measures may be appropriate to mitigate potential impacts to special status species if present in the project area. Such measures may include:

- Field surveys could be conducted to verify the absence or presence of the species in the project area and especially within individual project footprints.

- Project facilities or lay-down areas could not be placed in areas documented to contain or provide important habitat for those species.

11.0 Air Quality

The potential for adverse air quality impacts during the site monitoring and testing and operation phases would be limited. The greatest potential impacts would occur during the construction and decommissioning phases. Generation of fugitive particulates from vehicle traffic and earthmoving activities would need to be controlled. Typical measures (ABC Wind Company, LLC undated; PBS&J 2002) that could be implemented to control particulates and other pollutants include these:

- Mitigation measures for areas subject to vehicular travel

Access roads and on-site roads could be surfaced with aggregate materials, wherever appropriate.

Dust abatement techniques could be used on unpaved, unvegetated surfaces to minimize airborne dust.

Speed limits could be posted (e.g., 25 mph) and enforced to reduce airborne fugitive dust.

- Mitigation measures for soil and material storage and handling

Workers could be trained to handle construction material to reduce fugitive emissions.

Construction materials and stockpiled soils could be covered if they are a source of fugitive dust.

Storage piles at concrete batch plants could be covered if they are a source of fugitive dust.

- Mitigation measures for clearing and disturbing land

Disturbed areas could be minimized.

Dust abatement techniques could be used as earthmoving activities proceed and prior to clearing.

- Mitigation measures for earthmoving

Dust abatement techniques could be used before excavating, backfilling, compacting, or grading.

Disturbed areas could be revegetated as soon as possible after disturbance.

- Mitigation measures for soil loading and transport

If practicable, soil could be moist while being loaded into dump trucks.

Soil loads could be kept below the freeboard of the truck.

Drop heights could be minimized when loaders dump soil into trucks.

Gate seals could be tight on dump trucks.

Dump trucks could be covered before traveling on public roads.

- Mitigation measure for blasting

Dust abatement techniques could be used during blasting.

12.0 Audible Noise

The following mitigation measures could reduce potential noise impacts:

- Proponents of a wind energy development project could take measurements to assess the existing background noise levels at a given site and compare them with the anticipated noise levels associated with the proposed project.

- Noisy construction activities (including blasting) could be limited to the least noise-sensitive times of day (daytime only between 7 a.m. and 10 p.m.) and weekdays.

- Whenever feasible, different noisy activities (e.g., blasting and earthmoving) could be scheduled to occur at the same time since additional sources of noise generally do not add a significant amount of noise. That is, less-frequent noisy activities would be less annoying than frequent less-noisy activities.

- All equipment could have sound-control devices no less effective than those provided on the original equipment. All construction equipment used could be adequately muffled and maintained.

- All stationary construction equipment (i.e., compressors and generators) could be located as far as practicable from nearby residences.

- If blasting or other noisy activities are required during the construction period, nearby residents could be notified in advance.

13.0 Socioeconomics – no measures.

14.0 Paleontological and Cultural Resources

To mitigate or minimize potential paleontological resource impacts, the following mitigation measures could be adopted:

- Operators could determine whether paleontological resources exist in a project area on the basis of the sedimentary context of the area, a records search for past paleontological finds in the area, and/or a paleontological survey.

- A paleontological resources management plan could be developed for areas where there is a high potential for paleontological material to be present. Management options may include avoidance, removal of the fossils, or monitoring. If the fossils are to be removed, a mitigation plan could be drafted identifying the strategy for collection of the fossils in the project area. Often it is unrealistic to remove all of the fossils, in which case a sampling strategy can be developed. If an area exhibits a high potential but no fossils were observed during surveying, monitoring could be required. A qualified paleontologist could monitor all excavation and earthmoving in the sensitive area. Whether the strategy chosen is excavation or monitoring, a report detailing the results of the efforts could be produced.

