DOE/EIS - 0427

Draft Environmental Impact Statement

Grapevine Canyon Wind Project

July 2010

Volume I

Lead Agency:

U.S. Department of Energy,
Western Area Power Administration

Cooperating Agencies:

U.S. Department of Agriculture,
Forest Service, Coconino National Forest

Arizona State Land Department

Western
AREA POWER
ADMINISTRATION

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COVER SHEET

LEAD FEDERAL AGENCY: U.S. Department of Energy (DOE), Western Area Power Administration (Western)

COOPERATING AGENCIES: U.S. Department of Agriculture, Forest Service, Coconino National Forest (Forest Service) and Arizona State Land Department

TITLE: Draft Environmental Impact Statement for the Grapevine Canyon Wind Project, DOE/EIS-0427

LOCATION: Coconino County, Arizona

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ABSTRACT: The Grapevine Canyon Wind Project, proposed by Foresight Flying M, LLC (Applicant), would include: 1) a wind energy generating facility up to 500 megawatts; 2) a 345-kilovolt (kV) electrical transmission tie-line; and 3) a 345-kV electrical interconnection switchyard that would be owned and operated by Western. The wind energy generating facility would be located on private land and trust land administered by the Arizona State Land Department. The electrical transmission tie-line would be located on private and State trust lands, as well as Federal lands administered by the Forest Service. The interconnection switchyard would be located entirely on National Forest System lands. The project is located about 28 miles south and east of Flagstaff, Arizona in Coconino County, extending from the proposed wind generating facility south of Meteor Crater to the proposed switchyard just east of Mormon Lake, Arizona. The Applicant has applied to Western to interconnect the proposed wind energy generating facility to Western's power transmission system on its Glen Canyon-Pinnacle Peak 345-kV No. 1 and No. 2 transmission lines. Additionally, Foresight has applied to the Forest Service for a special use permit authorizing the use of a 200 foot wide right-of-way for a minimum period of 50 years to accommodate the construction and operation of the proposed 345-kV electrical transmission tie-line. The Draft EIS includes a description of Western's and the Forest Service's proposed Federal actions and a no action alternative and an analysis of their environmental impacts.

Western invites interested parties to comment on this Draft EIS during the 45-day comment period that will begin when the Environmental Protection Agency publishes a Notice of Availability of this Draft EIS in the *Federal Register*.

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

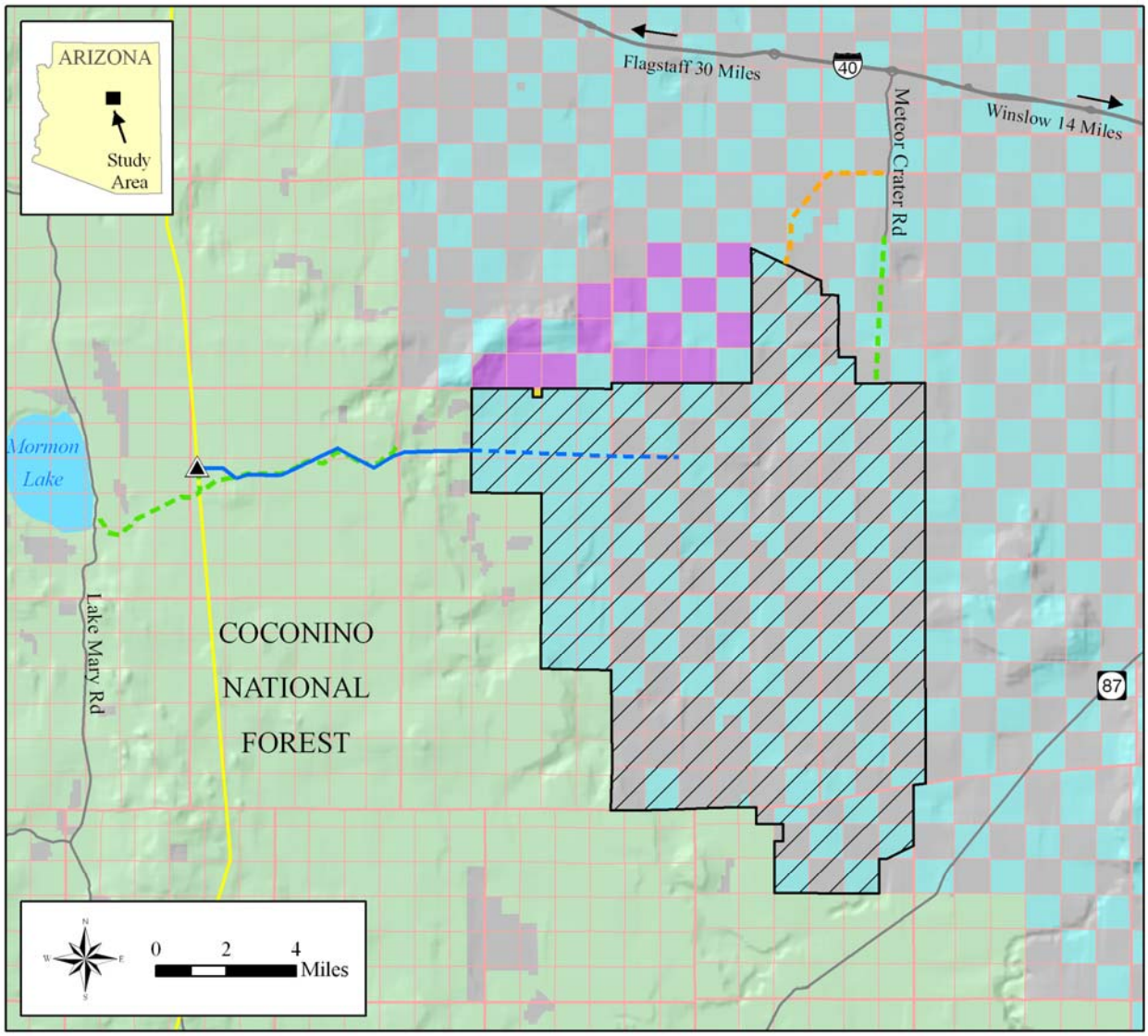
Foresight Flying M, LLC (Foresight or Applicant) proposes the development of the Grapevine Canyon Wind Project in Coconino County, Arizona. The project is located approximately 18 miles southwest of Winslow and 28 miles southeast of Flagstaff (Figure ES.1-1).

The project would include three main components: 1) a wind energy generating facility up to 500 megawatts (MW); 2) a 345-kilovolt (kV) electrical transmission tie-line; and 3) a 345-kV electrical interconnection switchyard and facilities that would be owned and operated by Western Area Power Administration (Western). The wind energy generation component would be located on private land and trust land administered by the Arizona State Land Department. The electrical transmission tie-line would be located on private and State trust lands, as well as Federal lands administered by the U.S. Department of Agriculture, Forest Service (Forest Service). The interconnection switchyard would be located entirely on National Forest System lands.

The wind energy generating facility may be built in two or more phases over a period of years, with an initial construction schedule for the first phase between 12 to 18 months. Construction is expected to begin in 2011.

Foresight has applied to Western to interconnect the proposed wind energy generating facility to Western's power transmission system on its Glen Canyon-Pinnacle Peak 345-kV No. 1 and No. 2 transmission lines. Additionally, Foresight has applied to the Forest Service for a special use permit authorizing the use of a 200-foot-wide right-of-way for a minimum period of 50 years to accommodate the construction and operation of the proposed 345-kV electrical transmission tie-line.

Western would seek approval and authorization from the Forest Service to construct and operate the proposed interconnection switchyard on an approximately 15-acres parcel beneath the Glen Canyon-Pinnacle Peak transmission lines, if the interconnection request is approved.



Legend

Applicant's Proposed Project

Grapevine Canyon Wind Project

- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Lines
- Bureau of Land Management
- Forest Service
- Arizona Game and Fish Department
- Private
- State Trust

FIGURE ES.1-1

ES.2 PURPOSE AND NEED FOR AGENCY ACTION

ES.2.1 Applicant's Purpose and Need

Most electricity produced in the U.S. comes from fossil fuels. However, in recent years, the majority of states in the southwestern U.S. have passed regulations or guidelines that require utilities to generate a specific percentage of their energy portfolio from renewable resources, such as wind, solar, biomass, and geothermal. The State of Arizona adopted new Renewable Energy Standard and Tariff rules in 2006 requiring public utilities to provide 15 percent of their retail electricity from renewable energy sources by 2025.

Foresight's goal is to construct and operate a utility scale wind energy generating facility that is tied into the regional grid so that the energy produced can be marketed to utility companies in Arizona and other western states to meet their State portfolio standards and energy requirements. The Applicant's objectives include the following:

- To construct, own, operate, and maintain an efficient, economic, and reliable, utility-scale wind generating facility that would help achieve State and/or regional renewable energy standards.
- To develop the wind energy generating facility on a site with an excellent wind resource.
- To interconnect to an electrical transmission system with available capacity that ties into the regional electric grid.
- To be consistent with the goals of the American Recovery and Reinvestment Act of 2009 that seeks to support home-grown renewable energy for economic recovery.
- To be consistent with Federal, Western Governors' Association, State and local goals for clean renewable energy and sustainable economic development.

ES.2.2 Federal Agency Purpose and Need

Western Area Power Administration

Foresight has requested an interconnection with Western's electrical transmission system. Western is required to approve or deny the interconnection request in accordance with Western's Open Access Transmission Service Tariff (Tariff). Western's Tariff provides open access to its transmission system. If there is available capacity in the transmission system, Western provides transmission services through an interconnection. This interconnection request requires Federal action which triggers a review under the National Environmental Policy Act of 1969 (NEPA).

U.S. Department of Agriculture, Forest Service, Coconino National Forest

In addition to the request for interconnection, Foresight has applied to the Forest Service for a special use permit authorizing a 200-foot-wide right-of-way for a minimum period of 50 years to accommodate an electrical transmission tie-line on National Forest System lands. Western would apply to the Forest Service for authorization to construct and operate an electrical switchyard, if the interconnection request is approved. The Forest Service is authorized to issue special use permits under the Federal Land Policy and Management Act. Consideration of special use requests is based on direction contained in 36 Code of Federal Regulations (CFR) 251, Subpart B, including screening criteria that address consistency with policies and land management plans.

In order to provide an interconnection with Western's electrical transmission system, the switchyard and the transmission tie-line would be located on National Forest System lands because the existing Western Glen Canyon-Pinnacle Peak 345-kV transmission lines are located on National Forest System lands. The special use permits would authorize Foresight and Western to construct, operate, and maintain the transmission tie-line and switchyard on National Forest System lands.

ES.3 PROPOSED ACTION AND ALTERNATIVES

ES.3.1 Federal Agency Proposed Actions

The proposed Federal actions evaluated in this Environmental Impact Statement (EIS) by each of the involved Federal agencies are as follows:

- **Western**: To approve Foresight's interconnection to Western's transmission system, on the Glen Canyon-Pinnacle Peak 345-kV transmission lines, an action which would also require a new Western switchyard on National Forest System lands.

- **Forest Service**: To approve Foresight's special use permit authorizing a 200-foot-wide right-of-way for a minimum period of 50 years to accommodate the construction, operation, and maintenance of a new 345-kV electrical transmission tie-line corridor across approximately 8.5 miles of National Forest System lands. In addition, the Forest Service would authorize Western to construct, operate, and maintain a new switchyard on an approximately 15-acre parcel.

ES.3.2 Applicant's Proposed Project

Foresight proposes to construct and operate a utility scale wind energy generating facility on private and State trust land. The wind energy generating facility would generate up to 500 MW of electricity from wind turbine generators (WTGs).

The proposed project includes three main components: 1) a wind energy generating facility (wind park); 2) a 345-kV transmission tie-line (tie-line); and 3) a 345-kV interconnection switchyard, constructed owned, and operated by Western (switchyard).

Wind Park

The proposed wind park would be built in one or more phases, dependent on one or more power sale contracts. The proposed wind park would include improved and new access and service roads, WTGs, an electrical collection system, a step-up electrical substation, communications system, operations and maintenance building, and meteorological monitoring towers. The exact location of these facilities would be determined during final project design, but all wind park facilities would be located within the wind park study area. The wind park study area encompasses almost 100,000 acres of private and State trust lands and substantially exceeds lands anticipated to be disturbed for the various wind park facilities. Construction of the wind park is expected to temporarily disturb 2,050 to 2,193 acres and permanently disturb 555 to 570 acres of land.

The number and model of WTGs are typically determined by one or more power sale contracts, the wind resource, and turbine availability and cost. The proposed wind park would generate electricity from WTGs rated at 1.5 to 3.0 MW. For purposes of this EIS, specifications for the Vestas V100 1.8-MW WTG are used to evaluate potential effects of the wind park. This 1.8-MW WTG is a tubular steel tower, 263 feet in height and 14 feet in maximum diameter. Three blades, each 161 feet in length, extend from the nacelle, located at the top of the tower, resulting in a maximum WTG height of 424 feet.

Engineering Surveys for the Wind Park

Geotechnical or geophysical investigations, soil resistivity and thermal conductivity tests, and a Worst-Case Fresnel Zone Study would be performed to aid in the final design of the wind park. A pre-construction site survey would be performed to stake out the exact location of the WTGs, service roads, electrical collection system, access entryways from public roads, step-up substation, operations and maintenance building, and other project features.

Construction of the Wind Park

Construction activities would be temporary and would involve the use of heavy equipment including bulldozers, graders, trenching machines, concrete trucks, tractor-trailer trucks, and large cranes. Prior to beginning construction activities, the exact location of wind park facilities would be determined. The initial steps in the construction of the wind park would include: constructing or improving access roads; developing a temporary power and water source; establishing borrow pits and setting up a rock crusher and batch plant; and establishing a project staging area. These activities would be followed by the construction of WTGs, the electrical collection system and communications system, the step-up substation, operations and maintenance building, and long-term meteorological towers.

Wind Park Primary Access and Service Roads

The primary site access road would originate from Meteor Crater Road and would extend to the west across Canyon Diablo and then south into the wind park study area across private and State trust lands. The access road would be approximately 16-feet wide and eight miles in length. The roadway would be cleared of vegetation and excavated to a depth of up to 12 inches and covered with aggregate. The road surface would then be graded and compacted and berms and other drainage features would be constructed as required.

The primary site access road would require a crossing of Canyon Diablo. This crossing would require a bridge-type structure, with a span of up to 80 feet and a roadway of approximately 16 to 18 feet.

In addition to the primary access road, Chavez Pass Road, an existing road located between Meteor Crater Road to the north and State Route 87 to the south, may also be used for site access for subsequent wind park phases. Chavez Pass Road is a primitive local road not maintained regularly by the County. Some improvements may be required, but it is anticipated the road would not need to be recontoured or upgraded outside of the existing roadway.

Once primary access has been established, service roads to each WTG site and other wind park facilities would be constructed. Approximately 143 miles of service roads would be expected within the wind park study area if the project is fully built out to 500 MW. Service roads would be sited to minimize disturbance and maximize transportation efficiency. Existing roads, ranch roads, and two-track trails would be used to the extent possible. Service roads would generally be constructed to the same specifications and standards as the primary site access road but would include a 10-foot shoulder on either side to accommodate a large crane. Public access to service roads would be based on consultation with the County, State, and private landowners, as necessary. Select wind park access or service roads that do not access public lands may be gated with limited public access.

Temporary Water and Power

Water would be required for construction activities during each project phase, including dust control and preparation of concrete. Water would be sourced from one or more privately owned wells located on private land within the wind park study area. Approximately 30 to 50 million gallons of water would be required during the initial 250-MW phase of construction, with 60 to 100 million gallons of total water required for full wind park build-out to 500 MW.

Potable water would also be sourced from within the wind park study area from a private landowner and would be available at the wind park staging area during construction.

There are currently no sources of electricity within the wind park study area. A temporary source of electricity would be required for construction. Two options are under consideration: 1) on-site

generation, or 2) extending an electrical distribution line along Meteor Crater Road into the wind park study area across private and State trust lands.

Borrow Pits, Rock Crusher, and Batch Plant

Base material and aggregate required for construction activities, including roads, staging areas, WTG foundations, tie-line structure foundations, operations and maintenance building foundation, and the step-up substation are expected to be sourced from borrow pits located within the wind park study area on private land. One or more borrow pits would be used; each would be approximately two to four acres in size.

Materials quarried from each borrow pit would be processed through a portable rock crusher located at each borrow pit. Each rock crusher would be located in an area approximately two acres in size.

One or more portable concrete batch plants would be located within the wind park study area. Each batch plant would require an area approximately two acres in size, including an area for the batch plant and stockpiling of materials, such as sand, cement, and water. Batch plants would be used to mix concrete for use in the WTG foundations, tie-line structure foundations, and other facilities that would require the use of concrete.

Staging Areas for the Wind Park

Staging areas are typical of construction sites and are temporary use areas used to store and assemble materials, host office trailers and sanitation stations, and conduct safety meetings. A temporary wind park staging area would be developed on approximately 8 to 12 acres located within the wind park study area for an initial wind park phase of up to 250 MW. A similar staging area would be established for any subsequent wind park phases. An additional staging area, four to six acres in size, located within the wind park study area would be used during access road construction for equipment and employee parking. Staging areas would be prepared by clearing and grading as needed. The areas would then be leveled with four to six inches of gravel.

Construction of Wind Turbine Generators

The construction of each WTG would require an area approximately 2.2 acres in size, each of which would be located within the wind park study area on private and/or State trust lands. This area would be cleared with a grader and excavated with a backhoe to prepare for each concrete foundation and to accommodate the WTG, temporary work areas, and a crane pad.

The components of each WTG would arrive via semi-trailers. If one crane is used at the site, 10 to 13 semi-trailer loads of wind facility components would be transported and offloaded at the project site per equipment delivery day; if two cranes are used at the site, 20 to 26 trailer loads would be transported and offloaded per equipment delivery day.

WTG assembly would involve connecting the anchor bolts to the concrete foundation, erecting the tower and nacelle, assembling and erecting the rotor, connecting the internal cables, and inspecting and testing the electrical system prior to operation. WTG assembly would be completed using a large crane.

Construction of Electrical Collection System and Communications System

The electrical collection system and communications system would be co-located within the wind park study area, adjacent to the WTG service roads to the extent possible. Up to approximately 241 miles of 34.5-kV collection lines and fiber optic cables are estimated if the project is built out to 500 MW. The majority of the lines would be underground. The underground lines would be constructed by excavating

trenches to a minimum depth of four feet and a width of one to two feet. If utilized, the overhead lines would be supported by wooden poles approximately 25- to 30-feet tall and spaced approximately 150 feet apart. In addition to the fiber optic cables, the communication system may include a microwave tower to transmit data.

Construction of the Step-Up Substation and Operations and Maintenance Building

The step-up substation would be constructed within the wind park study area, located on an approximately four acre parcel, with an additional two acres disturbed during construction activities. The electricity generated by the wind park would be gathered at the step-up substation, where the voltage would be transformed from 34.5-kV to 345-kV. Construction would involve site grading, installing gravel material within the fenced area of the substation, constructing concrete foundations for the transformers and other components within the substation, installing substation equipment, and erecting a chain-link security fence around the substation perimeter.

The operations and maintenance facility would be constructed within the wind park study area on private or State trust land, located on an approximately 2.4-acre parcel. Construction of the facility would include foundation preparation and pouring, framing the structure and roof trusses, installing the outer siding, installing plumbing and electrical work and finishing the interior carpentry. Once complete, the facility would have the appearance of a typical prefabricated steel building.

Meteorological Towers

Several temporary meteorological (met) towers have been constructed over the past several years to gather wind data indicating the feasibility of the wind park. These existing towers would remain in place until construction of the wind park is complete. In addition, up to five additional temporary met towers may be installed prior to construction to further analyze the wind resource across the wind park study area. Temporary towers would be decommissioned and removed during the construction process for wind park phases. Up to 16 long-term or permanent met towers would be used to monitor wind conditions at the site if the wind park is built out to 500 MW. These met towers would be free-standing structures, approximately 263-feet tall, constructed of steel lattice. The permanent towers would be connected to the plant's central Supervisory Control and Data Acquisition (SCADA) system. These towers would be lighted according to Federal Aviation Administration (FAA) requirements for structures over 200 feet, similar to the WTGs.

<u>Operation and Maintenance of the Wind Park</u>

Wind Park Start-Up

Plant commissioning would follow mechanical completion of the wind park, tie-line, and switchyard and would begin with a detailed plan for testing and energizing the electrical collection system, step-up substation, tie-line, and interconnection switchyard in a defined sequence with lock and tags on breakers to ensure safety and allow for fault detection prior to energizing any component of the system. Once the step-up substation is energized, feeder lines would be brought on line. Individual turbines would then be tested extensively and brought on line, one by one.

Wind Park Operating Requirements and Staffing

The wind park would be in operation 24 hours per day, 365 days per year. The wind park would be staffed as necessary to provide operational maintenance and environmental compliance support during core operating hours. The wind park's central SCADA system would stay online 24 hours per day, 365 days per year.

Fencing and Security

The wind park perimeter would not be fenced. Public access across wind park service roads that connect to wind park infrastructure would be based on consultation with the private and State landowners. Service roads that do not access public lands may be gated. A lockable steel door at the base of each WTG would restrict access to authorized personnel only. If the selected WTG requires a pad-mount transformer, these would be locked. The step-up substation would be fenced and gated and access would be limited to authorized personnel.

Wind Park Power

During the operating life of the wind park, electricity for the operations and maintenance facility would be needed. Once Western's interconnection switchyard, and the wind park's transmission tie-line, and step-up substation are complete and energized, station power to the wind park facilities would be fed via a dedicated circuit from the step-up substation.

Operation of the Communication System

Each turbine would be connected to the SCADA system. The SCADA system would allow for remote control and monitoring of individual turbines and the wind park as a whole from either the central host computer or from a remote computer. Any abnormalities or emergencies detected by the system would initiate a callout sequence, and a maintenance person would be alerted and, if required, dispatched to the WTG immediately to implement corrective action.

Operation of the WTGs

The wind turbines would be equipped with sophisticated computer control systems to monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch and yaw angles, etc. The main functions of the control system would include nacelle and power operations. Aerodynamic brakes and mechanical disk brakes would be installed as security measures in each WTG. The braking system is designed to be fail-safe, allowing the rotor to shut down during high wind conditions or in less than five seconds in case of electric power failure. Emergency stops would be located in the nacelle and in the bottom of the tower.

Typical chemicals would be used during operation and maintenance of WTGs, including anti-freeze liquid to prevent freezing, gear oil for lubricating the gearbox, hydraulic oil to pitch the blades and operate the brake, grease to lubricate bearings, and various cleaning agents and chemicals for maintenance of the turbine.

WTGs would be lighted according to FAA requirements for structures over 200 feet. The FAA would provide an approved lighting plan for perimeter WTGs and select internal WTGs for the final project layout, per phase, prior to construction. Typically the FAA requires that approximately one-third of all WTGs in a wind park are lighted. Industry standard lighting is a medium intensity red synchronized flashing LED (light-emitting diode) obstruction light with a horizontal beam pattern.

Operations and Maintenance Building

The operations and maintenance facility would be located within the wind park study area on private land or State trust land and would include a main building with offices, spare parts storage, restrooms, a shop area, outdoor parking facilities, a turn-around area for larger vehicles, and outdoor lighting. The facility is expected to be fenced and access would be limited to authorized personnel. During operations and maintenance, water to the facility would be provided by either an existing well or a new well. Domestic sewage would be treated through a closed septic system. The septic system would be leach field design,

typical to the region and permitted through Coconino County. Facility exterior lighting would be in conformance with the Coconino County Lighting Ordinance.

Transmission Tie-line

A new 345-kV double-circuit electrical transmission tie-line would be constructed between the wind park step-up substation and Western's existing Glen Canyon-Pinnacle Peak No. 1 and No. 2 345-kV transmission lines. The tie-line would be approximately 15 miles in length, extending 8.5 miles across National Forest System lands and up to approximately 6.5 miles across State trust and private lands. The Glen Canyon-Pinnacle Peak 345-kV transmission lines are part of the regional electrical grid. Connecting into this existing electrical transmission system would allow electricity produced at the wind park to be sold and used by Arizona and regional utilities.

The tie-line would include monopole structures, conductors (power lines), and associated access roads. Structures are expected to be gray steel structures with non-reflective finishes and would be approximately 120 feet in height and spaced approximately every 1,000 feet. Approximately 80 steel monopole structures would be erected. A minimum 50-year right-of-way, 200 feet in width, would be acquired for construction, operation, access, and maintenance. Details of the right-of-way lease and duration would be discussed with landowners prior to final design. Construction of the tie-line is expected to temporarily disturb 345 to 413 acres and permanently disturb 19 to 25 acres of land.

Engineering Surveys for the Tie-line

Pre-construction surveys would be conducted to locate the transmission tie-line right-of-way, to identify property boundaries, to provide accurate ground profiles along the transmission tie-line centerline; to locate existing structures; and to determine the locations and rough ground profiles for new service roads. Soils would be tested to determine physical properties, including the ability to support the proposed structures.

Construction of Tie-line

Tie-line Mobilization and Staging

Up to three staging areas are planned for the construction of the tie-line, one would be located near the switchyard (on National Forest System lands) and one would be located within the wind park study area near the step-up substation (on private/State trust land). A third staging area would be located at a central point along the tie-line route (on National Forest System lands). Each staging area would be approximately four to six acres in size, located adjacent to the tie-line route.

Construction of Tie-line Access Roads

Primary construction and maintenance access to the tie-line would be from either Lake Mary Road to Forest Service Route 125 (FS 125) or from the wind park through the primary site access road. Access to each structure location would be required. In order to minimize ground disturbance, existing roads would be used when possible, with new spur roads constructed to the structure sites. When existing roads are distant from the tie-line, a new access road or spur-road would be established adjacent to the tie-line within the right-of-way. Typically the roads would be between 12 and 16 feet in width with a surface that is bladed, compacted, and lightly graveled.

Construction of Tie-line and Temporary Use Areas

A right-of-way, 200 feet in width, and extending the length of the tie-line would be required. The right-of-way would extend 100 feet to either side of the tie-line structures. An authorization, which would include use of existing and newly constructed roadways outside of the right-of-way, would be obtained

from the Forest Service. If additional areas are needed, they would be identified, discussed with the appropriate landowner, and all necessary environmental clearances would be performed. All land rights would be acquired in accordance with applicable laws and regulations governing acquisition of property rights.

Structure Installation

Each structure location would be determined and access to the site would be constructed as necessary. Structures would generally be spaced 1,000 feet apart; however this distance may vary depending on topography. A foundation would be prepared at each structure site. Each foundation would be excavated using a power auger or drill. Once the hole is bored, a reinforcing steel cage would be inserted and then the hole would be filled with concrete to form the foundation. Sections of the new structures and associated hardware would then be delivered to each structure site by flatbed truck. Erection crews would use a large crane to position the base section. The base would be secured to the concrete foundation. The remaining sections of the structure would be lifted into place by the crane and secured.

Installation of Conductors, Insulators, Hardware, and Shield Wires

The conductor is the wire cable strung between the structures on the tie-line through which the electric current flows. Once all the structures have been erected, the conductor would be put in place through a process known as "stringing". Pulling and tensioning sites to conduct this stringing would be located at each end of the tie-line alignment and at turning structures.

Operation and Maintenance of the Tie-line

The transmission line would be operated from a remote power control center. Although the proposed transmission tie-line system would operate at 345-kV, the amount of power transferred along the conductors would vary depending on seasonal and time-of-day loads, as well as other system demands. The proposed transmission system would be maintained by monitoring, testing, and repairing equipment.

Western's Switchyard

Western's proposed 345-kV interconnection switchyard would be constructed on an approximately 15-acre parcel entirely on National Forest System lands, located about three-quarter mile north of FS 125 and generally within the existing rights-of-way of Western's two 345-kV transmission lines. The switchyard is expected to be approximately 650-feet wide by 1,000-feet long. The switchyard for this project would contain power circuit breakers, disconnect switches, steel busses, steel poles, cables, metering equipment, communication equipment, AC/DC batteries, and other equipment. The switchyard facilities would be constructed, owned, and operated by Western through an agreement with the Forest Service.

Pre-construction aerial and/or ground surveys would locate the switchyard property lines and corners; provide accurate ground profiles; locate structures; and determine the exact locations and rough ground profiles for new access roads.

The 345-kV switchyard would temporarily require approximately 24 acres during construction. Construction vehicles and equipment that would be needed for the construction of the switchyard include large cranes, heavy backhoes and earthmovers, large forklifts, and various power tools. Construction of the switchyard and interconnection facilities would involve several stages of work including access road construction and/or improvement; grading of the switchyard area; construction of foundations for transformers, steel work, breakers, control houses, and other outdoor equipment.

A temporary staging area would be developed on approximately three to four acres adjacent to the switchyard site. The staging area would be used for construction safety meetings, to host office trailers,

temporary sanitation stations, parking for equipment, vehicle parking for equipment operators and construction workers, and staging for limited project components. The staging area would be prepared by clearing and grading as needed. The area would then be covered with four to six inches of gravel to provide a level ground surface.

Primary construction and maintenance access to the switchyard site would come from Lake Mary Road to FS 125. From FS 125, the switchyard would be accessed via Western's current easement. An existing access road within this easement would be improved to allow movement of construction vehicles. Improvements of Western's access road would involve vegetation clearing, excavating current groundcover to a depth of up to 12 inches, and covering the surface with approximately four to six inches of aggregate from off-site sources or the borrow pits located in the wind park study area.

Western requires dual and redundant communication with its switchyards. A microwave communication tower would be installed within the new switchyard to deliver signals to operate switchyard equipment from control centers and other remote locations, and to report metering. A microwave communication tower up to 60 feet high would be constructed at the switchyard, with a microwave antenna aimed toward an existing communication link on Mount Elden, approximately 25 miles northwest of the proposed switchyard site.

Western would install four new in-lead dead-end structures to provide a tie with the new switchyard and the existing Glen Canyon-Pinnacle Peak transmission lines. Each dead-end structure would be a heavy-duty, galvanized steel monopole structure, and provide a tie into the new switchyard. It is envisioned that the new structures would be located within the existing Glen Canyon-Pinnacle Peak transmission line rights-of-way.

Switchyard start-up would follow a detailed plan for testing and energizing the step-up substation, tie-line, and interconnection switchyard in a defined sequence, with lock and tags on breakers to ensure safety and allow for fault detection prior to energizing any component of the system. Switchyard start-up would not require any heavy machinery to complete.

During operation of the new switchyard, authorized Western personnel would conduct periodic inspections and service equipment as needed. Properly trained maintenance personnel would monitor and manage the use, storage, and replacement of gas-filled breakers to minimize any releases to the environment. During inspections, equipment would be monitored for detection of leaks and repairs would be made as appropriate. The switchyard would be designed to operate from a remote location, and no permanent employees would be required.

ES.3.3 Alternative Transmission Tie-line Corridor

Foresight, in coordination with the Forest Service, has proposed a route for the transmission tie-line to address potential effects to visual resources. The alternative tie-line would deviate from the Applicant's proposed tie-line route by approximately one-half mile to avoid the intersection of FS 125 and FS 82 on National Forest System lands. The wind park and interconnection switchyard would be located in the same location and constructed in the same manner as described under the Applicant's Proposed Project.

Similar to the Applicant's proposed tie-line, the alternative tie-line would require approximately 80 structures and would be approximately 15-miles long, extending 8.5 miles across National Forest System lands and 6.5 miles across State trust and private lands. The alternative action would result in slightly more ground disturbance than the tie-line associated with the Applicant's proposed tie-line because it uses fewer existing roads. Ground disturbance for the alternative action is estimated to be 346 to 414 acres of temporary disturbance (approximately one acre more than the Applicant's proposed tie-line) and 20 to 26 acres of permanent disturbance (approximately one acre more than the Applicant's proposed tie-line).

ES.3.4 No Action Alternative

Under the No Action Alternative, Western would deny the interconnection request and the Forest Service would not permit facilities to be placed on National Forest System lands. For the purpose of impact analysis and comparison in this EIS, it assumed that the proposed wind park would not be built and the environmental impacts, both positive and negative, associated with construction and operation would not occur.

ES.3.5 Alternatives Considered but Eliminated from Consideration

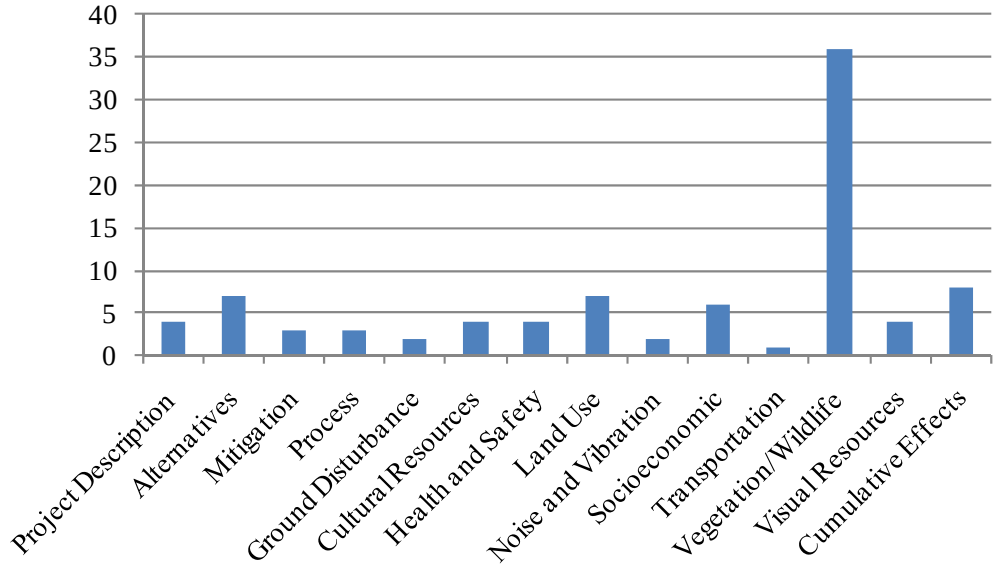
Five alternatives to the location of the proposed transmission tie-line and switchyard were considered during scoping. Additionally, an alternative addressing burying the transmission tie-line was considered. None of the transmission tie-line alternatives were carried forward for consideration based on criteria, including cost, construction feasibility, environmental resource sensitivities, and conformance with applicable land use plans.

ES.4 PUBLIC INVOLVEMENT, CONSULTATION, AND COORDINATION

Interested parties were notified of the proposed project and the public comment opportunity through a Notice of Intent (NOI) published in the Federal Register on July 24, 2009. The NOI announced the scoping meetings held in Mormon Lake and Flagstaff, Arizona, and the deadline for submitting comments as August 28, 2009. It included a description of proposed facilities, project location, how to submit comments and why they are important, and how to contact the lead agency. A packet of similar information was mailed directly to nearly 400 members of the public on July 20, 2009. A press release, radio announcements, flyers, newspaper advertisements, an e-mail notice, and Western's website provided additional notice and instruction for submitting comments beginning July 22, 2009.

A total of 27 parties submitted 91 specific comments. The issues, concerns, questions, and opportunities that were identified have shaped development of the EIS. A summary of the issues of concern to participants is depicted in Figure ES.4-1:

FIGURE ES.4-1
SUMMARY OF SCOPING COMMENTS RECEIVED



ES.5 SUMMARY OF RESOURCE PROTECTION MEASURES AND POTENTIAL IMPACTS

Construction and operation and maintenance of the proposed project would have certain impacts, both beneficial and adverse

The Applicant and agencies have proposed Resource Protection Measures (RPMs), listed in Section 2.7 of the EIS, for each resource area to minimize impacts associated with construction, operation, and maintenance. The Applicant and agencies have committed to these RPMs, and they are included in the evaluation of environmental impacts. Western and the Forest Service do not have jurisdiction over the siting, construction, or operation of the proposed wind park, so their proposed measures only apply to the proposed switchyard (Western) and the proposed switchyard and tie-line (Forest Service). Western, the Forest Service, and the Applicant are signatories to the Programmatic Agreement and are required to comply with the National Historic Preservation Act, and thus would abide by the provisions in the Programmatic Agreement addressing effects to properties on or eligible for listing to the National Register of Historic Places (NRHP).

If needed, additional RPMs would be developed in consultation with the appropriate regulatory agency (i.e., U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Arizona State Land Department). Any additional mitigation identified will be disclosed in the Final EIS.

Table ES.5-1 summarizes the environmental resources components evaluated and the environmental impacts of the proposed project, alternative transmission tie-line, and no action alternative.

TABLE ES.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Land Use	Would result in a permanent conversion of 591-627 acres of land from grazing to other use. Approximately 99 percent of the wind park study area would remain available for grazing.	Would result in a permanent conversion of 592-628 acres of land from grazing to other use, slightly more than under the proposed wind park, tie-line, and Western's proposed switchyard. Impacts would not be noticeably different than those described under the proposed wind park, tie-line, and Western's proposed switchyard.	Would result in no change to existing land uses.
Biological Resources	Construction of the wind park is expected to temporarily disturb 2,050-2,193 acres and permanently disturb 555-570 acres of scrub-shrub, grassland and a small amount (less than two percent) of evergreen forest. Construction of the tie-line and switchyard is expected to temporarily disturb 345-413 acres and permanently disturb 19-25 acres of grassland, pinyon-juniper woodland, and a small amount (less than three percent) of ponderosa pine forest. Landcover types and habitats found within the wind park study area and adjacent to the tie-line and switchyard are not unique to the surrounding landscape or region. Special status plant species have highly restricted distributions and very specific habitat requirements and are not expected to occur within the wind park study area based on either an absence of habitat, range or distribution. Canyon bottoms containing riparian areas, deciduous woodlands, wetlands or waterbodies may support wetland and mesic plant species would be mostly avoided by wind park facilities. Federally-listed wildlife species that have at least low potential to occur within the wind park include the Northern Mexican gartersnake and the Chiricahua leopard frog.	Construction of the wind park is expected to temporarily disturb 2,050-2,193 acres and permanently disturb 555-570 acres of scrub-shrub, grassland and a small amount (less than two percent) of evergreen forest. Construction of the alternative tie-line and switchyard is expected to temporarily disturb 346-414 acres of temporary disturbance (approximately one acre more than the Applicant's proposed transmission tie-line alignment) and 20-26 acres of permanent disturbance (less than one acre more than the Applicant's proposed tie-line alignment). The alternative tie-line route would affect open grassland. Impacts to special status species; birds, raptors, and bats; and big game would not be noticeably different than those under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect to biological resources.

TABLE ES.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Biological Resources (continued)	Implementation of these RPMs during construction and operation of the wind park facilities would minimize impacts to these species. Construction and operation of the proposed project may result in direct impacts to the birds, raptors and bats through collision and/or electrocution with the wind turbines and power lines. RPMs include additional pre-construction surveys, preparation of an Avian and Bat Protection Plan, constructing outside of bird nesting season or nest area avoidance, adherence to the Avian Power Line Interaction Committee suggested practices for avian protection on power lines, and formal post-construction monitoring study designed to estimate and address avian and bat mortality. Construction activities may cause short-term impacts to big game such as antelope, mule deer and elk populations. Big game behavior and movement throughout the area of potential disturbance may be affected, but operation of project facilities is not expected to have long-term impacts on big game behavior or movement patterns. Population trends and habitat viability associated with these species would not be impacted by construction and operation of the wind park, tie-line, and switchyard.		

TABLE ES.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Cultural Resources	Would directly disturb between 2,419-2,630 acres of land within areas known to have been used prehistorically and historically. Research identified 678 previously recorded cultural resources within the cultural resources evaluation area for the proposed project facilities. Twenty-four of the sites potentially occur within 100 feet of the wind park study area, tie-line, and/or switchyard. Of the 24 sites, four of these are recommended as eligible for listing on the National Register of Historic Places (NRHP). The development of wind park and tie-line facilities may also indirectly impact areas of interest to Native Americans, such as sacred areas, or areas used for collecting traditional resources, such as birds and medicinal plants. Visual impacts on significant cultural resources, such as sacred landscapes, historic trails, and viewsheds from other types of historic properties (e.g., homes and bridges) may also occur. In addition, there may be visual impacts on Traditional Cultural Properties (TCP) because the visible wind turbines may be perceived as an intrusion on a sacred or historic landscape that could result in a significant adverse effect to these TCPs.	Would directly disturb between 2,420-2,631 acres of land within areas known to have been used prehistorically and historically, slightly more than the proposed wind park, tie-line, and Western's proposed switchyard. Impacts would not be noticeably different than those under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on cultural resources.
Geology and Soils	Would temporarily disturb between 2,419-2,630 acres of land and would permanently remove vegetation from and alter the surface of 591-627 acres of land. This would result in increased erosion and the permanent loss of soils.	Would temporarily disturb between 2,420-2,631 acres of land and would permanently remove vegetation from and alter the surface of 592-628 acres of land. Impacts would be slightly greater than those described under the proposed wind park, tie-line, and Western's proposed switchyard because the tie-line associated with the alternative action requires a new access road across moderately erosive soils that are difficult to revegetate.	Would have no effect on geology and soils.

TABLE ES.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Air Quality	Air quality impacts would be minimal, generally resulting from emissions and fugitive dust from equipment and vehicle operations during construction. RPMs have been identified to further reduce the effects to air quality and there would be no measurable impact.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on air quality.
Water Resources	Construction would require approximately 307 acre feet of groundwater if the wind park is built out to 500 MW. Operations would require a negligible amount of water. Soil erosion and sedimentation would increase as a result of the temporary disturbance of between 2,419-2,630 acres of land as would the permanent disturbance and removal of vegetation from 591-627 acres of land.	Construction and operations would require the same amount of water as the proposed wind park, tie-line, and Western's proposed switchyard. Between 2,420-2,631 acres of land would be disturbed temporarily and 592-628 acres of land would be permanently disturbed resulting in erosion and sedimentation. Impacts would not be noticeably different than those described under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on water resources.
Socioeconomics	Would result in the employment of approximately 400 workers directly, or through local or regional construction and service contract firms, during construction and between 17-40 workers during regular operations for a typical 500 MW wind park. This would lead to a slightly greater demand on public facilities, including schools. Vacancy rates in housing units in the region suggest capacity is available for this level of employment. In addition, the project would create a supplemental source of revenue to ranchers and State trust land beneficiaries, and provide new tax revenues to the County and State.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would not realize the economic objectives of the Diablo Canyon Rural Planning Area since no similar economic development proposals are currently under consideration.
Environmental Justice	Would result in additional employment opportunities and tax revenue that would benefit directly or indirectly persons living below the Federal poverty level.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on environmental justice, beneficial or otherwise.

TABLE ES.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Transportation	Would result in a short-term (12-18 months per wind park phase) increase in construction related traffic of over 400 two-way vehicle trips each day during peak construction activity on I-40 and Meteor Crater Road, and approximately 25 two-way vehicle trips each day on Lake Mary Road and FS 125. It would result in a minimal long-term increase in vehicular traffic on I-40 and Meteor Crater Road.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on transportation.
Health, Safety, and Security	Would create minimal occupational hazards, public safety, and environmental hazards during construction and operations.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on health and safety.
Noise	Construction equipment would elevate ambient noise levels substantially over the short-term (12-18 months per wind park phase) during certain construction activities, but operations would result in a minimal increase in ambient noise levels that would dissipate over a short distance.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on noise.
Visual Resources	Would result in a visual contrast by introducing contrasting elements of form, line, and color. In addition, the proposed tie-line would result in a Visual Quality Objective of Modification within an area on National Forest System lands managed for a Visual Quality Objective of Partial Retention.	Effects would generally be the same as those described under proposed wind park, tie-line, and Western's proposed switchyard, except the tie-line would be routed to avoid the more sensitive area (Partial Retention) on National Forest System lands.	Would have no effect on visual resources.

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ACRONYMS

ACC	Arizona Corporation Commission
ACCAG	Arizona Climate Change Advisory Group
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
AIRFA	American Indian Religious Freedom Act
APLIC	Avian Power Line Interaction Committee
ARS	Arizona Revised Statute
ASLD	Arizona State Land Department
ATV	all-terrain vehicle
BLM	U.S. Department of the Interior, Bureau of Land Management
BMPs	Best Management Practices
CAA	Clean Air Act
CEC	Certificate of Environmental Compatibility
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
Foresight	Foresight Flying M, LLC
Forest Plan	Coconino National Forest Land Management Plan
Forest Service	U.S. Department of Agriculture, Forest Service
FS #	Forest Service Road/Route Number
FSH	Forest Service Handbook
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HAP	Hazardous Air Pollutants
ID Team	Interdisciplinary Team
I-40	Interstate 40
KOPs	Key Observation Points
MBTA	Migratory Bird Treaty Act
MIS	Management Indicator Species
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves and Repatriation Act
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service

NRCS	U.S. Department of Agriculture, Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTIA	National Telecommunication Information Administration
OHV	off-highway vehicle
O&M	Operation and Maintenance
PA	Programmatic Agreement
PSD	Prevent Significant Deterioration
ROD	Record of Decision
RPA	Rural Planning Area
RPM	Resource Protection Measure
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Office
SIL	Scenic Integrity Level
SMS	Scenery Management System
SPCC	Spill Prevention, Control, and Countermeasures
SR	State Route
TCP	Traditional Cultural Property
TMR	Travel Management Rule
USACE	U.S. Army Corps of Engineers
USC	United States Code
USD	Unified School District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
VMS	Visual Management System
VOC	volatile organic compounds
VQO	Visual Quality Objective
WEST	Western Ecoystems Technology, Inc.
Western	Western Area Power Administration
WRCC	Western Regional Climate Center
WTG	wind turbine generator
ZHHPO	Zuni Heritage and Historic Preservation Office

UNITS OF MEASURE/ABBREVIATIONS

AADT	Annual Average Daily Traffic volume estimate (bi-directional)
AU	animal unit
AUM	animal unit month
bls	below land surface
CO	carbon monoxide
dB	decibel
dBA	A-weighted decibel
F	Fahrenheit
ft bls	feet below land surface
kV	kilovolt
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
Ldn	day-night noise level
Leq	equivalent sound level
mph	miles per hour
MW	megawatt
NEG	Annual Average Daily Traffic volume estimate, decreasing highway milepost numbers
NO_2	nitrogen dioxide
O_3	ozone
Pb	lead
PM	particulate matter
POS	Annual Average Daily Traffic volume estimate, increasing highway milepost numbers
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
tpy	tons per year
µ/m	micrometer

CHAPTER 1: PURPOSE AND NEED

1.1 INTRODUCTION

This Draft Environmental Impact Statement (EIS) has been prepared to analyze the potential environmental consequences related to a wind energy generating facility's interconnection with Western Area Power Administration's (Western) electrical transmission system and the U.S. Department of Agriculture, Forest Service, Coconino National Forest's (Forest Service) authorization of a special use permit to construct and operate an electrical transmission line and switchyard on Federal land to support the wind energy generating facility.

Foresight Flying M, LLC (Foresight or Applicant) proposes the development of the Grapevine Canyon Wind Project in Coconino County, near Flagstaff, Arizona (Figure 1.1-1). The project would be located on Federal, State trust, and private land, and would include three main components: 1) a wind energy generating facility up to 500 megawatts (MW); 2) a 345-kilovolt (kV) electrical transmission tie-line; and 3) a 345-kV electrical interconnection switchyard with facilities that would be owned and operated by Western. The wind generation component would be constructed on private land and State trust land administered by the Arizona State Land Department (ASLD). The electrical transmission line and interconnection switchyard would be located on lands administered by the Forest Service. Construction is expected to begin in 2011. The wind energy generating facility may be built in two or more phases over a period of years, with an initial construction schedule for the first phase between 12-18 months.

Foresight has applied to Western to interconnect the proposed wind energy generating facility to Western's power transmission system on its Glen Canyon-Pinnacle Peak 345-kV No. 1 and No. 2 transmission lines. Western would construct the 345-kV interconnection switchyard within an area beneath the Glen Canyon-Pinnacle Peak transmission lines.

Additionally, Foresight has applied to the Forest Service for a special use permit authorizing a 200 foot wide right-of-way to accommodate the construction and operation of a new 345-kV electrical transmission tie-line. In addition, Western would apply to the Forest Service for authorization to construct and operate the proposed switchyard if the interconnection request is approved.

The project requires an environmental review under the National Environmental Policy Act (NEPA) because the permitting of the transmission tie-line and construction and operation of an electrical switchyard on Federal land under the jurisdiction of the Forest Service is a Federal action. In addition, the project requires the preparation of an EIS because of Western's interconnection requirements. Western is the lead Federal agency for this project and the Forest Service and ASLD are cooperating agencies.

1.2 PURPOSE AND NEED

1.2.1 Applicant's Purpose and Need

Nearly three-quarters of electricity produced in the United States comes from fossil fuels (Figure 1.2-1). However, in recent years, the majority of states in the southwest have passed regulations or guidelines that require utilities to generate a specific percentage of their energy portfolio from renewable resources, such as wind, solar, biomass, and geothermal.

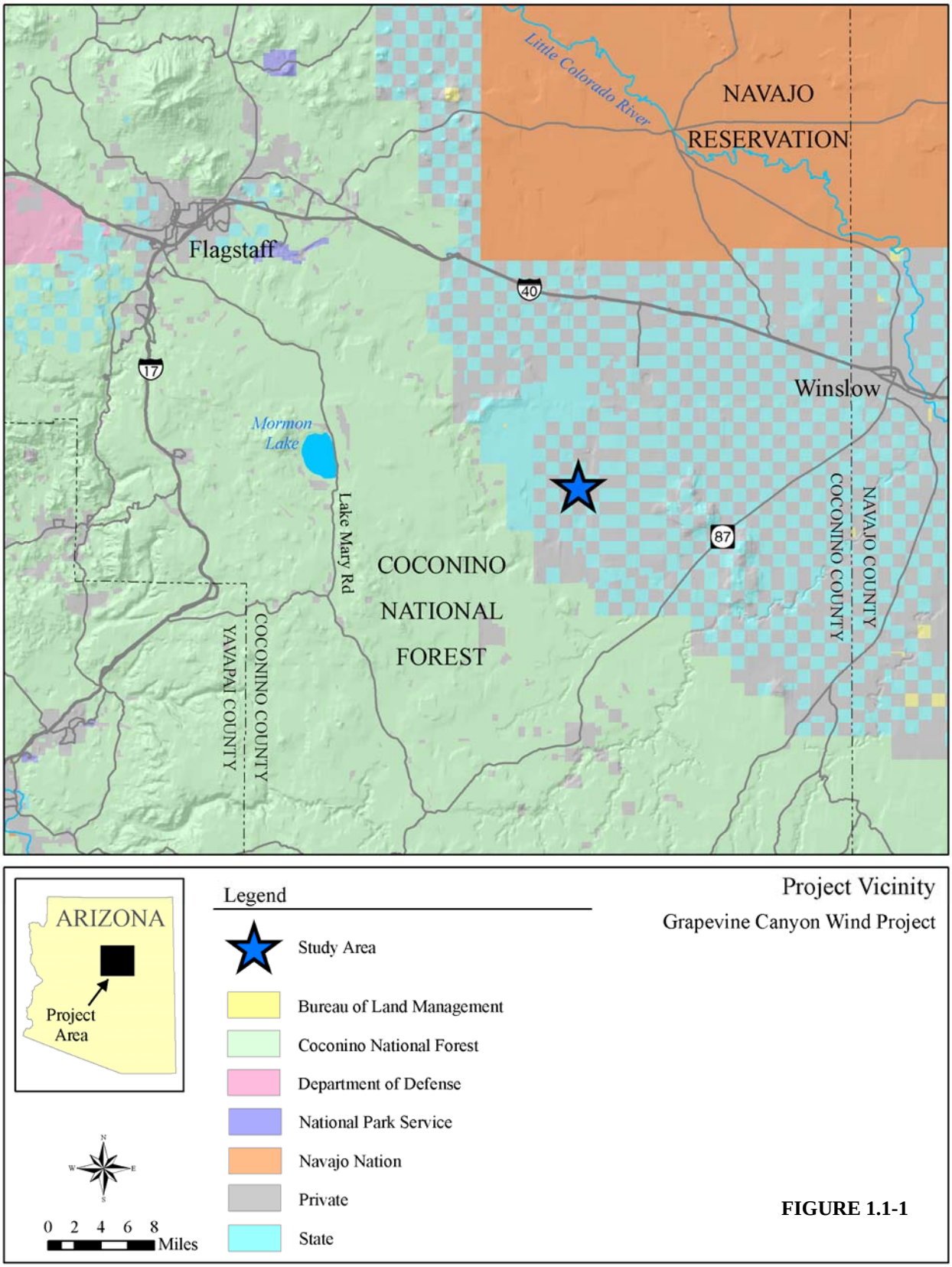
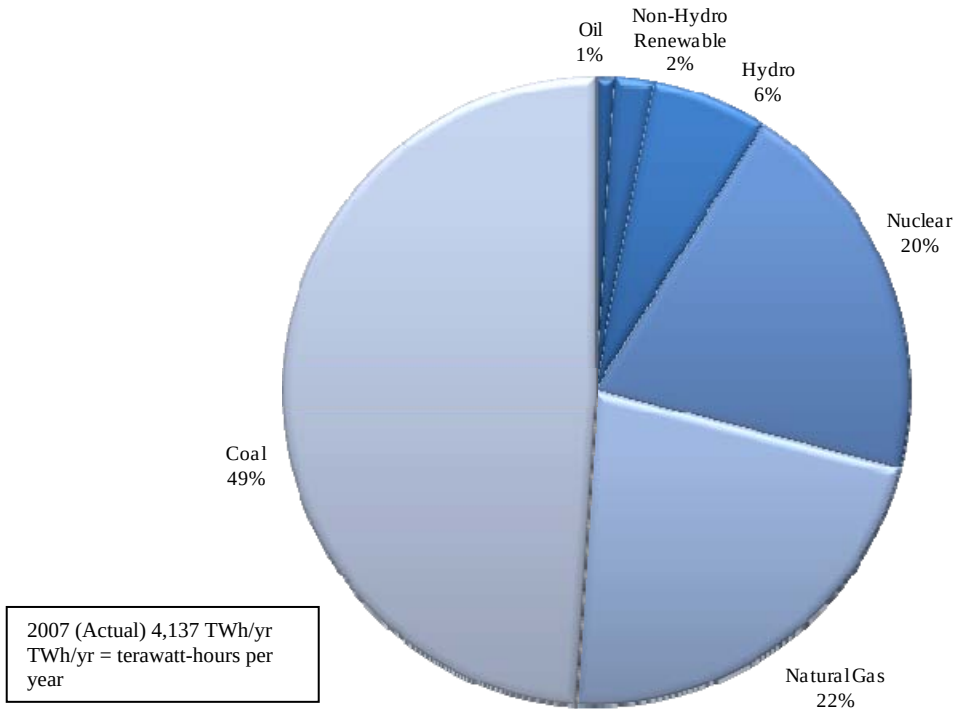

Little Colorado River
NAVAJO
RESERVATION
Flagstaff
40
17
Winslow
Mormon
Lake
Lake Mary Rd
87
COCONINO
NATIONAL
FOREST
COCONINO COUNTY
YAVAPAI COUNTY
COCONINO COUNTY
NAVAJO COUNTY
ARIZONA
Project
Area
Legend
Study Area
Bureau of Land Management
Coconino National Forest
Department of Defense
National Park Service
Navajo Nation
Private
State
N
W
E
S
0 2 4 6 8
Miles
Project Vicinity
Grapevine Canyon Wind Project

FIGURE 1.1-1

FIGURE 1.2-1
2007 U.S. ELECTRICITY PRODUCTION (TWh/yr) BY ENERGY SOURCE*



Source: DOE, March 2009 - 2. DOE. March 2009.
EIA, *Annual Energy Outlook 2009*, DOE/EIA-0383(2009), March 2009. Located online at www.eia.doe.gov.

The Arizona Corporation Commission (ACC) adopted new Renewable Energy Standard and Tariff rules in 2006. The ACC's order was endorsed by the Arizona Attorney General's Office in 2007 as Arizona Administrative Code, Article 18, Rules R14-2-1801 through R14-2-1815 requiring public utilities in Arizona to provide 15 percent of their retail electricity from renewable energy sources by 2025. Other states in the western U.S. have similar portfolio standards ranging up to 33 percent in California. A summary of these requirements by State is included in Table 1.2-1.

TABLE 1.2-1
SUMMARY OF RENEWABLE ENERGY PORTFOLIO BY STATE

State	Percentages of Energy Portfolio Generated from Renewable Resources	Deadline
Arizona	15 %	2025
California	33 %	2020
Colorado	20 %	2020
Nevada	25 %	2025
New Mexico	20 %	2020
Utah*	20 %	2025

*Voluntary
Source: Pewclimate 2009

Utilities in the western United States are seeking renewable energy as an important source of their generation mix. For example, a leading Arizona utility, through their resource planning process, anticipates that by 2025 the energy demand from customers will be 50 percent higher than today (Arizona Public Service 2009). To meet this growing need this utility is looking more and more toward renewable energy, with potentially 45 percent of this new demand being met by renewable sources. The Western Governors' Association has called for dramatic increases in energy produced by renewable resources in order to address climate change impacts and support workforce development and clean energy jobs (Western Governors' Association 2007).

The Western Governors' Association and other western State programs and initiatives have also identified an increasing concern between energy use and development and water resources. Sandia National Laboratory, for example, states that "continued security and economic health of the United States depends on a sustainable supply of both energy and water. These two critical resources are inextricably and reciprocally linked; the production of energy requires large volumes of water while the treatment and distribution of water is equally dependent upon readily available, low-cost energy. The nation's ability to continue providing both clean, affordable energy and water is being seriously challenged by a number of emerging issues" (Sandia National Laboratories 2007). Energy produced by wind requires the least amount of water among conventional and renewable energy resources.

Foresight would like to construct and operate a utility scale wind energy generating facility that is tied into the regional grid so that the energy produced can be marketed to utility companies in Arizona and other western States to meet their State portfolio standards and energy requirements. The Applicant's objectives include the following:

- To construct, own, operate, and maintain an efficient, economic, and reliable, utility scale wind generating facility that would help achieve State and/or regional renewable energy standards.
- To develop the wind energy generating facility on a site with an excellent wind resource.
- To interconnect to an electrical transmission system with available capacity that ties into the regional electric grid.
- To be consistent with the goals of the American Recovery and Reinvestment Act of 2009, which seeks to support home-grown renewable energy for economic recovery.
- To be consistent with Federal, Western Governors' Association, State and local goals for clean renewable energy and sustainable economic development.

1.2.2 Federal Agencies Purpose and Need

1.2.2.1 Western Area Power Administration

Foresight has requested an interconnection with Western's electrical transmission system. Western is required to approve or deny the interconnection request in accordance with Western's Open Access Transmission Service Tariff (Tariff). Western's Tariff provides open access to its transmission system. If there is available capacity in the transmission system, Western provides transmission services through an interconnection request. This interconnection request requires Federal action which triggers a review under NEPA. When responding to the need for agency action, and subject to its NEPA review, Western is bound by the following:

- Providing Transmission Service: Under Western's Tariff, Western offers capacity on its transmission system to deliver electricity when capacity is available. The Tariff reflects the Federal Energy Regulatory Commission's (FERC) Final Orders, which are intended to ensure non-discriminatory transmission system access. Western filed revisions to its non-jurisdictional Tariff with FERC in January 2005 to include certain terms associated with the Large Generator

Interconnection Procedures and a Large Generator Interconnection Agreement. Final approval for that filing was received from FERC in September 2007. In March 2007, Western filed another revision to incorporate certain terms of the Small Generator Interconnection Procedures and a Small Generator Interconnection Agreement. In September 2009, Western filed a third set of revisions to address FERC Order 890 requirements along with revisions to existing terms.

- Protecting Transmission System Reliability and Service to Existing Customers: Western must ensure that existing reliability and service are not degraded. Western's Large Generator Interconnection Procedures provide for transmission and system studies to ensure that system reliability and service to existing customers are not adversely affected by new interconnections. These studies also identify system upgrades or additions necessary to accommodate the proposed project and ensure that they are in the project scope.

1.2.2.2 U.S. Department of Agriculture, Forest Service, Coconino National Forest

In addition to the request for interconnection, Foresight has applied to the Forest Service for a special use permit for an electrical transmission tie-line which is located on National Forest System lands. Western would apply for authorization from the Forest Service to construct the switchyard if the interconnection request is approved. The Forest Service is authorized to issue special use permits under the Federal Land Policy and Management Act. Consideration of special use requests are based on direction contained in 36 Code of Federal Regulations (CFR) 251, Subpart B, including screening criteria that address consistency with policies and land management plans.

In order to provide an interconnection with Western's electrical transmission system, the switchyard and the transmission tie-line would be located on National Forest System lands, because the existing Western Glen Canyon-Pinnacle Peak 345-kV transmission lines are located on National Forest System lands. The special use permits would authorize Foresight and Western to construct, operate, and maintain the transmission tie-line and switchyard, respectively, on National Forest System lands.

In addition, the Coconino National Forest Land Management Plan (Forest Plan) provides direction that the Forest Service must "evaluate requests for transmission corridors based on public need, economics, and environmental impacts of the alternatives (Forest Service, Southwestern Region 1987)." This Draft EIS will fulfill the need to evaluate the environmental impacts of the proposed transmission line.

Finally, a Memorandum of Understanding (MOU) among several Federal agencies, including the U.S. Department of Agriculture and the U.S. Department of Energy, provides direction for efficient coordination of Federal agency review of electric transmission facilities on Federal land (October 23, 2009). The MOU is intended to "expedite the siting and construction of qualified electric transmission infrastructure" and provides direction for the Forest Service to work cooperatively with the Department of Energy to efficiently permit appropriate transmission projects on public lands. Western has a site specific MOU with the Coconino National Forest for existing facilities that would provide the framework for these new facilities.

1.3 STATUTORY, REGULATORY, AND POLICY AUTHORITY

1.3.1 Conformance with Forest Service Land and Resource Management Plan

The proposed project is in conformance with the Forest Plan of the Coconino National Forest.

1.3.2 Authorizations and Involved Entities

Foresight would adhere to all applicable laws and regulations guiding the actions of all entities involved in permitting the project, as summarized in Table 1.3-1. The ACC has jurisdiction over the siting of transmission lines over 115-kV and thermal generating power plants within the State of Arizona. The Applicant would obtain a Certificate of Environmental Compatibility (CEC) through the ACC for the transmission tie-line. If granted, the CEC would authorize construction of the 345-kV transmission tie-line under Arizona rules and regulations. The wind energy generating facility would not require a CEC since wind energy is not thermal generation.

TABLE 1.3-1
SUMMARY OF KEY AUTHORIZATIONS AND APPROVALS

Entity	**Regulation and/or Authorization**
FEDERAL	
Western Area Power Administration	National Environmental Policy Act lead; Section 106 National Historic Preservation Act lead; Section 7 Endangered Species Act lead
U.S. Department of Agriculture, Forest Service	National Environmental Policy Act cooperating agency; Federal Land Policy and Management Act for rights-of-way; 36 CFR 251 Subpart B, Special Uses Regulations; National Forest Management Act, consultation with other Federal agencies for Endangered Species Act and National Historic Preservation Act
Federal Aviation Administration	Determination of No Hazard Air Navigation Permits; Notice of Proposed Construction or Alteration Application; Lighting Plan in compliance with FAA Advisory Circular 70/7460-1K. 7460-2 Notice of Structures Reaching Full Height
U.S. Army Corps of Engineers	Clean Water Act Section 404
U.S. Department of Commerce/National Telecommunication Information Administration (NTIA)	Licensed Microwave Study; NTIA, Office of Spectrum Management Notification
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act Consultation
STATE	
Arizona Corporation Commission	Certificate of Environmental Compatibility for Transmission Tie-line
Arizona Department of Agriculture	Native Plant Law; Notice of Intent to Clear Land
Arizona Department of Environmental Quality	Clean Water Act Section 402; Arizona Pollution Discharge Elimination System Permit; Air Quality Permit (batch plant, rock crusher); Other permits as required
Arizona Department of Transportation	Oversize/Overweight Load Permit
Arizona State Historic Preservation Office	Section 106 National Historic Preservation Act (consultation and concurrence)
Arizona State Land Department	Special Land Use Permit and Development/Energy Production Right-of-Way
LOCAL	
Coconino County	General Plan Conformance/Conditional Use Permit; Other ministerial permits as required
Private Landowners	Property easements/leases

1.4 SUMMARY OF PUBLIC AND AGENCY SCOPING AND ISSUES OF CONCERN

Interested parties were notified of the proposed project and the public comment opportunity through a Notice of Intent (NOI) published in the Federal Register on July 24, 2009. The NOI announced the scoping meetings held in Mormon Lake and Flagstaff, Arizona, and the deadline for submitting comments as August 28, 2009. It included a description of proposed facilities, project location, how to submit comments and why they are important, and how to contact Western. A packet of similar information was mailed on July 20, 2009 directly to nearly 400 members of the public including nearby landowners, previously-identified stakeholders, tribes, government officials, and agencies. A press release, radio announcements, flyers, newspaper advertisements, an e-mail notice, and Western's website provided additional notice and instruction for submitting comments beginning July 22, 2009.

A total of 27 parties took advantage of scoping and submitted 91 specific comments. Comments were received from individuals, businesses, Federal and State agencies, and a nonprofit organization. The issues, concerns, questions, and opportunities that were identified have shaped development of the Draft EIS. A summary of the issues of concern to participants is included in Figure 1.4-1. Comments are summarized in Table 1.4-1. The Scoping Summary Report is included in Appendix B.1.

FIGURE 1.4-1
SUMMARY OF SCOPING COMMENTS RECEIVED

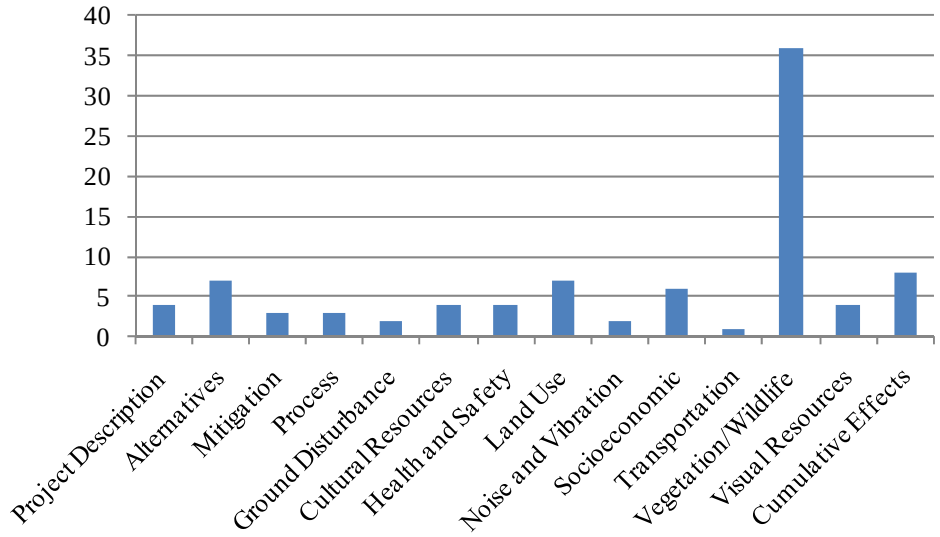


TABLE 1.4-1
SUMMARY OF PUBLIC INPUT FROM SCOPING

Issue/Comment Type	Comment Summary	Section Where Comment/Issue is Addressed in the EIS
Project Description	• Details on the wind turbines, meteorological towers, and roads should be discussed.	2.2, 3.9
Alternatives	• An underground electrical transmission line should be considered. • The transmission line and turbines should be sited in order to minimize ground disturbance. • The output of the wind generation facility should be increased through the use of a greater number of wind turbines.	2.2, 2.6

TABLE 1.4-1 SUMMARY OF PUBLIC INPUT FROM SCOPING		
Issue/Comment Type	**Comment Summary**	**Section Where Comment/Issue is Addressed in the EIS**
Mitigation	• Following construction, all disturbed areas not essential to maintenance and operation should be recontoured and revegetated with native vegetation.	2.2, 2.7
Process	• The Arizona Game and Fish Department would like to participate in the NEPA process.	5.2
Ground Disturbance	• What is the amount of ground disturbance that will be associated with the project?	2.2
Cultural Resources	• How are tribes being involved in the project? • The area is rich in cultural resources and these should be located, documented, and protected.	1.3, 2.7, 3.3, 5.6
Health and Safety	• Low level aerial flights occur in the area and aircraft safety should be considered in the design of the project.	2.2, 2.7, 3.9, 3.10
Land Use	• Will the project area be open to the public and will hunting be allowed? • Address the proximity of the project to nearby landowners.	2.7, 3.1
Noise and Vibration	• Transporting heavy equipment and materials will create vibrations, which is a cause for concern. • The noise generated by the wind turbines should be discussed relative to ambient noise levels. • How will the noise generated by the wind turbines be mitigated?	2.2, 2.7, 3.9, 3.11
Socioeconomic	• Western should look at the specific impacts this project would have on existing customers and agreements. • Benefits of the project should be considered. • Who will pay to maintain public roads used by the project?	2.7, 3.7, 3.9
Transportation	• The site is not easily accessible to heavy construction equipment and materials. How will the site be accessed?	2.2, 2.7, 3.9
Vegetation and Wildlife	• Wildlife species inhabiting the area should be studied and impacts to these species should be considered, in particular pronghorn, elk, deer, bats, and birds. • Measures should be taken through design and siting to minimize impacts to wildlife. • Pre and post-construction biological monitoring should be implemented.	2.2, 2.7, 3.2
Visual Resources	• Topographic simulations should be developed to aid in understanding and visualizing the project. • Measures should be considered to minimize visual impacts.	2.7, 3.12
Cumulative Effects	• Cumulative, direct, and indirect impacts should be considered. • Western should consider the impacts of this project on existing agreements, including reliability and operations. • The effects of the Navajo Wind Project on Western's system should be considered.	1.2, 2.1, 4.0

CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES

This chapter describes the proposed wind energy generating facility, transmission tie-line, and Western's electrical switchyard and includes information about how the location of the wind energy generating facility was selected, as well as specific details of the site, facilities, construction activities, site access, and operation and maintenance activities. Alternatives are also described, including an alternative routing for the proposed transmission tie-line, no action alternative, and alternatives considered but eliminated. A summary is provided at the end of this chapter outlining Resource Protection Measures (RPMs) that are proposed to mitigate associated impacts.

The project is located in Coconino County, Arizona, approximately 18 miles southwest of Winslow and 28 miles southeast of Flagstaff (refer to Figure 1.1-1).

2.1 FEDERAL AGENCY PROPOSED ACTIONS

The proposed Federal actions evaluated in this Draft EIS by each of the involved Federal agencies are specific and limited and are based on the purpose and need for agency action as described in Section 1.2.2. Proposed actions are as follows:

- Western: To approve the Applicant's interconnection to Western's transmission system, on the Glen Canyon-Pinnacle Peak 345-kV transmission lines, an action which also requires a new Western switchyard on National Forest System lands. Although the switchyard would be constructed, owned and operated by Western, details of the proposed switchyard are grouped under Section 2.2, Applicant's Proposed Project.

- Forest Service: To approve the Applicant's special use permit authorizing a 200 foot wide right-of-way to accommodate the construction, operation, and maintenance of a portion of a new 345-kV electrical transmission tie-line corridor across approximately 8.5 miles of National Forest System lands (see Section 2.2.2 for a detailed description of the proposed transmission tie-line), as well as an approximately 15-acre parcel to operate and maintain a new Western switchyard (see Section 2.2.3 for a detailed description of the proposed electrical switchyard).

The decisions of both Western and the Forest Service will be documented in separate Records of Decision (RODs) and published in the Federal Register.

2.1.1 Western System Modifications

Based on the completion of an Interconnection Feasibility Study, Interconnection System Impact Study, and Interconnection Facilities Study, Western proposes to modify its transmission system as described in Section 2.2.3 with the addition of an electrical switchyard within the rights-of-way of the existing Glen Canyon-Pinnacle Peak 345-kV transmission lines. Transmission service study work is underway and ongoing. Details, requirements, and environmental impacts for any other system improvements are unknown at this time, since they would be dictated by the on-going transmission service studies. These studies may identify additional upgrades needed to accommodate the transmission service needs, including modifications at other existing Western substations that could include, but would not be limited to, installing new control buildings; new circuit breakers and controls; adding new electrical equipment, which would include installing new concrete foundations for electrical equipment and buildings, substation bus work, cable trenches, buried cable grounding grid, and new surface grounding material; and/or replacing existing equipment and/or conductors with new equipment and/or conductors to accommodate the requests for transmission service.

If any needed transmission system modifications are identified after the completion of the EIS, Western and the Forest Service would address the environmental impacts of these modifications in accordance with regulatory requirements.

2.2 APPLICANT'S PROPOSED PROJECT

Foresight proposes to construct and operate a utility scale wind energy generating facility on private and State trust land. The wind energy generating facility would generate up to 500 MW of electricity from wind turbine generators (WTGs).

The proposed project includes three main components, depicted on Figure 2.2.-1:

1. Wind energy generating facility (wind park)
2. 345-kV transmission tie-line (tie-line)
3. 345-kV interconnection switchyard – constructed, owned, and operated by Western (switchyard)

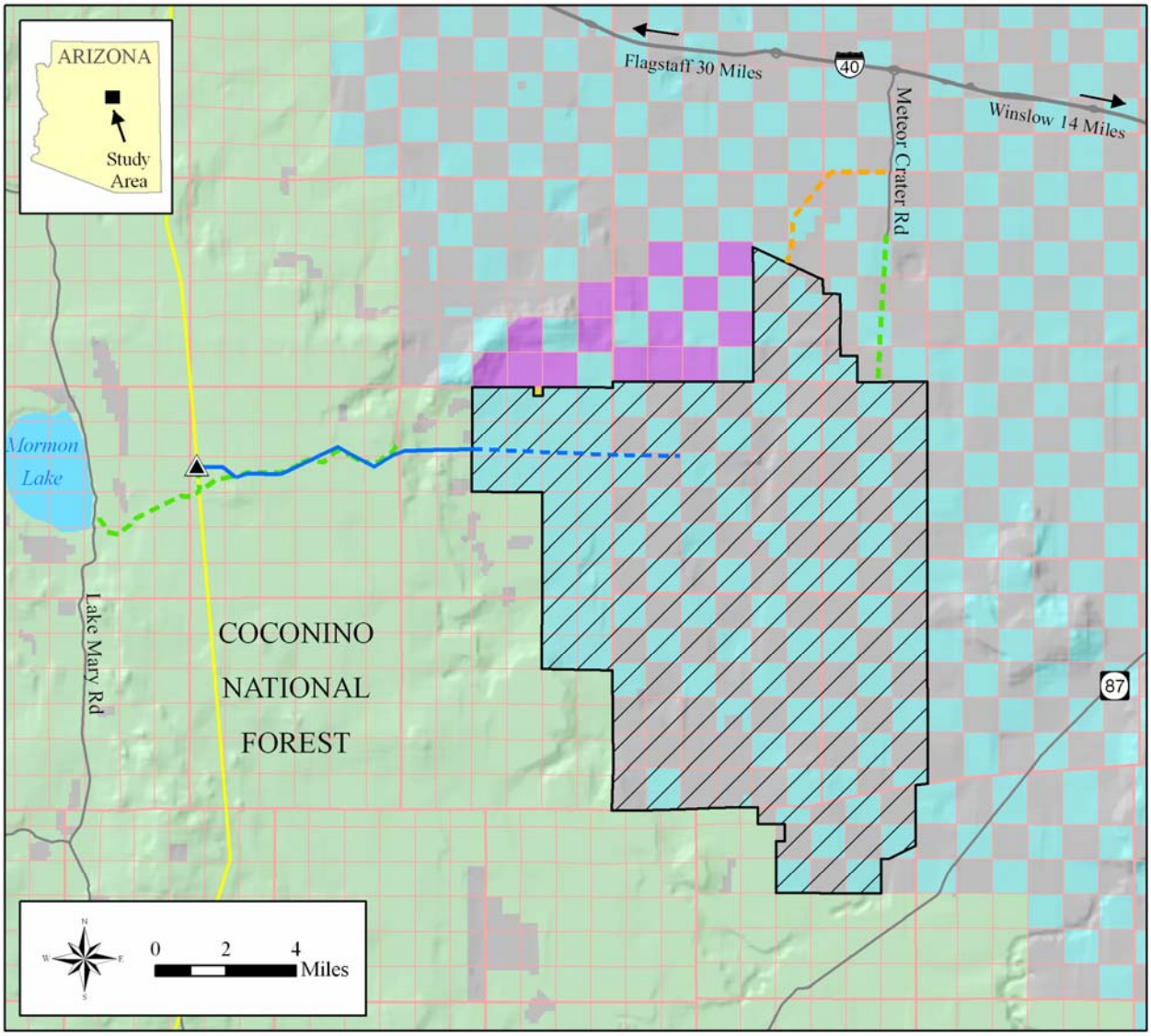
The wind park would, most likely, be constructed in two or more phases, if fully built out to 500 MW. The majority of the wind park components would be constructed concurrently for an initial phase, including new or improved site access and service roads, an Operations & Maintenance (O&M) facility, and a step-up substation. The number and timing of phases, and the number of turbines and size of each wind park phase, would be determined at a later time based on additional wind assessment, turbine model selection, and one or more power market agreements.

For ease in describing the proposed wind park, tie-line, and switchyard, each of the three components is discussed individually in this chapter. Descriptions include site survey activities, construction activities, operation and maintenance activities, decommissioning activities where applicable, and a summary of construction and operation related ground disturbance.

Wind parks are found throughout the United States and are typically sited in locations with strong prevailing winds. In Arizona, areas suitable for the development of utility-scale wind parks are generally located in the northern portions of the State. The screening process used to select the Grapevine Canyon Wind Park considered the following criteria:

- Availability of undeveloped wind resources suitable for utility-scale wind energy generation in a region that can serve power markets with portfolio standards.
- Suitability of site-specific conditions based on meteorological tower data and wind analysis.
- Ability to secure options for real property rights on contiguous lands suitable for wind energy generation.
- Ability to locate a wind project in an area where the County Comprehensive Plan cites wind energy as a viable land use.
- Location with transmission access to markets and utilities seeking to procure renewable energy
- Availability of cost-effective transmission access.
- Proximity to interstate highway system for equipment transportation and site access.

Another critical factor in identifying the Grapevine Canyon Wind Park included its proximity to a 345-kV electrical transmission line corridor. The corridor includes the Glen Canyon-Pinnacle Peak No. 1 and No. 2 345-kV transmission lines, both owned and operated by Western. The transmission lines have capacity available to transmit additional electricity.



Legend

- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Lines
- Bureau of Land Management
- Forest Service
- Arizona Game and Fish Department
- Private
- State Trust

Applicant's Proposed Project

Grapevine Canyon Wind Project

FIGURE 2.2-1

For the purposes of this EIS, the terms study area and project site are defined as follows:

- Study Area: The study area encompasses lands under evaluation for selecting specific locations for the wind park, tie-line, site access, and switchyard. The study area includes all lands that would be defined in the future for the project site (defined below). The study area covers approximately 150 sections of land, or approximately 150-square miles (approximately 96,000 acres).

- Project Site: The project site would comprise areas that would be directly disturbed by each phase of the wind park, tie-line, and switchyard (Table 2.2-1). The project site would be concentrated within a more limited portion of the broader study area. The project site would include the areas directly impacted by the placement of the proposed wind park, tie-line, and switchyard as described below.

TABLE 2.2-1
LEGAL DESCRIPTION BY LAND OWNERSHIP FOR STUDY AREA*

Land Ownership	Section(s)	Township	Range
Forest Service (approximately 220 acres)	10, 11, 12, 13, 14, 15, 16, 17, 18	18 N	10 E
	7, 8	18 N	11 E
Trust Lands administered by ASLD (approximately 50,965 acres)	2, 4, 10, 12, 14, 16	16 N	12 E
	1, 2, 11, 12	17 N	11 E
	2, 4, 6, 8, 10, 12, 14, 16, 18, 22, 24, 26, 32, 34, 36	17 N	12 E
	2, 10, 12, 14, 22, 24, 26, 34, 36	17 N	12.5 E
	1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 23, 24, 25, 26, 35, 36	18 N	11 E
	2, 4, 6, 8, 10, 12, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36	18 N	12 E
	2, 10, 12, 14, 22, 24, 26, 34, 36	18 N	12.5 E
	12, 14, 24, 26, 36	19 N	12 E
	2, 14, 26, 34	19 N	12.5 E
	34	20 N	12.5 E
Private (approximately 44,035 acres)	1, 3, 5, 9, 11, 15	16 N	12 E
	1, 3, 5, 7, 9, 11, 13, 15, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 33, 34, 35	17 N	12 E
	1, 3, 11, 13, 15, 23, 25, 27, 35	17 N	12.5 E
	1, 3, 5, 7, 9, 11, 13, 14, 15, 17, 19, 21, 23, 25, 26, 27, 29, 31, 33, 35	18 N	12 E
	1, 3, 11, 13, 15, 23, 25, 27, 35	18 N	12.5 E
	1, 13, 23, 24, 25, 35	19 N	12 E
	3, 11, 22, 23, 27, 34, 35	19 N	12.5 E
	35	20 N	12.5 E

* Gila and Salt River Baseline and Meridian, Arizona
Source: USGS 7.5 Minute Quadrangle Maps (Chavez Mountain East, Chavez Mountain NE, Chavez Mountain NW, Chavez Mountain West, Kinnikinick Lake, Meteor Crater, Mormon Lake)

2.2.1 Wind Park

A wind park consists of numerous WTGs and related energy generation and transmission infrastructure. The number and model of turbines are typically determined by one or more power sale contracts, the wind resource, and turbine availability and cost. The locations of WTGs are generally arranged in rows, spaced approximately one-quarter mile apart within rows, and approximately three-quarter mile apart between rows, known as arrays. Each of the WTGs generates electricity that is collected and transmitted to a new electrical step-up substation. Here, the voltage is converted for connection to the regional transmission system, from which it can be made available for use or sale to the utility marketplace.

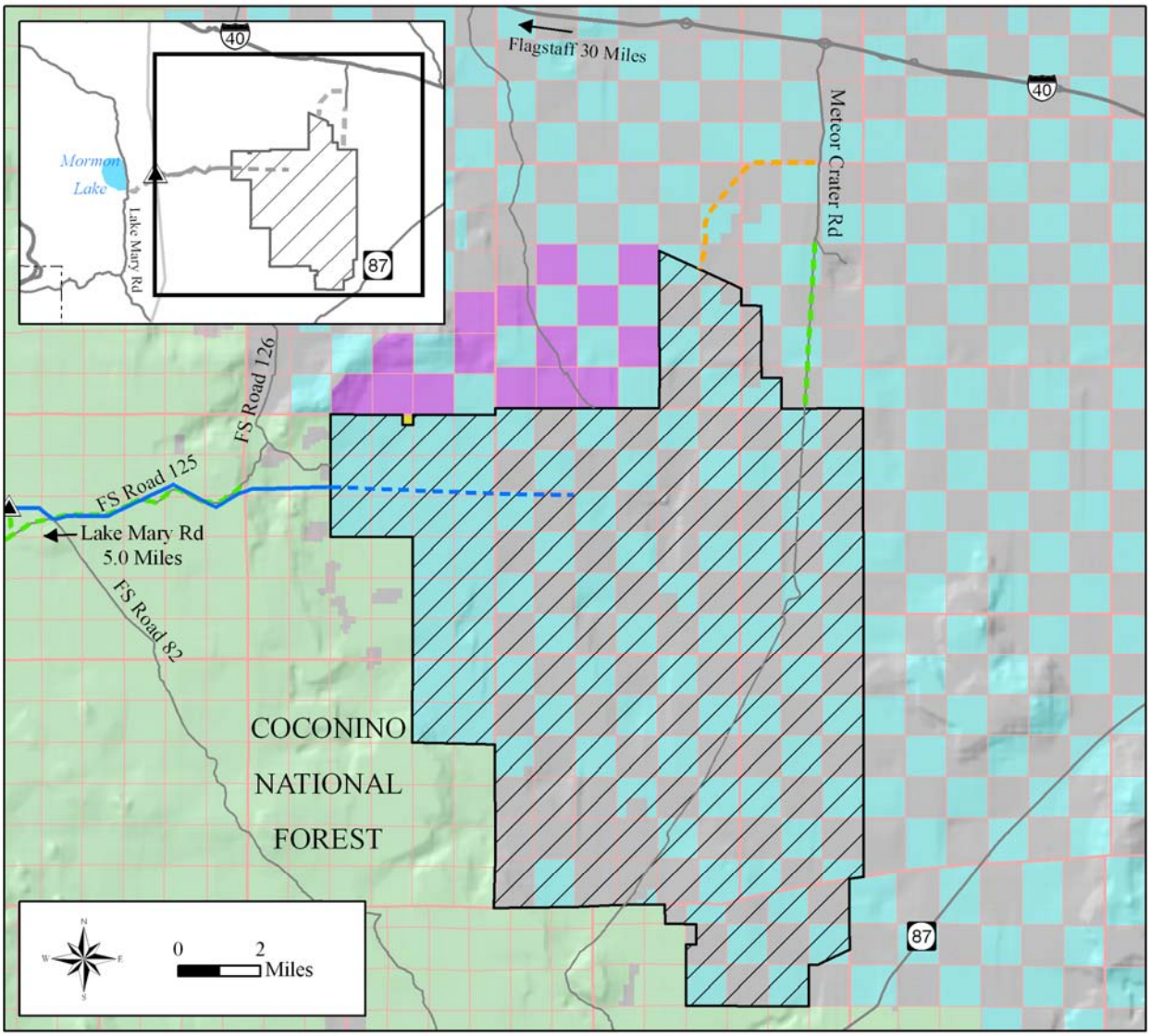
The proposed wind park study area is located entirely on private and State trust lands, not National Forest System lands, currently used for ranching operations. The wind park study area is depicted on Figure 2.2-2. The wind park would potentially generate up to 500 MW of electricity. It is anticipated that the wind park would be built in two or more phases. One or more power sale contracts would determine the wind park phases and the ultimate wind park size. Power sale contracts would determine size and the number of turbines per phase, timing of wind park phases, wind park layout and design, and related construction schedules.

The wind park would generate electricity from WTGs rated at 1.5 to 3.0 MW. For the purposes of this Draft EIS, it is assumed, unless specifically noted, that a 1.8-MW WTG would be used (Figure 2.2-3). Using 1.5, 1.8 and 3.0 MW turbines as an example, if the wind park is fully built out to 500 MW, either 333 1.5-MW WTGs, or 277 1.8-MW, or 166 3.0-MW WTGs would be utilized.

The WTG model and size would be determined once final wind analysis and project design are completed. It is typical that, once selected, all of the WTGs would be the same model or have similar dimensions, and be painted an industry-standard light gray.

For purposes of this Draft EIS, specifications for the Vestas V100 1.8-MW WTG are used to evaluate potential wind park impacts. This WTG is designed for high energy production for low wind sites and is suitable for northern Arizona's wind resource, altitude, and temperature range. This 1.8-MW WTG is a tubular steel tower, 263 feet in height and 14 feet in maximum diameter. Three blades, each 161 feet in length, extend from a nacelle, located at the top of the tower. In addition, the nacelle houses the generator equipment. A pad-mount transformer may be situated near the base, or located within the nacelle, depending on WTG selection (see Figure 2.2-3 and Figure 2.2-4).

In addition to the WTGs, other permanent components of the wind park would include an electrical collection system, a step-up electrical substation, communications system, operations and maintenance building, access and service roads, and meteorological monitoring towers.



Legend

- Wind Park Study Area
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- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
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- Existing Site Access Road
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- Bureau of Land Management
- Forest Service
- Arizona Game and Fish Department
- Private
- State Trust

Applicant's Proposed Wind Park

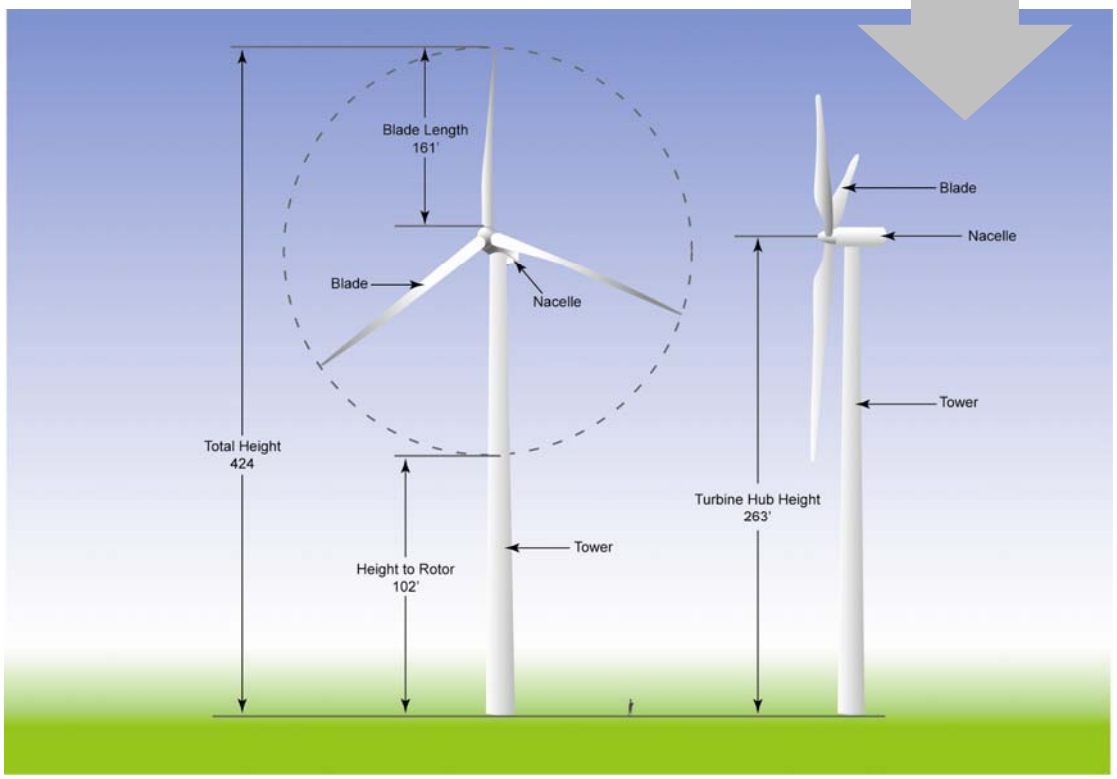
Grapevine Canyon Wind Project

FIGURE 2.2-2

FIGURE 2.2-3
TYPICAL WIND TURBINE GENERATOR

The WTG would be secured to a concrete foundation. A pad-mount transformer would be situated near the base or located within the nacelle depending on WTG selection. The nacelle, mounted at the top of the tower, would house the electric generator, a voltage step-up transformer, and a gearbox. Each WTG rotor would have three blades made of laminated glass and carbon fiber. The length of the blades would depend on the turbine model chosen, but Foresight anticipates that blades would be approximately 161 feet long. Overall WTG height after construction would be approximately 424 feet from the ground to the tip of the turbine blade when in the 12 o'clock position. The towers would be an industry-standard, neutral white to blend into the natural environment.