- If an area has a strong potential for containing fossil remains and those remains are exposed on the surface for potential collection, steps could be taken to educate workers and the public on how to report these resources to the landowner.

- To mitigate or minimize potential impacts to cultural resources, the following mitigation measures could be adopted. On state or federal lands, some measures could be required.

- Where a wind farm would be located on state or federal lands, agencies with permitting authority could consult with Native American governments early in the planning process to identify issues and areas of concern regarding the proposed wind energy development. Aside from the fact that consultation is required under the National Historic Preservation Act (NHPA), consultation is necessary to establish whether the project is likely to disturb traditional cultural properties, affect access rights to particular locations, disrupt traditional cultural practices, and/or visually impact areas important to the Tribe(s).

- The presence of archaeological sites and historic properties in the area of potential effect could be determined on the basis of a records search of recorded sites and properties in the area and/or an archaeological survey. The State Historic Preservation Officer (SHPO) is the primary repository for cultural resource information, and the State DNRC offices and most BLM Field Offices also maintain this information for lands under their jurisdiction.

- Archaeological sites and historic properties present in the area of potential effect could be reviewed by an agency and/or a project sponsor to determine whether they meet the criteria of eligibility for listing on the NRHP. Cultural resources listed on or eligible for listing on the NRHP are considered “significant” resources.

- When any ROW application includes remnants of a National Historic Trail, is located within the viewshed of a National Historic Trail’s designed centerline, or includes or is within the viewshed of a trail eligible for listing on the National Register of Historic Places (NRHP), the operator could evaluate the potential visual impacts to the trail associated with the proposed project and identify appropriate mitigation measures.

- If cultural resources are present at the site, or if areas with a high potential to contain cultural material have been identified, a cultural resources management plan could be developed by a regulatory agency and/or a project sponsor. This plan could address mitigation activities to be implemented for cultural resources found at the site. Avoidance of the area is always the preferred mitigation option. Other mitigation options include archaeological survey and excavation (as warranted) and monitoring. If an area exhibits a high potential, but no artifacts are observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area. A report could be prepared documenting these activities. The CRMP also could (1) establish a monitoring program, (2) identify measures to prevent potential looting/vandalism or erosion impacts, and (3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of artifacts and destruction of property on public land.

- Periodic monitoring of significant cultural resources in the vicinity of development projects may help curtail potential looting/vandalism and erosion impacts. If impacts are recognized early, additional actions can be taken before the resource is destroyed.

- Unexpected discovery of cultural resources during construction could be brought to the attention of the responsible authorized officer or landowner immediately. Work could be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

- Wind farm developers could inform construction workers and site operators of appropriate measures to avoid damage to or destruction of cultural resources.

15.0 Visuals

The potential for impacts to visual resources soils could occur during all phases of wind energy development. The following mitigation measures could reduce impacts (NWCC 2002; AusWEA 2002; Gipe 1998, 2002; NYSDEC 2000):

- Turbine arrays and the turbine design could be integrated with the surrounding landscape. To accomplish this integration, several elements of design need to be incorporated.

- The operator could provide visual order and unity among clusters of turbines (visual units) to avoid visual disruptions and perceived “disorder, disarray, or clutter” (Gipe 2002).

- To the extent possible given the terrain of a site, the operator could create clusters or groupings of wind turbines when placed in large numbers; avoid a cluttering effect by separating otherwise overly long lines of turbines, or large arrays; and insert breaks or open zones to create distinct visual units or groups of turbines.

- The operator could create visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers (Gipe 1998).

- The use of tubular towers is recommended for visual unity. Truss or lattice-style wind turbine towers with lacework, pyramidal, or prism shapes could be avoided. Tubular towers present a simpler profile and less complex surface characteristics and reflective/shading properties.