FIGURE 2.2-4
WIND TURBINE GENERATOR DETAILS



2.2.1.1 Engineering Surveys for the Wind Park

A pre-construction site survey would be performed to stake out the exact location of the WTGs, service roads, electrical collection system, access entryways from public roads, step-up substation, operations and maintenance building, and other project features.

Geotechnical or geophysical investigations would be performed to identify subsurface soil conditions, rock types, and strength properties for the design work of the roads, foundations, underground trenching, and electrical grounding systems.

Geotechnical investigations would occur at each turbine foundation location. For a 1.8-MW WTG, it is typical to perform soil borings to a depth of up to 31 feet at turbine sites using a 3.25-inch hollow-stem auger. Representative soil samples from the borings would be retained for further laboratory testing to evaluate the design specification for each WTG foundation. Boring holes would be backfilled after each test.

In addition, soil resistivity and thermal conductivity tests may be performed at select turbine sites. Resistivity would be tested by inserting probes into the ground to measure the resistivity of the soil. In addition, eight-inch borings would be performed to a depth of five feet and retained for laboratory testing of the thermal conductivity characteristics of the soil.

A Worst Case Fresnel Zone Study would be conducted to determine the locations of licensed microwave paths to further aid in locating each WTG to avoid conflicts with licensed communication pathways.

2.2.1.2 Construction of the Wind Park

It is anticipated that the wind park would be constructed in two or more phases. An initial phase, capable of generating up to 250 MW, would be constructed over a 12 to 18 month period of time. One or more subsequent phases would follow, resulting in a fully built-out wind park capable of generating up to approximately 500 MW. The timing and size of each phase would be dependent on one or more power sale contracts.

The wind park study area substantially exceeds lands anticipated to be disturbed for the wind park components. The location and siting of wind park infrastructure would be determined, per phase, based on additional wind assessment, turbine model selection, and one or more power market agreements. Typically, less than five percent of an overall wind park study area is permanently disturbed.

Approximately 250 to 400 workers could be on site during peak construction for a typical 250 MW project phase.

Construction activities would be temporary and would involve the use of heavy equipment, including bulldozers, graders, trenching machines, concrete trucks, tractor-trailer trucks, and large cranes. Table 2.2-2 lists the estimated type, number, and duration at the wind park site for construction equipment needed during construction of the proposed wind park.

TABLE 2.2-2 ESTIMATED TYPE, NUMBER, AND DURATION OF PROJECT CONSTRUCTION EQUIPMENT FOR A TYPICAL 250 MW PHASE		
Construction Phase/Equipment	**Estimated Average Number of Vehicles Onsite During Construction**	**Estimated Duration (months)**
Site Preparation and Road Construction		
Bulldozer	2-6	4-12
Road grader	1-3	4-12
Compactor	1-3	4-12
Backhoe	1-3	4-12
Foundations / Borrow Pit / Batch Plant, etc		
Backhoe	2-5	4-8
Crane (5 ton)	2-5	4-8
Forklift	4-12	4-8
Collection System		
Trenching machine	1-3	4-12
Reel carrier	1-3	4-12
WTG Assembly and Erection		
Crane (500 ton)	1-2	4-8
Crane (100 ton)	2-5	4-8
Substation/O&M Facility* Construction		
Bulldozer D-6	1-2	4-8
Backhoe	1-2	4-8
Grader	1-2	4-8
Crane (5 ton)	1-2	4-8
*May include the construction of a septic system and drilling a well. If a well is required, a drilling rig would be used		

Wind Park Mobilization, Staging, and Access

The initial steps in the construction of the wind park would include: constructing or improving access roads; establishing borrow pits and setting up a rock crusher and batch plant; developing a temporary power and water source; and establishing a wind park staging area.

Temporary Water

Water would be required during each project phase for construction activities, including dust control and preparation of concrete. Water would be sourced from one or more privately owned wells located on private land within the wind park study area.

Approximately 30 to 50 million gallons of water would be required during the initial 250 MW phase of construction, with between 60 and 100 million gallons of total water required for full wind park build-out during construction.

Potable water would also be sourced on site from a private landowner and would be available at the wind park staging area during construction. While not anticipated, potable water may be sourced from one or more commercial water haulers if necessary.

Temporary Power

There are currently no sources of electricity on-site. A temporary source of electricity would be required for construction. Two options are under consideration as described below.

1. On-site Generation: Either multiple 5-kW, or a single 50-kW, diesel generator would provide electricity during the construction period. Fuel would be purchased locally, and fuel would be housed on-site in accordance with requirements for on-site fuel storage.
2. Electrical Distribution Line: A temporary distribution line would be extended from an existing distribution line located along Meteor Crater Road. This line would be located adjacent to the primary site access road within a 60-foot-wide right-of-way, and would not require separate access. The overhead line would be strung on wooden poles approximately 25- to 30-feet tall and spaced approximately 150 feet apart. Construction of the line would occur over three to five months and would require between 15 and 30 workers at its peak.

Borrow Pits, Rock Crusher, and Batch Plant

Base material and aggregate required in the construction of the roads, staging areas, WTG foundations, tie-line structure foundations, operations and maintenance building foundation, and the step-up substation are expected to be sourced on site from within the wind park study area. The use of on-site borrow pits would eliminate the need to bring in raw materials that would require a substantial number of heavy truck trips to and from the wind park study area during construction. The borrow pits would become operational prior to road construction activities and would remain in operation until construction of the wind park and tie-line are completed.

One or more borrow pits would be located within the wind park study area on private land. Each of these would be approximately two to four acres in size and would provide aggregate that would be needed for wind park construction, as well as construction of the tie-line. The locations of these borrow pits have not been determined, but would be subject to geological analysis. If it is determined that aggregate material from these borrow pits would be used on National Forest System lands, the sites would be surveyed for noxious weeds and material colors would match the existing landscape where they would be utilized.

Breaking or blasting to fracture and loosen the limestone base may be required at each borrow pit. Blasting activities would be conducted by professionally trained and certified explosives experts, and would employ industry-standard techniques.

Quarried materials would be transported to a portable rock crusher located at each pit. The rock crusher would process the raw materials into aggregate for base construction material and concrete. The rock crusher would operate during the construction periods for the wind park and tie-line. Each crusher would be located in an area approximately two acres in size, and typically surrounded by a one-foot high earth berm to contain water runoff. A portable source air quality permit would be required for operation of each rock crusher.

One or more portable concrete batch plants (Figure 2.2-5) would be located within the wind park study area on private and/or State trust land. The location of each batch plant site would be determined during construction planning. Each batch plant would require an area approximately two acres in size, including an area for the batch plant and stockpiling of materials, such as sand, cement, and water. Batch plants would be used to mix concrete for use in the WTG foundations, tie-line structure foundations, and other facilities that would require the use of concrete. At least one batch plant would be in operation throughout the construction period of the wind park and tie-line. Each batch plant would require a portable source air quality permit.

Batch plants and rock crushers would be powered by portable electric generators and fuel would be stored on site in accordance with requirements for on-site fuel storage.

FIGURE 2.2-5
TYPICAL PORTABLE BATCH PLANT

Source: http://www.cemcoinc.comproducts.php

Staging Areas for the Wind Park

Staging areas are typical of construction and are multi-purpose areas used to store and assemble materials. A temporary wind park staging area would be developed on approximately 8 to 12 acres within the wind park study area for an initial phase of up to approximately 250 MW. A similar staging area would be established for any subsequent wind park phases. The location of the wind park staging area would be determined upon final wind park design and layout. The wind park staging area would be used for construction safety meetings, to host office trailers, temporary sanitation stations, parking for equipment, vehicle parking for equipment operators and construction workers, and staging for limited wind park components.

An additional on-site temporary staging area would be used during access road construction for equipment and employee parking. The staging area would be approximately four to six acres in size, and may or may not be located in the same place as the larger staging area described above but would be located with the wind park study area on private land.

Staging areas would be prepared by clearing and grading as needed. The areas would then be covered with four to six inches of gravel to provide a level ground surface. The gravel would be sourced from borrow pits on site. Excess spoil material and topsoil salvaged from the site would be used for top-fill in other construction areas.

Temporary security fencing may be located around construction staging areas. If utilized, fencing would be a six-foot-high chain link structure with additional security wiring located at the top. When construction is complete, the fencing around the staging areas would be removed.

Temporary staging areas would be reclaimed once construction is complete. The initial wind park staging area would be kept but reduced in size to accommodate permanent parking and other uses near operations and maintenance facilities. Excess gravel would be removed and salvaged for resale to other construction projects in accordance with landowner requirements.

Wind Park Primary Access and Service Roads

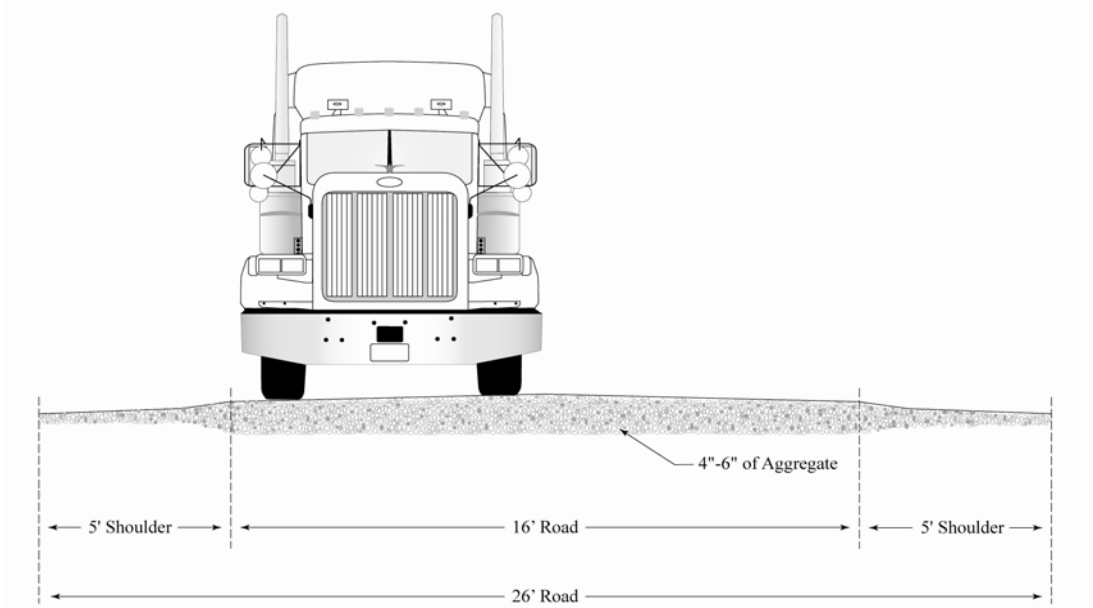
Construction and improvement of the new and existing primary access and service roads would occur over a period of four to six months and would require between 50 and 100 workers at its peak.

Primary access and service roads would be improved or designed and constructed to State and Federal Water Quality Certification Standards for Linear Transportation Projects. The roads would be constructed using typical road construction equipment, including a bulldozer, grader, front-end loader, excavator, and a small crane. The roads would be cleared of vegetation and excavated to a depth of up to 12 inches and covered with approximately four to six inches of aggregate. The road surface would then be graded and compacted. Berms and other drainage features would be constructed as required. Topsoil removed during road construction would be used for top fill, or stockpiled for berms and other drainage features.

Trucks and other vehicles would access the wind park study area from Interstate-40 (I-40) at the Meteor Crater Road exit. In order to accommodate construction traffic, additional gravel may be placed on already disturbed roadway shoulders at the intersection of I-40 and Meteor Crater Road. If additional offsite transportation roadway improvements are not identified until after the completion of the Final EIS, any environmental impacts associated with these modifications would be addressed in accordance with regulatory requirements.

The primary site access road would originate from Meteor Crater Road and would extend to the west across Canyon Diablo and then south into the wind park study area. The access road would be constructed as a new all-weather, compacted gravel road approximately eight miles in length. The road would generally be 16 feet wide, with a five foot shoulder on either side (Figure 2.2-6).

FIGURE 2.2-6
CROSS-SECTION ILLUSTRATION OF TYPICAL PRIMARY SITE ACCESS ROAD



The primary access road would require a crossing of Canyon Diablo. This crossing is expected to occur at one of three suitable locations that have been identified based on a preliminary evaluation (Figure 2.2-7). The final crossing location, structure, and design would be determined based on engineering and analysis completed during the design of the wind park. It is anticipated the crossing would require a bridge-type structure, with a span of up to 80 feet and a roadway width of approximately 16 to 18 feet. The crossing would be designed to maintain stream flows and prevent erosion. In addition to Canyon Diablo, the road is expected to cross up to five smaller ephemeral washes. Culverts would likely be placed within these washes at crossings. Up to 75 feet on either side of the road would be disturbed where culverts or other drainage structures are located.

In addition to the primary access road, Chavez Pass Road, an existing road located between Meteor Crater Road to the north and State Route 87 to the south, may also be used for site access for subsequent wind park phases. Chavez Pass Road is maintained by the County and it is anticipated the road would not need to be recontoured or be upgraded outside of the existing roadway. If used, minor grading may be necessary and new surface material added, but no improvements are anticipated to be made outside of the current road area.

Once primary access has been established, service roads to each WTG site and other wind park facilities would be constructed. Up to approximately 143 miles of service roads would be needed if the wind park is fully built out to 500 MW. All service roads would be located within the wind park study area on private and/or State trust land. Service roads would be sited to minimize disturbance and maximize transportation efficiency. Existing roads, ranch roads, and two-track trails would be used to the extent possible. Service roads would be constructed to the same specifications and standards as the primary site access road with the exception of an additional five feet on either side, resulting in a ten foot shoulder (Figure 2.2-8). This additional width is necessary to facilitate the movement of a large crane from one WTG to the next. Following construction, this additional shoulder width would be reclaimed.

Service road public access would be based on consultation with State trust and private landowners. Select wind park access or service roads that do not access public lands may be gated with limited public access.

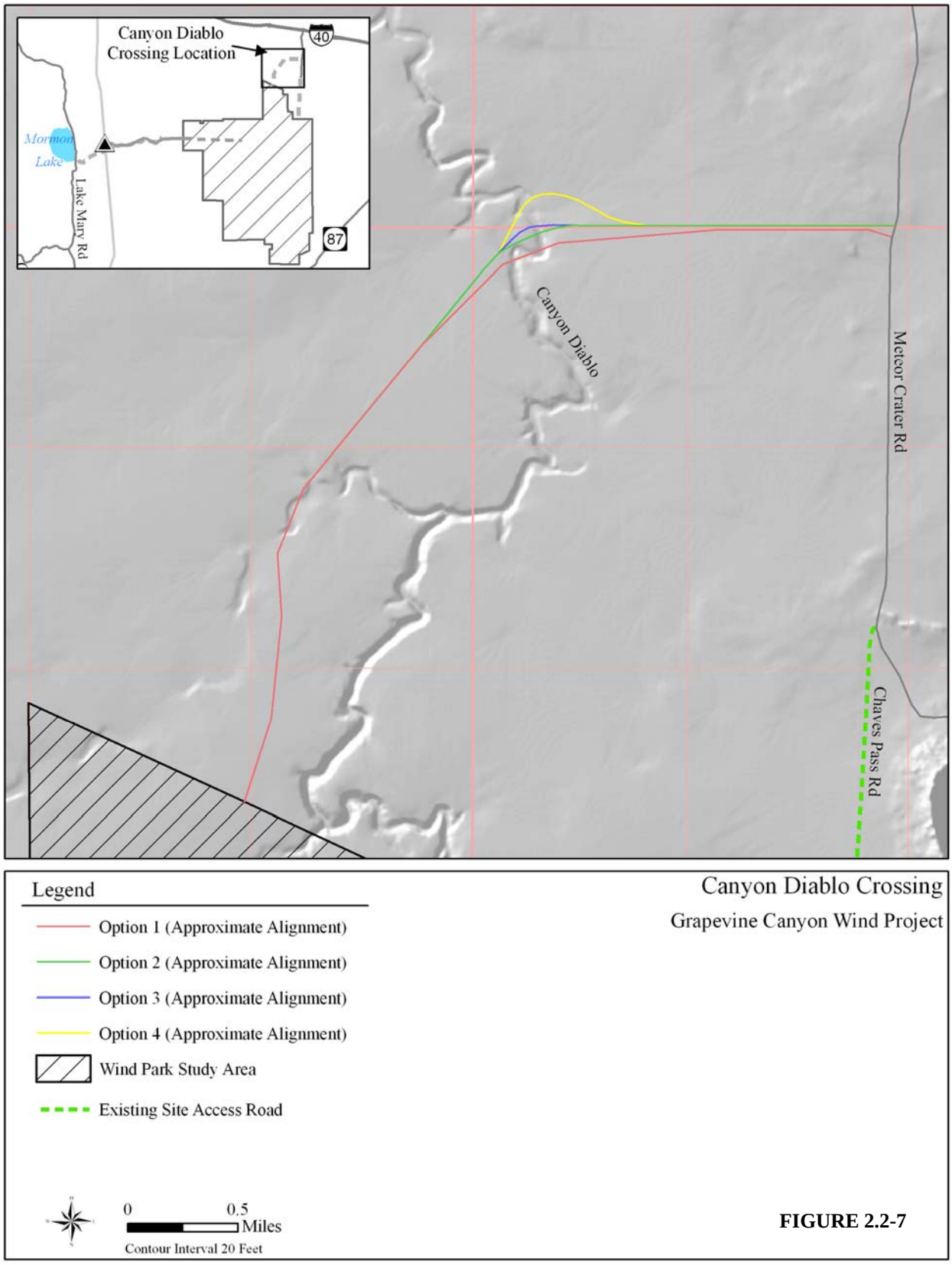
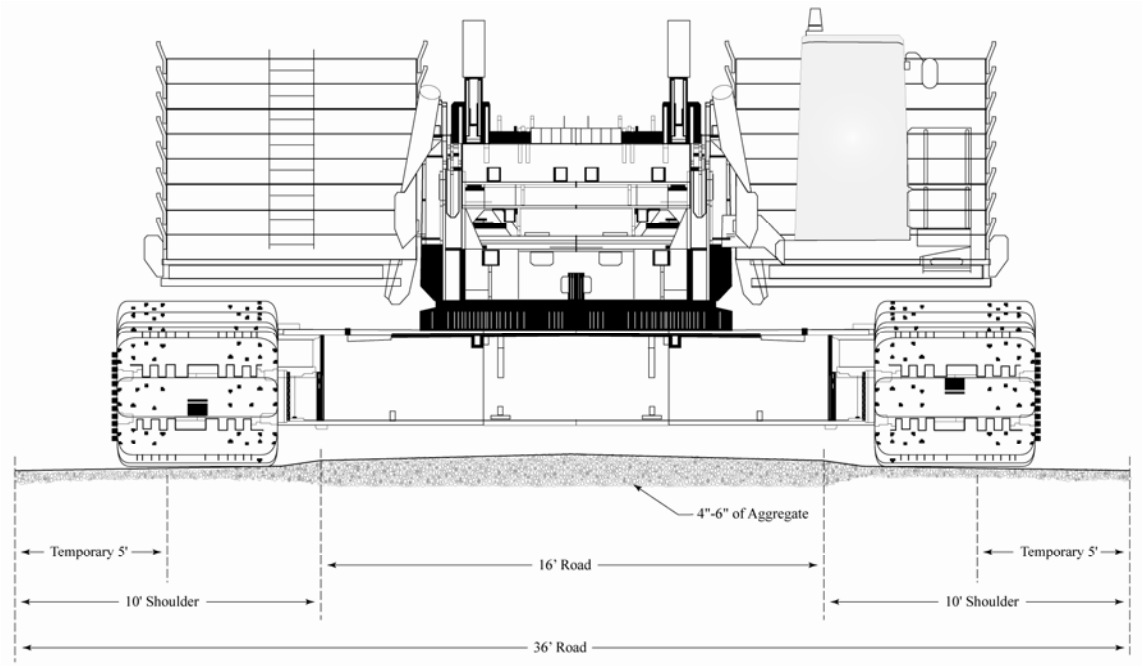

Canyon Diablo
Crossing Location
40
Mormon
Lake
Lake Mary Rd
87
Canyon Diablo
Meteor Crater Rd
Chaves Pass Rd
Legend
Option 1 (Approximate Alignment)
Option 2 (Approximate Alignment)
Option 3 (Approximate Alignment)
Option 4 (Approximate Alignment)
Wind Park Study Area
Existing Site Access Road
0
0.5
Miles
Contour Interval 20 Feet
Canyon Diablo Crossing
Grapevine Canyon Wind Project

FIGURE 2.2-7

FIGURE 2.2-8
ILLUSTRATION OF TYPICAL SERVICE ROAD TO ACCOMMODATE LARGE CRANE



Construction of Wind Turbine Generators

The typical construction sequence of the WTGs is depicted in Figure 2.2-9 and described below.

FIGURE 2.2-9
TYPICAL WTG CONSTRUCTION STAGES

An area approximately 2.2 acres in size at each WTG location would be cleared with a grader and excavated with a backhoe to prepare for each concrete foundation and to accommodate the WTG, temporary work areas, and a crane pad. The crane pad would be an approximate 50 foot by 50 foot compacted and graveled area adjacent to each WTG and would remain after construction.

Each turbine and pad transformer, if required, would require foundations. The most likely foundation design for the Vestas V100 WTG is a spread footing with an octagonal base. Each foundation would consist of approximately 25 to 40 tons of steel and approximately 350- to 400-cubic yards of concrete per WTG. The excavated area would be approximately 10- to 15-feet deep and 45 to 60 feet in diameter. A

16-foot-diameter pedestal would be centered within the foundation footprint, with approximately one foot of the foundation protruding above grade. Excess excavated material, including topsoil, would either be stockpiled for backfill and reclamation, or disposed of in accordance with applicable regulations and permit conditions.

Each WTG would be assembled and erected by cranes in multiple stages. A 400-ton crane would likely be used similar to the model illustrated in Figure 2.2-9. The crane would arrive to the wind park in sections and be assembled on site.

The components of each WTG would arrive via semi-trailers. If one crane is utilized at the site, 10 to 13 semi-trailer loads of wind facility components would be transported and offloaded at the project site per equipment delivery day; if two cranes are utilized at the site, 20 to 26 trailer loads would be transported and offloaded per equipment delivery day.

WTG assembly would involve connecting the anchor bolts to the concrete foundation, erecting the four-section tower, erecting the nacelle, assembling and erecting the rotor, connecting the internal cables, and inspecting and testing the electrical system prior to operation.

The blades would be assembled into a rotor assembly on the ground prior to placement on the nacelle. The rotor assembly consists of connecting the three blades to the hub. The hub is the central element that connects the blades to the shaft of the gearbox. The hub would be placed on a special stand that elevates it approximately eight feet above grade. The blades would then be individually attached to the hub, and then raised into place by the crane and attached to the nacelle.

Construction of Electrical Collection System

Construction of the collection system would last approximately 10 to 14 months and would occur prior to or concurrent with WTG construction. Approximately 15 to 30 workers would be on site during peak construction.

To the extent possible, the collection system would be located adjacent to the WTG service roads. Approximately 241 miles of 34.5-kV collection lines would be needed if the wind park is fully built out to 500 MW. The collection system would be located within the wind park study area on private and/or State trust land, and the majority of the collection system would be underground. However, if a combination of underground and overhead collection system is utilized, the length of underground collection system would be proportionally reduced by the length of overhead collection line. Each collector line would consist of three cables: an electrical conductor, a solid copper (unshielded) ground wire, and a fiber optic line.

The underground collection lines would be constructed by excavating trenches to a minimum depth of four feet, depending on the underlying soil and rock conditions, and to a width of one to two feet. The three cables would then be placed in the trench, and the trench would be backfilled with a warning tape placed 12 to 18 inches above the cabling.

Temporary disturbance resulting from the construction of the underground collection system would include tracks from the trenching equipment and a three to five foot swath of disturbed soil as a result of excavating and backfilling the trench. All surface disturbances would be limited to a 25-foot-wide construction corridor, inclusive of temporary construction disturbance and any collection line service roads.

If utilized, the overhead collection lines would be supported by wooden poles approximately 25 to 30 feet tall and spaced approximately 150 feet apart. The lines would be constructed in two phases, using typical

construction techniques. First the pole structures would be set using a single multi-purpose truck. The truck would include a small crane suitable for lifting and placing poles. A pole trailer would be towed behind the crane truck to transport the poles to the installation site. Affixed to the crane would be an auger for boring the holes for the pole structures. Soil excavated during construction would be used for backfill and for restoration of disturbed areas. Second, cable would be installed using a cable truck and a truck with a person lift. The cable would be strung out along the installation route and the man lift would be used to place the cable on the pole structure.

Temporary construction and permanent service access to the line would be primarily provided by the WTG service roads. In areas where overhead collection cannot be collocated with the WTG service roads, surface disturbance would be limited to a 25-foot-wide construction corridor.

Construction of Communications System

The communication system for the wind park includes a series of fiber optic cables connecting the WTGs. The fiber optic cable would connect each WTG to the step-up substation. The fiber optic cables would terminate at a switchgear enclosure located within the proposed step-up substation. Data may be transmitted via an on-site microwave tower or via a fiber optic cable included on the transmission tie-line to the switchyard. The fiber optic cables would be installed at the same time as the electrical collection system, either within the same trench or attached to the same overhead structures.

Construction of the Step-Up Substation

The step-up substation would be located within the wind park study area on private and/or State trust land on an approximately four acre parcel, with an additional two acres disturbed during construction activities. Construction would involve site grading, installing gravel material within the fenced area of the substation, constructing concrete foundations for the transformers and other components within the substation, installing substation equipment, and erecting a chain-link security fence around the substation perimeter. Figure 2.2-10 includes a picture of a typical step-up substation. A bulldozer, backhoe, grader, crane, and general purpose trucks would be used in the construction of the substation. It is expected that the substation would be constructed over a four to eight month period, and 15 to 25 workers would be onsite during peak construction.

Construction of the Operations and Maintenance Building

The O&M facility would be located within the wind park study area on private and/or State trust land on an approximately 2.4-acre parcel, typically co-located with the wind park construction staging area. Drainage features would be constructed, if needed. Construction of the O&M facility would include foundation preparation and pouring, framing the structure and roof trusses, installing the outer siding, installing plumbing and electrical work and finishing the interior carpentry. The facility would typically require a septic system and potentially a well. Once complete, the O&M facility would have the appearance of a typical prefabricated steel building.

Equipment required for construction of the O&M facility would include a bulldozer, road grader, compactor, backhoe, concrete mixer, crane, and general purpose truck. Construction of the O&M facility would be accomplished in approximately four to six months with approximately 15 to 30 workers on site during peak construction.

FIGURE 2.2-10
TYPICAL STEP-UP SUBSTATION

FIGURE 2.2-11
TYPICAL LONG-TERM MET TOWER

Meteorological Towers

Several temporary meteorological (met) towers have been constructed over the past several years within the wind park study area on private and State trust land to gather wind data indicating the feasibility of the wind park. These existing towers would remain in place until construction of the wind park is complete. In addition, up to five additional temporary met towers may be installed prior to construction to further analyze the wind resource across the wind park study area. Temporary towers would be decommissioned and removed during the construction process for wind park phases.

Up to 16 long-term or permanent met towers would be used to monitor wind conditions at the site if the wind park is built out to 500 MW. These met towers would be free-standing structures, approximately 263 feet tall, constructed of steel lattice. A typical long-term met tower is depicted in Figure 2.2-11. Construction equipment needed for the installation of the met towers would include a bulldozer, road grader, and compactor for site preparation; a backhoe and concrete mix truck for the foundation; and a crane and general purpose truck for erection of the towers. Approximately six to nine workers would be on site during construction of each of the permanent met towers.

Security During Wind Park Construction

The wind park owner or manager would develop and implement a security plan to effectively monitor the wind park activities during construction. A security plan would be developed and adapted throughout the course of construction to address the level of construction activity and the type of equipment being used. Lighting would be in conformance with the Coconino County Lighting Ordinance.

Construction materials would be stored at individual WTG locations, or at the staging areas. Temporary fencing with a locked gate may be installed around a roughly 1.5-acre area adjacent to the O&M facility for temporary storage of any special equipment or materials.

2.2.1.3 Operation and Maintenance of the Wind Park

Wind Park Start-Up

Plant commissioning would follow mechanical completion of the wind park, tie-line, and switchyard and would begin with a detailed plan for testing and energizing the electrical collection system, step-up substation, tie-line, and interconnection switchyard in a defined sequence with lock and tags on breakers to ensure safety and allow for fault detection prior to energizing any component of the system. Once the step-up substation is energized, feeder lines would be brought on line, one by one. Individual turbines would then be tested extensively then brought on line, one by one. Commissioning does not require any heavy machinery to complete.

Wind Park Operating Requirements and Staffing

Operating Schedule

The wind park would be in operation 24 hours per day, 365 days per year. The wind park would be staffed as necessary to provide operational maintenance and environmental compliance support. The wind park's central Supervisory Control and Data Acquisition (SCADA) system would stay online fulltime, 24 hours per day, 365 days per year.

Operation and Maintenance Staff

The wind park would be operated and maintained by a team of approximately 17 to 40 personnel if fully built out for a typical 500-MW project, consisting of the following staff positions (Table 2.2-3):

TABLE 2.2-3
TYPICAL WIND PARK OPERATION AND MAINTENANCE STAFFING (BASED ON UP TO 500 MW WIND PARK)

Position	**Number of Personnel***
O&M Project Manager	1
Administrative Assistant	1
I&E Technician	1-2
Lead Wind Turbine Technician	1-3
WTG Technicians (Technician 1, Technician 2)	12-32
Misc services (security, housekeeping, general maintenance)	up to 0.5

*depends on quantity and type of turbine selection

Fencing and Security

The wind park perimeter would not be fenced. Public access across wind park service roads that connect to wind park infrastructure would be based on consultation with the private and State landowners. Service roads that do not access public lands may be gated. A lockable steel door at the base of each WTG would restrict access to authorized personnel only. If the selected WTG requires a pad-mount transformer, these would be locked. Consistent with industry standard practices, WTGs and pad-mount transformers would not be fenced.

The step-up substation would be fenced and gated to industry standards for electric utility infrastructure. The area would be secured and limited to authorized personnel.

Wind Park Power

During the operating life of the wind park, electricity for the O&M facility would be needed. Once Western's interconnection switchyard, and the wind park's transmission tie-line, and step-up substation are complete and energized, station power to the wind park facilities would be fed via a dedicated circuit from the step-up substation. From here, power would be delivered to the O&M building.

Operation of the Step-up Substation

The step-up substation would be equipped with night-time and motion sensor lighting systems, as well as emergency lighting with back-up power. Lighting fixtures would be in conformance with the Coconino County lighting ordinance.

Operation of the Communication System

Each turbine would be connected to the SCADA system. The SCADA system would allow for remote control and monitoring of individual turbines and the wind park as a whole from both the central host computer or from a remote computer. The SCADA equipment would be located in the control panel housed inside the base of each WTG. The SCADA system would allow the operator to remotely control and monitor project performance via an internet connection or dedicated high-speed phone line on a continuous basis. Any abnormalities or emergencies detected by the system would initiate a callout sequence, and a maintenance person would be alerted and, if required, dispatched to the WTG immediately to implement corrective action.

Operation of the WTGs

The WTGs would be equipped with sophisticated computer control systems to monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch and yaw angles, etc. The main functions of the control system would include nacelle and power operations. Heat dissipation for the operating machinery inside the wind turbines, such as the generator and gearbox, would be achieved with air cooling. Heat dissipation is very minimal.

Aerodynamic brakes and mechanical disk brakes are security measures installed in each WTG. The braking system is designed to be fail-safe, allowing the rotor to shut down during high wind conditions or in less than five seconds in case of electric power failure. Emergency stops are located in the nacelle and in the bottom of the tower. Turbines are also designed to allow for disconnection from all power sources during inspection and maintenance.

Typical chemicals used during operation and maintenance of WTGs include anti-freeze liquid to prevent freezing, gear oil for lubricating the gearbox, hydraulic oil to pitch the blades and operate the brake, grease to lubricate bearings, and various cleaning agents and chemicals for maintenance of the turbine. Turbines are certified to ISO 14001:20004 for environmental system compliance. All chemicals would

be stored and handled in accordance with applicable laws and regulations throughout the construction and operating periods of the wind park.

WTGs would be lighted according to Federal Aviation Administration (FAA) requirements. The FAA has an administrative procedure that provides a Determination of No Hazard with permits for each WTG tower over 200 feet in height. The FAA would provide an approved lighting plan for perimeter WTGs and select internal WTGs for the final project layout, per phase, prior to construction. Typically the FAA requires that approximately one-third of all WTGs in a wind park are lighted. Industry standard lighting is a medium intensity red synchronized flashing LED (light-emitting diode) obstruction light with a horizontal beam pattern.

Operations and Maintenance Building

The O&M facility would include a main building with offices, spare parts storage, restrooms, a shop area, outdoor parking facilities, a turn-around area for larger vehicles, and outdoor lighting. The O&M facility is expected to be fenced. The building would be secured with locking access and service doors, with access limited to authorized personnel. Public access to WTG service roads that connect to the O&M facility would be based on consultation with the private and State landowners.

During operations and maintenance, water to the O&M facility would be expected to be piped from a private on-site well and stored in on-site storage tanks. Domestic sewage would be discharged and treated in an on-site closed septic system. The septic system would be a leach field design, typical to the region and permitted through Coconino County.

Heating for the facility would be determined at the final design stage; electricity, propane or natural gas would be evaluated. If propane or natural gas is selected, storage of this fuel would be addressed in the Spill Prevention, Control, and Countermeasure (SPCC) Plan and other approvals and permitting required for construction, operations, and maintenance of the facility.

Facility exterior lighting would be in conformance with the Coconino County Lighting Ordinance.

Operation of the Meteorological Towers

The wind park design would include up to 16 permanent met towers (for a 500 MW wind park) fitted with multiple sensors to track and monitor wind speed and direction and temperatures. The permanent towers would be connected to the plant's central SCADA system.

These met towers would be lighted according to FAA requirements. Similar to the WTGs, the FAA has an administrative procedure that provides a Determination of No Hazard with permits for each met tower over 200 feet in height. The wind park owner or manager would meet the FAA requirements for lighting.

2.2.1.4 Summary of Wind Park and Ground Disturbance and Reclamation Activities

Table 2.2-4 provides estimates of the extent of temporary and permanent ground disturbance associated with construction, operation, and maintenance of the proposed wind park.

TABLE 2.2-4
ESTIMATED PERMANENT AND TEMPORARY GROUND DISTURBANCE ASSOCIATED WITH A 500 MW WIND PARK

Facility	**Temporary Ground Disturbance (acres)**			**Permanent Ground Disturbance (acres)**		
	1.5 MW WTG	**1.8 MW WTG**	**3.0 MW WTG**	**1.5 MW WTG**	**1.8 MW WTG**	**3.0 MW WTG**
Project staging area	28 – 40			24 – 36		
Borrow pits	2 – 4			2 – 4		
Batch plants	2			0		
Electrical distribution line	61 – 86			0		
Step-up substation	6			4		
O&M building	2 – 3			2 – 3		
Primary access roads	41	35	44	25	22	27
Internal access roads	592	628	382	427	454	276
Wind turbine generators	665 – 786	553 – 654	332 – 392	51	42	25
Collection system/ communication system	712	730	608	0*	0*	0*
Long-term meteorological towers	5	5	3	5	5	3
TOTAL	2,116-2,277	2,050-2,193	1,468-1,570	540-555	555-570	363-378

*Some permanent disturbance is likely in areas where an overhead collection system is constructed. Permanent disturbance would include the foundation and footprint of each structure and would amount to less than one acre total.

Reclamation of Disturbed Areas

Following construction, areas not maintained as permanent facilities would be returned to a condition reasonably similar to their pre-construction state. This would include replacing topsoil of the same or similar type and reseeding the affected areas with plant species native to the region. Post-construction re-contouring is not anticipated since excavation activities would be conducted to retain natural contours.

After construction has been completed, the graveled wind park staging area would be reduced to accommodate permanent parking and other uses near the O&M facility or step-up substation. Excess gravel would be removed and salvaged for resale to other construction projects, or according to landowner desires. The area would be graded and reclaimed as described above.

2.2.1.5 Wind Park Decommissioning

The design life of major wind park equipment such as the turbines, transformers, substations, and supporting infrastructure is typically considered to be at least 25 years. It is likely that after mechanical wear takes its toll, the wind facilities could be upgraded with more efficient equipment and could have a useful life longer than 25 years. Such upgrades may require additional Federal, State, and local review and approval.

Once it is determined that the wind park would be decommissioned, financial and decommissioning responsibility would rest with the owner or operator of the wind park. Currently, the details of decommissioning the wind park are not known. As such, the potential effects associated with decommissioning of the wind park are not analyzed as part of this EIS.

2.2.2 Transmission Tie-line

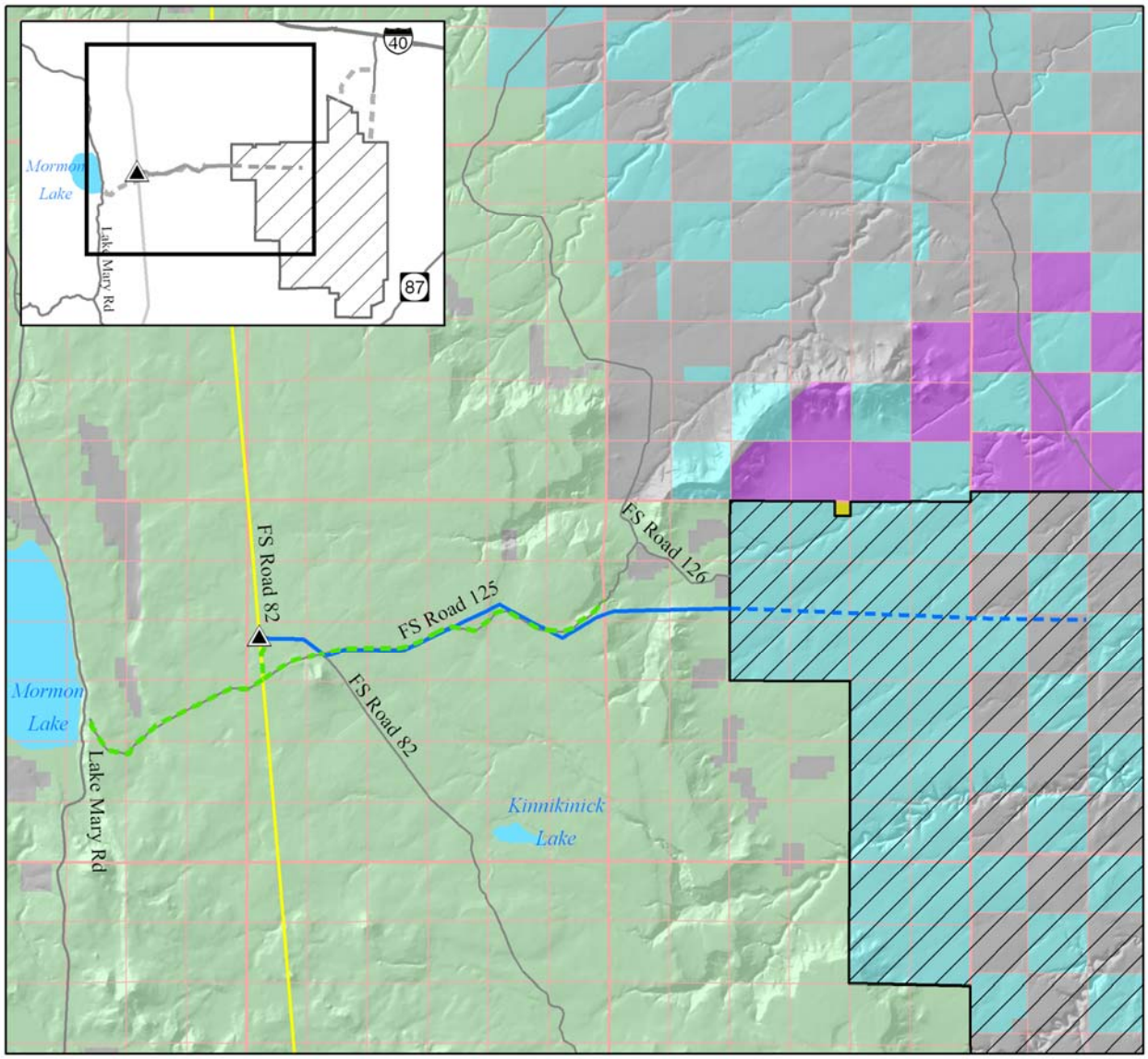
The electricity generated by the wind park would be gathered at the step-up substation located within the wind park study area on private and/or State trust land, where the voltage would be transformed from 34.5-kV to 345-kV. A new 345-kV double-circuit electrical transmission tie-line would be constructed between the wind park step-up substation and Western's existing Glen Canyon-Pinnacle Peak No. 1 and No. 2 345-kV transmission lines. The proposed tie-line would be located on private, State trust, and National Forest System lands.

The Glen Canyon-Pinnacle Peak 345-kV transmission lines are part of the regional electrical grid. Connecting into this existing electrical transmission system would allow electricity produced at the wind park to be sold and utilized by Arizona and regional utilities.

The tie-line includes monopole structures, conductors, and associated access roads. The tie-line would be up to approximately 15 miles in length, extending 8.5 miles across National Forest System lands and up to approximately 6.5 miles across State trust and private lands. A 200-foot-wide right-of-way would be acquired for construction, operation, and maintenance of the tie-line for the sections that cross the Coconino National Forest. General design characteristics of the proposed tie-line are provided in Table 2.2-5 and a location map is provided as Figure 2.2-12. Gray steel monopole structures with non-reflective finishes would be utilized (Figure 2.2-13, is indicative of a typical transmission tie-line structure).

TABLE 2.2-5
TYPICAL 345-kV STRUCTURE CHARACTERISTICS

Feature	Description
Length	Up to approximately 15 miles
Structure height	Approximately 120 feet
Structure diameter	Approximately 7-8 feet
Span length	Approximately 1,000 feet
Right-of-way width	200 feet
Number of structures on National Forest System lands	Approximately 45
Number of structures on State trust or private lands	Up to approximately 35



Legend

- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Proposed Interconnection Switchyard
- Existing Site Access Road
- Existing Western 345-kV Transmission Lines
- Bureau of Land Management
- Forest Service
- Arizona Game and Fish Department
- Private
- State Trust

Applicants Proposed 345-kV Tie-line and Western's Proposed Interconnection Switchyard

Grapevine Canyon Wind Project

0 1 Miles

FIGURE 2.2-12

FIGURE 2.2-13
TYPICAL DOUBLE-CIRCUIT 345-kV POLE STRUCTURE

2.2.2.1 Engineering Surveys for the Tie-line

Pre-construction surveys would be conducted to locate the transmission tie-line right-of-way, to identify property boundaries, to provide accurate ground profiles along the transmission tie-line centerline; to locate existing structures; and to determine the locations and rough ground profiles for new service roads. This information would also be utilized to determine the legal descriptions of properties to be used for the tie-line. Soils would be tested to determine physical properties, including the ability to support the proposed structures. A portion of the proposed tie-line would follow an existing cattle trail west out of the proposed wind park to minimize new land disturbance. Affected landowners and land managers would continue to be consulted during the initial route selection and structure siting process to reduce impacts to land uses and avoid or minimize disturbance to sensitive environmental areas.

2.2.2.2 Construction of Tie-line

The construction of the 345-kV transmission tie-line would involve many steps, detailed below. Approximately 10 to 30 workers would construct the line over a period of six to ten months. Construction may be paced to accommodate seasonal conditions and to minimize impacts to wildlife.

Tie-line Mobilization and Staging

Three staging areas are planned for the construction of the tie-line, one would be located near the switchyard (on National Forest System lands) and one would be located within the wind park study area near the step-up substation (on private/State trust land). The third staging area would be located at a central point along the tie-line route (on National Forest System lands). Each staging area would be approximately four to six acres in size, located adjacent to the tie-line route. The staging area located near the switchyard may be co-located with the switchyard construction staging area, depending on construction sequencing.

The staging areas would be used for construction safety meetings, to host office trailers, temporary sanitation stations, parking for equipment, vehicle parking for equipment operators and construction workers, and staging for limited project components.

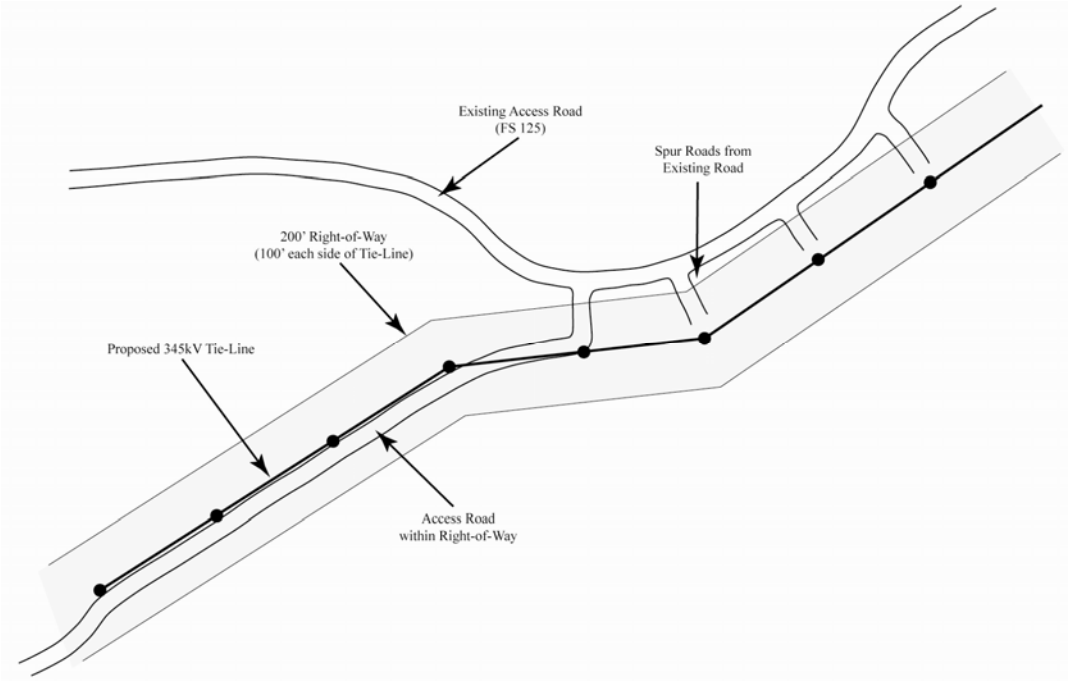
The staging areas would be prepared by clearing and grading as needed. The area would then be covered with four to six inches of gravel to provide a level ground surface. The gravel would be obtained from borrow bits within the wind park study area located on private and/or State trust land. Excess spoil material and topsoil salvaged from the site would be used for reclamation of the area after construction or for top-fill in other construction areas. Water or other approved dust suppressant would be used during the grading of the staging area.

Construction of Tie-line Access Roads

Primary construction and maintenance access to the tie-line would be from either Lake Mary Road to Forest Service Route 125 (FS 125) or from the wind park through the primary site access road. Access to each structure location would be required. In order to minimize ground disturbance, existing roads would be used when possible, with new spur roads constructed to the structure sites. When existing roads are distant from the tie-line, a new access road or spur-road would be established adjacent to the tie-line within the right-of-way. Figure 2.2-14 depicts typical parallel and spur roads access for tie-line construction and maintenance.

The number and location of spur roads and newly constructed access roads would be determined at the time of tie-line design. Access and spur roads would not be maintained but would be used regularly to access the tie-line for routine inspections over the lifetime of the project. Typically the roads would be between 12 and 16 feet in width with a surface that is bladed, compacted, and lightly graveled. Gravel would be sourced from a site approved by the Forest Service, inspected for noxious weeds, and of a color that would match existing roadways and landscapes.

FIGURE 2.2-14
TYPICAL ACCESS ASSOCIATED WITH THE PROPOSED TIE-LINE



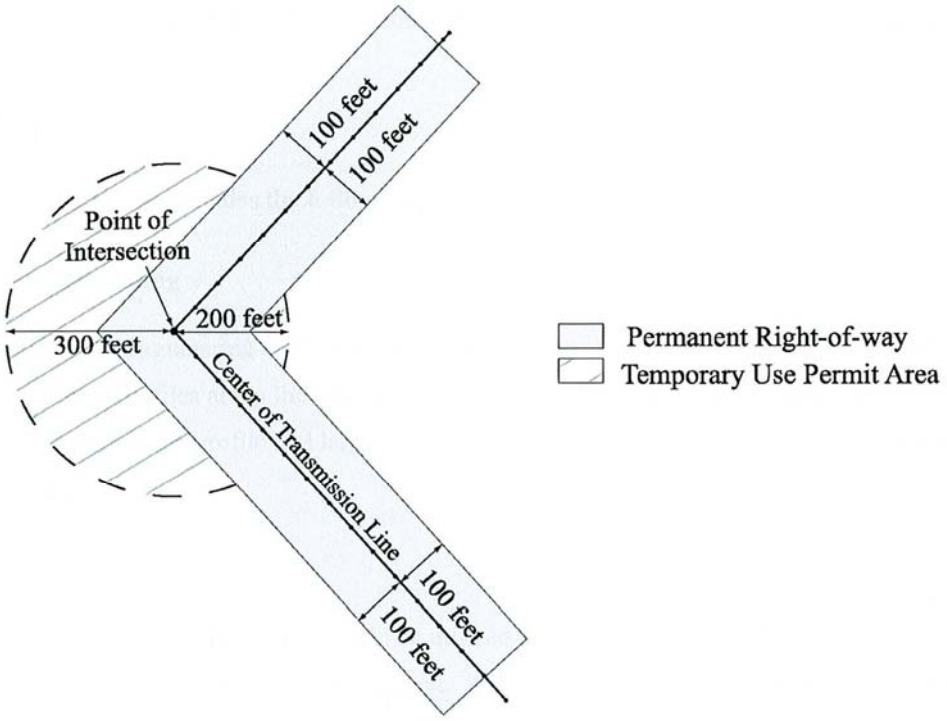
Construction of Tie-line and Temporary Use Areas

A right-of-way, 200 feet in width, and extending the length of the tie-line across National Forest System lands would be required. The right-of-way would extend 100 feet to either side of the tie-line structures. A portion of the proposed tie-line would follow an existing cattle trail west out of the proposed wind park to minimize new land disturbance. An authorization for the long-term use of existing and newly constructed roadways outside of the right-of-way would be obtained from the Forest Service.

Construction of the tie-line would require temporary construction areas extending outside of the 200-foot right-of-way. A temporary use permit for these areas would be obtained from the Forest Service. If additional areas are needed, they would be identified, discussed with the appropriate landowner, and all necessary environmental clearances would be performed. All land rights would be acquired in accordance with applicable laws and regulations governing acquisition of property rights.

Temporary use areas include staging areas, turning structures, and pulling/tensioning sites. Staging areas have been previously described. Pulling/tensioning sites would be located along the tie-line, spaced at 15,000- to 20,000-foot intervals. Each of these sites would be approximately 125 feet by 125 feet. For each turning structure, an area beyond the permanent right-of-way of up to 300 feet on the exterior angle and 200 feet on the interior angle of each turning structure would be required (Figure 2.2-15).

FIGURE 2.2-15
PERMANENT AND TEMPORARY USE AREAS FOR TURNING STRUCTURES



Structure Installation

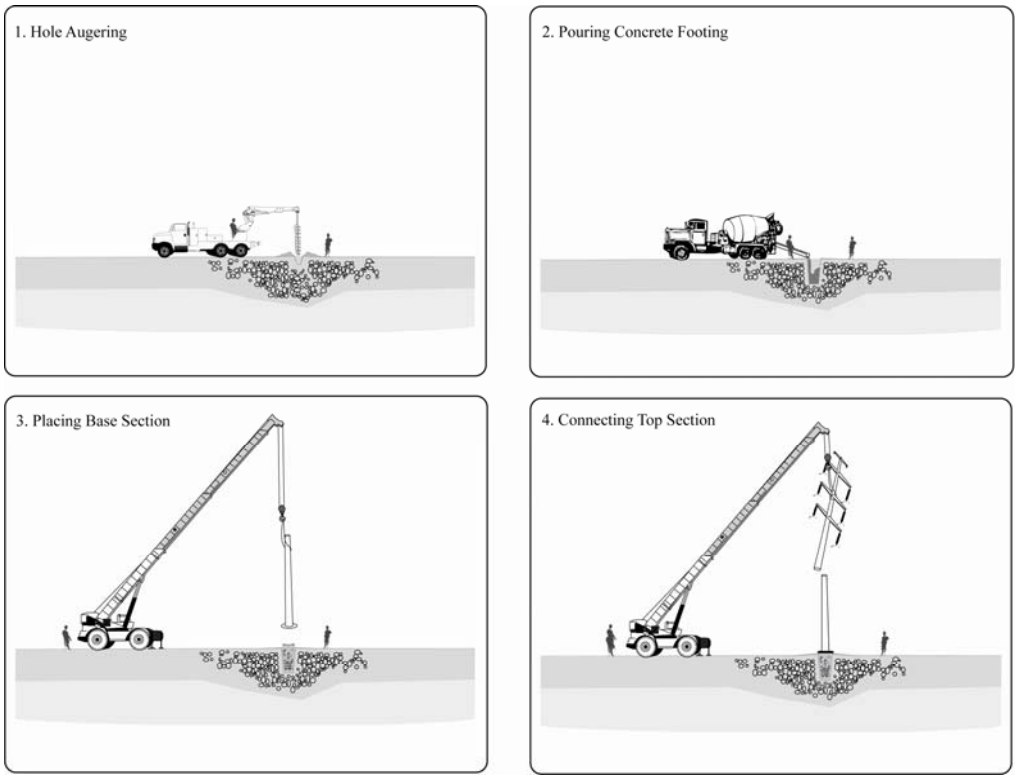
Each structure location would be determined and access to the site would be constructed as necessary. Structures would generally be spaced 1,000 feet apart; however this distance may vary depending on topography.

A foundation would be prepared at each structure site. Each foundation would be excavated using a power auger or drill. If rock is encountered, blasting may be required to break up the rock before the hole can be drilled. All safeguards associated with using explosives (e.g., blasting mats) would be employed. Once the hole is bored, a reinforcing steel cage would be inserted and then the hole would be filled with concrete to form the foundation. Concrete would be sourced from a portable batch plant, located within the wind park study area on private and/or State trust land and transported to each foundation location in a ready-mix concrete truck.

Sections of the new monopole structures and associated hardware would then be delivered to each structure site by flatbed truck. Erection crews would use a large crane to position the base section. The base would be secured to the concrete foundation. The remaining sections of the monopole structure would be lifted into place by the crane and secured. Typical steel monopole installation is depicted below in Figure 2.2-16.

While not anticipated at this time, difficult terrain may require that some structures be installed via helicopter.

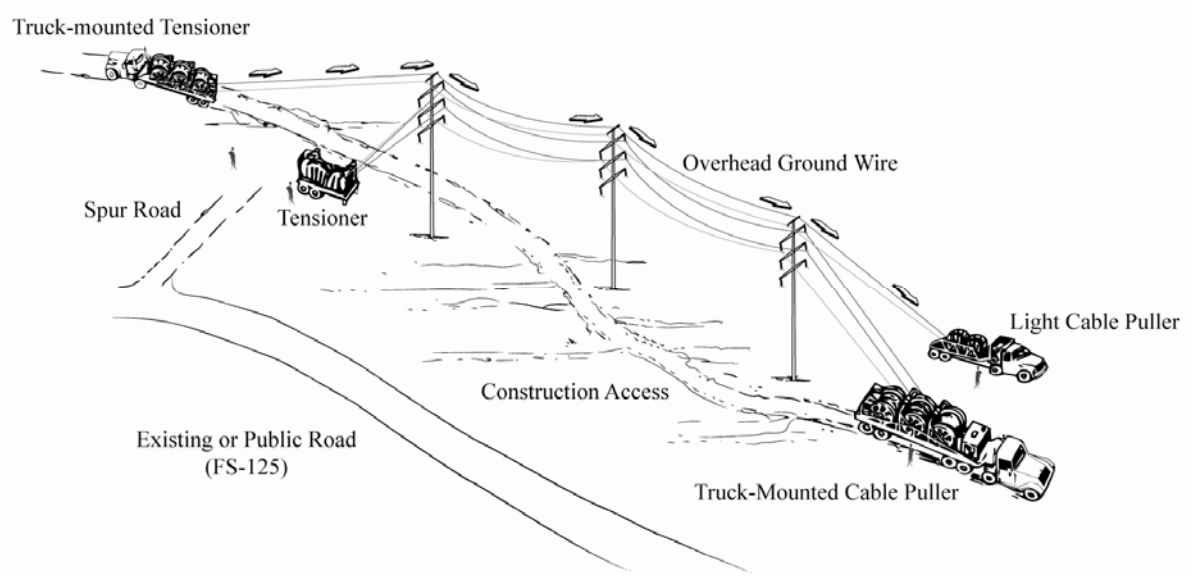
FIGURE 2.2-16
TYPICAL 345-kV STEEL MONOPOLE INSTALLATION



Installation of Conductors, Insulators, Hardware, and Shield Wires

The conductor and ground-wire stringing process is depicted in Figure 2.2-17.

FIGURE 2.2-17
CONDUCTOR AND GROUND WIRE STRINGING ACTIVITIES



Conductor

Conductors would be strung between the structures on the tie-line. Conductor is the wire cable through which the electric current flows. Three conductors would be required to complete a single electrical circuit. Conductors for this project would be steel reinforced aluminum. The aluminum carries most of the electrical current while the steel provides tensile strength to support the aluminum strands. The height of the conductors would be a minimum of 29 feet above the ground, based on standards set forth by the National Electric Safety Code (NESC). The minimum vertical conductor clearances in some instances may be greater in response to logistical requirements or more specific NESC requirements (e.g., sufficient altitude to clear remaining trees).

Once all the structures have been erected, the conductor would be put in place through a process known as “stringing”. Pulling and tensioning sites would be spaced at 15,000- to 20,000-foot intervals and would be located at each end of the tie-line alignment and at turning structures. Stringing equipment at each pulling site would be set up approximately 300 feet from the initial structure. Pulling sites would be about 125 feet by 125 feet, located along the transmission line centerline. Angle structure pulling sites would be located outside the right-of-way because of the need to pull the conductor on a straight line. Reels of conductor and overhead shield wire would be delivered to each of these pulling and tensioning sites. Some earth moving may be needed at pulling and tensioning sites.

Crews would then install insulators and sheaves using a cable truck and a truck with a person lift. Sheaves are rollers attached to the lower end of the insulators at the end of each structure cross-arm. The sheaves allow crews to pull sock lines (rope or wire used to pull power line conductors into place). Once

the equipment is set up, a light-weight vehicle would pull the sock line from one structure to the next. At each structure, the sock line would be hoisted to the cross-arm and passed through the sheaves on the ends of the insulators. The sock line would be used to pull the conductor through the sheaves. The conductors would then be attached to the sock line and pulled through each supporting structure under tension. After the conductors are pulled into place, they are pulled to a pre-calculated sag and then tension-clamped to the end of each insulator. Finally, the sheaves are removed and replaced with vibration dampers and accessories.

Insulators and Associated Hardware

Insulators made of an extremely low conducting material such as porcelain, glass, or polymer would be used to suspend the conductors from each structure. Insulators inhibit the flow of electrical current from the conductor to the ground, or from one conductor to another conductor. A permanent assembly of insulators would be used to position and support each of the three conductors to the structure. These assemblies are "I"-shaped. The assemblies of insulators are designed to maintain electrical clearances between the conductors, the structure, and the ground.

Overhead Ground Wires (Shield Wires)

To protect conductors from lightning, two overhead ground wires about one-half inch in diameter would be installed on top of the structures. Energy from lightning strikes would be transferred through the ground wires and structures into the ground. One ground wire may also contain fiber optic cable to serve, in part, as a communications system for the project.

2.2.2.3 Operations and Maintenance of the Tie-line

The transmission line would be operated from a remote power control center. The proposed transmission tie-line system would operate at 345-kV. The amount of power transferred along the conductors would vary depending on seasonal and time-of-day loads, as well as other system demands.

The proposed transmission system would be maintained by monitoring, testing, and repairing equipment. Typical maintenance activities include:

- Periodic routine aerial inspections, with emergency aerial inspections after storms, severe wind, lightning, other weather factors, wildfire, or reported vandalism.
- Periodic and emergency ground inspections.
- Routine maintenance to inspect and repair damaged structures, conductors, and insulators.
- Emergency maintenance to immediately repair transmission lines damaged by storms, floods, vandalism, or accidents. Emergency maintenance would involve prompt movement of crews to the site.
- Access road maintenance to regrade and fill gullies, clear and repair culverts, and repair erosion-control features and gates.
- Vegetation management activities would occur approximately every three to five years within the 200 foot wide right-of-way, consistent with standard practices, and would include cutting, trimming, lopping, and clearing trees, brush, noxious weeds, and undergrowth.

2.2.2.4 Summary of the Tie-line and Ground Disturbance and Reclamation Activities

Table 2.2-6 provides estimates of temporary and permanent ground disturbance associated with construction, operation, and maintenance of the proposed 345-kV transmission tie-line.

TABLE 2.2-6 GROUND DISTURBANCE ESTIMATES FOR TRANSMISSION TIE-LINE		
Facility	**Temporary Ground Disturbance (acres)**	**Permanent Ground Disturbance (acres)**
Mobilization and staging	12 – 18	0
Access and spur roads	18 – 24	18 – 24
Turning structures	24	0*
Structure installation	291 – 347	1
TOTAL	345 – 413	19 – 25
*Permanent disturbance associated with turning structures is incorporated under structure installation.		

Reclamation of Disturbed Areas

A 200-foot right-of-way is generally the area of potential construction disturbance. Additional disturbance would occur within a radius of 150 feet around each structure and within 300 feet of angle structures. Excess soils from structure construction would be spread at the structure location, or if necessary, transported to a suitable offsite disposal location. Temporarily disturbed areas associated with tie-line construction would be reclaimed. These efforts typically include gate repair (if utilized, and as necessary), regrading, revegetation, and waste material removal.

2.2.2.5 Tie-line Decommissioning

Once the wind park has reached the end of its useful life and is decommissioned, it is likely that the tie-line would also be decommissioned. Currently, the details of decommissioning the tie-line are not known. As such, the potential effects associated with decommissioning of the tie-line are not analyzed as part of this EIS.

2.2.3 Western's Switchyard

Western's proposed 345-kV interconnection switchyard would be located entirely on National Forest System lands about three-quarter mile north of FS 125 and generally within the rights-of-way of Western's two 345-kV transmission lines (Figure 2.2-18). The switchyard is expected to be approximately 650-feet wide by 1,000-feet long. The switchyard facilities would be constructed, owned, and operated by Western.

In general, switchyards contain electrical equipment that enables a utility to interconnect different transmission lines, disconnect lines for maintenance or outage conditions, and regulate voltage. The switchyard for this project would contain power circuit breakers, disconnect switches, steel busses, steel poles, cables, metering equipment, communication equipment, AC/DC batteries, and other equipment. A breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike, trees or tree limbs falling on a line or other unusual event. Disconnect switches are used to mechanically or electrically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers. Power moves within the switchyard and between breakers and other equipment on rigid aluminum pipes called bus tubing. This tubing is supported and vertically elevated by pedestals called bus pedestals. Figure 2.2-19 depicts a typical 345-kV switchyard.

FIGURE 2.2-18
WESTERN'S PROPOSED SWITCHYARD LOCATION

FIGURE 2.2-19
TYPICAL 345-kV SWITCHYARD

The proposed switchyard would include seven bays. Nine 345-kV power circuit breakers would be installed within the switchyard and used to automatically interrupt power flow on the transmission line at the time of a fault. Two bays within the switchyard would accommodate the wind generating facility. These two bays would include three 345-kV gas-filled breakers that would connect the proposed wind generating facility to the grid. The other bays would accommodate the Glen Canyon-Pinnacle Peak No. 1 and No. 2 transmission lines.

In addition, an oil-filled 10 MVA 345/34.5 KVA 277/480 volt transformer would be installed within the switchyard to provide station electrical service, since station service is unavailable from other sources. During the design of the switchyard, a determination would be made on the need for secondary containment per Clean Water Act requirements. If required, secondary containment would be installed within the substation to prevent the migration of oil from the substation site. Backup station service would be provided by an on-site generator located within the substation.

2.2.3.1 Engineering Surveys for the Switchyard

Pre-construction aerial and/or ground surveys would locate the switchyard property lines and corners; provide accurate ground profiles; locate structures; and determine the exact locations and rough ground profiles for new access roads. This information would help complete legal descriptions of properties to be used for the switchyard. Soils would be tested to determine physical properties, including the ability to support the proposed structures.

2.2.3.2 Construction of the Switchyard

The 345-kV switchyard would temporarily require about 24 acres during construction and 15 acres permanently. Construction of the switchyard would take place in approximately seven months over a two year period, depending on weather and outages required on the Western/Colorado River Storage Project system, and following equipment procurement and delivery. Construction would be completed by approximately 20 to 30 workers on site at any given stage of the construction process. Construction vehicles and equipment that would be needed for the construction of the switchyard include large cranes, heavy backhoe and earthmovers, large forklifts, and various power tools. Access roads would be constructed using typical road construction equipment, including a bulldozer, grader, front-end loader, and excavator.

Construction of the switchyard and interconnection facilities would involve several stages of work including access road construction and/or improvement; grading of the switchyard area; construction of foundations for transformers, steel work, breakers, control houses, and other outdoor equipment.

<u>Switchyard Mobilization and Staging</u>

A temporary staging area would be developed on approximately three to four acres adjacent to the switchyard site. The staging area would be used for construction safety meetings, to host office trailers, temporary sanitation stations, parking for equipment, vehicle parking for equipment operators and construction workers, and staging for limited project components.

The staging area would be prepared by clearing and grading as needed. The area would then be covered with four to six inches of gravel to provide a level ground surface. The gravel would be obtained from an outside contractor and trucking companies and would be certified weed free. Excess spoil material and topsoil salvaged from the site would be used for reclamation of the area after construction or for top-fill in other construction areas. Water or other approved dust suppressant would be used during the grading of the staging area.

Construction of Switchyard Access Roads

Primary construction and maintenance access to the switchyard site would come from Lake Mary Road to FS 125. A short piece of a paved segment of FS 125 may need to be modified within the existing road area to reduce the grade at a high point to facilitate passage of large equipment. From FS 125, the switchyard would be accessed via Western's current easement. An existing access road within this easement would be improved to allow movement of construction vehicles.

Improvements to Western's existing access road would involve vegetation clearing, excavating current groundcover to a depth of up to 12 inches, and placing approximately four to six inches of aggregate from off-site sources or the borrow pits located in the wind park study area. The road surface would then be graded and compacted. Berms and other drainage features would be constructed as required. Topsoil removed during road construction would be used for top fill, or stockpiled for berms and other drainage features.

Switchyard Site Grading and Preparation

The 15 acre site would be cleared and leveled with a grader and backhoe. The area would then be covered with about six inches of aggregate from an outside contractor and trucking companies and would be certified weed free. The primary purpose of the aggregate is to provide insulating properties to protect operation and maintenance personnel from electrical danger. Water or other approved dust suppressant would be used during the clearing and grading of the switchyard site. Less than ten acre-feet of water would be required at the switchyard site.

Installation of Components

Concrete footers and foundations would be poured for the bus work and control building. The concrete would come from an outside contractor. Transformers, breakers, control houses, and other outdoor equipment would be transported to the site for installation. Lastly, steel work and electrical work for all of the required terminations would occur.

Communication Facilities

Western requires dual and redundant communication with its switchyards. A microwave communication tower would be installed within the new switchyard to deliver signals to operate switchyard equipment from control centers and other remote locations, and to report metering. The microwave system would also provide voice communication from dispatchers to maintenance personnel. New communication equipment would be installed at the switchyard. Microwave communications require an unobstructed "line of sight" between antennas. A tower up to 60-feet high would be constructed at the switchyard, with a microwave antenna aimed toward an existing communication link on Mount Elden, approximately 25 miles northwest of the proposed switchyard site.

A second communication system would be provided by radio.

2.2.3.3 Construction of the Transmission Interconnection

Western would install four new in-lead dead-end structures to provide a tie with the new switchyard and the existing Glen Canyon-Pinnacle Peak transmission lines. Each dead-end structure would be a heavy duty galvanized steel monopole structure, and provide a tie into the new switchyard. It is envisioned that the new structures would be located on National Forest System lands within the existing Glen Canyon-Pinnacle Peak transmission line rights-of-way in the span between four existing towers near the proposed switchyard site. Also, depending on design considerations, existing structures near the new switchyard site may need to be modified to accommodate the interconnection. Once the new dead-end structures are installed, and upon completion of the new switchyard, the existing Glen Canyon-Pinnacle Peak

transmission lines' conductors in the span above the switchyard would be cut and attached to the new dead-end structures. New conductors would be installed from the new dead-end structures to A-frame tubular steel take-off structures within the switchyard, then on the bus tubing within the switchyard.

2.2.3.4 Operations and Maintenance of the Switchyard

Switchyard Start-Up

Switchyard start-up would follow a detailed plan for testing and energizing the step-up substation, tie-line, and interconnection switchyard in a defined sequence, with lock and tags on breakers to ensure safety and allow for fault detection prior to energizing any component of the system. Switchyard start-up would not require any heavy machinery to complete.

Operation and Maintenance Activities

During operation of the new switchyard, authorized Western personnel would conduct periodic inspections and service equipment as needed. Properly trained maintenance personnel would monitor and manage the use, storage, and replacement of gas-filled breakers to minimize any releases to the environment. During inspections, equipment would be monitored for detection of leaks and repairs would be made as appropriate.

The switchyard would be designed to operate from a remote location, and no permanent employees would be required.

Operation and Maintenance Access

Access to the switchyard for both construction and operation and maintenance would be from the existing access road associated with the Glen Canyon-Pinnacle Peak 345-kV transmission lines. This access road may be improved, but would remain open. Gates would be located at the entrance to the switchyard.

Communication Facilities

Communication facilities would be inspected and serviced as needed by authorized Western personnel.

2.2.3.5 Summary of the Switchyard and Ground Disturbance and Reclamation Activities

Temporary and permanent ground disturbance estimates from construction, operations, and maintenance of the switchyard are provided in Table 2.2-7.

TABLE 2.2-7
PERMANENT AND TEMPORARY GROUND DISTURBANCE ASSOCIATED WITH THE SWITCHYARD

Facility	Temporary Ground Disturbance (acres)	Permanent Ground Disturbance (acres)
Staging area	3	0
Access roads	2	2
Switchyard	15	15
In-lead Dead-end Structures	4	0
TOTAL	24	17

2.2.3.6 Switchyard Decommissioning

Once the wind park has reached the end of its useful life and is decommissioned, it is possible that Western's switchyard would also be decommissioned. Currently, the details of decommissioning the switchyard are not known. As such, the potential effects associated with decommissioning of the switchyard are not analyzed as part of this EIS.

2.3 ALTERNATIVE TRANSMISSION TIE-LINE CORRIDOR

Foresight, in coordination with the Forest Service, has proposed a route for the transmission tie-line as discussed in Section 2.2.2. The Forest Service has identified an alternative route for the transmission tie-line to address potential effects to visual resources. As with the proposed tie-line, a portion of the alternative tie-line would follow an existing cattle trail west out of the wind park to the top of Anderson Mesa. The proposed and alternative tie-line would then parallel FS 125 west to a point approximately one-third mile east of the intersection of FS 9483g. At this point, the alternative tie-line corridor would then proceed north approximately one-quarter mile before veering to the west into the interconnection switchyard (Figure 2.3-1). The wind park and interconnection switchyard would be located in the same location and constructed in the same manner as described under the Applicant's Proposed Project in Section 2.2.

Similar to the tie-line included in the Applicant's Proposed Project (Section 2.2.2), the alternative tie-line would require approximately 80 structures and would be approximately 15 miles long, extending 8.5 miles across National Forest System lands and 6.5 miles across State trust and private lands. The alternative action would result in slightly more ground disturbance than the tie-line associated with the Applicant's Proposed Project because it uses less existing roads. Ground disturbance for the alternative action is estimated to be 346-414 acres of temporary disturbance (approximately one acre more than the Applicant's Proposed Project tie-line) and 20 to 26 acres of permanent disturbance (approximately one acre more than the Applicant's Proposed Project tie-line).

2.4 NO ACTION ALTERNATIVE

Under the No Action Alternative, Western would deny the interconnection request and the Forest Service would not permit facilities to be placed on National Forest System lands. For the purpose of impact analysis and comparison in this Draft EIS, it assumed that the proposed wind park would not be built and the environmental impacts, both positive and negative, associated with construction and operation would not occur.

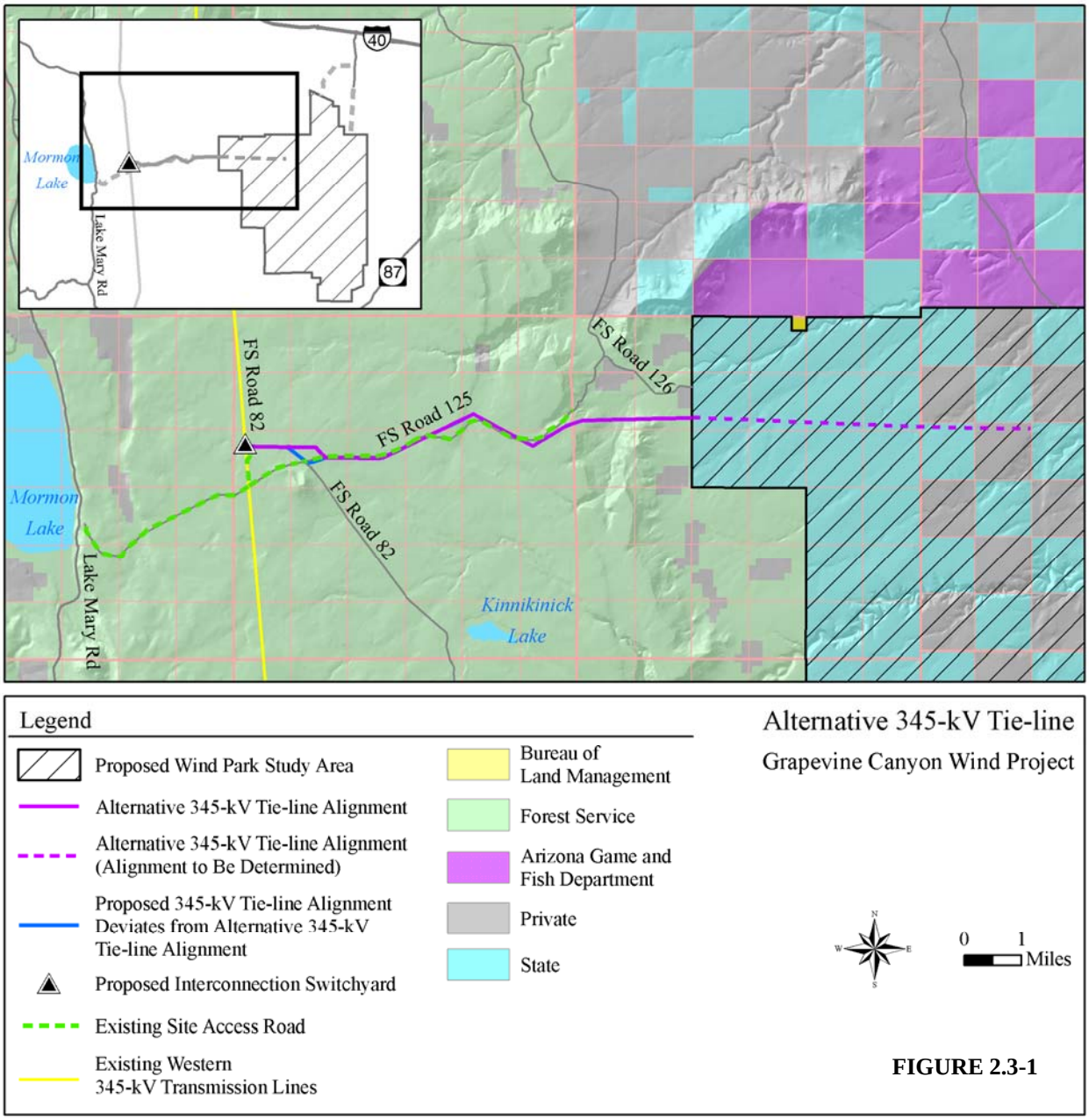

40
87
Mormon Lake
Lake Mary Rd
FS Road 82
FS Road 125
FS Road 126
FS Road 82
Mormon Lake
Lake Mary Rd
Kinnikinick Lake
Legend
Proposed Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Alternative 345-kV Tie-line Alignment (Alignment to Be Determined)
Proposed 345-kV Tie-line Alignment Deviates from Alternative 345-kV Tie-line Alignment
Proposed Interconnection Switchyard
Existing Site Access Road
Existing Western 345-kV Transmission Lines
Bureau of Land Management
Forest Service
Arizona Game and Fish Department
Private
State
Alternative 345-kV Tie-line
Grapevine Canyon Wind Project
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FIGURE 2.3-1

2.5 COMPARISON OF ALTERNATIVES

TABLE 2.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Land Use	Would result in a permanent conversion of 591-627 acres of land from grazing to other use. Approximately 99 percent of the wind park study area would remain available for grazing.	Would result in a permanent conversion of 592-628 acres of land from grazing to other use, slightly more than under the proposed wind park, tie-line, and Western's proposed switchyard. Impacts would not be noticeably different than those described under the proposed wind park, tie-line, and Western's proposed switchyard.	Would result in no change to existing land uses.
Biological Resources	Construction of the wind park is expected to temporarily disturb 2,050 to 2,193 acres and permanently disturb 555 to 570 acres of scrub-shrub, grassland and a small amount (less than two percent) of evergreen forest. Construction of the tie-line and switchyard is expected to temporarily disturb 345 to 413 acres and permanently disturb 19 to 25 acres of grassland, pinyon-juniper woodland, and a small amount (less than three percent) of ponderosa pine forest. Landcover types and habitats found within the wind park study area and adjacent to the tie-line and switchyard are not unique to the surrounding landscape or region. Special status plant species have highly restricted distributions and very specific habitat requirements and are not expected to occur within the wind park study area based on either an absence of habitat, range or distribution. Canyon bottoms containing riparian areas, deciduous woodlands, wetlands or waterbodies may support wetland and mesic plant species would be mostly avoided by wind park facilities.	Construction of the wind park is expected to temporarily disturb 2,050 to 2,193 acres and permanently disturb 555 to 570 acres of scrub-shrub, grassland and a small amount (less than two percent) of evergreen forest. Construction of the alternative tie-line and switchyard is expected to temporarily disturb 346-414 acres of temporary disturbance (approximately one acre more than the Applicant's proposed transmission tie-line alignment) and 20 to 26 acres of permanent disturbance (less than one acre more than the Applicant's proposed tie-line alignment). The alternative tie-line route would affect open grassland. Impacts to special status species; birds, raptors, and bats; and big game would not be noticeably different than those under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on biological resources.

TABLE 2.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Biological Resources (continued)	Federally-listed wildlife species that have at least low potential to occur within the wind park study area include the Northern Mexican gartersnake and the Chiricahua leopard frog. Implementation of these RPMs during construction and operation of the wind park facilities would minimize impacts to these species. Construction and operation of the proposed project may result in direct impacts to the birds, raptors and bats through collision and/or electrocution with the wind turbines and power lines. RPMs include additional pre-construction surveys, preparation of an Avian and Bat Protection Plan, constructing outside of bird nesting season or avoiding nest areas, adherence to the Avian Power Line Interaction Committee suggested practices for avian protection on power lines, and formal post-construction monitoring study designed to estimate and address avian and bat mortality. Construction activities may cause short-term impacts to big game such as antelope, mule deer and elk populations. Big game behavior and movement throughout the area of potential disturbance may be affected, but operation of project facilities is not expected to have long-term impacts on big game behavior or movement patterns. Population trends and habitat viability associated with these species would not be impacted by construction and operation of the wind park, tie-line, and switchyard.		

TABLE 2.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Cultural Resources	Would directly disturb between 2,419-2,630 acres of land within areas known to have been used prehistorically and historically. The development of wind park and tie-line facilities may also indirectly impact areas of interest to Native Americans, such as sacred areas, or areas used for collecting traditional resources, such as birds and medicinal plants. Visual impacts on significant cultural resources, such as sacred landscapes, historic trails, and viewsheds from other types of historic properties (e.g., homes and bridges) may also occur. In addition, there may be visual impacts on Traditional Cultural Properties (TCP) because the visible wind turbines may be perceived as an intrusion on a sacred or historic landscape that could result in a significant adverse effect to these TCPs	Would directly disturb between 2,420-2,631 acres of land within areas known to have been used prehistorically and historically, slightly more than the proposed wind park, tie-line, and Western's proposed switchyard. Impacts would not be noticeably different than those under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on cultural resources.
Geology and Soils	Would temporarily disturb between 2,419-2,630 acres of land and would permanently remove vegetation from and alter the surface of 591-627 acres of land. This would result in increased erosion and the permanent loss of soils.	Would temporarily disturb between 2,420-2,631 acres of land and would permanently remove vegetation from and alter the surface of 692-628 acres of land. Impacts would be slightly greater than those described under the proposed wind park, tie-line, and Western's proposed switchyard because the tie-line associated with the alternative action requires a new access road across moderately erosive soils that are difficult to revegetate.	Would have no effect on geology and soils.
Air Quality	Air quality impacts would be minimal, generally resulting from emissions and fugitive dust from equipment and vehicle operations during construction. RPMs have been identified to further reduce the effects to air quality and there would be no measurable impact.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on air quality.

TABLE 2.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Water Resources	Construction would require up to approximately 307 acre feet of groundwater if the wind park is built out to 500 MW. Operations would require a negligible amount of water. Soil erosion and sedimentation would increase as a result of the temporary disturbance of between 2,419-2,630 acres of land as would the permanent disturbance and removal of vegetation from 591-627 acres of land.	Construction and operations would require the same amount of water as the proposed wind park, tie-line, and Western's proposed switchyard. Between 2,420-2,631 acres of land would be disturbed temporarily and 692-628 acres of land would be permanently disturbed resulting in erosion and sedimentation. Impacts would not be noticeably different than those described under the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on water resources.
Socioeconomics	Would result in the employment of approximately 400 workers directly, or through local and regional construction and service contract firms, during peak construction activities and between 17-40 workers during regular operations for a typical 500 MW wind park, plus indirect economic impacts. This would lead to a slightly greater demand on public facilities, including schools. Vacancy rates in housing units in the region suggest capacity is available for this level of employment. In addition, the project would create a supplemental source of revenue to ranchers and State trust land beneficiaries, and provide new tax revenues to the County and State.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would not realize the economic objectives of the Diablo Canyon Rural Planning Area since no other economic development proposals are currently under consideration.
Environmental Justice	Would result in additional employment opportunities and tax revenue that would benefit directly or indirectly persons living below the Federal poverty level.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on environmental justice, beneficial or otherwise.
Transportation	Would result in a short-term (12-18 months per wind park phase) increase in construction related traffic of over 400 two-way vehicle trips each day on I-40 and Meteor Crater Road during peak construction activity, and approximately 25 two-way vehicle trips each day on Lake Mary Road and FS 125. It would result in a minimal long-term increase in vehicular traffic on I-40 and Meteor Crater Road.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on transportation.

TABLE 2.5-1
COMPARISON OF EFFECTS TO RESOURCES FOR ALTERNATIVES

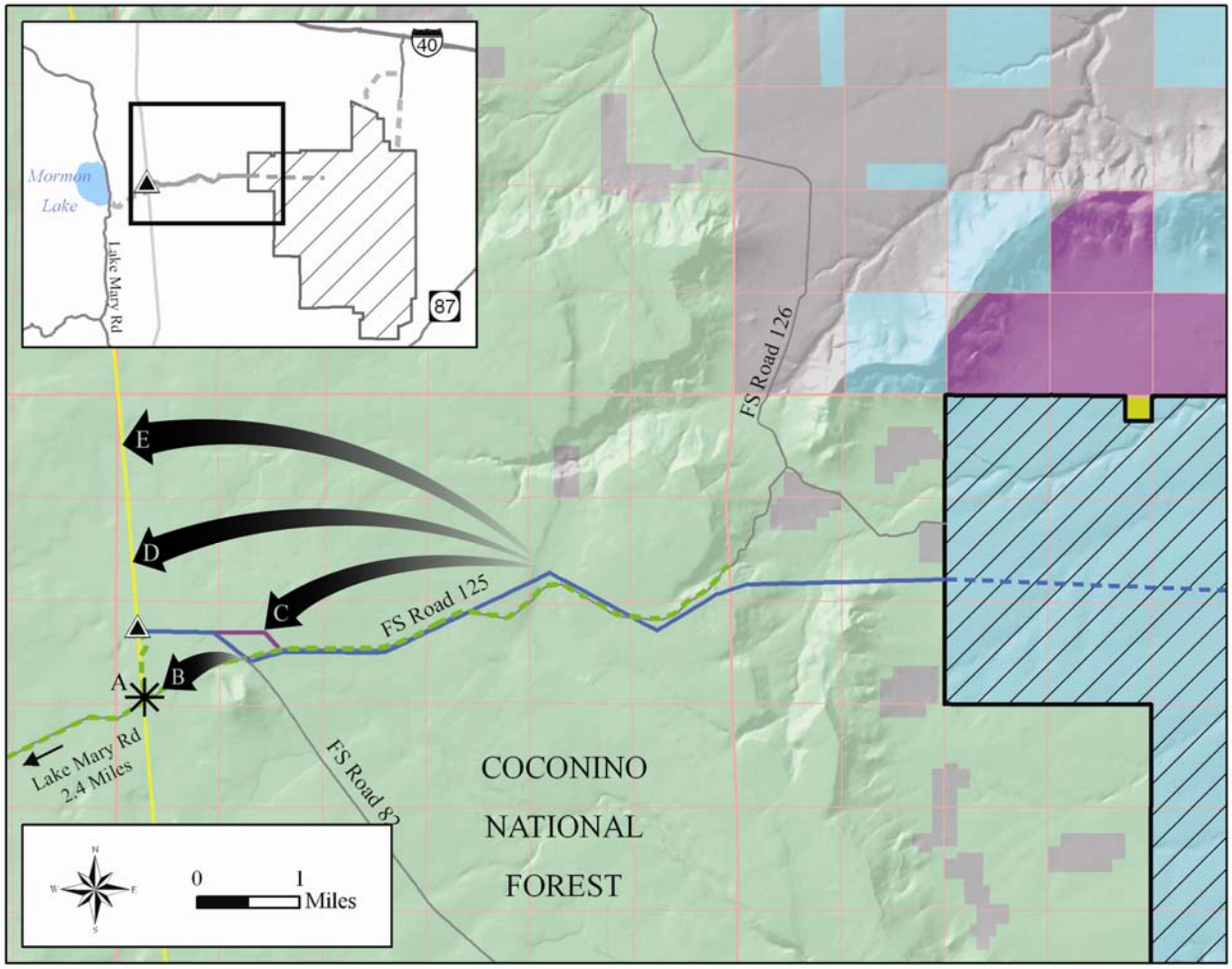
Resource	Proposed Wind Park (500 MW), Transmission Tie-line, and Western's Proposed Switchyard	Proposed Wind Park (500 MW), Alternative Transmission Tie-line Corridor, and Western's Proposed Switchyard	No Action Alternative
Health, Safety, and Security	Would create minimal occupational hazards, public safety, and environmental hazards during construction and operations.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on health and safety.
Noise	Construction equipment would elevate ambient noise levels substantially over the short-term (12-18 months per wind park phase) during certain construction activities, but operations would result in a minimal increase in ambient noise levels that would dissipate over a short distance.	Would be the same as the proposed wind park, tie-line, and Western's proposed switchyard.	Would have no effect on noise.
Visual Resources	Would result in a visual contrast by introducing contrasting elements of form, line, and color. In addition, the proposed tie-line would result in a Visual Quality Objective of Modification within an area on National Forest System lands managed for a Visual Quality Objective of Partial Retention.	Effects would generally be the same as those described under proposed wind park, tie-line, and Western's proposed switchyard, except the tie-line would be routed to avoid the more sensitive area (Partial Retention) on National Forest System lands.	Would have no effect on visual resources.

2.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM CONSIDERATION

Several alternatives to the location and/or design of the proposed Federal actions were considered during development of this project. An alternative was not carried forward for full analysis if there were issues with cost, construction feasibility, environmental resource sensitivities, and conformance with applicable land use plans. Based on this criteria, a number of alternatives were not carried forward for further consideration as described in Table 2.6-1, along with rationale for their elimination, and are roughly depicted on Figure 2.6-1. Alternatives addressing the location of the proposed wind park were not considered since no alternative locations were proposed during the EIS scoping process and decisions and actions related to the proposed wind park are outside of the decisions that will be made by Western and the Forest Service.

TABLE 2.6-1
ALTERNATIVES CONSIDERED BUT ELIMINATED FROM CONSIDERATION

Alternative Description	Rationale for Elimination	Figure 2.6-1 Location
Bury the transmission tie-line underground.	High costs for installation and repair, 2-4 times more expensive than overhead lines; adds considerable time for maintenance and repair. There would be more temporary land disturbance and environmental impacts versus overland structure placement as proposed.	—
Locate the interconnection switchyard at the intersection of FS 125 and the Western 345-kV transmission lines.	Would not provide a direct line of site to a communications tower atop Mt. Elden; would be located within an area managed by the Forest Service as Partial Retention for visual resources, and would require a Forest Plan amendment.	A
Site the transmission tie-line adjacent to FS 125 from the top of Anderson Mesa to the Western 345-kV transmission lines.	This site is located within an area managed for visual resources and would require a Forest Plan amendment.	B
Site the transmission tie-line approximately one-quarter mile north of FS 125.	Would be located within the foreground viewshed of FS 125 towards the San Francisco Peaks.	C
Site the transmission tie-line approximately one mile north of FS 125.	Would be located within the middleground viewshed of FS 125 towards the San Francisco Peaks; would be located within a prairie dog town.	D
Site the transmission tie-line approximately two miles north of FS 125.	Would be a considerably longer route affecting more wildlife habitat, including a prairie dog town and an area actively managed for pronghorn antelope.	E



Legend

- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Alternative 345-kV Tie-line Alignment
- Proposed Interconnection Switchyard
- Existing Site Access Road
- Existing Western 345-kV Transmission Lines
- Considered Interconnection Switchyard
- Considered 345-kV Tie-Line Corridor *Letter denotes description in text
- Bureau of Land Management
- Forest Service
- Arizona Game and Fish Department
- Private
- State Trust

Alternatives Considered but Eliminated from Consideration

Grapevine Canyon Wind Project

FIGURE 2.6-1

2.7 APPLICANT AND AGENCY RESOURCE PROTECTION MEASURES

The Applicant and agencies have proposed Resource Protection Measures (RPMs) by resource area for the proposed project and proposed Federal actions to minimize impacts associated with construction, operation, and maintenance. The Applicant and agencies have committed to these RPMs and they are included in the evaluation of environmental impacts. Western and the Forest Service do not have jurisdiction over the siting, construction, or operation of the proposed wind park, so their proposed measures only apply to the proposed switchyard (Western) and the proposed switchyard and tie-line (Forest Service). Western, Forest Service, and the Applicant are signatories on the Programmatic Agreement (PA) for compliance with the National Historic Preservation Act (NHPA), and thus would abide by the provisions in the PA addressing effects to properties on or eligible for listing to the National Register of Historic Places (NRHP).