- Components could be in proper proportion to one another. Nacelles and towers could be planned to form an aesthetic unit and could be combined with particular sizes and shapes in mind to achieve an aesthetic balance between the rotor, nacelle, and tower (Gipe 1998).
- Color selections for turbines could be made to reduce visual impact (Gipe 2002) and could be applied uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.

- The operator could use nonreflective paints and coatings to reduce reflection and glare. Turbines, visible ancillary structures, and other equipment could be painted before or immediately after installation. Uncoated galvanized metallic surfaces could be avoided because they would create a stronger visual contrast, particularly as they oxidize and darken.

- Commercial messages on turbines and towers could be avoided (Gipe 2002).

- The site design could be integrated with the surrounding landscape.

- To the extent practicable, the operator could avoid placing substations or large operations buildings on high land features and along "skylines" that are visible from nearby sensitive view points. The presence of these structures could be concealed or made less conspicuous. Conspicuous structures could be designed and constructed to harmonize with desirable or acceptable characteristics of the surrounding environment (Gipe 2002).

- The operator could bury power collection cables or lines on the site in a manner that minimizes additional surface disturbance.

- Commercial symbols (such as logos), trademarks, and messages could be avoided on sites or ancillary structures of wind energy projects. Similarly, billboards and advertising messages could be avoided (Gipe 1998, 2002).

- Site design could be accomplished to make security lights nonessential. Such lights increase the contrast between a wind energy project and the night sky, especially in rural/remote environments, where turbines would typically be installed. Where they are necessary, security lights could be extinguished except when activated by motion detectors (e.g., only around the substation) (Gipe 1998).

- Operators could minimize disturbance and control erosion by avoiding steep slopes (Gipe 1998) and by minimizing the amount of construction and ground clearing needed for roads, staging areas, and crane pads. Dust suppression techniques could be employed in arid environments to minimize impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.

- Disturbed surfaces could be restored as closely as possible to their original contour and revegetated immediately after, or contemporaneously with construction. Action could be prompt to limit erosion and to accelerate restoring the preconstruction color and texture of the landscape.

- The wind development site could be maintained during operation. Inoperative or incomplete turbines cause the misperception in viewers that "wind power does not work" or that it is unreliable.

- Inoperative turbines could be completely repaired, replaced, or removed. Nacelle covers and rotor nose cones could always be in place and undamaged (Gipe 1998).

- Wind energy projects could evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power. Nacelles and towers could also be cleaned regularly (yearly, at minimum) to remove spilled or leaking fluids and the dirt and dust that would accumulate, especially in seeping lubricants.

- Facilities and off-site surrounding areas could be kept clean of debris, "fugitive" trash or waste, and graffiti. Scrap heaps and materials dumps could be prohibited and prevented. Materials storage yards, even if thought to be orderly, could be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size could not be allowed to accumulate (Gipe 2002).

- A decommissioning plan could be developed, and it could include the removal of all turbines and ancillary structures and restoration/reclamation of the site.

16.0 Mitigation during Site Monitoring and Testing

Site monitoring and testing would generally result in only minimal impacts to ecological resources. The following mitigation measures may ensure that ecological impacts during this stage of the project would be minimal:

- Existing roads could be used to the maximum extent feasible to access a proposed project area.

- If new access roads are necessary, they could be designed and constructed to the appropriate standard.

- Existing or new roads could be maintained to the condition needed for facility use.

- The area disturbed during the installation of meteorological towers (i.e., the tower footprint and its associated lay-down area) could be kept to a minimum.

- Individual meteorological towers could not be located in or near sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.

- Installation of meteorological towers could be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors (e.g., during periods of grouse nesting).

17.0 Mitigation during Plan of Development Preparation and Project Design

Mitigation measures may be considered during preparation of the project design to ensure that the siting of the overall wind energy development project and of individual facility structures, as well as various aspects of the design of individual facility structures, do not result in unacceptable impacts to ecological resources. The following measures could be incorporated into the siting of the wind development project:

- Operators could identify important, sensitive, or unique habitat and biota in the project vicinity and site, and design the project to avoid (if possible), minimize, or mitigate potential impacts to these resources. The design and siting of the facility could follow appropriate guidance and requirements from other resource agencies, as available and applicable.