The Applicant would follow standard construction practices, Best Management Practices (BMPs) and RPMs during the construction, operation, and maintenance of the proposed wind park and tie-line facilities; these measures may be imposed by State, local, or other jurisdictions as the result of approvals for storm water management, grading permits, building permits, etc. or would be implemented based on the Applicant's construction practices.

The Forest Service has proposed certain measures that would be binding on the Applicant for the proposed transmission tie-line and on Western for its proposed switchyard, if adopted by the Forest Service. In addition, Western requires its construction contractors to implement standard environmental protection provisions. These provisions are provided in Western's Construction Standard 13 (Appendix A) and would be applied to the proposed switchyard. Specific BMPs that the Coconino National Forest would require for soil and water resources for the proposed tie-line and switchyard, as well as invasive species management, are found in Appendix C. Table 2.7-1 below summarizes the Applicant's and agency's RPMs as would be applied to the proposed project components.

TABLE 2.7-1
PROJECT RESOURCE PROTECTION MEASURES

Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
LAND USE			
The Applicant would work closely with landowners to site access roads to minimize land-use disruptions to the extent possible.	X		
Applicant would consult the Arizona Game and Fish Department (AGFD) Ombudsman and file a petition with the Arizona Game and Fish Commission in the event an area requires a hunting closure during construction or operations.	X		
In the event of unexpected property damage caused by the activities during project construction, the Applicant, Forest Service, or appropriate authority would quickly investigate and reasonably attempt settlement with the party who incurred property damages.	X		X
Concrete wastes shall not be disposed of on any Western property, right-of-way, or easement; or on any streets, roads, or property without the owner's or land management agency's consent.		X	

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
BIOLOGICAL RESOURCES			
Special status species or other species of particular concern would continue to be considered during post-EIS phases of the proposed project's development following management policies set forth by the appropriate land or resource managing agency. This may entail conducting pre-construction surveys for plant and wildlife species of concern along access and spur roads, staging areas, and construction sites as agreed upon by the land or resource managing agency. In cases where such species are identified, appropriate action would be taken to avoid adverse impacts on the species and its habitat and may include, but is not limited to mitigation (such as habitat restoration or translocation) or altering the placement of roads or structures as practical and monitoring construction activities.	X		X
Prior to the start of switchyard construction, Western would provide training to all contractor and subcontractor personnel and others involved in the construction activity if there is a known occurrence of protected species or habitat in the construction area. Untrained personnel shall not be allowed in the construction area. Western would provide drawings or maps showing sensitive areas located on or immediately adjacent to the transmission line right-of-way and/or facility. These sensitive areas shall be considered avoidance areas. Prior to any construction activity, the avoidance areas shall be marked on the ground (no paint or permanent discoloring agent would be used) by Western. If access is absolutely necessary, the contractor shall first obtain written permission from Western, noting that a Western and/or other Federal biologist may be required to accompany personnel and equipment. Ground markings shall be maintained through the duration of the contract. Western would remove the markings during or following final inspection of the project.		X	
Prior to the start of wind park and/or tie-line construction, the Applicant would provide training to all contractor and subcontractor personnel and others involved in construction activities if there is a known occurrence of protected species or habitat in the construction area.	X		

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
If an active nest for a State or federally-listed species is found in the project area, the contractor shall immediately notify AGFD and provide the location and nature of the findings. The contractor shall stop all activity within 200 feet of the protected species or habitat and not proceed until directed to do so. The Forest Service would also be notified of the finding if on National Forest System lands.	X	X	X
Clearing activities associated with construction would occur outside of the bird nesting season in order to reduce impacts to breeding birds and their habitats to the extent possible, comply with the Migratory Bird Treaty Act and other Federal and State laws. Should habitat clearance activities be required during the nesting season – defined as March through September – biological monitors would inspect areas identified for ground clearing for active bird nests to prevent destruction of active nests.	X	X	X
In order to avoid or minimize risk of destruction of bat roost sites during the maternity season, clearing activities resulting in the destruction of snags suitable for roosting bats would be conducted to the extent possible outside the bat maternity season defined here as May through September. If clearing activities must occur during the maternity season, biological monitors would inspect snags immediately prior to clearing to prevent destruction of active bat roosts.	X	X	X
Additional bird and bat data collection may occur for potions of the wind park study area not already surveyed. For these areas, the Applicant may conduct additional pre-construction surveys for the project phase prior to siting turbines associated with each of the subsequent phases of the wind park. These surveys may include: • point count avian surveys; • surveys to identify raptor nests; • surveys for caves and/or ground fissures to identify potential bat roosting habitat within the wind park phase study area boundary as well as other potential roost sites in the general vicinity of the project phase. • acoustic surveys for bats; and • sensitive species surveys or habitat mapping.	X		

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
After the wind park begins operation, the Applicant would contract with experienced wildlife biologists to conduct a formal post-construction monitoring study designed to estimate avian and bat mortality. Post-construction mortality monitoring would be conducted by trained consultants to industry standard protocols, starting the first year after commercial operation begins. One year of post-construction monitoring would occur. However, if the first year's monitoring suggests an extraordinary fatality rate or where weather conditions are highly variable to substantially affect migration timing and testing, additional post-construction monitoring would occur. A summary of the results of post-construction monitoring would be shared with wildlife agencies.	X		
An Avian and Bat Protection Plan would be developed prior to wind park construction to help ensure the wind park is operated in an environmentally sustainable manner to minimize potential impacts to birds, bats, and other wildlife and their habitats, and to ensure compliance with applicable State and Federal laws. It would include, but not be limited to, construction requirements; post-construction avian and bat survey and reporting requirements; avian and bat mortality monitoring; and operational practices. Operational practices would be implemented for the project whereby iterative decision making (evaluating results and adjusting actions on the basis of what has been learned) would be undertaken to reduce impacts to biological resources. Operational practices may also be refined based upon observed impacts which have been documented as occurring at the project site. Data collected during monitoring studies or facility operation would be used to refine operational practices. Operational practices may involve consultation with experts, consultants, agency personnel, landowners, and other stakeholders. Operational practices may also be developed internally by the Applicant and implemented proactively.	X		
The transmission tie-line structures, conductors and design would meet suggested practices for avian protection on power lines, as determined by the Avian Power Line Interaction Committee (APLIC).	X		X
Applicant would adhere to BMPs provided in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona" (see Appendix C).	X		X

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
The wind park would seek to reduce impacts to wildlife by taking into consideration the recommendations as set forth in AGFDs Guidelines to Reducing Impact to Wildlife from Wind Energy Development in Arizona.	X		
Fill, rock, or additional topsoil would be obtained from the project area whenever possible. If rock or aggregate is obtained from off-site sources outside the project area, the material would be cleaned prior to entering the project site to prevent the introduction of invasive weeds and plant species.			X
Soil would be stored on or near its original location to minimize impacts to vegetation, reduce the potential for compaction and erosion of bare soils, and minimize the spread of invasive species.			X
All construction vehicles and equipment would be sprayed before initial ingress onto National Forest System lands. A high pressure hose would be used to clear the undercarriage, tire treads, grill, radiator, and beds of any mud, dire, and plant parts that may potentially spread the seeds of noxious plants.		X	X
The Applicant would use BMPs described in Forest Service Handbook (FSH) 2509.22 during construction and operation, including revegetating disturbed areas with native grasses and forbs.	X		X
The aerial limits of construction activities normally would be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents would be applied to rocks or vegetation to indicate limits of survey or construction activity.			X
Speed limits along the right-of-way and access roads would be restricted to 25 miles per hour to avoid possible collisions with birds, wildlife, or livestock.	X		X
CULTURAL RESOURCES			
Construction and operations activities would be consistent with the PA to ensure that any NRHP-eligible archeological sites and traditional cultural properties would be protected.	X	X	X
Consistent with the PA, TCPs or other sensitive areas identified by Tribes in advance of project design would be considered during project design and buffered to the extent practical.	X	X	X
The Applicant, Western, and the Forest Service, in advance of project micrositing, would make a reasonable effort to design the project in such a manner as to minimize impacts to NRHP listed and eligible properties. This may include siting project facilities to avoid specific cultural resource sites.	X	X	X

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
Tribes that are in the consultation process would be contacted by Western if archaeological resources or other properties of tribal interest are identified during construction. The Applicant and Western would act in accordance with the project's unanticipated discovery provisions of the PA.	X	X	X
The appropriate tribal representatives, State Historic Preservation Office (SHPO), and Forest Archeologist (if on National Forest System lands) would be contacted if a burial site is encountered during construction in accordance with the project's unanticipated discovery provisions of the PA. The Native American Graves Protection and Repatriation Act allows tribes to protect American Indian graves and to repatriate human remains.	X	X	X
No surface disturbance would occur within the boundary of any NRHP eligible property prior to completion of the field phase of a data recovery plan that would be reviewed and approved by the Arizona SHPO.	X	X	X
No surface disturbance would occur within the boundary of a site identified and recommended for listing under NRHP until its eligibility is determined. If a site is determined to be eligible, no surface disturbance would occur within the boundary of the site prior to completion of the field phase of a data recovery plan that would be reviewed by the PA signatories.	X	X	X
Prior to construction, all construction personnel would be instructed on the protection of cultural, paleontological, and ecological resources. To assist in this effort, the construction contract would address (a) Federal, State and tribal laws regarding cultural resources, fossils, plants and wildlife, including collection and removal; and (b) the importance of these resources and the purpose and necessity of protecting them.	X	X	X
GEOLOGY AND SOILS			
Except where necessary for the safe installation of the new structures, measures would be taken to confine vehicle traffic to the existing roads and minimize the disturbances to the soil protective mechanisms (i.e., vegetation and soil crusts).			X
If soil moisture would cause off-road rutting by construction equipment, movement of construction equipment may be temporarily discontinued if directed by the Forest Service for project elements located on National Forest System lands.			X

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
Temporary construction areas, access road buffer zones, temporary construction roads, and staging areas would be restored to a condition approximate or equal to that which existed prior to disturbance. Where necessary, land would be restored to its original contour and natural drainage patterns to facilitate natural revegetation, and prevent erosion.	X	X	X
Site-specific BMPs would be identified on the construction plans for the site slopes, construction activities, weather conditions, and vegetative buffers. The sequence and methods of construction activities would be controlled to limit erosion. Clearing, excavation, and grading would be limited to the minimum areas necessary to construct the project.	X	X	
The Applicant would use BMPs described in FSH 2509.22 during construction and operation of the proposed transmission tie-line to protect topsoil and to minimize soil erosion. Practices may include containing excavated material, applying water, use of silt fences, protecting exposed soil with fabrics (especially near wetlands), stabilizing restored material, and revegetating disturbed areas.	X		X
Construction managers would be careful to stabilize disturbed soils promptly to avoid erosion and invasive weeds. Disturbed areas would be seeded with a mix chosen with assistance from the landowner or land management agency to ensure it would meet their objectives.	X		X
Areas disturbed during site grading outside the switchyard's footprint and at the switchyard construction staging area would be regraded so that all surfaces drain naturally, blend in with the natural terrain, and prevent erosion or transport of sediments. If revegetation is required by the Forest Service, Western would use seed mixtures as recommended by the Forest Service.		X	X
Construction activities and revegetation efforts would avoid spreading subsurface soils over or mixing them with surface soils.			X
AIR QUALITY			
Unpaved access roads and areas scheduled for earthmoving activities would be watered or treated on a regular basis to minimize dust. Oil shall not be used as a dust suppressant.	X	X	
Stockpiled soils or materials would be covered or watered for a visible crust when not currently being used.	X		

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
Vehicles traveling on unpaved surfaces would be restricted to 25 mph or less to minimize the creation of dust.	X		
The Contractor and subcontractor machinery shall have, and shall use the air emissions control devices required by Federal, State or local regulation or ordinance.		X	
Burning or burying of waste material is not permitted.		X	
Dump trucks would be covered before traveling on public roads.	X		
Equipment would be shut off, rather than left idling between uses unless that equipment requires a significant start up or idling prior to use for proper operation.	X		X
The rock crusher would contain dust-suppression features including screens and water-spray.	X		
Operation of the rock crusher and concrete batch plants would require individual minor source permits or a combined general permit from Arizona Department of Environmental Quality (ADEQ). The construction contractor would obtain authorization to operate under the general permits available for these facilities and would comply with all terms and conditions of the permit(s).	X		
Western would ensure that construction activities and the operation of equipment are undertaken to reduce the emission of air pollutants. Western would require its construction contractor to submit a copy of permits for construction activities, if required, from Federal, State, or local agencies 14 days prior to the start of work.		X	
WATER RESOURCES			
Applicant would avoid, to the extent possible, placing temporary or permanent facilities in floodplains and washes.	X		
Construction activities would be conducted in a manner to minimize disturbance to vegetation, drainage channels, and stream banks.	X	X	X
An Arizona Pollutant Discharge Elimination System (AZPDES) permit would be obtained and a Stormwater Pollution Prevention Plan (SWPPP) prepared for disturbed areas include staging, parking, fueling, stockpiling, and any other construction related activities. The SWPPP would include both structural and non-structural BMPs.	X	X	

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
The Applicant would use BMPs during construction, operation, and maintenance of the site to protect topsoil and water resources and to minimize soil erosion. Practices may include containing excavated material, applying water, use of silt fences and fabrics, protecting exposed soil, stabilizing restored material, and revegetating disturbed areas with native species.	X		X
The SWPPP would be prepared by the Balance of Plant contractor when design level surveying, mapping, road design, collection system design, and all turbine locations are prepared for the wind park and tie-line alignment.	X		
Operational BMPs would be adopted as part of the SWPPP to implement good housekeeping, preventive and corrective maintenance procedures, steps for spill prevention and emergency cleanup, employee training programs, and inspection and record keeping practices, as necessary, to prevent storm water pollution.	X	X	
Site-specific BMPs would be identified on the construction plans for the site slopes, construction activities, weather conditions, and vegetative buffers. The sequence and methods of construction activities would be controlled to limit erosion. Clearing, excavation, and grading would be limited to the minimum areas necessary to construct the project.	X		X
In addition to BMPs identified in the SWPPP, the Applicant would adhere to site specific BMPs recommended by the Forest Service in FSH 2509.22.	X		X
A Spill Prevention, Control, and Countermeasure (SPCC) Plan would be prepared before construction to provide measures to prevent spills of pollutants, including hazardous materials, and respond appropriately if a spill occurs.	X		
Western would ensure that its construction contractor obtains a dewatering permit from the appropriate agency, if required for construction dewatering activities.		X	
Applicant would ensure that hazardous materials, fuels, and lubricants shall not be drained onto the ground or into drainage areas.	X		X
Watering facilities and other range improvements would be repaired or replaced if they are damaged or destroyed by construction activities to their condition prior to disturbance, as agreed to by the parties involved.	X		X

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
Western would require that its construction contractor control runoff from excavated areas and piles of excavated material, construction material or wastes (to include truck washing and concrete wastes), and chemical products such as oil, grease, solvents, fuels, pesticides, and pole treatment compounds. Excavated material or other construction material shall not be stockpiled or deposited near or on stream banks, lake shorelines, ditches, irrigation canals, or other areas where run-off could impact the environment.		X	
Western would not permit the washing of concrete trucks or disposal of excess concrete in any ditch, canal, stream, or other surface water. Concrete wastes shall be disposed in accordance with all Federal, State, and local regulations.		X	
TRANSPORTATION			
The Applicant would comply with all local, State and Federal transportation regulations and would develop a traffic control plan in consultation with the Coconino County Public Works Department prior to wind park and/or tie-line construction activities.	X		
Damaged streets or roadways caused by wind park and/or tie-line construction would be repaired to preconstruction condition in accordance with the appropriate jurisdictional authority.	X		
Wind park and/or tie-line construction crews would use regulation-sized vehicles, except for specific construction equipment which may haul oversized loads.	X		
Local hauling permits from appropriate agencies would be obtained prior to wind park and/or tie-line construction and adhering to their conditions.	X		
Wind park and/or tie-line construction equipment transport and deliveries would be scheduled to occur during the day to the extent practical to limit additional traffic during commuting hours.	X		
The Applicant would obtain Determination of No Hazard Air Navigation Permits for all structures over 200 feet from the FAA and an FAA-approved Lighting Plan.	X		
HEALTH, SAFETY, AND SECURITY			
During wind park and/or tie-line construction, standard health and safety practices would be conducted in accordance with the most recent Occupational Health and Safety Administration's (OSHA) policies and procedures.	X		

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
For the switchyard, Western's construction contractor would comply with the latest effective OSHA standards and other applicable Federal, State, and local regulations. During operations, facility maintenance would be conducted in accordance with Western's Power Safety Manual, which meets or exceeds OSHA requirements.		X	
Risk of construction-related injury would be minimized through regular safety training for construction personnel, use of appropriate safety equipment, and compliance with applicable construction safety standards.	X		
The Applicant would develop and implement an Emergency Response Plan for use during wind park and/or tie-line construction and operation. The plan should contain emergency fire precautions, notification procedures, and emergency response sequences.	X		
Security measures would be taken during construction and operation, including temporary and permanent (safety) fencing at the substation, warning signs, and locks on equipment and wind power facilities. Also, turbines would sit on solid steel enclosed tubular towers in which all electrical equipment would be located, within the towers except for the pad-mounted transformer and collection system. Access to the tower would only be through a solid steel door that would be locked when not in use.	X		
Security measures would be taken during construction and operation of the switchyard, including temporary and permanent (safety) fencing at the switchyard and warning signs.		X	
Access to the wind park and/or tie-line work site would be monitored, to the extent possible, to avoid unauthorized public access.	X		
Signs would be posted at the entrance of wind park project site access roads to alert the public and maintenance workers of potential ice shedding risks.	X		
A SPCC Plan would be prepared before construction to provide measures to prevent spills of pollutants, including hazardous materials, and respond appropriately if a spill occurs.	X	X	
Western would require its construction contractor to provide a Tanker Oil Spill Prevention and Response Plan as required by the U.S. Department of Transportation, if oil tankers with volume of 3,500 gallons or more are used as part of the project.		X	

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
During the design of Western's proposed switchyard, a determination would be made on the need for secondary containment per SPCC Plan requirements. If required, secondary containment would be installed within the substation to prevent the migration of oil from the switchyard site.		X	
Material Safety Data Sheets for potentially hazardous materials would be provided to local fire and emergency service personnel and to land management agencies.	X		
As dictated in the SPCC Plan, hazardous materials and petroleum products would not be drained onto the ground or drainage areas. Totally enclosed containment would be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials would be removed to a disposal facility authorized to accept such materials.	X		X
As dictated in the SPCC Plan, fuel or hazardous waste leaks, spills, or releases would be reported immediately to the appropriate land management agencies that administer the land where the incident occurs, as well as appropriate State or Federal agencies that regulate spills.	X		X
The proposed tie-line would be designed and operated to comply with industry best practices for controlling electric and magnetic fields.	X		
Any petroleum wastes generated would be handled and disposed of in accordance with local, State and Federal regulations.	X		
Western would require its construction contractor to dispose or recycle waste material in accordance with applicable Federal, State and local regulations and ordinances. No waste shall be left on Western property, right-of-way, or easement. Burning or burying of waste material is not permitted.		X	
Western would develop a Fire Plan, approved by the Forest Service, for the construction, operations, and maintenance of the proposed switchyard.			X
The Applicant would develop a Fire Plan, approved by the Forest Service, for the construction, operations, and maintenance of the transmission tie-line.			X
NOISE			
All engine-powered equipment would have mufflers installed according to the manufacturer's specifications and would comply with applicable equipment noise standards.	X		
Wind park and/or tie-line construction crews would locate stationary construction equipment a minimum of one-half mile from residences.	X		

TABLE 2.7-1 PROJECT RESOURCE PROTECTION MEASURES			
Resource Protection Measure	**Applicant (Wind Park and Tie-line)**	**Western (Switchyard)**	**Coconino NF (Tie-line and Switchyard)**
Wind park and/or tie-line construction operations would be primarily scheduled during daylight hours.	X		X
Residences within a mile of the wind park study area and land management agencies would be notified whenever extremely noisy work, including blasting, would occur.	X		
If helicopter construction is required, helicopter staging areas would be sited a minimum of one mile from residences. In addition, helicopter pilots would be instructed to avoid flight paths over residential areas, or other sensitive receptors.	X		
VISUAL RESOURCES			
Clearing of the tie-line right-of-way shall be performed so as to minimize landscape impact and preserve the natural beauty to the maximum extent possible. Except for danger trees, no clearing shall be performed outside the limits of the right-of-way.	X		X
Industry-standard finishes (neutral white) would be used for the WTG towers, nacelles, and rotors to minimize contrast with the sky backdrop.	X		
Neutral gray and non-reflective finishes would be used for all permanent structures that are part of the tie-line. Non-reflective steel should be used in the switchyard where possible due to forested nature of that site.	X		X
Exterior lighting on the turbines required by the FAA would be kept to the minimum number and intensity required to meet FAA standards.	X		
Outdoor lighting at the O&M facility, substation, and switchyard would be limited to the minimum required for safety and security; except for the switchyard, sensors and/or switches would be used to keep lighting turned off when not required; and lights would minimize backscatter and offsite light as required by the Coconino County lighting ordinance.	X	X	X

CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter discusses environmental and human resources including areas such as land use and economics which may be affected by the Grapevine Canyon Wind Project, and describes the environmental consequences (direct and indirect impacts) of the proposed wind park, transmission tie-line, and Western switchyard. The discussion of these topics under each resource section is structured into the Affected Environment and Environmental Consequences. The Affected Environment describes the existing conditions within the study area specific to the resource or other areas of interest to establish the base condition. As part of this description, a resource evaluation area is described. The resource evaluation area is the physical area that bounds the environmental, sociological, economic, or cultural feature of interest that could be impacted by construction and operation of the proposed project. The boundary of the resource evaluation area varies depending on the resource being analyzed.

The Environmental Consequences sections under each resource are the scientific and analytical basis for the EIS and provide an assessment of potential impacts resulting from implementation of the proposed project. An environmental impact is a change in the status of the existing environment as a direct or indirect result of the proposed project or the No Action Alternative. Impacts can be direct or indirect; positive (beneficial) or negative (adverse); and permanent (long-term) or temporary (short-term). Direct impacts are those that are the result of construction, operation and/or maintenance, whereas indirect impacts generally occur following construction and may not be directly related to the project. Short-term impacts are generally associated with the construction phase of the project, while long-term impacts remain for the life of the proposed project and beyond. To define the criteria for impact evaluation, "thresholds of significance" for a given environmental effect are provided for each resource area. These thresholds of significance establish benchmarks for increasing levels of effects, the highest of which is "significant impact". Per 40 CFR 1508.27, "Significantly" as used in NEPA requires considerations of both context and intensity: (a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. (b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.[1]

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[1] The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Mitigation to reduce possible project effects, are embedded as part of the Applicant's Proposed Project and Western's proposed switchyard, and include Forest Service measures that would be implemented on National Forest System lands for the proposed transmission tie-line and switchyard. The mitigation includes the RPMs in Table 2.7-1. The Applicant, Forest Service, and Western committed to this mitigation prior to the evaluation of environmental impacts.

After discussion of impacts by resource section, this chapter also addresses Short-term Uses and Long-term Productivity, Unavoidable Adverse Effects, and Irreversible and Irretrievable Commitments of Resources. A discussion of Cumulative Impacts for the project is provided in Chapter 4.

3.1 LAND USE

3.1.1 Affected Environment

3.1.1.1 Resource Evaluation Area

The land use evaluation area includes the proposed wind park and primary access routes, the proposed tie-line right-of-way, and the proposed Western switchyard, as well as a two-mile buffer extending beyond each of these three components. This two-mile buffer is the distance within which existing or proposed land uses could be directly or indirectly affected by the proposed project components, considering the location and height of the WTGs, and the level of noise expected during construction, operation and maintenance of the wind park, tie-line, and switchyard.

3.1.1.2 Characterization

Information was collected for the land use evaluation area on land ownership and jurisdiction, existing land use, zoning, and planned land uses. Inventoried data were gathered through aerial photograph interpretation, field verification, and review of various documents including the Coconino County Comprehensive Plan, Coconino County Zoning Ordinance, Coconino National Forest Plan, and Diablo Canyon Rural Planning Area (RPA), a 2005 amendment to the Coconino County Comprehensive Plan. In addition, jurisdictional websites were accessed for information, and discussions were held with agency staff.

Land Ownership and Jurisdiction

Land ownership and jurisdiction depicts the limits of administrative or jurisdictional control maintained by the major landholders located in the vicinity of the proposed project components (Figure 3.1-1). Land status designations are important to the siting of wind parks, transmission lines, switchyards, and related access roads because they influence or directly determine such things as expenditure of management funds, land use and zoning regulations, and administrative planning goals for particular parcels or districts.

The private and State trust lands within the land use evaluation area fall under the jurisdiction of Coconino County. The private lands are owned by the Flying M Ranch, and the Bar T Bar Ranch and the State trust lands are administered by the ASLD.

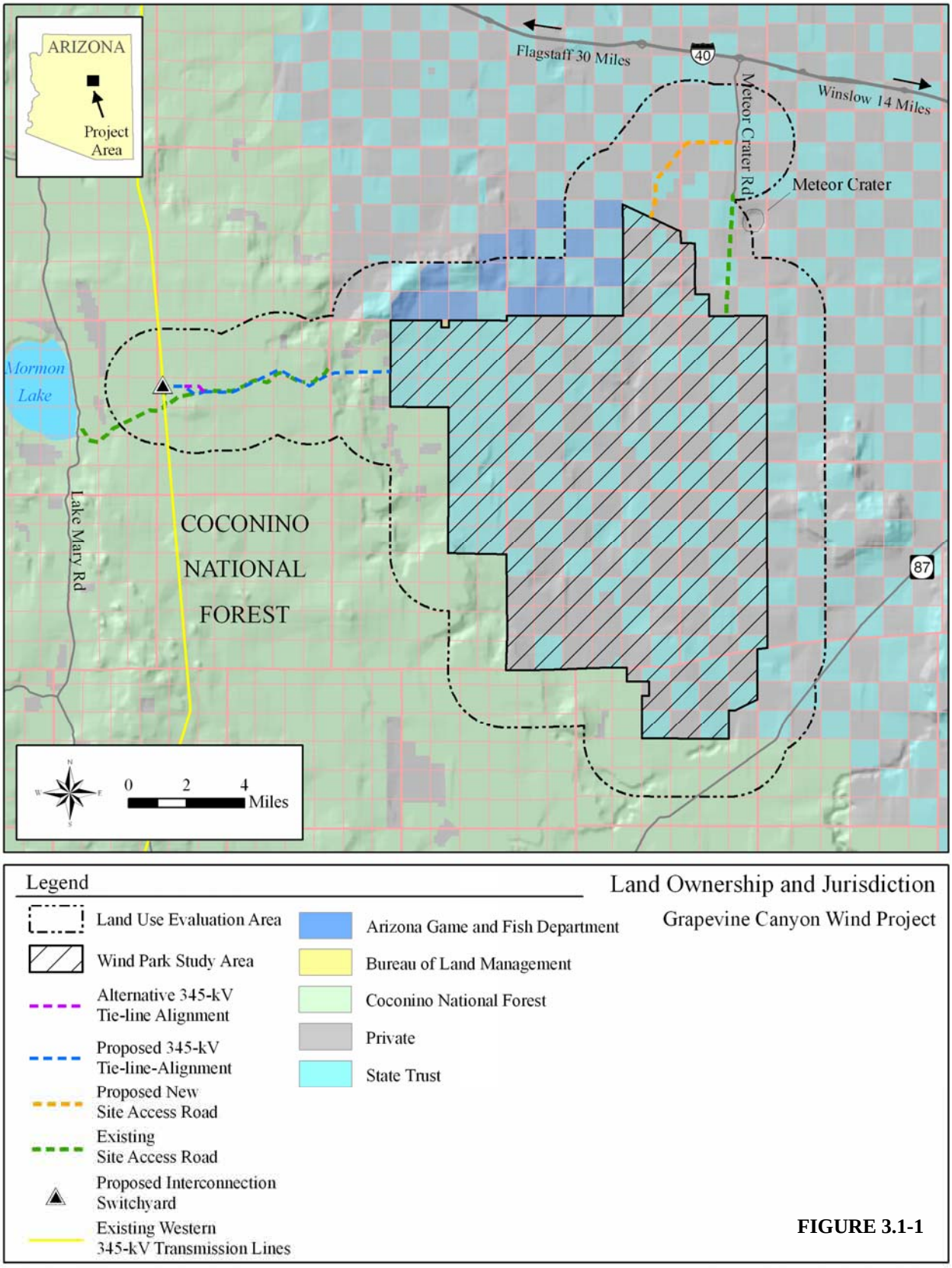

ARIZONA
Project Area
Flagstaff 30 Miles
40
Winslow 14 Miles
Meteor Crater Rd
Meteor Crater
Mormon Lake
Lake Mary Rd
COCONINO NATIONAL FOREST
87
0 2 4 Miles
Legend
Land Use Evaluation Area
Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-line-Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Lines
Arizona Game and Fish Department
Bureau of Land Management
Coconino National Forest
Private
State Trust
Land Ownership and Jurisdiction
Grapevine Canyon Wind Project

FIGURE 3.1-1

Flying M Ranch is a combination of a number of historic homesteads which were purchased over the years by the Metzger family, with its first claim filed on Anderson Mesa in 1914. The ranch covers approximately 90,000 acres, a quarter of which is located on private land, and the remainder of which consists of Forest Service grazing allotments and ASLD grazing leases.

The land that comprises Bar T Bar Ranch has been acquired from several ranches by the Tremaine and Chilson families since as early as 1913. Bar T Bar extends across approximately 326,200 acres. The ranch is located on private land, ASLD grazing leases, and Forest Service grazing allotments. Bar T Bar Ranch is now in its third generation of ownership and operation by the Chilson family.

Lands administered by ASLD are scattered throughout the land use evaluation area and typically have grazing leases. A portion of these lands, external to, and north of the wind park study area, make up the Raymond Ranch Wildlife Area. The Raymond Ranch Wildlife Area is managed by AGFD. The ranch was acquired by AGFD in 1942 and is 14,637 acres in size, of which 9,438 acres are owned in fee and the remainder are leased from ASLD for grazing. Initially the AGFD operated ranch was managed to provide winter range to the pronghorn antelope. However in 1945, a small herd of bison was introduced to the ranch and the management objectives of the ranch were expanded to include these animals. Today, the ranch provides range for many species of big game and the management objectives have continued to evolve. Currently the grazing of livestock is prohibited on all lands operated as part of the Raymond Ranch Wildlife Area.

In addition, Federal lands are located within the land use evaluation area, generally west of the proposed wind park study area. The vast majority of Federal land within the land use evaluation area is under the jurisdiction of the Forest Service. National Forest System lands are administered for multiple uses. They are primarily used for grazing but also for dispersed uses such as recreation, hunting, and other forest management activities. An isolated parcel of land, approximately 40 acres in size, is under the jurisdiction of the U.S. Department of the Interior, Bureau of Land Management (BLM), Hassayampa Field Office, and is located external to and just north of the wind park study area.

Existing Land Use

Developed land use within the land use evaluation area is limited to a few scattered residences, outbuildings, corrals, and limited commercial development. The closest residences are located near the northwest corner of the wind park study area, which is the location of the Flying M Ranch winter headquarters. The vast majority of the land use evaluation area, including Federal and State trust lands, is used primarily for grazing (Figure 3.1-2). Some of these lands are also used for recreation.

Two commercial developments are located near the land use evaluation area. Meteor Crater, an impact crater created by a meteorite approximately 50,000 years ago (Meteor Crater Enterprises, Inc), is located approximately two miles external to and northeast of the wind park study area (Figure 3.1-3). Meteor Crater Enterprises, Inc. operates a museum, gift shop, and fast-food restaurant near the north rim of the crater. In addition, Meteor Crater Enterprises operates another development located at the Meteor Crater Road exit, south of I-40. The development includes an RV park, convenience market with gas sales, and a fast-food restaurant. Business offices for Meteor Crater Enterprises are also located in this development.

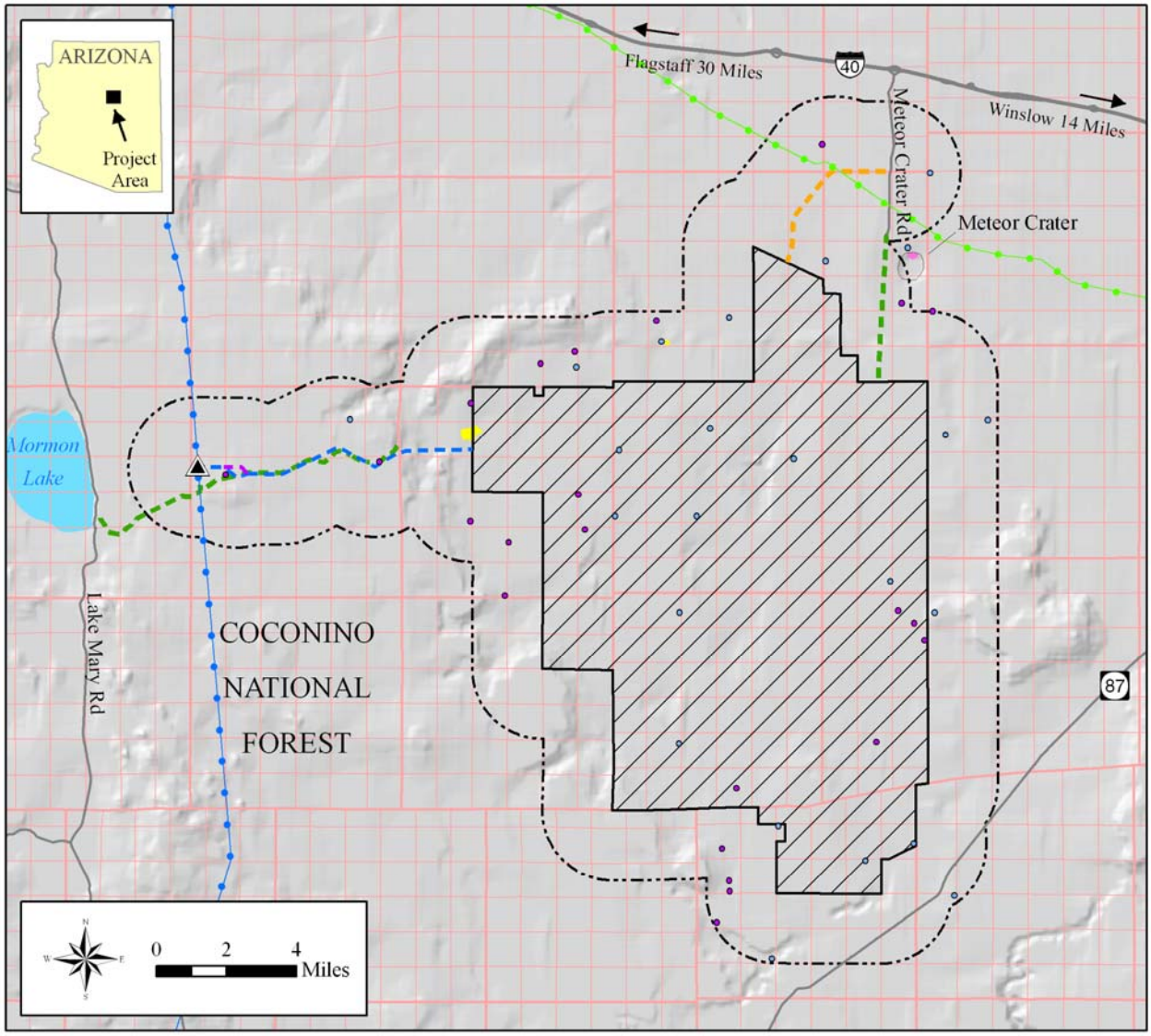
Other land uses within the land use evaluation area include roads, electrical and natural gas transmission lines, and a number of livestock tanks and wells. The Glen Canyon-Pinnacle Peak 345-kV transmission lines, operated by Western, are located approximately seven miles west of the wind park study area. The transmission lines travel in a north-south direction and are supported by steel lattice towers. These lines carry electricity from Glen Canyon Power Plant on the Colorado River and the Navajo Generating Station near Page, Arizona to the metropolitan Phoenix area. Western's proposed switchyard would interconnect with these transmission lines for the proposed wind park. Existing land uses are illustrated in Figure 3.1-4.

FIGURE 3.1-2

Open range land on Anderson Mesa within the land use evaluation area (transmission tie-line).

FIGURE 3.1-3

Meteor Crater located north and east of the wind park study area is over 4,000-feet across and 570-feet deep. The crater, privately owned by Meteor Crater Enterprises, has been a popular tourist attraction since the early 1900s.



Legend

- Land Use Evaluation Area
- Wind Park Study Area
- Alternative 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Commercial
- Residential
- Well
- Livestock Tank
- Existing Western 345-kV Transmission Lines
- Gas Pipeline

Existing Land Use

Grapevine Canyon Wind Project

FIGURE 3.1-4

Agriculture and Grazing

There are no agricultural lands actively under cultivation and no lands are classified as prime farmland by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) within the land use evaluation area.

Livestock grazing, especially cattle grazing, is the dominant land use and occurs throughout the majority of the land use evaluation area on Federal, State trust, and private lands. Livestock grazing is authorized on lands administered by the Forest Service and ASLD by permit only. Permits are issued over a specified length of time for a specific unit of land, referred to as a grazing allotment on Federal land and a grazing lease on State trust land. Grazing allotments on National Forest System lands are expressed in terms of total animal unit months (AUMs), and grazing leases on State trust land are expressed in animal units (AUs). An AU is defined as one mature (1,000 lb.) cow or the equivalent based on an average consumption rate of 26 pounds of forage dry matter per day, and one AUM is the amount of forage required by an AU for one month, or the tenure of one AU for a one-month period. Grazing allotments and leases within the land use evaluation area, including acres and AUMs/AUs specific to each unit, are depicted Figure 3.1-5.

Recreation

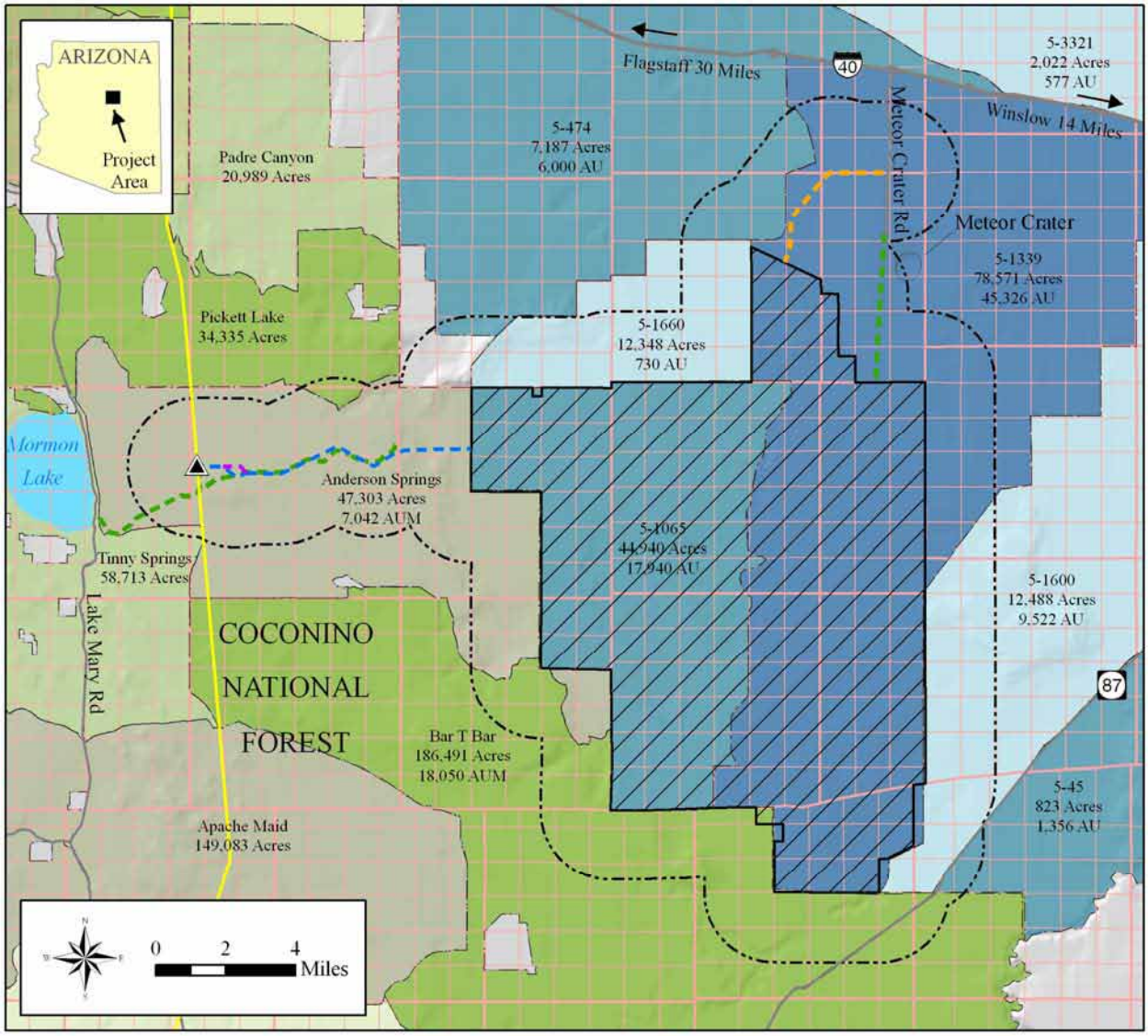
Federal lands are considered public. Public lands under the jurisdiction of the Forest Service and BLM are managed for multiple uses, including recreation. National Forest System lands within and surrounding the land use evaluation area offer a variety of recreation opportunities including boating, swimming, fishing, camping, all-terrain vehicle use, picnicking, hiking, rock climbing, horseback riding, mountain biking, and hunting. Recreation in the vicinity of the proposed transmission tie-line is mostly dispersed in nature and includes camping in the Pine Hill area, located toward the western end of the proposed tie-line and alternative (Figure 3.1-6). Jacks Canyon, considered one of the best sport climbing locations in the country, is located just south of the wind park study area (Figure 3.1-7).

Although State trust lands managed by ASLD are not considered public land, the opportunity for dispersed recreation on these lands is available within the land use evaluation area, but requires a permit.

The AGFD-managed Raymond Ranch Wildlife Area, located just north of the wind park, study area is open to camping, hunting (in season), and wildlife viewing.

Hunting in the State of Arizona is regulated by the AGFD, which mandates hunting season dates, legal wildlife, the number of permits authorized, and licensing fees. All valid hunting licenses are also issued by the AGFD. Hunting is permitted within the land use evaluation area, subject to Federal and State regulation, local ordinances, and seasons. Hunting is allowed on State trust lands through a recreation permit and on private land with permission from landowners.

Big and small game hunting currently occurs throughout the land use evaluation area. This area sits within the AGFD's Game Management units 5A and 5B, managed by the Flagstaff regional office. Figure 3.1-8 depicts the location of these management units with respect to the land use evaluation area. Game species include antelope, band-tailed pigeon, black bear, cottontail rabbit, deer (mule and white-tailed), elk, Merriam's turkey, mountain lion, tree squirrel, and waterfowl. Hunting seasons vary by species, but generally occur between the months of August and December. Hunts for big game species are issued on a draw basis and are generally limited to one animal of each species type, per hunter, per calendar year. The number of tags per Game Management Unit varies by year and species and is determined by AGFD.



Legend

- Land Use Evaluation Area
- Wind Park Study Area
- Alternative 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line-Alignment
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Lines
- Federal Grazing Allotments
- State Land Grazing Leases

Grazing Leases and Allotments

Grapevine Canyon Wind Project

FIGURE 3.1-5

FIGURE 3.1-6

Anderson Mesa, located within the land use evaluation area (transmission tie-line), on the Coconino National Forest. The foreground shows FS 125 and Pine Hill is shown in the background on the left.

FIGURE 3.1-7

Jack's Canyon located just south of the wind park study area.
Located online at http://farm1.static.flickr.com/193/444408908_8ef56fc300.jpg.

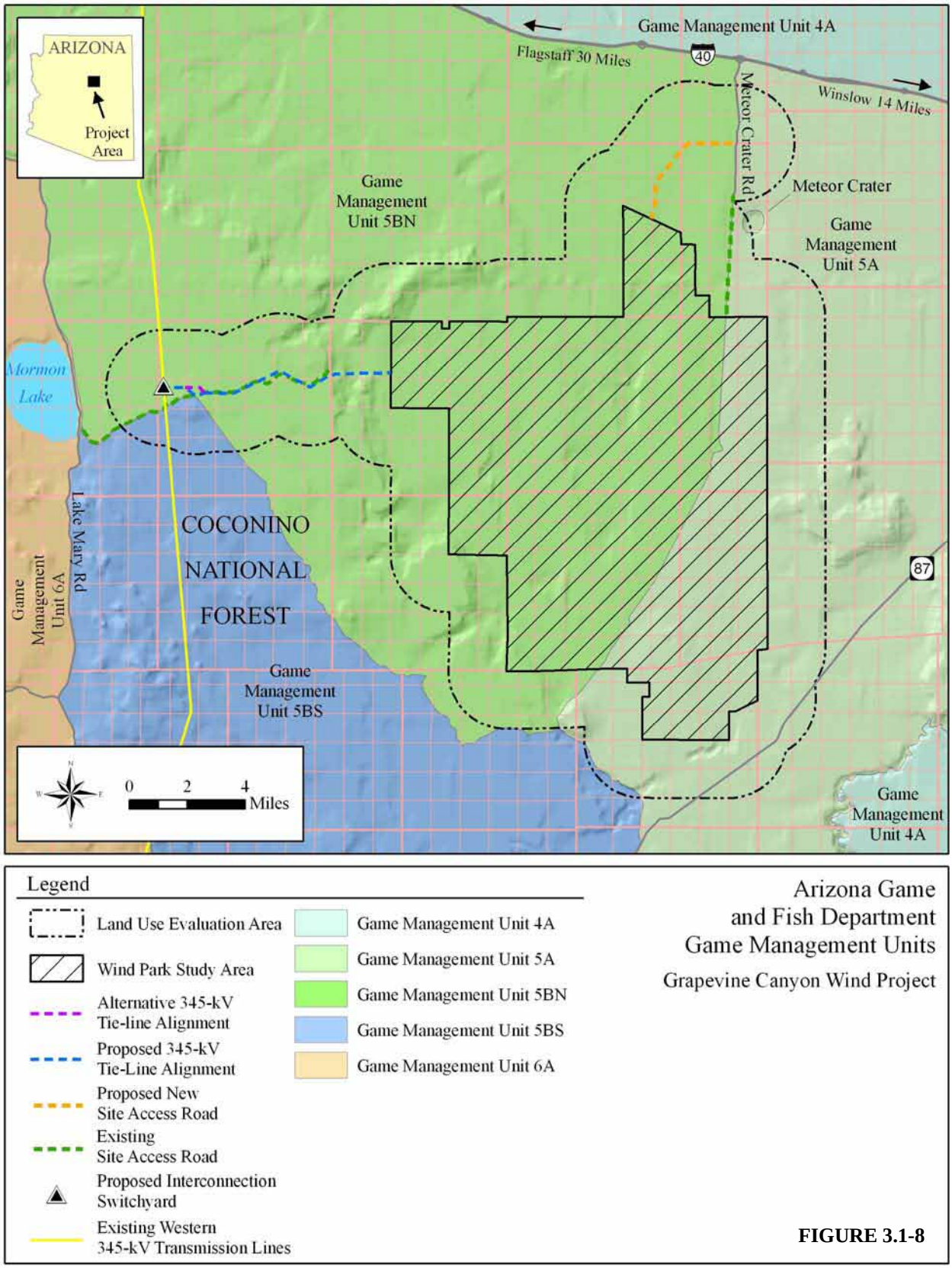

ARIZONA
Project Area
Game Management Unit 4A
Flagstaff 30 Miles
40
Winslow 14 Miles
Meteor Crater Rd
Meteor Crater
Game Management Unit 5BN
Game Management Unit 5A
Mormon Lake
Lake Mary Rd
COCONINO NATIONAL FOREST
Game Management Unit 6A
Game Management Unit 5BS
87
0 2 4 Miles
Game Management Unit 4A
Legend
Land Use Evaluation Area
Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-Line Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Lines
Game Management Unit 4A
Game Management Unit 5A
Game Management Unit 5BN
Game Management Unit 5BS
Game Management Unit 6A
Arizona Game and Fish Department Game Management Units
Grapevine Canyon Wind Project

FIGURE 3.1-8

Zoning

Zoning is the single most commonly used legal device for implementing a land use plan or for controlling the type of development within a given area. Zoning is an exercise of police power. This police power resides with the Arizona State government whose purpose is to promote the health, safety, and general welfare of the community. Most State legislatures delegate the power of zoning to local governments, and this is true of Arizona as well. The source of statutory authority for the Zoning Code is in the form of the State enabling act. Specifically, this authority is granted to counties from the Arizona Revised Statute (ARS) Title 11. Section 11-821 allows for the creation of county zoning regulations and county zoning districts, Section 11-829 authorizes rezoning and zoning code amendments for counties, and Section 11-808 gives the Zoning Inspector authority for zoning enforcement and interpretation.

All privately owned land and State trust land within the land use evaluation area is located within the jurisdiction of Coconino County and is zoned G (General – 10 Acre Minimum). This zoning district is a general rural land use category intended for application to those unincorporated areas of the County, with parcels of ten acres or more, not specifically designated in any other zone classification. Only those uses which are complementary and compatible with a rural environment are permitted, including very low density residential development, as well as agricultural-related uses. Certain uses, including wind turbines and other utilities, are possible in this zone with the approval of a Conditional Use Permit.

Applicable Land Use Plans

Coconino National Forest Land Management Plan

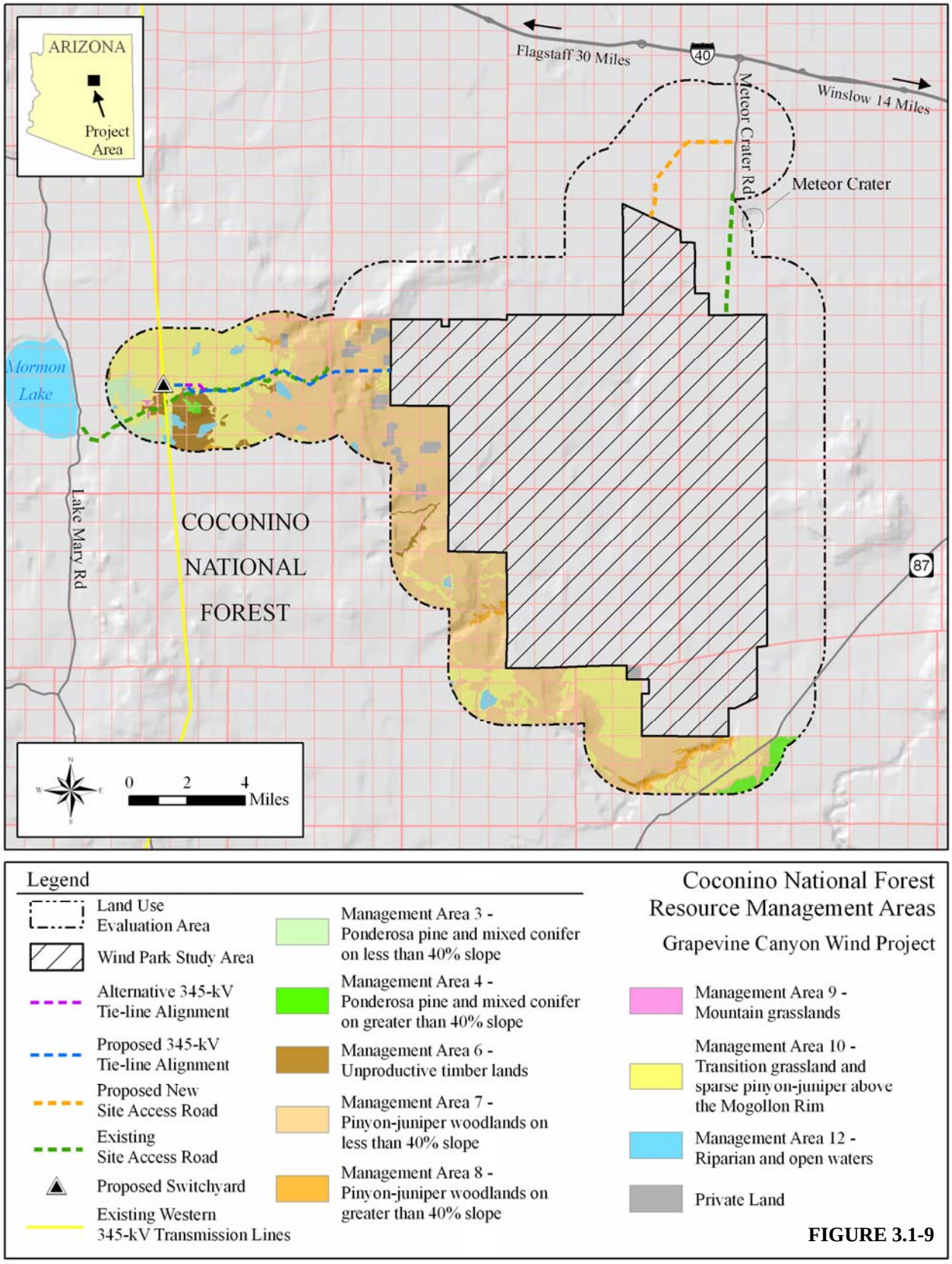
The Coconino National Forest Land Management Plan provides guidance on electrical transmission corridors. The Forest Plan explains that requests for electrical transmission corridors should be based on public need, economics, and environmental impacts. Utility corridors are managed to maintain resource conditions to the extent possible.

The proposed and alternative tie-line and the proposed switchyard are subject to the Forest Plan. The Forest Plan does not prohibit the occurrence of the facilities on National Forest System lands, but requests that existing corridors be used whenever possible. Further, the Forest Plan states that when a new corridor is determined necessary it should be sited to avoid wilderness areas, Research Natural Areas, geological and botanical areas, the Elden Environmental Study Area, ponderosa pine and mixed conifer vegetation types, and impacts to threatened and endangered species.

The land use evaluation area is located within eight Management Areas (Figure 3.1-9). The proposed Western switchyard is located within Management Area 10 (Pinyon-juniper Woodland), and the proposed and alternative tie-line traverses Management Areas 7 (Grassland and sparse Pinyon-juniper) and 10. The wind park study area does not fall within any Management Areas, since it is not located on National Forest System lands. In general, guidelines for these Management Areas promote wildlife habitat, particularly for indicator species; watershed condition; livestock grazing; and well-planned use of natural resources (e.g., timber, and maintenance and protection of scenic quality) (Forest Service, Southwestern Region 1987).

Coconino County Comprehensive Plan and Diablo Canyon Rural Planning Area

The Coconino County Comprehensive Plan is the document that guides the County on a course of action to manage growth, preserve the quality of life, and ensure sustainability. The ultimate goal of the plan is to present one document that reflects a County-wide consensus and ensures a coordinated effort between incorporated cities and towns, Federal, State, Native American, and regional agencies, and public/private service providers. Additionally, this plan aims to meet required State law “to conserve the natural resources of the County, to insure efficient expenditure of public funds, and to promote the health, safety, convenience, and general welfare of the public.”


ARIZONA
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Flagstaff 30 Miles
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87
0 2 4 Miles
Legend
Land Use Evaluation Area
Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-line Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Switchyard
Existing Western 345-kV Transmission Lines
Management Area 3 - Ponderosa pine and mixed conifer on less than 40% slope
Management Area 4 - Ponderosa pine and mixed conifer on greater than 40% slope
Management Area 6 - Unproductive timber lands
Management Area 7 - Pinyon-juniper woodlands on less than 40% slope
Management Area 8 - Pinyon-juniper woodlands on greater than 40% slope
Management Area 9 - Mountain grasslands
Management Area 10 - Transition grassland and sparse pinyon-juniper above the Mogollon Rim
Management Area 12 - Riparian and open waters
Private Land
Coconino National Forest
Resource Management Areas
Grapevine Canyon Wind Project

FIGURE 3.1-9

The County looks at Federal and State trust lands as open space. Open space is "primarily undeveloped land that provides scenic, ecological, or recreational values". The County's goal is to "ensure the preservation of open space." Additionally, the Comprehensive Plan lists the goal for utility services and corridors as "Promote the installation of utilities in a manner compatible with community character, scenic resources, and ecological integrity," and a policy that "Utilities infrastructure shall be located in a manner sensitive to environmental and scenic resources." Transmission lines over 115-kV are exempt from local jurisdiction.

Private lands within the land use evaluation area are located entirely within several large ranches. A Comprehensive Plan goal is to "preserve working ranches, unfragmented landscapes, and the County's natural character." In order to accomplish this goal, an additional method for long-term planning has been provided through the use of a Rural Planning Area (RPA). One such RPA has been created within the land use evaluation area, the Diablo Canyon RPA which was a 2005 amendment to the Coconino County Comprehensive Plan (Figure 3.1-10).

The idea of an RPA was created by statute to provide a means of preserving traditional ranches for conservation. Specifically, the statute states that an RPA is an area created by petition of owners of a majority of the property to prepare a plan that emphasizes voluntary, non-regulatory incentives for accommodating the continuation of traditional rural and agricultural enterprises; designated by the Board of Supervisors under ARS §11.806.D.3.

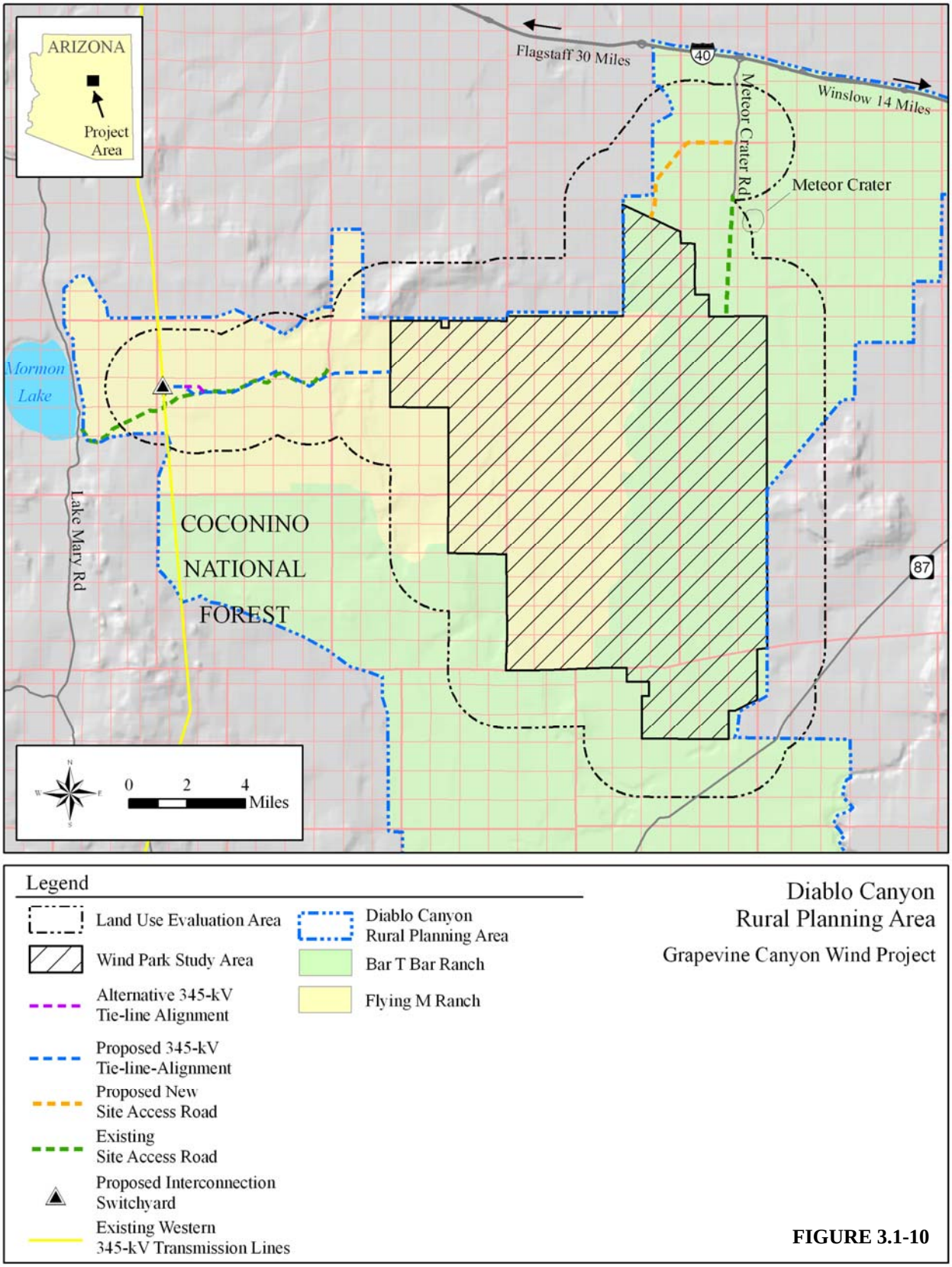
The Diablo Canyon RPA was established by the Coconino County Board of Supervisors on March 11, 2003, at the request of the Bar T Bar and Flying M Ranches, whose grazing leases and allotments are incorporated into the plan area (Figure 3.1-10). The final plan was approved by the Coconino County Board of Supervisors on August 16, 2005, and adopted as an amendment to the Coconino County Comprehensive Plan. The primary objectives of the Diablo Canyon RPA are to maintain historic ranching operations and address various economic opportunities as possible alternatives to supplement the cost of ranching and various range improvements.

Economic opportunities identified by the Diablo Canyon RPA include: 1) value added beef; 2) tourism, recreation, and education; 3) wood products; 4) energy development; 5) housing; 6) land protection options; and 7) other ideas to consider.

Specifically, the goal of the Diablo Canyon RPA with respect to energy development is to "facilitate the development of alternative energy projects while maintaining the integrity of the ranches and preserving aesthetics and views." Two forms of alternative energy production were considered in detail, including biomass and wind. Wind has been studied in Coconino County for the past several years. The studies identified several sites throughout the County with potential wind resources sufficient to justify a wind park, including the majority of the Diablo Canyon RPA.

Proposed Land Use

There are no other proposed developments within the land use evaluation area (Coconino County Community Development Department 2009). Regionally proposed projects include the Sunshine Wind Park, located just north of the wind park study area. The Sunshine Wind Park includes approximately 40 state-of-the-art wind turbines that would provide 60 MW of generating capacity, enough electricity to serve the average annual electricity needs of more than 14,000 homes. This project received a Conditional Use Permit from Coconino County in early 2005 for the construction of up to 40 turbines. The project would advance pending a power purchase agreement (Sunshine Wind 2009).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Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Lines
Diablo Canyon Rural Planning Area
Bar T Bar Ranch
Flying M Ranch
Diablo Canyon Rural Planning Area
Grapevine Canyon Wind Project

FIGURE 3.1-10

In addition, several meteorological (met) towers have been installed throughout Coconino County, used to gather wind data necessary for the site evaluation and development of wind energy projects. Locations of the towers, and the associated owners, include the following:

- Sempra Energy has seven met towers and is negotiating a lease agreement with the Navajo Nation. Sempra has been working with the Cameron Chapter of the Navajo Nation for more than two years on developing a 500-MW wind power plant on Gray Mountain near Cameron, Arizona. Sempra has filed for interconnection into the Moenkopi-Eldorado Transmission Line, and has begun the environmental and cultural monitoring that will be required by the Navajo Nation and the NEPA process. Sempra expects to begin construction of an initial 250-MW phase in 2011.
- Northern Arizona University has been monitoring wind power since 2005 at several locations: five met towers at Aubrey Cliffs and one at Aubrey Valley near Seligman, Arizona; two met towers on Babbitt Ranches; and two met towers at Gray Mountain.
- Foresight Wind has permits for five met towers at Aubrey Cliffs near Seligman, Arizona, on the Big Boquillas Ranch operated by the Navajo Nation. The Big Boquillas Ranch is comprised of intermingled State trust lands and private lands owned in fee simple by the Navajo Nation.

The County Community Development Department was not aware of any other proposed projects, including large-scale residential or commercial developments, within 25 to 30 miles of the land use evaluation area.

3.1.2 Environmental Consequences

3.1.2.1 Standards of Significance

Within the land use evaluation area, the following types of potential land use impacts are considered significant if the Applicant's Proposed Project or the proposed Federal actions and alternatives would:

- Result in the loss of a residence or business structure.
- Create unresolved conflict with existing utility rights-of-way.
- Permanently remove acres of land from grazing to the point it affects the economic viability of the ranching operation.
- Cause major conflicts to established recreational areas.
- Eliminate, or severely curtail, the opportunity for hunting in the area.
- Conflict with adopted land use plans and goals of the community or area in which they are located, including open space designations, game management areas, or other types of areas designated for preservation.

3.1.2.2 Applicant's Proposed Project and Proposed Federal Actions

Wind Park

Land Ownership and Jurisdiction

The wind park study area would be located entirely on private and State trust land, under the jurisdiction of Coconino County. Lease agreements would be negotiated between the landowners and Foresight (Applicant), including a long-term right-of-way from ASLD. These leases would allow construction and operation of the wind park over a negotiated term. In exchange, each landowner, including the Flying M Ranch, Bar T Bar Ranch, and ASLD would receive financial compensation on an annual basis.

Existing Land Use

The proposed wind park would be located on largely undeveloped land used for grazing. Existing residences and other ranch structures are located just outside of the wind park study area and would not be

directly affected by project implementation. A buried natural gas pipeline is located within the wind park study area. Wind turbines would be placed outside of the pipeline right-of-way and no impacts to the pipeline would be expected. The proposed wind park would not cause any unresolved conflicts with any other utility right-of-way, and listed land use significance standards listed in Section 3.1.2.1 would not be exceeded.

Grazing

Grazing is the predominant land use occurring throughout the wind park study area and would be allowed to continue as a compatible land use. The construction of the proposed wind park, if fully built out to 500 MW, would result in the temporary loss of 2,050 to 2,193 acres of grazing land, resulting in the temporary loss of approximately 1,010 to 1,080 AUs. With the proposed reclamation of disturbed areas not needed for permanent facilities, grazing land temporarily disturbed would return to production within approximately three years of the completion of construction activities. The placement of WTGs and access and service roads within the wind park study area would permanently remove 555 to 570 acres of land from grazing, if fully built out to 500 MW, resulting in a permanent loss of approximately 273 to 281 AUs, less than one percent of the total for the wind park study area. More than 99 percent of the wind park study area would remain available to ranching and the economic viability of the ranching operations would not be affected by the permanent removal of up to 570 acres of grazing land and the significance criteria related to grazing would not be exceeded.

Temporary and permanent acres of grazing land and the number of AUs that would be lost with the construction of the proposed wind park are shown in Table 3.1-1 arranged by ranch and ASLD lease number.

TABLE 3.1-1
SUMMARY OF THE EFFECTS OF THE 500 MW WIND PARK ON GRAZING

Ranch Name	Lease Number	Acreage within Wind Park	Total AUs within Wind Park	Temporary Land Disturbance[1] (%)	Temporary Grazing Impacts (AUs)[2]	Permanent Land Disturbance[1] (%)	Permanent Grazing Impacts (AUs)[2]
Flying M Ranch	5-1065	44,940	17,940	973-1,041 acres (2.2-2.3%)	389-415	263-270 acres (0.6%)	105-108
Bar T Bar	5-1339	49,742	28,695	1,077-1,152 acres (2.2-2.3%)	621-665	292-300 acres (0.6%)	168-173
TOTAL		94,682	46,635	2,050-2,193 acres (2.2-2.3%)	1,010-1,080	555-570 acres (0.6%)	273-281

[1] assume a proportionate distribution of land disturbance
[2] assume forage and capacity is even across all lands

Recreation

There would be no impacts to established, designated recreation areas. The proposed wind park would be located on a combination of private and State trust lands for which AGFD issues hunting permits. By law, no State trust lands can be closed to hunting or fishing without the consent of AGFD, and no person may lock a gate blocking access to these lands (ARS § 17-304 and Arizona Administrative Code R12-4-110). In the event it is determined that an area located on State trust lands should be closed to hunting during construction of the proposed wind park, the Applicant would consult with the AGFD as required, and a temporary impact to hunting would occur. However, hunting is likely to be allowed throughout portions of the wind park study area located on State trust land once wind park operations begin. Thus, long-term opportunities for hunting in the wind park study area are not expected to be severely curtailed or eliminated, and significance criteria related to recreation would not be exceeded.

Zoning

The proposed wind park is not a permitted use within the County's General zone. However, wind turbines may be allowed within the zone subject to approval of a Conditional Use Permit. The Applicant would obtain this required permit from Coconino County prior to beginning construction on any portion of the proposed wind park. With the issuance of the Conditional Use Permit, there would be no conflict with existing land use plans.

Applicable Land Use Plans

The overarching goal of the Diablo Canyon RPA is to supplement ranching operations with additional economic opportunities that allow for continued operations of ranches within the RPA. The proposed wind park would be located entirely within the Diablo Canyon RPA and would be consistent with its adopted land use plans and goals. The proposed wind park is, in fact, a proposed land use that enhances the General Plan goals of economic development for rural areas, and therefore represents a positive influence for the area to continue as a viable economic community into the foreseeable future.

Tie-line

Land Ownership and Jurisdiction

The proposed transmission tie-line would be located on private, State trust, and National Forest System lands. An agreement would be made between the private landowners and Foresight (Applicant) to secure a lease or right-of-way easement for these lands. Additionally, a 200-foot right-of-way would be obtained from ASLD and the Forest Service for the use of these lands. The Applicant would be responsible for the payment of fees required for the use of private, State trust, and Federal lands.

Existing Land Use

The proposed transmission tie-line is located within portions of an existing cattle trail and adjacent to portions of an existing roadway. The cattle trail extends from the Flying M Ranch winter range (wind park study area) to the summer range on top of Anderson Mesa. Short-term impacts during tie-line construction may occur to cattle moving along this trail; however, this would be considered a minor impact because construction of the tie-line would be scheduled to avoid conflicts with the limited timeframes in which cattle would use the trail. Long-term impacts to the cattle trail and movement of cattle between the winter and summer ranges would be minimal, and may be beneficial, because the tie-line would create a wider area cleared of vegetation that could be used by the cattle.

Grazing

Grazing occurs throughout the tie-line study area and would be allowed to continue once the tie-line is constructed and operating. The construction of the tie-line would result in the temporary loss of 345 to 413 acres of land and the permanent removal of 19 to 25 acres of land from grazing. Impacts to grazing would be distributed between the Anderson Springs Allotment and ASLD Lease No. 5-1065, both part of the Flying M Ranch. However, with the proposed reclamation of disturbed areas not needed for permanent facilities, grazing land temporarily disturbed would return to production within approximately three years of the completion of construction. This would result in a minimal loss of land available to grazing and would not affect the economic viability of the ranching operations. Therefore, the significance standard associated with grazing would not be met.

Recreation

The impacts to hunting and recreation from the construction and operation of the tie-line across private and State trust lands would be the same as those associated with the proposed wind park. Temporary

impacts to recreation uses, such as noise, traffic, diminished views, and closure of areas during construction on National Forest System lands may occur during the construction of the tie-line; however, hunting and other recreation uses would not be expected to be restricted on private, State trust, and Federal lands as a result of tie-line operation, and significance thresholds associated with recreation would not be exceeded.

Zoning

The proposed tie-line is not subject to local zoning requirements.

Applicable Land Use Plans

The proposed tie-line is not located within a Wilderness Area, Research Natural Area, or the Elden Environmental Study Area, so would not cause direct land use impacts to these resources. The tie-line would be consistent with the Forest Plan. (The extent to which the tie-line affects sensitive environmental resources is discussed under the Geology and Soils section and the Biological Resources section of this report). The proposed tie-line is not subject to local jurisdictional authority as governed by the Coconino County Comprehensive Plan, but requires a Certificate of Environmental Compatibility from the Arizona Corporation Commission. The Applicant would obtain this certificate prior to beginning construction on any portion of the proposed tie-line.

Western's Switchyard

Land Ownership and Jurisdiction

The proposed switchyard would be located on Federal land under the jurisdiction of the Forest Service, generally within the existing rights-of-way for the Glen Canyon-Pinnacle Peak transmission lines. Authorization for the use of lands for the proposed switchyard would be decided by the Forest Service.

Existing Land Use

The majority of the proposed switchyard would be located within the rights-of-way of the existing Glen Canyon-Pinnacle Peak transmission lines. Four additional towers would be added to the transmission lines to accommodate the interconnection but neither the transmission lines, nor their functions, would be negatively affected by the modification. The switchyard would not create an unresolved conflict with existing utility rights-of-way, and land use significance standards would not be exceeded.

Grazing

The proposed switchyard is located within the Anderson Springs Grazing Allotment. Grazing occurs throughout the switchyard study area and would be allowed to continue once the switchyard is constructed and operating. The construction of the switchyard would result in the temporary loss of up to 24 acres of grazing land and the permanent removal of about 15 acres of land from grazing. This would result in a minimal loss of land available to grazing in the grazing allotment and would not affect the economic viability of the ranching operations, and would not exceed the significance standards.

Recreation

Temporary impacts to recreation uses on National Forest System lands would occur during the construction of the switchyard by limiting access to the construction area; however, hunting and other recreation uses would not be restricted on the Forest as a result of switchyard operation.

Zoning

The proposed switchyard is not subject to local zoning requirements.

Applicable Land Use Plans

The proposed switchyard is not located within a Wilderness Area, Research Natural Area, or the Elden Environmental Study Area, so it would not cause direct land use impacts to these resources. The switchyard would be located within an established utility corridor, consistent with the Forest Plan. Since the installation of the switchyard would be consistent with applicable land use plans, project impacts would be minimal and significance criteria would not be exceeded.

3.1.2.3 Alternative Transmission Tie-line Corridor

Impacts to land use associated with the construction and operation of the alternative tie-line would be similar to those described for the proposed tie-line. The alternative tie-line would require the construction of a new access road over a distance of approximately three-quarter mile, resulting in approximately one additional acre of temporary and permanent ground disturbance, slightly increasing the loss of land available for grazing. This new access road may lead to an increase in off-road recreation use on this particular portion of National Forest System lands and may require that new access roads are signed or closed if illegal use becomes an issue. Potential land use impacts associated with the alternative transmission tie-line corridor would be minimal and would not exceed significance thresholds.

3.1.2.4 No Action Alternative

No direct impacts on existing or planned land uses or recreation opportunities would result through implementation of the No Action Alternative. Under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a right-of-way for the tie-line proposed for the wind park. The wind park, tie-line, and switchyard would not be constructed and the land use and recreation resources of the area would remain unchanged.

3.2 BIOLOGICAL RESOURCES

Biological resources within the evaluation area were evaluated through a search of existing data, including published literature, field guides, public data sets, and site visits. In addition, the U.S. Fish and Wildlife Service (USFWS), AGFD, and the Coconino National Forest were contacted concerning the presence of sensitive species and habitats within the evaluation area. The Forest Service sensitive species lists for plants and wildlife were used for analysis of the tie-line and switchyard portion of the project. Due to issues raised in scoping, raptors, bats, and big game species have been addressed individually. Biological concerns for development of commercial wind energy facilities has generally centered on collision risk of birds and bats with wind turbines, indirect affects due to habitat loss or alteration, and direct and indirect impacts to sensitive species.

This chapter relies on an evaluation conducted in 2009 by Western Ecoystems Technology, Inc. (WEST) (Tidhar and Chatfield 2010a and 2010b), as well as baseline avian and bat studies conducted on Study Area A of the proposed wind park (Young et al 2009), and bird and bat study results from a nearby proposed wind-energy project (WEST 2006; Gruver et al 2009). The evaluation is comprised of three separate reports: a Wildlife and Botanical Report (Tidhar and Chatfield 2010b) for the proposed transmission line right-of-way and switchyard which would be sited on Forest Service lands; a Site Characterization Report (Tidhar and Chatfield 2010a) for the proposed Grapevine Canyon Wind Resource Area (referred to in this EIS as the wind park study area, which has been divided into three distinct areas defined as Study Area A, Study Area B, and Study Area C by WEST in the Site Characterization Report); and a baseline wildlife survey report conducted by WEST in 2007 and 2008 within Study Area A of the wind park study area (Young et al. 2009). The reports are included in Appendices D.1, D.2, and D.3 of this EIS. These reports address land cover and habitats, the potential for sensitive plants and wildlife to occur, the potential for avian migratory pathways, important biological features such as raptor nests, prey populations, and other biological resources, and results from baseline wildlife surveys completed on

Study Area A in 2007-2008. The primary objective of the surveys was to generate data on seasonal and annual use by birds and bats that would be useful in evaluating impacts from the proposed wind-energy facility. AGFD, USFWS, Forest Service, and Western biologists have reviewed and commented on the evaluation contained in the reports. Correspondence from USFWS and AGFD related to the reports is found in the Site Characterization Report (Appendix D.1). Based on these comments, information from these reports has been used to prepare this section of this EIS.

3.2.1 Affected Environment

3.2.1.1 Resource Evaluation Area

The biological resources evaluation area consists of the proposed wind park study area (including the sub-areas Study Area A, Study Area B, and Study Area C), the proposed site access road, a two-mile buffer around the wind park study area and site access road, and a one-mile buffer around the tie-line and switchyard study area (Figure 3.2-1). This area includes all infrastructure including but not limited to WTGs, underground and potentially overhead electrical collection lines, roads, step-up substation, operations and maintenance facility buildings, 345-kVtransmission tie-line and Western's interconnection switchyard.

3.2.1.2 Characterization

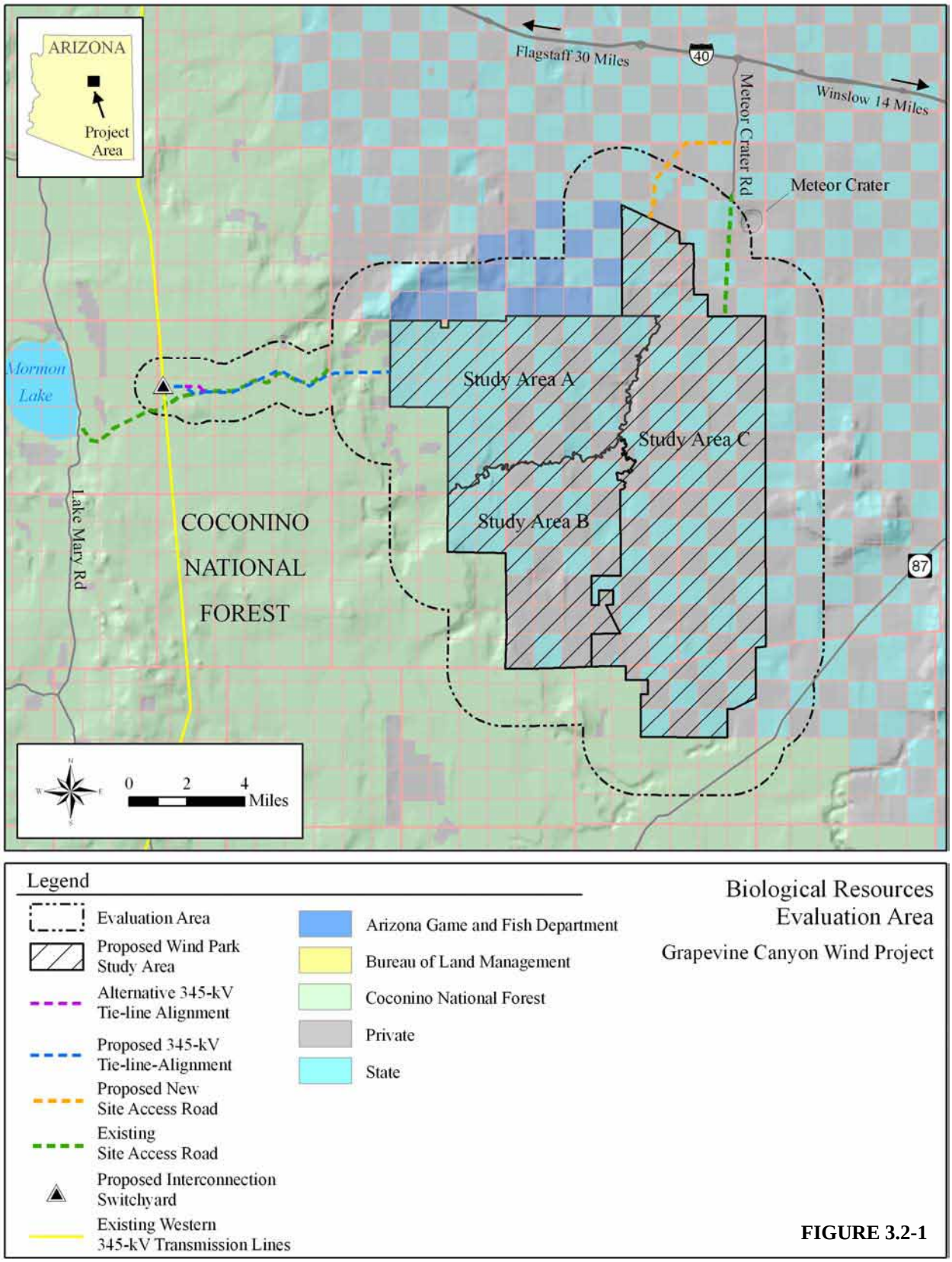
Environmental Setting

The biological resources evaluation area is located in the transition zone between the Arizona/New Mexico Plateau Ecoregion, which covers much of northern Arizona and northwestern New Mexico, and the higher elevation Arizona/New Mexico Mountain Ecoregion immediately to the west (EPA 2004).

The Plateau Ecoregion is a transitional region between the semiarid, low relief tablelands in the east, the drier, shrubland/woodland covered, higher relief tablelands in the Colorado Plateau, and the lower, hotter, less-vegetated Mojave Basin and Range in the east and Chihuahuan Desert in the south. Higher, more forested, mountainous ecoregions border the Arizona/New Mexico Plateau to the northeast and southwest. Vegetation communities in the region are characteristic of Great Basin shrublands and grasslands. Higher elevations within the region support pinyon pine (*Pinus edulis*) and juniper (*Juniperus* spp.) forests. Improper grazing management has caused widespread habitat degradation throughout much of the region. Lack of regular fires and high grazing pressure may have led to conversion of areas from native grassland to Great Basin desert scrub or Great Basin conifer woodland (AGFD 2006).

The Arizona/New Mexico Mountain Ecoregion lays immediately to the west of the existing Western 345-kV transmission lines. Chaparral is common on the lower elevation slopes of this Ecoregion, with pinyon-juniper and oak (*Quercus* spp.) woodlands found on lower and mid elevations, and open to dense ponderosa pine (*Pinus ponderosa*) forests occur at higher elevations. Forests of spruce (*Picea* spp.), fir (*Abies* spp.) and Douglas fir (*Pseudotsuga menziensii*) are found in only a few high-elevation parts of the region and are not present within the evaluation area.

Topography within the evaluation area is generally very flat to gently sloping with the exception of a few low ridges and larger canyons with moderate to steep embankments or cliffs. The vast majority of the evaluation area is characterized by Great Basin shrubland and grassland. The vegetation transitions into areas of juniper savannah, pinyon-juniper woodland, and ponderosa pine forest as the western portion of the area extends onto the Anderson Mesa. Elevations range from approximately 5,410 to 7,480 feet above sea level.


ARIZONA
Project Area
Flagstaff 30 Miles
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87
0 2 4 Miles
Legend
Evaluation Area
Proposed Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-line-Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Lines
Arizona Game and Fish Department
Bureau of Land Management
Coconino National Forest
Private
State
Biological Resources Evaluation Area
Grapevine Canyon Wind Project

FIGURE 3.2-1

Land Cover

Land cover types for the biological resources evaluation area were analyzed using the USGS National Land Cover Database (NLCD) maps (USGS 2001). The dominant cover types in the evaluation area are scrub-shrub and grassland. Other cover types include evergreen forest (comprised of ponderosa pine), woody wetlands, pinyon/juniper woodlands, barren land, cropland, pasture/hay fields, and developed open space. The evaluation area is based on the area included in the wind park study area if the project is fully built out to 500 MW. Under that scenario, the evaluation area is approximately 123,355 acres of which the dominant cover type is scrub-shrub which comprises about 70 percent of the area. This land cover type comprises about 74 percent of the approximately 94,950-acre wind park study area. The only other major land cover type in the evaluation area and wind park study area is grassland, which comprises about 32,842 acres (18 percent) of the evaluation area and about 22,530 acres (24 percent) of the wind park study area. If the project is fully built out, then direct impacts to land (both permanent and temporary) would result in approximately 2,420 to 2,631 acres of land disturbance, which is less than three percent of the evaluation area.

According to NLCD maps, evergreen forest is primarily restricted to the northwest corner of Study Area A, and along the western and southern boundary of Study Area B. Landcover does not significantly differ among the three Study Areas of the Project. Study Area C is the largest of the three Study Areas; constituting approximately 49,470 acres or 52 percent of the overall wind park study area. Study Area C contains slightly more grassland than the other Study Areas according to NLCD data. Study Area A contains the largest amount of woody wetlands (about 69 acres), due to the greater proportion of canyons found within this area of the wind park study area compared with Study Areas B or C.

The transmission tie-line right-of-way encompasses approximately 678 acres of which approximately 63 percent is grassland and 34 percent is pinyon-juniper woodland. The remaining area (less than three percent) is comprised of ponderosa pine forest. Plains grassland which covers the majority of the tie-line alignment consists of a grass-forb association dominated by western wheatgrass (*Agropyron smithii*). Pinyon-juniper woodlands are composed of Utah juniper (*Juniperus osteosperma*) intermixed with varying amounts of pinyon pine. The proposed transmission line transverses only a very small amount of ponderosa pine habitat, limited to two small areas in the western portion of the proposed tie-line corridor, and near the proposed Western switchyard. The areas of pine forest that would be impacted by the proposed tie-line are located along the very edge of larger tracts of mature to intermediate-aged pure ponderosa pine forest to the south of the tie-line. Habitat types found along the alternative tie-line alignment are generally similar to those of the proposed transmission line, except the alternative tie-line alignment does not cross any ponderosa pine forests.

Wetlands and Riparian Areas

Anderson Mesa contains a network of small seasonal wetlands which contain water following periods of monsoon rainfall or winter snowfall, and provide habitat for a diversity of waterfowl and other wildlife and plant species. Several small lakes, including Pine Lake and Yaeger Lake, are present within the evaluation area. Larger waterways include Jack's Canyon, Canyon Diablo, Grapevine Canyon, and Yaeger Canyon. These canyons generally do not hold water year-round, although water is present in some canyon bottom locations year-round, indicating the presence of ephemeral springs. Livestock drinkers and earthen stock ponds are also present throughout the evaluation area; however, little to no natural wetland vegetation is present in these areas. Wetland delineations have not been performed at this time but would be completed prior to project construction within areas subject to permanent and temporary disturbances.

Special Status Species – Rank of Classifications

Special status plants and wildlife habitat and distribution information was reviewed and species were assessed for potential of occurrence within the biological resources evaluation area qualitatively along a scale ranging from no potential for occurrence ("none"), to highest probability for occurrence ("high"). Rank classifications and definitions used for qualitative assessment for probability of occurrence are as follows (Tidhar and Chatfield 2010a and 2010b):

- None – No potential for occurrence. Known range and distribution do not overlap the project evaluation area. Potential habitat completely absent from the evaluation area. No species accounts for the evaluation area or surrounding area exist.

- Extremely Low – Extremely low probability of occurrence. Known range and distribution may not include the evaluation area. Very limited potential habitat is available within the evaluation area. No species accounts for the evaluation area or surrounding area exist.

- Low – Low probability of occurrence. Known range and distribution include the evaluation area. Potential habitat available patchily or in isolated areas within the evaluation area. No species accounts for the evaluation area or surrounding area exist.

- Moderate – Moderate probability of occurrence. Range and distribution include the evaluation area. Habitat present within the evaluation area. Species accounts for the evaluation area or surrounding area may exist.

- High – Highest probability of occurrence. Range and distribution overlap the evaluation area. Habitat abundant within the evaluation area. Species accounts exist for the evaluation area.

Special Status Plant Species

Federal- and State-listed plant species recorded for Coconino County within the biological resources evaluation area were obtained from the USFWS (2009b) and AGFD (2009h). The Forest Service list of threatened, endangered, and sensitive plant species for the Mormon Lake and Peaks Ranger Districts in the Coconino National Forest was used to evaluate species for the tie-line and switchyard.

Threatened, Endangered, and Sensitive Plant Species: Wind Park

The USFWS lists seven plant species designated as endangered, threatened, or candidate species with known or potential occurrence in Coconino County. Additionally, the AGFD lists six plants as Federal species of concern and one federally-listed endangered species as having documented presence at the watershed level within the Canyon Diablo and/or Middle Little Colorado Watersheds, which encompass the biological resources evaluation area (AGFD 2009h). Based on information received from the AGFD, no Federal threatened, endangered, or sensitive plant species are known to occur within five miles of the wind park study area.

Threatened, Endangered, and Sensitive Plant Species: Tie-Line and Switchyard

The Forest Service has compiled a list of 14 threatened, endangered, and sensitive plant species for the Mormon Lake and Peaks Ranger Districts in the Coconino National Forest. Table 3.2 in the Wildlife and Botanical Report provides a list of these species, as well as status, habitat information, and analysis of potential to occur within a one-mile evaluation area of the tie-line and switchyard. After review, two of these species, Bebb's willow (*Salix bebbiana*) and Flagstaff beardtongue (*Penstemon nudiflorus*), were ranked as having potential to occur in the vicinity of the tie-line and switchyard. There is moderate potential for Bebb's willow to occur within one mile of the tie-line and switchyard, but no potential for

the species to be located immediately adjacent to the tie-line and switchyard due to the absence of suitable habitat. Suitable habitat is present within the tie-line evaluation area only for Flagstaff beardtongue (Tidhar and Chatfield 2010b). The transmission tie-line and evaluation area do not have evidence of limestone or sandstone outcrops; instead the mesa is built upon a basalt soil foundation. The probability of occurrence for the species is considered extremely low due to the absence of limestone-derived soil. The switchyard does not contain suitable habitat for Flagstaff beardtongue.