- The operators could contact appropriate agencies early in the planning process to identify potentially sensitive ecological resources that may be present in the area of the wind energy development.

- The operators could conduct surveys for federal- and state-protected species and other species of concern within the project area.

- Operators could evaluate avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project area by using scientifically rigorous survey methods (e.g., see NWCC 1999).

- The project could be planned to avoid (if possible), minimize, or mitigate impacts to wildlife and habitat.

- Discussion could be held with the appropriate agency biologists regarding the occurrence of sensitive species or other valued ecological resources in the proposed project area.

- Existing information on species and habitats in the project area could be reviewed.

The amount and extent of necessary preproject data would be determined on a project-by-project basis, based in part on the environmental setting of the proposed project location. Methods for collecting such data may be found in NWCC (1999) and California Energy Commission (2007).

17.1 Mitigating Habitat Impacts. The following measures could be considered during project siting to minimize potential habitat disturbance:

- If survey results indicate the presence of important, sensitive, or unique habitats (such as wetlands and sagebrush habitat) in the project vicinity, facility design could locate turbines, roads, and support facilities in areas least likely to impact those habitats.

- Habitat disturbance could be minimized by locating facilities (such as utility corridors and access roads) in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing power line corridors).

- Existing roads and utility corridors could be utilized to the maximum extent feasible.

- New access roads and utility corridors could be configured to avoid high quality habitats and minimize habitat fragmentation.

- Site access roads and utility corridors could minimize stream crossings.

- A habitat restoration management plan could be developed that identifies vegetation, soil stabilization, and erosion reduction measures and requires that restoration activities be implemented as soon as possible following facility construction activities.

- Individual project facilities could be located to maintain existing stands of quality habitat and continuity between stands.

- The creation of, or increase in, the amount of edge habitat between natural habitats and disturbed lands could be minimized.

- To minimize impacts to aquatic habitats from increased erosion, the use of bridges or fill ramps rather than stream bank cutting could be designated for all stream crossings by access roads.

- Stream crossings could be designed to provide in-stream conditions that allow for and maintain uninterrupted movement and safe passage of fish.

17.2 Mitigating Site/Wildlife Interactions. To reduce the potential use of site facilities by perching birds, to reduce the potential for collisions with project facilities, and to reduce the potential for electrocution, the following measures could be considered during the design of individual facility structures:

- Locations that are heavily utilized by migratory birds and bats could be avoided.

- Permanent meteorological towers, transmission towers, and other facility structures could be designed to discourage their use by birds for perching or nesting.

- The use of guy wires on permanent meteorological towers could be avoided or minimized.

- Electrical supply lines could be buried in a manner that minimizes additional surface disturbance. Overhead lines could be used in cases where the burial of lines would result in further habitat disturbance.

- Power lines could be configured to minimize the potential for electrocution of birds, by following established guidelines (e.g., APLIC [2006], APLIC and USFWS ~2O05]).

- Operators could consider incorporating measures to reduce raptor use of the project site into the design of the facility layout (e.g., minimize road cuts and maintain nonattractive vegetation around turbines).

- Turbines and other project facilities could avoid locations in areas with known high bird usage; in known bird and/or bat migration corridors or known flight paths; near raptor nest sites; and in areas used by bats as colonial hibernation, breeding, and maternity/nursery colonies, if site studies show that they would pose a high risk to species of concern.

- Wind energy projects could avoid locations in areas with a high incidence of fog and mist.

- To reduce attraction of migratory birds to turbines and towers, the need for or use of sodium vapor lights at site facilities could be minimized or avoided.

- Turbines could be configured to avoid landscape features known to attract raptors, if site studies show that placing turbines there would pose a significant risk to raptors.