State Sensitive Plant Species: Wind Park

The AGFD lists 16 State sensitive plant species with documented occurrence in the Canyon Diablo and/or Middle Little Colorado Watersheds. Table 2.4 in the Site Characterization Report provides a list of all these species, as well as status, habitat information, and analysis of potential to occur. The wind park study area contains relatively low diversity, and due to a limited distribution and/or specific habitat requirements, the State-listed species are not expected to occur in the area.

Special Status Wildlife Species

All Federal- and State-listed species recorded for Coconino County and/or considered by the USFWS (2009b) or AGFD (2009h) to have the potential for occurrence within the county were evaluated for the wind park study area and biological resources evaluation area. AGFD maintains distribution lists for sensitive species at the watershed level, and these data were also incorporated into the analyses. The Forest Service list of special-status wildlife species on the Mormon Lake and Peaks Ranger Districts in the Coconino National Forest was used to evaluate species for the tie-line and switchyard. This list includes Federal threatened, endangered, and candidate wildlife species, Arizona State wildlife of special concern, Forest Service sensitive wildlife species, Forest Service Management Indicator Species (MIS), and migratory birds. Species habitat and distribution information available from published reports and publicly available data sets were reviewed. Species were ranked for potential of occurrence using the same scale used for special status plant species.

Threatened, Endangered, and Sensitive Wildlife Species: Wind Park

Table 3.2 in the Site Characterization Report provides a list of all the Federal threatened, endangered, and candidate wildlife species, as well as status, habitat information, and analysis of potential to occur. The majority of the species are not expected to occur in the wind park study area. Two wildlife species that may occur were identified: (1) the northern Mexican gartersnake (*Thamnophis eques megalops*), listed as a Federal Species of Concern and (2) the Chiricahua leopard frog (*Rana chiricahuensis*), listed as a Federal Threatened species.

The northern Mexican gartersnake is most abundant in densely vegetated habitat surrounding cienegas, cienega-streams, and stock tanks, and in or near water along streams in valley floors and generally open areas (AGFD 2009e). They are strongly associated with the presence of a native prey base including native fish and leopard frogs. In Arizona, the species is not known to occur in the vicinity of the wind park primarily because wetland habitat is very limited within the wind park study area; however, the species may occur in perennial pools found within canyon bottoms or near water tanks surrounded by suitable vegetation.

The Chiricahua leopard frog requires a permanent or nearly permanent water source that is mostly free from introduced fish, crayfish, and bullfrogs. These water sources can range from natural aquatic systems to man-made systems. The leopard frog's primary habitat type is oak, mixed-oak, and pine woodlands; however, other habitat types include chaparral, grassland, and even desert (AGFD 2009e). Aquatic habitats are very limited within the wind park study area and largely restricted to water tanks and impoundments, and ephemeral streams. The species may occur at suitable habitats within the wind park

study area; however, no observations of the species have been recorded within five miles of the wind park study area.

Threatened, Endangered, and Sensitive Wildlife Species: Tie-Line and Switchyard

Based on information provided by the Coconino National Forest, 22 special status wildlife species occur on the Mormon Lake and Peaks Ranger Districts, which encompass the biological resources evaluation area. Table 3.3 in the Wildlife and Botanical Report provides a list of all these species, as well as status, habitat information, and analysis of potential to occur in the vicinity of the tie-line and switchyard. Those species with a low, moderate, or high potential to occur within the transmission tie-line evaluation area are listed in Table 3.2-1. Eleven of these species may occur and/or have suitable habitat within a one-mile buffer of the evaluation area, while only three may occur within the transmission tie-line right-of-way or switchyard.

TABLE 3.2-1
THREATENED, ENDANGERED, AND SENSITIVE WILDLIFE SPECIES THAT MAY OCCUR ADJACENT TO THE TIE-LINE AND SWITCHYARD

Species	**Status[1]**	**Potential to Occur within Tie-line Right-of-Way**	**Potential to Occur within One Mile Buffer**
BIRDS			
American peregrine falcon *Falco peregrinus anatum*	FSC, WSC, SEN	None (nesting) Low (presence)	None (nesting) Moderate (presence)
Bald eagle *Haliaeetus leucocephalus*	WSC, SEN	None (nesting) Moderate (presence)	None (nesting) Moderate (presence) [2]
Clark's grebe *Aechmophorus clarkia*	WSC, SEN	None (nesting) Extremely low (presence)	Moderate (nesting) Moderate (presence)
Northern goshawk *Accipiter gentilis*	FSC, WSC, SEN	None (nesting) Extremely low (presence)	Extremely low (nesting) Moderate (presence)
MAMMALS			
Allen's lappet-browed bat *Idionycteris phyllotis*	FSC, SEN	Extremely low (breeding) Low (presence)	Extremely low (breeding) Low (presence)
Greater western mastiff bat *Eumops perotis californicus*	FSC, SEN	None (breeding) Extremely low (presence)	None (breeding) Moderate (presence)
Merriam's shrew *Sorex merriami leucogenys*	SEN	Low (breeding) Low (presence)	Low (breeding) Low (presence)
Navajo Mogollon vole *Microtus mogollonensis Navaho*	SEN	Extremely low (breeding) Extremely low (presence)	Low (breeding) Low (presence)
Pale Townsend's big-eared bat *Corynorhinus townsendii pallescens*	FSC, SEN	None (breeding) Low (presence)	None (breeding) Low (presence)
Spotted bat *Euderma maculatum*	FSC, WSC, SEN	None (breeding) Extremely low (presence)	None (breeding) Low (presence)
AMPHIBIANS			
Northern leopard frog *Rana pipiens*	WSC, SEN	None	Low [3]

[1] FE = Federal Endangered; FT = Federal Threatened; FSC = Federal Species of Concern; WSC = Arizona State Wildlife of Special Concern; SEN = Forest Service sensitive species
[2] Criteria for classifications does not meet high because there is not abundance of habitat within the evaluation area. The evaluation area is not considered optimal habitat, but rather contains pockets of good habitat.
[3] Potential for occurrence is low because some habitat, in the form of wetlands and/or waterbodies, are present within one mile but no records exist for the evaluation area.

Five wildlife species presented in Table 3.2-1 with a low or moderate potential to exist within the proposed tie-line and switchyard rights-of-way are described in more detail below. Information on species which may occur within one mile may be found in the Wildlife and Botanical Report in Appendix D.2.

The American peregrine falcon is generally found in open country with tall cliffs for roosting or nesting and with open water, woodland, or riparian areas nearby that support abundant avian prey species. The species is unlikely to nest within the tie-line right-of-way due to the lack of suitable cliffs for nesting. Peregrines are regularly observed foraging at wetlands on the Anderson Mesa and there is potential for peregrines to forage at the lakes within one mile of the tie-line. As a result, the peregrine could be a transient visitor across or through the tie-line alignment or switchyard area while traveling between foraging areas, or during migration.

Breeding bald eagles are found near large lakes, reservoirs, or perennial streams throughout central Arizona, where they perch in large riparian trees, pines, or on cliffs (Corman and Wise-Gervais 2005). Historically, bald eagles have nested within 3.5 miles of the tie-line right-of-way along the Mogollon Rim (AGFD 2009e). The nearest known bald eagle breeding area is greater than three miles away (McCarty and Jacobson 2008); however, wintering or transient eagles are known to occur in the vicinity of the tie-line alignment and switchyard site. Mormon Lake and Upper and Lower lake Mary are important foraging and roosting areas for wintering bald eagles. Bald eagles have been observed at the Raymond Wildlife Area northeast of the proposed tie-line (AGFD 2009g), and were observed during 2007/2008 baseline avian studies at Study Area A of the wind park study area (Young et al. 2009). There is no potential for the species to nest in the vicinity of the tie-line or switchyard, but the bald eagle could be a transient visitor through the transmission line right-of-way or switchyard area.

Allen's lappet-browed bat primarily inhabits ponderosa pine, pinyon-juniper, and pine-oak woodlands, and riparian areas of sycamore (*Platanus wrightii*), cottonwood (*Populus* spp.), and willow (*Salix* spp.). Maternity colonies and roosts have been found in caves, abandoned mines, rock piles, and beneath the loose bark of large ponderosa pine snags (Bat Conservation International 2009). This species has been documented within the Canyon Diablo Watershed (AGFD 2009h), in which the tie-line and switchyard are planned. Suitable woodland habitat is present in the vicinity of the tie-line; however, there is extremely low potential for the species to breed within the area, and low potential for the species to occur during the migration or maternity seasons.

Merriam's shrews are associated with sagebrush throughout their range. In Arizona, specimens have been found in or near open ponderosa pine woodlands, spruce-fir stands, and grasslands with patches of aspen and spruce. Of these habitat types, there exists an extremely small area of ponderosa pine forest within the evaluation area, and no records for the species exist within the study area; therefore, the species has been ranked as having a low probability for occurrence.

Pale Townsend's big-eared bat is widespread in Arizona. They typically occur in arid desert scrub habitats up to woodlands and coniferous forests. There is no potential for the species to occur during breeding or over-wintering seasons due to the lack of suitable roost sites or hibernacula. The species is widespread and likely forages at wetlands, ponds and lakes and, therefore, the potential for occurrence in the vicinity of the tie-line is considered low for foraging and/or migrating bats.

State Sensitive Wildlife Species: Wind Park

The AGFD lists 14 wildlife species as State species of special concern with documented presence within the Canyon Diablo and/or Middle Little Colorado Watersheds. Table 3.3 in the Site Characterization Report provides a list of all these species, as well as status, habitat information, and analysis of potential to occur. Two of the species with low potential to occur in the wind park study area (northern Mexican gartersnake and Chiricahua leopard frog) also have Federal endangered, threatened, or candidate status

under the Endangered Species Act (ESA), and are addressed above in the Threatened, Endangered, and Sensitive Wildlife Species: Wind Park section. Four of the species (American peregrine falcon, bald eagle, northern goshawk, and northern leopard frog) are described in the Threatened, Endangered, and Sensitive Wildlife Species: Tie-line and Switchyard section. A discussion on their potential to occur within the wind park study area is provided below. In addition, two other State sensitive species that may occur in the wind park study area, the Little Colorado sucker (*Catostomus* sp.3) and the Navajo Mexican vole (*Microtis mexicanus navaho*), are also discussed below.

Peregrine falcons may occur as a rare winter visitor or migrant through the wind park study area. No known records exist within five miles of the wind park study area (AGFD and USFWS Correspondence, Site Characterization Report, Appendix D.1). While there is no suitable bald eagle nesting habitat within the wind park study area, there is some potential for wintering or transient bald eagles to occur. There is some potential for goshawks to occur within the patches of ponderosa pine forest within the wind park study area; however, very limited ponderosa pine forest is present within the evaluation area. Additionally, no goshawks were observed during baseline avian surveys conducted at either the Grapevine A (Young et al. 2008) or Sunshine Wind (WEST 2006) studies, and there are no records within five miles of the wind park study area (AGFD and USFWS Correspondence, Appendix D.1). There is low potential for the northern leopard frog to occur in this area, primarily because wetland habitat is limited throughout the wind park study area.

The Little Colorado sucker occurs in creeks, small to medium rivers, and impoundments, primarily in pools with abundant cover. According to Heritage Data Management System, the species has been documented in drainages within five miles to the south and southeast of the wind park study area (AGFD and USFWS Correspondence, Site Characterization Report, Appendix D.1). There is some potential for the Little Colorado sucker to occur in several of the larger drainages or springs within the biological resources evaluation area, particularly within Canyon Diablo, Grapevine Canyon, or Jack's Canyon.

The Navajo Mexican vole is found in a wide range of vegetation communities from Great Basin desert scrub and Great Basin woodland to Rocky Mountain montane and subalpine forests. In Coconino County, the species is known to occur on the south rim of the Grand Canyon and approximately 20 miles west of the wind park study area in Walnut Canyon National Monument (AGFD 2009e). Shrub, grassland, and juniper woodland habitats are present within the wind park study area, thus there is potential for the Navajo Mexican vole to occur.

Forest Service Management Indicator Species

Forest Service MIS were evaluated for the tie-line, alternative tie-line and switchyard only. The Coconino National Forest Plan identifies 17 MIS defined as: "... plants or animals whose population change reflects a population change in other species within a group. MIS respond to habitat changes early or at low levels of stress and, therefore, are sensors of the effect of management activities that occur in various habitat" (Forest Service 2002). As such, MIS were selected to serve as a benchmark for potential effects of management actions on other species within the particular habitat type for which they were chosen. Table 3.4 in the Wildlife and Botanical Report, provides a list of these 17 species, as well as habitat information, and analysis of potential to occur within the tie-line, alternative tie-line route and switchyard ("tie line components") portion of the project. Nine may occur along tie-line and switchyard components and are presented in Table 3.2-2.

TABLE 3.2-2 COCONINO NATIONAL FOREST MANAGEMENT INDICATOR SPECIES WITH THE POTENTIAL TO OCCUR IN THE TIE-LINE PORTION OF THE PROJECT		
Species	**Potential to Occur within Tie-line Right-of-Way or Switchyard**	**Potential to Occur within One Mile of Tie-line or Switchyard**
BIRDS		
Cinnamon teal *Anas cyanoptera*	None	High
Hairy woodpecker *Picoides villosus*	Low	High
Juniper titmouse *Baeolophus griseus*	High	High
Pygmy nuthatch *Sitta pygmaea*	Low	High
Wild turkey *Meleagris gallopavo merriamii*	Low	Moderate
MAMMALS		
Abert squirrel *Scirurus aberti*	Low	High
Elk *Cervus elaphus*	Moderate	High
Mule deer *Odocoileus hemonius*	High	High
Pronghorn antelope *Antilocapra americana Americana*	High	High

Migratory and Breeding Birds

Most species of birds are provided protection by the Migratory Bird Treaty Act (MBTA), which states that it is unlawful to take, kill, or possess any bird listed under its protection. Legal protection for migratory birds is further explained under Executive Order (EO) 13186 (2001). The project biological resources evaluation area contains stopover habitat for songbirds, waterfowl, and shorebirds in the forms of grassland, shrubland, pinyon-juniper woodland, and a few wetland/riparian areas, and it is likely that migrating birds utilize these areas during migration.

Important Bird Areas

The Audubon Society lists Important Bird Areas that are sites providing essential habitat for one or more species of bird (Audubon 2009). These include sites for breeding, wintering and/or migrating birds and can range from a few, to thousands of acres in size. The western portion (approximately six miles) of the proposed tie-line and the proposed switchyard lies within the Anderson Mesa Important Bird Area, located within the Coconino National Forest.

USFWS Bird of Conservation Concern

The biological resources evaluation area lies near the southwestern boundary of the Southern Rockies/Colorado Plateau Bird Conservation Region. Twenty-seven species are listed by the USFWS as birds of conservation concern within this region (USFWS 2008). These species do not receive special protection unless they are also listed by the USFWS under the ESA or by the AGFD, but have been identified as vulnerable to population declines in the area by the USFWS (2008). Of these, four species have been documented by Arizona's Natural Heritage Program as occurring within the Canyon Diablo

Watershed: bald eagle, ferruginous hawk (*Buteo regalis*), peregrine falcon, and burrowing owl (*Athene cunicularia*) (AGFD 2009h). During WEST's 2007/2008 baseline avian surveys, seven USFWS species of conservation concern were observed in the Study Area A: bald eagle, ferruginous hawk, prairie falcon, burrowing owl, gray vireo (*Vireo vicinior*), pinyon jay, and Cassin's finch (*Carpodacus cassinii*) (Young et al. 2009).

Raptors

Seventeen diurnal raptor species have the potential to occur as residents and/or migrants in the biological resources evaluation area at some point during the year. In addition, one species of vulture, and five species of owls occur in the region. Of the 17 diurnal raptors with the potential to occur, eight species have the potential to nest or reside year-round within the biological resources evaluation area: sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk, red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), bald eagle, American kestrel (*Falco sparverius*), and prairie falcon (*Falcon mexicanus*). Three other species may occur as winter residents and/or migrants in the area: northern harrier (*Circus cyaneus*), ferruginous hawk, and rough-legged hawk (*Buteo lagopus*). Six species are not likely to reside in the area due to specific habitat requirements, but may pass through the evaluation area as migrants and/or occasional visitors from the surrounding region: zone-tailed hawk (*Buteo albonontatus*), Swainson's hawk (*Buteo swainsonii*), common black hawk (*Buteogallus anthracinus*), osprey (*Pandion haliaetus*), peregrine falcon, and merlin (*Falco columbarius*).

During baseline wildlife studies conducted at Study Area A of the overall wind park study area by WEST in 2007 and 2008 (Young et al. 2009), ten raptor species were observed using the area either as residents or during migration: Cooper's hawk, sharp-shined hawk, red-tailed hawk, northern harrier, bald eagle, golden eagle, American kestrel, merlin, prairie falcon, and burrowing owl. Bald eagles have historically nested at approximately 3.5 miles to the west of the proposed tie-line and switchyard (AGFD 2009e). Additionally, bald eagles, ferruginous hawks, sharp-shinned hawks, and burrowing owls have been documented within the Raymond Wildlife Area to the northeast of the evaluation area (AGFD 2009c). Peregrine falcons are regularly observed foraging at seasonal wetlands on Anderson Mesa.

Eight owl species have the potential to occur within the biological resources evaluation area, primarily because forested areas could provide suitable foraging and breeding habitat. These eight species are: barn owl (*Tyto alba*), long-eared owl (*Asio otus*), western burrowing owl, great-horned owl (*Bubo virginianus*), western screech-owl (*Megascops kennicottii*), northern saw-whet owl (*Aegolius acadicus*), northern pygmy owl (*Glaucidium gnoma*), and flammulated owl (*Otus flammeolus*).

All raptor and owl species are protected under the MBTA. The golden eagle and bald eagle also receive protection under the Bald and Golden Eagle Protection Act.

The biological resources evaluation area lies within the Intermountain West region of the extensive American Pacific Flyway, one of five primary migratory routes for waterbirds, shorebirds, songbirds, and raptors. Several factors influence the migratory pathways of raptors; the most significant of which is geography. Larger canyons in the area may serve as important stopover areas for some raptor species during migration. Raptors that utilize updrafts and thermals could follow topography along these canyon rims. Additionally, the presence of prairie dog (*Cynomys gunnisoni*) colonies and waterfowl/shorebirds concentrated at water sources could attract resident and migrating raptors.

Potential nesting habitat for raptors is located primarily within ponderosa pine forests, juniper woodlands, and along the major drainages within the biological resources evaluation area. Forests provide nest structure for tree-nesting raptors such as northern goshawk, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, American kestrel, great-horned owl, western screech-owl, flammulated owl, northern saw-whet owl, and northern pygmy owl. Stands of oak and cottonwood in the canyon bottoms, as well as

canyon walls and rock outcroppings, likely provide nest sites for raptors. Open, grassland habitat for ground-nesting species such as burrowing owl is also present within the evaluation area, especially within prairie-dog colonies which have been documented in the wind park Study Area A (Young et al. 2009). During a site visit conducted as part of the Site Characterization Report, a single occupied red-tailed hawk nesting territory and nest site was documented within the overall wind park study area. When raptor nest surveys were conducted in 2008 within Study Area A and potential raptor nesting areas within a two-mile buffer, one active red-tailed hawk nest was observed in Yaeger Canyon and two inactive golden eagle nests were observed within Grapevine Canyon (Young et al. 2009). No raptor nests were found in the immediate vicinity of the tie-line alignment. Given the proximity of an existing road and general lack of optimal nest structures, the likelihood of nesting raptors to occur proximate to the tie-line is low.

Bats

Due to the current lack of understanding of bat populations in North America, the species and relative abundance of bats occurring within the biological resources evaluation area are difficult to determine. Based on range maps and species accounts from Bat Conservation International (2009), 30 species of bat are known to occur in Arizona, with 20 species having an approximate range that includes the evaluation area or surrounding region. Of these 20 species, 11 have the potential to roost or forage within the wind park study area; pallid bat (*Antrozous pallidus*), pale Townsend's big-eared bat, big brown bat (*Eptesicus fuscus*), spotted bat, California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), Arizona myotis (*Myotis occultus*), fringed myotis (*Myotis thysanodes*), big free-tailed bat (*Nyctinomops macrotis*), canyon bat (*Parastrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). An additional three species are likely seasonal migrants through the wind park study area; silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), and hoary bat.

The most likely roosting habitat for bats within the biological resources evaluation area is within the canyons. Caves, crevices, and rock outcrops along the canyon walls likely provide habitat for roosting and hibernating bats. Juniper savannah/woodlands may also provide roosting habitat for tree-roosting species. Bats undoubtedly forage at the creeks, springs, ponds, and stock tanks throughout the evaluation area and these areas are likely to concentrate both resident and migrant species.

Big Game

The wind park and tie-line and switchyard evaluation areas provide habitat for several species of big game including elk, mule deer, and pronghorn antelope. All three species were observed during 2007-2008 surveys at Study Area A.

Elk populations within Arizona are considered to be demonstrably widespread, abundant, and secure state-wide (AGFD 2009e), with the elk herds occurring in the Coconino National Forest and surrounding State and private lands considered the core of Arizona's elk population (AGFD 2007a). The elk in this region typically summer in mountain meadows and montane coniferous forests, and winter in lower-elevation pinyon-juniper woodlands and grasslands (Forest Service 2002; AGFD 2007a). The elk herd occurring in the 5BN Game Management Unit (AGFD 2008), in which the tie-line and switchyard are located, is considered stable (AGFD 2007a). Ponderosa pine, pinyon-juniper woodland, and grassland habitats used by elk are present within the wind park study area, and the tie-line and switchyard areas. The species is likely to occur during the winter, and possibly throughout the year.

Mule deer typically summer at high elevation aspen and ponderosa pine forests, and winter in lower elevation pinyon-juniper woodlands (Forest Service 2002). While mule deer populations within Arizona are considered to be demonstrably widespread, abundant, and secure state-wide (AGFD 2009e), from 1985 to 2001 a declining trend in mule deer populations has been observed on the Coconino National Forest (Forest Service 2002). This may be due to a number of factors including disease, poaching,

climatic conditions (drought), and habitat changes. Populations in the past few years appear to have stabilized, possibly in response to increased precipitation in recent years (AGFD 2008). Habitats used by mule deer (e.g., pinyon-juniper woodlands, ponderosa pine forests) are present in the vicinity of the tie-line and switchyard, and the species is likely to occur in these areas.

Most pronghorn occur between 3,000 and 7,000 feet elevation and inhabit a variety of habitat types from desert grassland to forest and mountain meadows; however, they generally prefer flat, open grassland areas (AGFD 2007b). The tie-line, switchyard, and the wind park study area fall within the range of the Anderson Mesa herd of pronghorn antelope. This population declined throughout recent decades as a result of habitat degradation and drought (AGFD 2007b; Forest Service 2002). The pronghorn in this area are functionally split into two groups; one group spends the winter at lower elevation grasslands and spends the rest of the year on Anderson Mesa, and the second group lives year-round in the lower elevation habitat. The majority of the herd winters in grasslands and shrublands. Migration movement through the wind park study area is moderate. The overall trend for grasslands within the Coconino National Forest is stable to declining due to tree encroachment, fire suppression, long-term climatic trends, short-term drought, and ungulate grazing (Forest Service 2002).

Invasive and Non-native Species

The State of Arizona has laws addressing the control and eradication of noxious weeds and identifying specific species that fall under noxious weed definitions (A.A.C. R3-4-244 and 245). Noxious weeds and other non-native plant species typically associated with rangeland are currently found within the biological resources evaluation area. Noxious and invasive weeds are defined as "those plant species designated as noxious and invasive weeds by the Secretary of Agriculture or by the responsible state official." Noxious and invasive weeds generally possess one or more of the following characteristics: "aggressive and difficult to manage, poisonous or toxic, parasitic, a carrier or host of serious insects or disease, and being non-native or new to or not common to the United States or parts thereof" (Forest Service 1995a). Although the project area was not surveyed for noxious and invasive weeds, Scotch thistle, Russian knapweed, diffuse knapweed, bull thistle, and Dalmatian toadflax are likely to occur in the project evaluation area.

3.2.2 Environmental Consequences

This section evaluates the project's impacts on biological resources. Primary concerns are impacts to federally- and State-listed species, Forest Service MIS and Sensitive Species, birds, bats, and big game. Definitions of impacts are as follows:

- Short-term impacts are those that last through the construction phase of a project, or one or two reproductive cycles, whichever is longer.
- Long-term impacts are those that last more than two reproductive periods, or as long as the life of the proposed project facilities, depending on the organism or habitat involved.
- Direct impacts are those that occur as a result of construction or operation of the wind park, transmission line, switchyard and all other associated infrastructure; including avian or bat collisions with wind turbines or tie-line conductors and overhead groundwires.
- Indirect impacts are those that may occur as a result from new access roads providing increased human accessibility to a previously inaccessible area, or habitat alteration or loss resulting in displacement.

3.2.2.1 Standards of Significance

The proposed project components and alternatives would have a significant and adverse effect on biological resources if they would:

- Adversely affect a listed endangered, threatened, or proposed plant or animal species or designated critical habitat.
- Cause direct impacts to populations which trends toward Federal listing or loss of viability for Forest Service Sensitive Species
- Result in a long-term loss of vegetation or habitat which leads to the decline of populations and would threaten the continued existence of a plant or animal species.
- Affect the biological viability of a local, regional, or national population of a listed wildlife species or one of concern/interest leading to a downgrading in its listing.
- Violate the ESA, the Bald and Golden Eagle Protection Act, or the MBTA, which all protect Federal- and State-listed species.
- Substantially interfere with the movement of any native resident or migratory fish or wildlife species for more than two reproductive seasons.
- Reduce the value of habitat for fish, wildlife, or plants to an unusable level.
- Cause a native fish or wildlife population to drop below self-sustaining levels.
- Adversely and substantially affect important riparian areas, wetlands, or other wildlife habitats.

3.2.2.2 Applicant's Proposed Project and Proposed Federal Actions

Based on the information presented in the Wildlife and Botanical Report, Site Characterization Report, and Avian and Bat Studies Report it is determined that construction and operation of the proposed wind park, tie-line, and switchyard would result in impacts to biological resources, as described below.

Impacts to Special Status Plant Species

The majority of the special status plant species have highly restricted distributions and very specific habitat requirements and are not expected to occur within the wind park study area based on either an absence of habitat, range or distribution. Few records for any of the species evaluated exist for either the biological resources evaluation area or the surrounding five miles evaluated during agency scoping (see Appendix D). Canyon bottoms containing riparian areas, deciduous woodlands, wetlands or waterbodies may support wetland and mesic plant species not found within the vast majority of the wind park. Canyon bottoms are not likely to be impacted by project facilities or infrastructure, although if it is determined that project-related activities might result in these areas, ground disturbing activities in these areas would be preceded by appropriate plant surveys to ensure sensitive plant species are not present prior to construction. Populations of the species located during pre-construction surveys would be avoided or translocated, if possible, to avoid direct impacts. Indirect impacts to the species would be mitigated, if necessary, following RPMs identified in Table 2.7-1.

Bebbs willow and Flagstaff beardtongue may occur within the tie-line and switchyard portion of the project, although the lack of water or wetlands and non-suitable soil types would result in an extremely low potential for occurrence, and no impacts to these species are expected. The proposed tie-line and switchyard would not likely effect Bebb's willow because suitable habitat is not present. No riparian habitats are found within or immediately adjacent to the tie-line. The probability of occurrence of Flagstaff beardtongue is considered extremely low due to the absence of limestone-derived soil. The proposed tie-line may have short-term, direct impacts on Flagstaff beardtongue resulting in the loss of individuals during construction, if suitable habitat is available. Soils along the tie-line alignment and within the switchyard area are generally derived from basalt, which are not characterized as suitable for the species; however, locations in the Coconino National Forest include sites with similar forest characteristics to those found along portions of the tie-line, which include mixed oak and pinyon-juniper woodlands. The tie-line evaluation area does not have evidence of limestone or sandstone outcrops; instead the mesa is built upon a basalt soil foundation. Preconstruction surveys of potentially suitable habitat along the tie-line to identify the species may be warranted (refer to RPMs listed in Table 2.7-1).

Populations of the species located during pre-construction surveys would be avoided or translocated, if possible, to avoid direct impacts. Indirect impacts to the species would be mitigated, if necessary and possible, following RPMs identified in Table 2.7-1. The switchyard does not contain suitable habitat for this species and there would be no effect of the switchyard on the species. Therefore, no impacts to special status plant species are expected as a result of construction and operation of the wind park facilities and impacts which may occur would not be expected to result in impacts to populations.

No State sensitive plant species are expected to occur in the wind park study area. Of Federal- and State-listed plant species, only the Peebles Navajo cactus (*Pediocaactus peeblesianus* var. *peeblesianus*) was ranked as having moderate potential to occur within the wind park based on availability of habitat and known distribution within the vicinity of the biological resources evaluation area. The proposed wind park may have short-term direct impacts on Flagstaff beardtongue resulting in the loss of individuals during construction, if suitable habitat is available. Field surveys for the species have not occurred. Pre-construction surveys within construction zones, as described in Table 2.7-1, would result in avoidance of direct impacts to the species. Populations of the species located during pre-construction surveys would be avoided or translocated, if possible, to avoid direct impacts. Indirect impacts to the species may be mitigated through habitat restoration, if necessary, following RPMs identified in Table 2.7-1. With application of these measures, adverse direct and indirect impacts would be minimized and applicable biological resources significance standards would not be exceeded.

Impacts to Special Status Wildlife Species

Several special status species may occur within areas evaluated outside of the wind park, transmission line right-of-way, switchyard site, and primary access roads. Those species and their habitat and potential for occurrence are described in Appendices D.1 and D.2. Special status species which have the potential to be impacted by the proposed project are described below.

Within the wind park study area, federally-listed species that have at least low potential to occur include the Northern Mexican gartersnake and the Chiricahua leopard frog. There is low potential for the Northern Mexican gartersnake to occur at suitable habitats within the wind park study area and no observations of the species have been recorded within five miles of the wind park study area. Likewise, there is low potential for the Chiricahua leopard frog to exist within the wind park study area because aquatic habitats are very limited and largely restricted to water tanks and impoundments, and ephemeral streams. Those species with at least some potential for occurrence are primarily associated with canyons, wetlands and waterbodies which would be largely avoided during construction of the project. Riparian areas, wetlands or waterbodies would not likely be impacted by project facilities or infrastructure. If project facilities are unavoidable in these areas, ground disturbing activities should be preceded by appropriate surveys for the species to determine presence prior to construction. If present, the project may result in short term direct and indirect impacts to the species. Direct impacts would be restricted to the loss of individuals during construction. Any individuals located during pre-construction surveys would be avoided or translocated, if possible, to avoid direct impacts. Indirect impacts would result in the temporary loss of suitable habitat. Long-term impacts are not anticipated because of implementation of RPMs (see Table 2.7-1) which include necessary mitigation for documented sensitive species. Thus, implementation of these RPMs during construction and operation of the wind park facilities would result in minimal impacts to the Northern Mexican gartersnake and the Chiricahua leopard frog, and applicable significance thresholds would not be exceeded.

Construction and operation of the tie-line and switchyard may result in direct impacts to the American peregrine falcon through collision with power lines and/or electrocution. Direct impacts from collisions with wind turbines are not expected, and there has not been documented evidence of peregrine falcons colliding with wind turbines at other wind facilities. The risk of collision is considered extremely low because the tie-line would not be located in breeding or foraging habitat and the species occurs at

extremely low density in the region, primarily during migration seasons. Construction and operation of the proposed tie-line and switchyard may result in direct impacts to the American peregrine falcon, but is not likely to result in a downward trend toward Federal listing. Peregrine falcons are known to hunt waterfowl concentrated at seasonal wetlands occurring throughout Anderson Mesa. Several of these wetlands are located within the tie-line evaluation area; however, no wetlands exist immediately adjacent to the tie-line, and no potential peregrine falcon foraging habitat would be impacted by the proposed tie-line and switchyard. Therefore, no indirect impacts are anticipated. There remains, however, a very low risk for peregrine falcons flying between foraging areas or during migration to collide with the proposed transmission line, which could result in the fatality of individuals. Following guidance of the APLIC Suggested Practices for Avian Protection on Power Lines (2006) would minimize and mitigate risk of potential avian collisions and electrocutions along the proposed tie-line and any other overhead transmission lines associated with the wind park. An avian and bat protection plan would be implemented at the wind park in addition to post-construction monitoring. Biological resource monitoring would provide scientifically credible data from which refinements to operational practices[2] may be developed (refer to Table 2.7-1). Any collision fatalities would be documented and resource agencies informed. Operational practices would be discussed in that situation to determine whether additional appropriate mitigation measures may be employed to reduce further collision risk for the species. As a result of these RPMs, impacts would be minimized and significance standards would not be exceeded.

The proposed tie-line may affect the bald eagle through collision with power lines and/or electrocution. The proposed project may affect the bald eagle, but is not likely to result in a downward trend toward Federal listing. Bald eagles have historically nested on the Anderson Mesa including at Mormon Lake and Lake Mary, approximately 3.5 miles to the west and eight miles to the northwest of the tie-line, respectively. While eagles are no longer known to nest in these areas, the lakes are known to support wintering populations. There is no nesting or foraging habitat for bald eagles immediately adjacent to the tie-line, and habitat for the species would not be affected by the proposed tie-line; therefore, no indirect impacts are anticipated. However, individuals may pass through the area as transients or during movement between foraging areas, and may even use transmission line structures for perching. As a result, there remains a low risk of collision with or electrocution from the transmission line which may result in direct impacts to individuals. To minimize and mitigate risk of potential avian collisions and electrocutions along the proposed tie-line and any other wind park overhead transmission or distribution lines, APLIC's Suggested Practices for Avian Protection on Power Lines (APLIC 2006) would be followed. No bald eagle casualties from wind turbine collisions have been published in the U.S. An avian and bat protection plan would be implemented at the wind park in addition to post-construction monitoring. Biological resource monitoring would provide scientifically credible data from which refinements to operational practices may be developed. Any collision fatalities would be documented and resource agencies informed. Operational practices would be discussed in that situation to determine whether additional appropriate mitigation measures may be employed to reduce further collision risk for the species. With implementation of these RPMs during construction and operation, impacts to the bald eagle would be minimized and significance thresholds would not be exceeded.

The Allen's lappet-browed bat has a low potential to occur within or adjacent to the proposed transmission tie-line right-of-way. Further, caves and mines used by the species for roosting are not presently adjacent to the tie-line and switchyard; therefore, no breeding habitat or important hibernation

[2] Operational practices would be implemented at the project whereby iterative decision-making (evaluating results and adjusting actions on the basis of what has been learned) would be undertaken to reduce impacts to biological resources. Operational practices may also be refined based upon observed impacts which have been documented as occurring at the Project. Data collected during monitoring studies or facility operation would be used to refine operational practices. Operational practices may involve consultation with experts, consultants, agency personnel, landowners, and other stakeholders. Operational practices may also be developed internally by Grapevine Wind and implemented proactively.

areas would be affected. While the species is not listed by the AGFD as occurring within five miles of the proposed wind park, the bat has been documented within the Canyon Diablo Watershed, in which the tie-line occurs. Suitable woodland habitat is present within the biological resources evaluation area and a few loose-bark mature ponderosa pine snags are present in the area. There is extremely low potential for the species to roost within these snags during the maternity season, and low potential for the species to occur during the migration or maternity seasons. There is low risk that construction of the transmission line or switchyard could result in the loss of individuals roosting within suitable snags during the maternity season. Avoidance of these snags and/or avoidance of construction clearing during the maternity season are measures included in the RPMs (see Table 2.7-1) and, therefore no direct effects to the species are anticipated, and significance standards listed in Section 3.2.2.1 would not be met.

The proposed tie-line and switchyard would result in a loss of habitat for the Merriam's shrew. There is very limited amount of dry forest habitat suitable for the species within or adjacent to the tie-line alignment or switchyard. The tie-line and switchyard would remove less than 10 acres of dry coniferous forest habitat potentially used by the species, but this small amount of lost habitat would not result in loss of species viability. The construction and operation of project facilities is not likely to result in direct impacts which would lead toward a downward trend toward Federal listing. Construction operations may result in the destruction of individual burrows or loss of individuals, however, construction operations would be short-lived and operation of the tie-line would have no long-term effect on the species.

Construction and operation of the proposed tie-line and switchyard would have no direct effects to the pale Townsend's big-eared bat. Suitable habitat for the species in the form of caves and mines for roosting and large ponds for drinking are not present adjacent to the tie-line alignment or the switchyard. The species may pass through the tie-line in transit between wetland foraging areas and roost sites in the surrounding region, but habitat for pale Townsend's big-eared bat would not be impacted by the proposed tie-line or switchyard. Impacts to this species would be minimal and applicable significance thresholds would not be exceeded.

Forest Service MIS that may be impacted by the proposed tie-line and switchyard include the juniper titmouse, elk, mule deer, and pronghorn antelope. Discussion of expected impacts to elk, mule deer, and pronghorn antelope are described in the following sections and in detail in Appendix D.2. The proposed tie-line may have indirect impacts on juniper titmouse, although impacts would be small and would not be expected to affect overall habitat on Forest Service managed lands or population trends for the species. While the proposed tie-line would remove some pinyon-juniper woodland (up to approximately 233 acres), this incremental loss is minor to the overall amount of pinyon-juniper woodland on the Coconino National Forest (estimated at more that 630,000 acres). This habitat type is abundant in the region and not a unique habitat feature. Construction, depending on timing, may result in the loss of individual juniper tit mouse nests or the mortality of individuals. Avoidance of direct impacts would be accomplished through restricting clearing operations conducted as part of construction during the breeding season. Resulting direct and indirect impacts would not result in impacts to Forest-wide population and habitat trends and would not exceed significance thresholds defined in Section 3.2.2.1. Discussion of expected impacts to elk, mule deer, and pronghorn antelope are described in the following sections.

Migratory/Breeding Birds and Raptors

Bird species protected under the MBTA may be affected by the proposed tie-line both directly and indirectly. Collisions may occur with resident birds foraging and flying within the project area or with migrant birds seasonally moving through the area. While construction and maintenance of the tie-line would likely result in disturbance to and removal of habitat for some species, particularly those inhabiting grassland and pinyon-juniper woodland habitats within or adjacent to the tie-line and switchyard, the total area impacted would be relatively small compared to surrounding similar habitat and construction

activities would be short-term. The major habitat types that would be impacted by the tie-line and switchyard are abundant throughout the region and are not unique habitat features. Thus, removal of habitat for construction of the tie-line and switchyard is not expected to have impacts on resident and migratory birds that exceed the significance thresholds in the region since the removal would not substantially interfere with the movement of any migratory species for more than two reproductive season. To minimize and mitigate risk of potential avian collisions and electrocution, the tie-line and any overhead collection lines would be designed according to APLIC's Suggested Practices for Avian Protection on Power Lines (APLIC 2006). Thus, the effects would not result in a downward trend toward Federal listing for any of the migratory species. In addition, the iterative operational practices aspects of the proposed Avian and Bat Protection Plan would help address any take of migratory birds. Implementation of these RPMs would minimize project related impacts and help ensure that the proposed tie-line would be in compliance with the MBTA. Applicable significance thresholds for migratory birds and raptors would not be exceeded.

During migration, bird species within the wind park study area are at risk of turbine-collision, however, previous studies of Study Area A (Young et al. 2009) do not suggest these species migrate in abundance over that portion of the wind park study area. RPMs as described in Table 2.7-1, would include construction requirements, post-construction monitoring and reporting requirements, and operational practices. Also, iterative operational practices aspects of the proposed Avian and Bat Protection Plan, including an impact assessment for birds protected under the MBTA, would help address any take of migratory birds. This proactive approach would help ensure that the proposed wind park would be in compliance with the MBTA, and applicable significance thresholds defined in Section 3.2.2.1 would not be exceeded.

Breeding bird species found at Study Area A during 2007/2008 avian surveys (Young et al. 2009) do not suggest the potential for breeding rare or sensitive bird species within the wind park study area. Pre-construction raptor nest surveys would be conducted for the spring or appropriate season immediately preceding construction in order to provide data on the location of raptor nest structures throughout the wind park project area so that project planning may be informed by the location of nesting raptors. Actions would be taken to help ensure no migratory birds, their nests, or nest contents would be harmed during construction (see RPM in Table 2.7). With the proposed preconstruction measures, effects on breeding rare or sensitive species within the wind park are not anticipated.

Bird species inhabiting the Anderson Mesa Important Bird Area may be affected by the proposed transmission tie-line. While several smaller lakes do occur, none occur within or immediately adjacent to the tie-line or switchyard. Larger lakes in the region (Lake Mary and Mormon Lake) are located over three miles from the proposed tie-line alignment. The tie-line and switchyard would be constructed across grasslands and pinyon-juniper woodlands which are important landcover components of the Audubon Society's Important Bird Areas; however, both of these habitat types are abundant throughout the Anderson Mesa and are not unique habitat features to the region. Thus, the removal of habitat for construction of the tie-line and switchyard is not expected to affect the biological viability on resident and migratory birds in the region. While avian collision with the proposed tie-line would remain an unavoidable risk, particularly for waterfowl species utilizing wetland areas adjacent to the tie-line, implementation of the APLIC standards and the Avian and Bat Protection Plan would serve to minimize this potential threat. Based on these measures and the small amount of habitat loss, the proposed project would not result in a downward trend toward Federal listing for migratory species.

Substantial data on bird mortality at wind-energy facilities are available from studies in California and throughout the west and Midwest (see Young et al. 2009). The annual mean raptor use at the wind park study area was compared with other wind-energy facilities that implemented similar protocols and had data for three or four seasons. Similar studies were conducted at 36 other wind resource areas proposed

for wind-energy facility construction. The annual mean raptor use at these wind-energy facilities ranged from 0.09 birds/20-min survey at San Gorgonio in California to 2.34 birds per 20-minute survey at High Winds, California. Mean raptor use at Study Area A of the Grapevine wind park was 0.67 birds per 20-minute survey which is in the mid-range of all the sites studies (Young et al. 2009). Although high numbers of raptor fatalities have been documented at some wind-energy facilities (e.g., Altamont Pass in California), a review of studies at wind-energy facilities across the U.S. reported that only 3.2 percent of casualties were raptors (Erickson et al. 2001). Indeed, although raptors occur in most areas with the potential for wind-energy development, individual species appear to differ from one another in their susceptibility to collision (National Research Council 2007). A regression analysis of raptor use and mortality for 12 new-generation wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality. In general, raptor fatalities at other western wind-energy facilities have been relatively low, between 0 and 0.14 raptors per MW per year. Using this regression to predict raptor collision mortality at Study Area A of the Grapevine Canyon wind park study area, based on an adjusted mean raptor use of 0.67 birds per 20-minute survey, an estimated fatality rate of 0.10 raptors per MW per year, or 10 raptor fatalities per year for each 100 MW of wind-energy generated at the facility (Young et al. 2008).

It is likely that many factors, in addition to abundance, are important in predicting raptor mortality. A high density of small mammal prey and the conditions favorable to high prey densities (Smallwood and Thelander 2004) have often been presumed to be the main factors responsible for the high raptor use. High prey densities relative to the surrounding landscape are not estimated to occur within the study area. Prairie dog colonies are believed to be most prevalent within Study Area A, relative to other portions of the biological evaluation area (Appendix D.1). Use by raptors observed at Study Area A was highest adjacent to prairie dog towns. Therefore, risk to raptors may be highest within portions of Study Area A associated with prairie dog towns and decreased within other portions of the evaluation area. For comparison, the results of avian use surveys conducted at the proposed Sunshine Wind Park, which is located nearby and in similar habitats to Study Areas B and C of the proposed wind park help substantiate this risk to raptors. Raptor use at the Sunshine Wind Park was estimated at 0.26 birds per 20-minute survey during fall, winter and spring (WEST 2006), which would yield a raptor fatality estimate of less than four raptors per 100 MW. Based on this information it is unlikely that the raptor use estimate derived at Study Area A would be as high in other portions of the biological evaluation area (Study Areas B and C).

Exposure indices may provide some insight into what species might be the most likely turbine casualties based on site specific data on abundance and flight behavior. The index considers relative probability of exposure based on abundance, proportion of activity recorded as flying, and observed flight height of each species. The analysis is based on observations of birds made during the studies and does not take into consideration varying ability among species to detect and avoid turbines, habitat selection, or other factors that may influence exposure to turbines such as breeding or hunting behavior. Based on species composition of the most common raptor fatalities at other western wind-energy facilities, species composition of raptors observed during 2008 surveys at Study Area A, and considering the exposure indices calculated, the diurnal raptors most likely at risk of turbine collision would be red-tailed hawk, American kestrel, and golden eagle. Small numbers of fatalities of other raptors, including other falcons, accipiters, harriers, and eagles may also occur over the life of the wind-energy facility, but are expected to be rare. Based on the seasonal use estimates, it is also expected that risk to raptors would be lowest risk in the winter, when very few raptors were observed, and highest during the fall season, likely due to migrants passing through the area.