17.3 Mitigating Habitat Disturbance. To mitigate habitat reduction or alternation during construction, the following measures may be implemented:

- The size of all disturbed areas could be minimized.

- Where applicable, the extent of habitat disturbance could be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.

- Habitat restoration activities could be initiated as soon as possible after construction activities are completed.

17.4 Mitigating Disturbance and Injury of Vegetation and Wildlife. These measures may be applicable to mitigate the disturbance or injury of biota during construction:

- In consultation with staff from natural resource management agencies, construction activities could be scheduled to avoid important periods of wildlife courtship, breeding, nesting, lambing, or calving.

- All construction employees could be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship, nesting) seasons. In addition, any pets could not be permitted on site during construction.

- Buffer zones could be established around raptor nests, bat roosts, and biota and habitats of concern, if site studies show that proposed facilities would pose a significant risk to avian or bat species of concern.

- Noise-reduction devices (e.g., mufflers) could be maintained in good working order on vehicles and construction equipment.

- Explosives could be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by local, state and federal management agencies.

- The use of guy wires on permanent meteorological towers could be avoided.

17.5 Mitigating Erosion and Fugitive Dust Generation. Measures to minimize disturbance of ecological resources from erosion and fugitive dust may include:

- Erosion controls that comply with county, state, and federal standards could be applied. Controls such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- All areas of disturbed soil could be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities could be undertaken as early as possible on disturbed areas.

- Dust abatement techniques could be used on unpaved, unvegetated surfaces to minimize airborne dust.

- Construction materials and stockpiled soil could be covered if they are a source of fugitive dust.

- Erosion and fugitive dust control measures could be inspected and maintained regularly.

17.6 Mitigating Fuel Spills. To minimize potential impacts to ecological resources from accidental fuel spills, the following mitigation measures may be implemented:

- All refueling could occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.

- Drip pans could be used during refueling to contain accidental releases.

- Drip pans could be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

- Spills could be immediately addressed per the appropriate spill management plan, and soil cleanup and soil removal initiated if needed.

18.0 Mitigation during Operation

18.1 Mitigating Fuel Spills and Exposure to Site-Related Chemicals. The following measures may be implemented to minimize the potential for exposure of biota to accidental spills:

- Drip pans could be used during refueling to contain accidental releases.

- Pesticide use could be limited to nonpersistent, immobile pesticides and herbicides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Spills could be immediately addressed per the appropriate spill management plan, and soil cleanup and removal initiated, if needed.

18.2 Mitigating Site/Wildlife Interactions. Measures to mitigate these interactions were identified for inclusion in wind farm location and design. The following measures may further reduce the potential for bird collisions, primarily through reducing the attractiveness of the facility to birds:

- Taller vegetation (i.e., shrub species) could be encouraged along powerline transmission corridors to minimize foraging in these areas by raptors to the extent local conditions will support this vegetation.

- Areas around turbines, meteorological towers, and other facility structures could be maintained in an unvegetated state (e.g., crushed gravel), or only vegetation that does not support wildlife use could be planted.

- All unnecessary lighting could be turned off at night to limit attracting migratory birds.

- Employees, contractors, and site visitors could be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. In addition, pets could be controlled to avoid harassment and disturbance of wildlife.

- Observations of potential wildlife problems, including wildlife mortality, could be reported to wildlife management agencies.

19.0 Mitigation during Decommissioning

The measures identified to mitigate construction impacts are applicable to decommissioning activities and may include:

- All turbines and ancillary structures could be removed from the site.

- Topsoil from all decommissioning activities could be salvaged and reapplied during final reclamation.

- All areas of disturbed soil could be reclaimed using weed-free native shrubs, grasses, and forbs.

- The vegetation cover, composition, and diversity could be restored to values commensurate with the ecological setting.

Following removal of the project facilities, implementation of appropriate habitat restoration activities could restore disturbed areas to pre-project conditions.