A post-construction monitoring study would be implemented to determine the overall level of raptor fatalities resulting from operation of the proposed wind park. In addition, avian and bat protection measures would be developed prior to construction to mitigate potential direct impacts to raptors. RPMs

would include construction requirements, post-construction raptor monitoring and reporting requirements, and operational practices. With the iterative operational practices aspects of the proposed Avian and Bat Protection Plan, the proposed project would minimize impacts to raptors and applicable significance standards for raptors would not be exceeded.

Of the non-raptor avian groups, passerines have been the most abundant avian fatality at newer generation wind facilities, often comprising more than 80 percent of the avian fatalities (Erickson et al. 2001). Both migrant and resident passerine fatalities have been observed. Based on species and date information, in some studies up to 70 percent of fatalities found were believed to be migrants (Howe et al. 2002); however, the estimates are highly variable and range from 0 percent to 70 percent. In general, the number of migrant fatalities is higher in wind projects in the eastern U.S. (Erickson et al. 2002). The overall national average for passerine fatalities at wind projects has been approximately 2.2 birds per turbine per year (Erickson et al. 2002).

Exposure indices of non-raptors indicate that unidentified swallow, raven, and pinyon jay (*Gymnorhinus cyanocephalus*) are most likely to be exposed to potential collision with wind turbines at Study Area A. Despite relatively high use and exposure, common ravens are rarely reported as fatalities according to monitoring studies at other wind-energy facilities (Erickson et al. 2001; 2002). At the Tehachapi Pass wind-energy facility in California, common ravens were found to be the most common large bird in the wind resource area, yet no fatalities for this species were documented during intensive studies (Anderson et al. 1996). Most non-raptors had relatively low exposure indices due to the majority of individuals flying below the zone of risk.

Predicting numbers of fatalities is difficult in large part due to the lack of monitoring studies in the desert southwest and similar environments as the Grapevine Canyon Wind Project. However, due to generally low impacts for other western wind projects and the low exposure risks at Study Area A, it is unlikely that non-raptor populations would be adversely affected by direct mortality from the operation of the wind-energy facility and any impacts would be on individuals and not species.

Breeding in the grassland and pinyon-juniper habitat are likely to be displaced from construction zones during the breeding season but the overall loss of habitat is not expected to be substantial and over time would be reduced as construction areas revert to native habitat. Results from studies at the Stateline wind-energy facility in Oregon and Washington (Erickson et al. 2004) and the Combine Hills facility in Oregon (Young et al. 2005) suggest a relatively small-scale impact of wind-energy facilities on grassland steppe nesting passerines. Transect surveys conducted prior to and after construction of the facilities indicated that grassland passerine use was significantly reduced within approximately 164 feet of turbine strings; areas further away from turbine strings did not have reduced bird use. The reduced use was attributed to temporary and permanent habitat loss/disturbance near the turbines. While it is likely that similar impacts would occur at the Grapevine Canyon wind park, the species subject to these impacts are typically common in grassland and pinyon-juniper habitats and the impacts are not expected to exceed the significance thresholds.

Some resources are considered more sensitive to indirect impacts such as disturbance or displacement, including nesting raptors and other sensitive species. Indirect effects caused by disturbance-type impacts, such as construction activity near an active nest or primary foraging area, have the potential to impact raptor species. Birds displaced from the wind-energy facility might move to areas with fewer disturbances, but lower quality habitat, with an overall effect of reducing breeding success. There have been few studies on raptor displacement at wind-energy facilities, and most of these have suggested indirect effects to be negligible or immeasurable (Howell and Noone 1992; Johnson et al. 2000; Madders and Whitfield 2006). In general, due to the low density of nesting raptors, there is limited potential for nesting displacement of raptors at the proposed wind park. Observation of a no-disturbance buffer around

known nests when siting turbines would further minimize potential for impact. Disturbance or displacement related impacts are expected to be minimal and significance thresholds would not be exceeded.

A post-construction monitoring study would be implemented to determine the overall level of bird fatalities resulting from operation of the proposed wind park. In addition, avian and bat protection measures would be developed prior to construction to mitigate potential direct impacts to birds. RPMs would include construction requirements, post-construction bird monitoring and reporting requirements, and operational practices. With the iterative operational practices aspects of the proposed Avian and Bat Protection Plan, the proposed project would minimize impacts to birds and applicable significance standards for birds would not be exceeded.

Bats

Due to the current lack of understanding of bat populations in North America, the species and relative abundance of bats occurring within the wind park are difficult to determine. During acoustic bat monitoring conducted by WEST at Study Area A of the proposed project in 2007 and 2008, bat activity (mean = 9.11 bat passes per detector-night) was relatively high compared to that observed at facilities in Minnesota and Wyoming, where bat collision mortality was low, but it was much lower than activity recorded at sites in West Virginia and Tennessee, where bat mortality rates were high. Bat activity at the nearby proposed Sunshine Wind Park was considerably lower, with a mean of 2.48 bat passes per detector night (Gruver et al 2009), suggesting decreased bat activity may occur in grassland and desert scrub areas associated with large portions of Study Areas B and C compared with observed detections in Study Area A. While there are no known published studies of bat mortality at wind projects in the desert southwest, other western projects including those in California have generally shown relatively low impacts. The recently published Dillon, California fatality project showed a bat fatality rate of 2.17 fatalities per turbine per year (2.17 fatalities per MW per year; Chatfield et al 2009). Due to the overall lack of understanding regarding bat and wind turbine interactions in Arizona, it is difficult to predict if the proposed project may potentially result in a high fatality rate for bats. No known bat hibernaculum or roosts of importance have been noted within the vicinity of the wind park study area by the AGFD or the USFWS. Based on this information, it is unlikely that the bat use estimate derived at Study Area A would be as high in other portions of the biological resources evaluation area (Study Areas B and C).

A post-construction monitoring study would be implemented to determine the overall level of bat fatalities resulting from operation of the proposed wind park. In addition, avian and bat protection measures would be developed prior to construction to mitigate potential direct impacts to bats. RPMs would include construction requirements, post-construction bat monitoring and reporting requirements, and operational practices. With the iterative operational practices aspects of the proposed Avian and Bat Protection Plan, the proposed project would minimize impacts to bats and applicable significance standards for bats would not be exceeded.

Big Game

Due to the lack of data regarding impacts of wind energy development on big game, it is difficult to predict the effects of the proposed project components on antelope, mule deer and elk populations, though based on information received from AGFD the following is anticipated: 1) potential displacement would be moderate for wintering individuals utilizing Study Area A; 2) impacts during parturition would be low for the wind park study area as a whole, and; 3) avoidance of portions of Study Area A, and to a lesser extent Study Area B, by migrating pronghorn would be possible. However, this effects analysis is based on telemetry data from individuals collared outside the wind park study area and it is possible that individuals trapped and collared within the wind park study area may exhibit different spatial use patterns.

The proposed tie-line may have indirect impacts on elk by providing access into previously unused areas, although impacts would not affect overall elk habitat in the Coconino National Forest or population trends for the species. The tie-line and switchyard would result in the loss of less than 10 acres of ponderosa pine forest, representing less than 0.01 percent of estimated ponderosa pine forest habitat within Coconino National Forest. Age class composition of ponderosa pine in the area is not specifically understood at this time, however, observations during the site visit indicate only individual trees classed as early seral ponderosa pine may be present within the area identified as ponderosa pine forest. The loss of individual early seral ponderosa pine within the small area of ponderosa pine forest impact from the tie-line would not affect elk habitat, habitat use or population trends within the Coconino National Forest. The species preferred summer habitat, mixed-conifer and spruce-fir forests, are absent from the area immediately adjacent to the tie-line and switchyard; however, pinyon-juniper woodlands in the area likely support wintering elk. While the proposed tie-line and switchyard would permanently remove up to 25 acres of pinyon-juniper woodland; there are roughly 630,000 acres of pinyon-juniper woodland within the Coconino National Forest. This habitat type is abundant in the region and not a unique habitat feature. Construction activities may cause short-term disturbance on elk behavior or movement in the local area. Operation of the tie-line and switchyard is not anticipated to have long-term impacts on elk behavior or movement patterns. Population trends and habitat viability associated with this species would not be impacted by construction and operation of the tie-line and switchyard.

The proposed tie-line and switchyard also may have indirect impacts on mule deer, however, impacts and would not affect overall deer habitat within the Coconino National Forest or population trends for the species. Aspen forests are absent from the area and, while the proposed tie-line and switchyard would permanently remove up to 25 acres of pinyon-juniper woodland, there are roughly 630,000 acres of pinyon-juniper woodland on the Forest. This habitat type is abundant in the region and not a unique habitat feature. Population trends and habitat viability associated with this species would not be impacted by construction and operation of the tie-line and switchyard.

The proposed tie-line and switchyard may have indirect impacts on antelope, however, impacts would not affect overall habitat in the Forest or population trends for the species. Open grassland, the species preferred habitat, is the dominant habitat type comprising the tie-line and switchyard. Construction activities may result in short-term impacts to grassland habitats preferred by the species, however, grassland occurs over 151,000 acres within Management Area 10, which includes Anderson Mesa as required by Forest Best Management Practices. Temporary construction impacts to grassland would be mitigated through vegetation restoration. Construction may also result in short-term changes in pronghorn movement or behavior if pronghorn occur in the project area during construction. Operation of the tie-line and switchyard would not be expected to have an effect on pronghorn populations. Given the small acreage of grassland habitat impacted by the proposed tie-line and switchyard, and the fact that this habitat type is abundant throughout the region, the Anderson Mesa pronghorn population trends and habitat viability would not be impacted by construction and operation of the tie-line and switchyard.

Invasive and Non-native Species

Construction of all project elements, including the access roads, wind turbines, wind park infrastructure, transmission tie-line, and switchyard could introduce noxious species to the project area if construction vehicles track contaminated soil from a contaminated area, or if contaminated soil is used in fill areas. The project Applicant would prepare a Weed Control Plan for the wind park and proposed tie-line that is designed to prevent the spread of non-native and invasive species. The plan would address monitoring and educating personnel on weed identification, and methods for treating infestations. The Applicant would ensure that all earth moving equipment brought onto the project area would be cleaned prior to entering Coconino National Forest. A high pressure hose should be used to clear the undercarriage, tire treads, grill, radiator, and any other areas where mud and dirt may accumulate. In addition, Western would require its construction contractor to employ the same measures to control noxious species.

Following construction, site restoration activities would begin immediately to further minimize the spread of noxious weeds. Temporary construction areas around project facilities would be restored according to the construction plan and any applicable State or Federal permits. In general, restoration activities would include the removal of excess rock/gravel, re-establishing pre-construction contours, spreading of stockpiled topsoil, and re-vegetation by seeding and mulching.

Additional Best Management Practices identified as Integrated Weed Management Practices in the Coconino, Kaibab, and Prescott National Forests Noxious and Invasive Weed Strategic Plan 1998, Amended 2002 (Appendix C.2) would be implemented for the construction of the proposed transmission tie-line and switchyard. Thus, the spread of invasive and non-native species would be minimized on National Forest System lands and significance thresholds listed in Section 3.2.2.1 would not be exceeded.

3.2.2.3 Alternative Transmission Tie-line Corridor

Impacts described above would be similar to the impacts that would result from the implementation of the Applicants proposed transmission tie-line alignment. The location of the alternative alignment is within one-half mile of the proposed alignment, and similar biological conditions exist along this alignment.

3.2.2.4 No Action Alternative

Biological resources would not be disturbed or otherwise affected if the wind park, tie-line, and switchyard were not constructed. As a result, no impacts to biological resources would be expected.

3.3 CULTURAL RESOURCES

This section provides contextual background information on cultural resources in proximity to the wind park study area, tie-line, and Western switchyard including the area's prehistoric, ethnographic, and historical settings. This section also summarizes the results of previous cultural surveys in the vicinity and analyzes the proposed project's potential impacts on cultural resources. Cultural resources include archaeological sites and historic structures and features as well as Traditional Cultural Properties (TCPs) that are important to a community's practices and beliefs and that are necessary to maintain a community's cultural identity.

Information on cultural resources was derived from a number of sources. A Class I (literature search) report (Duncan et al 2010) was prepared for Western. For this report record searches were conducted at the Arizona State Museum, Arizona State Historic Preservation Office (SHPO), and Forest Service. In addition, historic maps and documents were researched at the BLM, including General Land Office maps and homestead and mining patents. Consultation was also carried out with experts knowledgeable in the cultural resources of the area.

3.3.1 Affected Environment

3.3.1.1 Resource Evaluation Area

The cultural resources evaluation area is based on information derived from the draft Programmatic Agreement (PA) for the project and includes the wind park study area, the proposed site access road, transmission tie-line, and switchyard and an area one mile on each side of linear portions (the transmission tie-line and switchyard) and within three miles of the wind park study area to account for indirect visual effects.

3.3.1.2 Characterization

Regulatory Background

Federal agency responsibilities with regard to cultural resources are addressed by a number of laws, implementing regulations, EOs, PAs, and other requirements. These include the National Historic Preservation Act of 1966 (NHPA), Native American Graves and Repatriation Act (NAGPRA), American Indian Religious Freedom Act (AIRFA), EO 13007 "Native American Religious Practices," and EO 13175 "Consultation and Coordination With Indian Tribal Governments." This protection extends to sites on private land potentially affected by actions requiring Federal approval.

The principal Federal law addressing cultural resources is the NHPA, as amended (16 USC 470), with its implementing regulations (36 CFR Part 800). NHPA describes the process for identifying and evaluating historic properties; assessing the effects of Federal actions on historic properties; and consulting to avoid, reduce, or minimize adverse effects. The term "historic properties" refers to cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP). Section 106 of the NHPA requires that Federal agency decisions affecting these places consider cultural and historic values and the options available to protect these properties. Section 106 also requires consultation with Indian tribes whose traditional lands may be affected by "undertakings." EO 13175 delineates the Government-to-Government Relationship between Native American Tribal Governments and Federal agencies through which these consultations must occur. NAGPRA was enacted in 1990 to protect Native American burials, associated funerary objects, and objects of cultural patrimony encountered on Federal land. The AIRFA and EO 13007 both pertain to Native American sacred sites. EO 13007 states that Federal agencies must "to the extent practicable and not clearly inconsistent with essential agency functions, accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites."

Western, as the lead Federal agency, is responsible for identifying, evaluating, and assessing effects of construction and operation of the proposed project on cultural resources in concurrence with SHPO, land managing agencies, and other consulting parties. These responsibilities have been outlined in a PA that would be signed by Western, the Forest Service, and the SHPO, and other concurring parties, including the Applicant, ASLD, and Tribes. As is common practice, this Draft EIS does not present the exact locations of cultural resources (including historical sites, prehistoric archaeological sites, and TCPs in an effort to help preserve those sites from vandalism.

Cultural History

Prehistoric Period (11,500 B.C.–A.D. 1500)

The earliest evidence of human occupation in Arizona dates to the Paleoindian Period roughly 11,500 years ago. Paleoindian groups were known for mobile, hunting-based lifestyles with an emphasis on the exploitation of megafauna. The Clovis complex, the earliest undisputed culture during this time period, is strongly evident in southeastern Arizona (Danson 1961; Huckell 1982; Downum 1993). However, Geib and Pilles have compiled evidence of the occupation of Paleoindian groups in northern Arizona and have documented the discovery of Clovis points near the project area, specifically Anderson Mesa, Anderson Canyon, and Dog Valley (Geib and Pilles 2000).

Major environmental changes and the extinction of megafauna marked the beginning of the Archaic Period (7500 B.C.–A.D. 500) and prompted a shift in subsistence strategies. Archaic groups are characterized by their use of diverse plant resources and their adaptation to hunting smaller game. Within the Flagstaff region knowledge of this period is derived from scattered Archaic-style points and a limited number of archaeological sites (Windmiller and Huckell 1973; Bremer 1989; Anderson 1990; Keller and Dosh 1996). Archaic period points and possible Late Archaic sites have been located in the area surrounding the project (Wilson 1969; Batcho 1982).

The Formative Period is characterized by the emergence of a ceramic tradition. The associated cultural group within the Formative Period, termed the Sinagua by Colton, occupied the Flagstaff area from roughly A.D. 600 to 1400 (Colton 1939; Reid and Whittlesey 1997). Regionally, the Sinagua are situated amidst the major cultural units of the Southwest, the Mogollon, Anasazi, Patayan and Hohokam. Two distinct Sinagua populations distinguish themselves within the archaeological record due to their regionally diverse material cultures and adaptations to different environmental zones. These groups are known as the Northern Sinagua, located in and around Flagstaff (including the project study area), and the Southern Sinagua, situated in Verde Valley (Colton 1946).

From their pottery, early pithouse styles, and later rectangular ceremonial structures (kivas), the Sinagua seem to be a regional variation of the Mogollon cultural tradition and are recognized by their locally manufactured brownwares and a general lack of decorated pottery. Being located at the interface between several cultural groups, non-local material culture attributes, such as Hohokam-like pithouses and ballcourts are occasionally found (Fish, Pilles and Fish 1980; Cordell 1984). Whether these shared cultural traits indicate population movement between groups, extensive trade networking or some combination of both, is still debated.

The Hopi claim ancestry to the Sinagua and other Ancestral Puebloan groups. The Zuni claim ancestry to all Ancestral Puebloan groups, including the Sinagua. Archaeological sites in and around the project study area may show evidence of Ancestral Puebloan cultures and thus, may be of interest to the Zuni and the Hopi people. The Zuni recognize the project study area and the areas surrounding it to have important cultural and religious meaning. Archaeological sites, trails, petroglyphs, and shrines that are located within or near the project study area are viewed as physical record that this area is a part of the Zuni cultural landscape and figured prominently in Zuni history. Chavez Pass, which is located immediately to the south of the wind park study area, is an area of interest to both the Hopi and Zuni people. Canyon Diablo, which runs southwest/northeast within the wind park study area, and Meteor Crater to the northeast, are both important religious areas for the Zuni. The San Francisco Peaks, visible from the wind park, are important to the Zuni for medicinal plant, minerals, and pinyon nut collecting activities. Thus, the Zuni Heritage and Historic Preservation Office (ZHHPO) states that the project study area and surrounding area play a "significant role in the continuation of the cultural identity of the Zuni people" (ZHHPO 2010).

Hopi traditions recognize Chavez Pass as an ancestral gateway on a prehistoric route located south of the project study area (Pilles 1987). This trail, part of an extensive prehistoric trade route from New Mexico through north-central Arizona, was used for more than 1,200 years and has been named the "Palatkwapi Trail" by historian James Byrkit (Byrkit 1988a). Zuni traditions also recognize Chavez Pass as a sacred place where the A:Shiwi separated during their migrations. Zuni cultural advisors identified shrines and petroglyphs at Chavez Pass during a field visit in April 2010 that supports this traditional oral history (ZHHPO 2010). Canyon Diablo contains important Zuni ancestral migration sites for the Zuni and both Canyon Diablo and Meteor Crater have names in the Zuni language (ZHHPO 2010). "The Zuni believe that these places are still spiritually inhabited by their ancestors and that their preservation is vital to maintaining a harmonious balance with nature and the spiritual world. The Zuni believe that physical disturbances to these sacred places can cause an imbalance in the natural and spiritual worlds" (ZHHPO 2010).

Sinagua chronology is related to a major eruption that occurred in the Flagstaff area resulting in the creation of Sunset Crater (McGregor 1936; Colton 1960; Pilles 1979). Some researchers postulate that the eruptions lasted as late as 1250 AD, but most accept a late 11th century date. The Sinagua chronology is divided in terms of pre-eruptive and post-eruptive phases initially established by Colton and still in use today (Colton 1946; Pilles 1988).

The three pre-eruptive phases are known as Cinder Park (A.D. 600 to 700), Sunset (A.D. 700 to 900), and Rio de Flag (A.D. 900 to roughly 1066) (Pilles 1988). According to Pilles, the ceramics, architectural styles, settlement plans, and subsistence strategies were fairly uniform throughout these phases (1979). During this time the Sinagua were characterized as "hunter-gathers and farmers living in small to medium-sized pit house villages" (Kamp and Whittaker 1999). Sites dating to these phases have been discovered in and around the project study area (Wilson 1969; Henderson 1979; Batcho 1982).

Post-eruptive phases began with the Angell-Winona (A.D. 1064 to 1100) and Padre (A.D. 1100 to 1150) phases (Kamp and Whittaker 1999). During this phase there existed a variety of pithouse forms, but the classic Angell house with an entry/alcove to the east is most common. Populations settled at lower elevations among the piñon-juniper zones as opposed to settlement locations in the higher ponderosa zone, preferred in previous phases. Masonry architecture is common during the subsequent Padre phase, including rectangular masonry-lined pit houses, field houses, above-ground structures, and community rooms (Pilles 1996).

The Elden phase (A.D. 1150 to 1250) marked a peak in Sinagua culture characterized by the construction of large pueblos, extensive agricultural systems, and numerous field houses (Pilles 1978; Reid and Whittlesey 1997). Agricultural features during this phase included terraces, check dams, reservoirs, linear border, and grid border systems (Kamp and Whittaker 1999). Population was concentrated in locations north and east of Flagstaff and in the Anderson Mesa area to the south. "Forts" were built atop hills and high cinder cones during this time, but their primary function is still unknown (Pilles 1987).

The final two phases, Turkey Hill (A.D. 1250–1300) and Clear Creek (A.D. 1300–1400), were periods of decline and abandonment (Reid and Whittlesey 1997). According to researchers, hardships were likely due to unfavorable environmental conditions (McGregor 1965; Downum 1988, 1992). The Turkey Hill phase is noted for the reduction or abandonment of settlement units and agricultural systems.

After A.D. 1425, complete abandonment of the large pueblo towns occurred and the Sinagua culture disappeared as a distinct entity from the cultural landscape. Archaeological evidence as well as Hopi oral traditions indicates that the remaining Sinagua moved to the Homol'ovi sites and then later to the Hopi Mesas, where their descendants still live today (Pilles 1987; Reid and Whittlesey 1997). Hopi and Zuni traditions suggest some of the Anderson Mesa Sinagua moved to the Zuni area, as well.

Historic Period (A.D. 1540–1930)

Spanish exploration of the region reportedly began when Coronado's men visited the Hopi Mesas and the Grand Canyon in the 1540s (Cline 1976). Later, members of the Antonio de Espejo expedition traveled through Chavez Pass in 1583. Historians speculate that Espejo's route followed the prehistoric Palatkwapi Trail through Sunset and Chavez Passes and south into the Verde Valley (Bartlett 1942; Hammond and Rey 1966; Byrkit 1988a). In 1598 Spanish explorer Marcos Farfan de los Godos, under the leadership of Juan de Onate, reportedly traveled along the same trail in search of silver mines (Cline 1976). By 1604 Onate and the Farfan party returned to New Mexico via the same route (Stein 1994). Franciscan missionaries established a series of missions on the Hopi Mesas in 1629 but were driven out a few decades later (Cline 1976). Through the rest of the 17th century, no renewed Spanish exploration or missions occurred in the region (Wilson 1969).

In the project vicinity two trails, the Thirty-Fifth Parallel and the Palatkwapi Trail, were used extensively by sheep herders prior to the American Period. The Thirty-Fifth Parallel trail was part of the famous sheep herding route from New Mexico to California (Cline 1976; Neff 1984). This trail, used mainly by Spanish and Basque herders, was located north of the project study area. The Palatkwapi Trail, previously mentioned as a prehistoric trade route, served as a sheep herding trail for Anglo, Spanish, and Basque herders before and into the American Period (Byrkit 1988a).

Interest in the Flagstaff and Winslow areas was rekindled after the Treaty of Guadalupe Hidalgo was signed in 1848 to end the war with Mexico (Byrkit 1988a). As a result, the first American expeditions to the region are documented with journeys by Captain Lorenzo Sitgreaves in 1851 and Lieutenant Edwards F. Beale in 1857 (Cline 1976). Stories of Navajo groups hiding in Canyon Diablo to escape and combat Anglo travelers were validated with the location of a few sites within the canyon, but outside of the project study area (Wilson 1969). European discovery of a giant crater formed by meteor impact, a major landmark later known as Meteor Crater, drew scientists to the area at the end of the 19th century.

Chavez Pass was named for Colonel J.F. Chavez who escorted the territorial government party from Santa Fe to Fort Whipple in 1863 (Neff 1984). Chavez's routes were associated with a military and stage coach road and he traversed the project study area on several other occasions during 1864 (Byrkit 1988a; Byrkit 1988b). According to these sources, Chavez never passed directly through the pass which now carries his name.

Sheep and cattle herding along with lumber became major industries in and around Flagstaff in the late 1800s. A populous Basque community resided in Flagstaff due to their role in the local sheep industry (Stein 1991). During this period a major sheep operation owned by Anglo sheep herders, the Daggs brothers, was headquartered near Chavez Pass (Neff 1984). Wild horses were rounded up for military use during World War I in the Anderson Mesa area and a few remnants of the corrals still exist.

The Star Line Transportation Company established a stage coach route from Prescott to Santa Fe with Chavez Pass as a stop (Byrkit 1988a). However the establishment of the Atlantic and Pacific Railroad through Flagstaff in 1882 resulted in fewer travelers utilizing the older route through Chavez Pass (Byrkit 1988a). The railroad, situated along the Thirty-Fifth Parallel, led to the growth and development of towns along the line, such as Flagstaff and Winslow.

The Coconino National Forest was established in July 1908 and serves as the western edge of the wind park study area. Homesteads and livestock operations occurred in and around the project study area due to favorable laws such as the Homestead Act of 1862 and the Stock-Raising Homestead Act of 1916 (Neff 1984). Eleven homesteads were established within the project study area during the 1920s and 1930s, although the Christian Jurgenson homestead dates to 1898. Fourteen stock raising homesteads were established between 1922 and 1936. In addition, a mineral lands patent was obtained to quarry the rock at Meteor Crater. By the 1930s the project study area was mainly used by the Bar T Bar Ranch Corporation for the winter ranging of cattle (Neff 1984).

Previous Sites and Surveys

Records were checked at the Arizona State Museum, Arizona SHPO, Coconino National Forest, and the AZSITE on-line cultural resources database. Searches were conducted to determine whether previously identified cultural resources were present or if previously reported archaeological investigations had been conducted within the evaluation area.

Background research identified 69 previously conducted surveys within the resource evaluation area; 23 of these surveys overlap or occur within 100 feet of the wind park study area, tie-line, and/or switchyard.

The Class I Cultural Resources Overview prepared for the project identified 678 previously recorded cultural resources within the cultural resources evaluation area, of which 24 sites potentially overlap or occur within 100 feet of the wind park study area, tie-line, and/or switchyard. Previously identified sites consist of both prehistoric and historic manifestations. In general, the research indicates a relatively low density of sites within the wind park study area and the two primary access routes originating from Meteor Crater Road. The Class I Cultural Resources Overview indicates that the 345-kV tie-line may extend through areas of higher site density that may include large prehistoric habitation sites and historic structures. Low site density is found in the vicinity of Western's proposed switchyard.

TCPs may be present within the cultural resources evaluation area. Western has initiated consultation with the Hopi and Zuni Tribes and the Navajo Nation. These consultations are being conducted to evaluate TCPs and support Western's and the Forest Service's government-to-government consultations with the tribal governments and appointed tribal staff. Tribal cultural staff members have been invited to participate in cultural resource surveys and to conduct ethnographic and TCP studies. Consultations are expected to continue into the construction stages of the proposed project.

3.3.2 Environmental Consequences

3.3.2.1 Standards of Significance

Of the 24 sites potentially overlapping or occurring within 100 feet of the wind park study area, tie-line, and/or switchyard, four are eligible for listing on the NRHP. To define the criteria for impact evaluation, thresholds of significance for a given environmental effect are provided for cultural resources. Significance of any cultural resources is determined following the criteria for eligibility for nomination to the NRHP, as defined in 36 CFR Part 60.4. The NRHP criteria states:

> "The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, building(s), structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and

a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
b) That are associated with the lives of persons significant in our past; or
c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d) That have yielded, or may be likely to yield, information important to history or prehistory."

If resources are determined to be eligible for listing on the NRHP, and SHPO concurs with Western's determination, these resources are then considered significant and the agency must avoid or lessen the impacts to them. If it is not possible to avoid one or more of these eligible sites, a treatment plan would be developed through consultation with Indian Tribes, land managing agencies, State and local agencies, public, and the Advisory Council on Historic Preservation to mitigate project-related effects.

A significant impact on cultural resources may result if any of the following were to occur from construction or operation of the proposed project components:

- Damage to, or loss of a site of archaeological, Tribal or historical value that is listed, or eligible for listing, on the NRHP.
- Loss or degradation of a traditional cultural property or sacred site, or if the property or site is made inaccessible for future use.
- Disturb human remains, including those interred outside of formal cemeteries.

3.3.2.2 Applicant's Proposed Project and Proposed Federal Actions

Research identified 678 previously recorded cultural resources within the cultural resources evaluation area for the proposed project facilities. Twenty-four of the sites potentially occur within 100 feet of the wind park study area, tie-line, and/or switchyard. Of the 24 sites, four of these are recommended as eligible for listing on the NRHP. Provisions of the PA provided in Section 2.7 (Applicant and Agency Resource Protection Measures) state that a reasonable effort would be made to design the project in such a manner as to minimize impacts to NRHP listed and eligible properties. This may include siting project

facilities to avoid specific cultural resource sites. Based on these measures, there would be no significant impacts to, or loss of a site of archaeological, Tribal or historical value that is listed, or eligible for listing, on the NRHP.

The development of wind park and tie-line facilities may also indirectly impact areas of interest to Native Americans, such as sacred areas, or areas used for collecting traditional resources, such as birds and medicinal plants. Visual impacts on significant cultural resources, such as sacred landscapes, historic trails, and viewsheds from other types of historic properties (e.g., homes and bridges) may also occur. In addition, there may be visual impacts on TCPs because the visible wind turbines may be perceived as an intrusion on a sacred or historic landscape that could result in a significant adverse effect to these TCPs. TCPs are currently being evaluated through tribal consultation.

A draft PA among Western, Coconino National Forest, ASLD, Arizona SHPO, the Applicant, Tribes, and other interested parties has been prepared and is currently under review by the agencies. The PA, prepared by Western and reviewed by consulting parties, establishes the area of potential effect for the proposed project, proposes a treatment plan for identified resources that cannot be avoided, describes procedures for unanticipated discoveries, sets forth procedures for tribal consultation, and suggests general mitigation measures. The PA would ensure that there would be no "unmitigatable" adverse effects on historic properties as defined under the NHPA.

The Applicant would avoid, to the extent possible, areas containing identified resources. Further, the PA would address options for the treatment of historic properties, and specific mitigation measures would reduce impacts to sensitive resources so that there would be no adverse effect on cultural sites. Class III surveys on all proposed disturbance areas would be conducted prior to land disturbance for construction.

3.3.2.3 Alternative Transmission Tie-line Corridor

Construction and operation of the alternative tie-line would not result in substantial difference to the impacts of cultural resources in the area. The location of the alternative alignment is within one-half mile of the proposed alignment and would have a similar cultural resources density.

3.3.2.4 No Action Alternative

Cultural resources would not be encountered or otherwise affected if the wind park, tie-line, and switchyard were not constructed. As a result, no impacts to cultural resources would occur.

3.4 GEOLOGY AND SOILS

3.4.1 Affected Environment

3.4.1.1 Resource Evaluation Area

The geology and soils evaluation area for this analysis is the footprint of the wind park study area, transmission tie-line, and Western switchyard. Maps, data, and publications about local soils and geological resources were gathered from websites maintained by NRCS, U.S. Geological Survey (USGS), and the Coconino National Forest Terrestrial Ecosystem Survey. This information was used for supporting geology and soils analysis, and project planning and implementation.

3.4.1.2 Characterization

Geomorphology and Geology

The geology and soils evaluation area is situated just above the Mogollon Rim at the southern boundary of the Colorado Plateau. It is located between Anderson Mesa and the Little Colorado River in a section of the Colorado Plateau known locally as the Mogollon Plateau. Basement rock is Kaibab limestone and,

below that, Coconino sandstone that formed in the Permian period at the end of the Paleozoic era. Both limestone and sandstone are sedimentary rock, laid down 286 to 245 million years ago (USGS 1997). Late in the Permian, the region was uplifted above a sea and eroded into a plain incised by shallow stream channels (Cronic 1983). The Plateau was uplifted again about five million years ago, this time tipping toward the north and establishing present-day stream channels (Foos 1999).

About 50,000 years ago, an iron mass plunged into the earth creating Meteor Crater, located approximately five miles southeast of the intersection of I-40 and Meteor Crater Road. The meteorite crashed and exploded, creating a vast hole and rim in the Kaibab limestone bedrock. The impact threw fragments of the meteorite onto the area including Canyon Diablo (Chronic 1983).

Mineral Resources

The geology and soils evaluation area does not have deposits of oil, natural gas, or minerals that would be used in industrial or energy applications (Arizona Geological Survey 2009). Sand and gravel are common resources in the region.

Geologic Hazards

Four million years ago, volcanic activity was a hazard near present-day Flagstaff and Springerville. The most recent eruptions occurred over a 150 year period beginning in 1064, at Sunset Crater located approximately 35 miles northwest of the evaluation area. However, there is no evidence of frequent small earthquakes caused by the movement of molten rock, or other activities that normally signal renewed activity (Fellows 2000). Fewer than ten shallow earthquake episodes have been recorded in the area south and east of Flagstaff since 1990. There is a 25 percent probability of a magnitude 5.0 or greater earthquake occurring in the next 50 years within 30 miles of the geology and soils evaluation area (USGS 2009). Figure 3.4-1 depicts the probability of an earthquake in the general vicinity of the evaluation area. There are several small fault zones within 25 miles of the evaluation area. The closest faults in Quaternary rock strata are the Rock House and Leupp faults, located north and west of I-40, and the Lake Mary and Mormon Lake fault zones located on Anderson Mesa.

Soils

The geology and soils evaluation area is almost 100,000 acres in size and has many soils formed from lithic bedrock. Mapped soil units are listed in Table 3.4-1 and their general locations are depicted on Figure 3.4-2 (wind park study area) and Figure 3.4-3 (tie-line and switchyard).

Three soils, Deama, Epikom, Winona and their associated map units, account for 96 percent of the soils within the wind park study area. Deama and Winona soils are shallow and well-drained, formed from limestone and sandstone. Unweathered bedrock is often 19 to 23 inches beneath the surface with substantial stony, cobbly, and gravelly components in the subsoil layers. Epikom complex occurs on shallow to steep slopes. These soils have low potential to respond to frost or corrode concrete foundations. Most soils make poor natural road surfaces because of low strength, presence of a restrictive layer, and the potential for erosion and rutting.

Soils on National Forest System lands (depicted in Figure 3.4-3) within the proposed transmission tie-line and alternative tie-line rights-of-way are mapped as part of the Forest Service's Terrestrial Ecosystem Survey. The vast majority of these soils are deep, well-drained, and weathered from basalt and related volcanic rocks (Hendricks 1985). Most of these soils are fine-textured (clayey), are moderately susceptible to erosion (moderate erosion hazard) and have severe limitations as a natural road base due to low strength and high shrink-swell hazard.

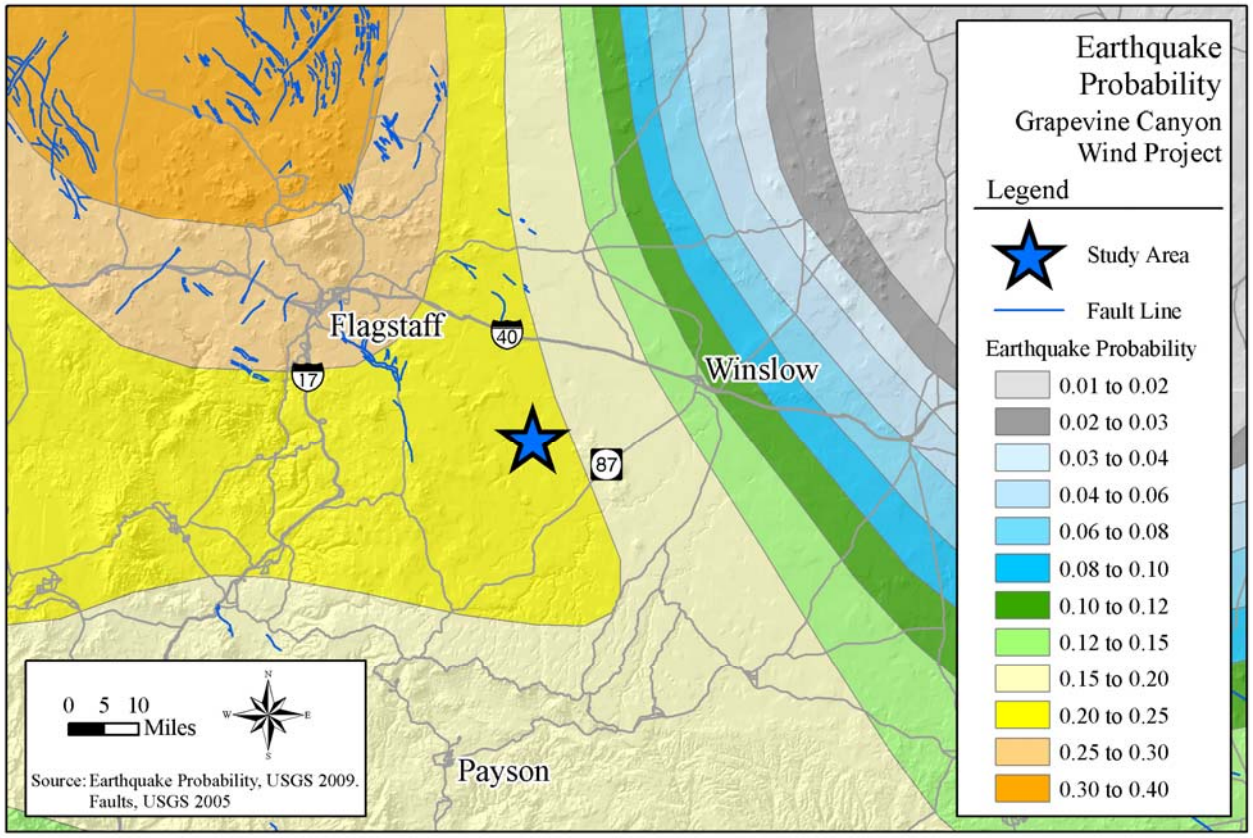


FIGURE 3.4-1

TABLE 3.4-1
MAPPED SOILS

Map Key	Soil Name	Area (acres)	Area %	Slope	Erosion Hazard		Corrosion Hazard Uncoated Steel	Limitations for Roads	Runoff Potential
					Water	Wind			
10	Deama gravelly loam	8,460	9%	2-15%	high	low	moderate	severe	high
11	Deama stony loam	13,032	14%	1-15%	high	low	moderate	severe	high
13	Deama-Toqui complex	1,440	2%	0-8%	high	low	moderate	severe	high
18	Epikom complex	3,974	4%	0-15%	high	low to moderate	high	severe	high
19	Epikom-Rock outcrop complex	—	<1%	8-60%	high	low	high	severe	high
29	Paymaster-Lynx association	871	<1%	gently sloping	low	low to moderate	moderate	moderate	moderately low
37	Rune silty clay loam	891	<1%	0-8%	low	low	high	low moderate	moderately high
38	Rune-Disterheff association	502	<1%	gently sloping	low	low	high	moderate	moderately high
39	Servilleta fine sandy loam	105	<1%	1-8%	moderate	moderate	high	moderate	moderately high

TABLE 3.4-1
MAPPED SOILS

Map Key	Soil Name	Area (acres)	Area %	Slope	Erosion Hazard		Corrosion Hazard Uncoated Steel	Limitations for Roads	Runoff Potential
					Water	Wind			
40	Servilleta-Tusayan complex	700	<1%	1-8%	moderately high	low to moderate	high	moderate	moderately high
44	Springerville very stony clay	235	<1%	0-8%	moderate	low	high	severe	high
48	Thunderbird-Rock outcrop complex	450	<1%	30-60%	moderately high	none	high	severe	high
49	Thunderbird-Springerville association	484	<1%	strongly sloping	moderately high	low	high	severe	high
55	Tusayan-Lynx association	232	<1%	gently sloping	low to moderately high	low	high	moderate	moderately low to moderately high
60	Winona gravelly loam	35,194	37%	0-8%	high	low	moderate	severe	high
61	Winona stony loam	11,881	13%	0-8%	high	low	moderate	severe	high
62	Winona-Boysag gravelly loams	218	<1%	0-8%	high	low	moderate	severe	high
64	Winona-Rock outcrop complex	7,022	7%	15-30%	high	low	moderate	severe	high
65	Winona-Rock outcrop complex	3,659	4%	30-70%	high	low	moderate	severe	high
66	Winona-Tusayan association	5,448	6%	gently sloping	high	low	moderately high	severe	high
436	Lithic and Calcic Ustochrepts-fine sandy loam	12	<1%	0-15%	moderate	moderate	—	moderate to severe	—
437	Lithic and Calcic Ustochrepts-fine sandy loam	24	<1%	0-15%	low to moderate	low to moderate	—	moderate to severe	—
439	Typic Haplustalfs-deep cobbly loam	15	<1%	15-40%	moderate	moderate	—	severe	—
453	Vertic and Typic Haplustalfs-deep cobbly clay loam	138	<1%	0-15%	moderate	moderate	—	moderate to severe	—
465	Typic and Vertic Haplustalfs-deep cobbly clay loam	20	<1%	0-15%	low to moderate	low to moderate	—	severe	—
523	Mollic Eutroboralfs-deep very cobbly clay loam	6	<1%	0-15%	low	low	—	severe	—
524	Typic Argiborolls and Mollic Eutroboralfs-moderately deep very stony and cobbly loam	7	<1%	15-40%	high	high	—	severe	—
	TOTAL	95,043	100 %						

Source: NRCS 2008, 2009; CNF 1995

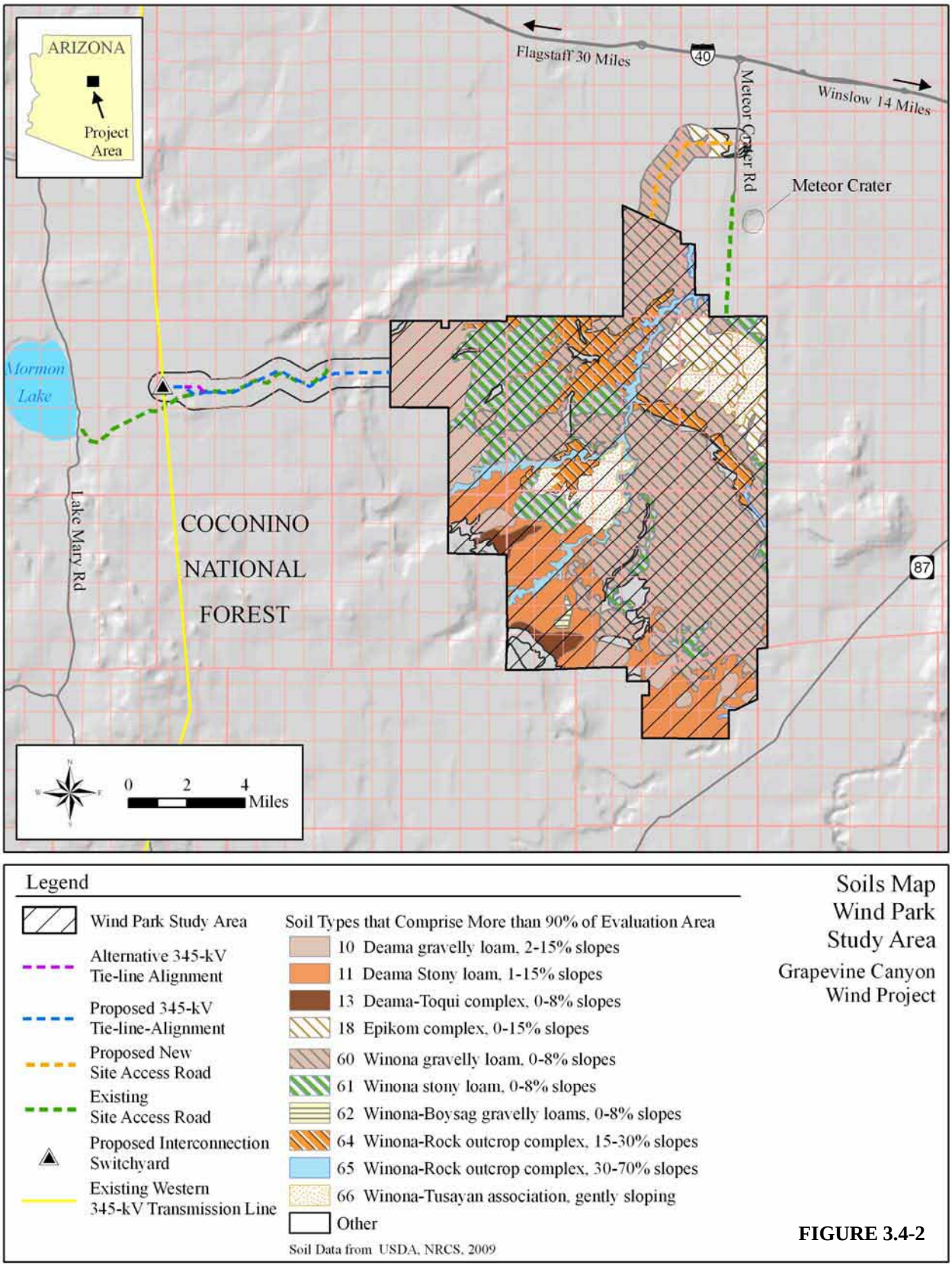
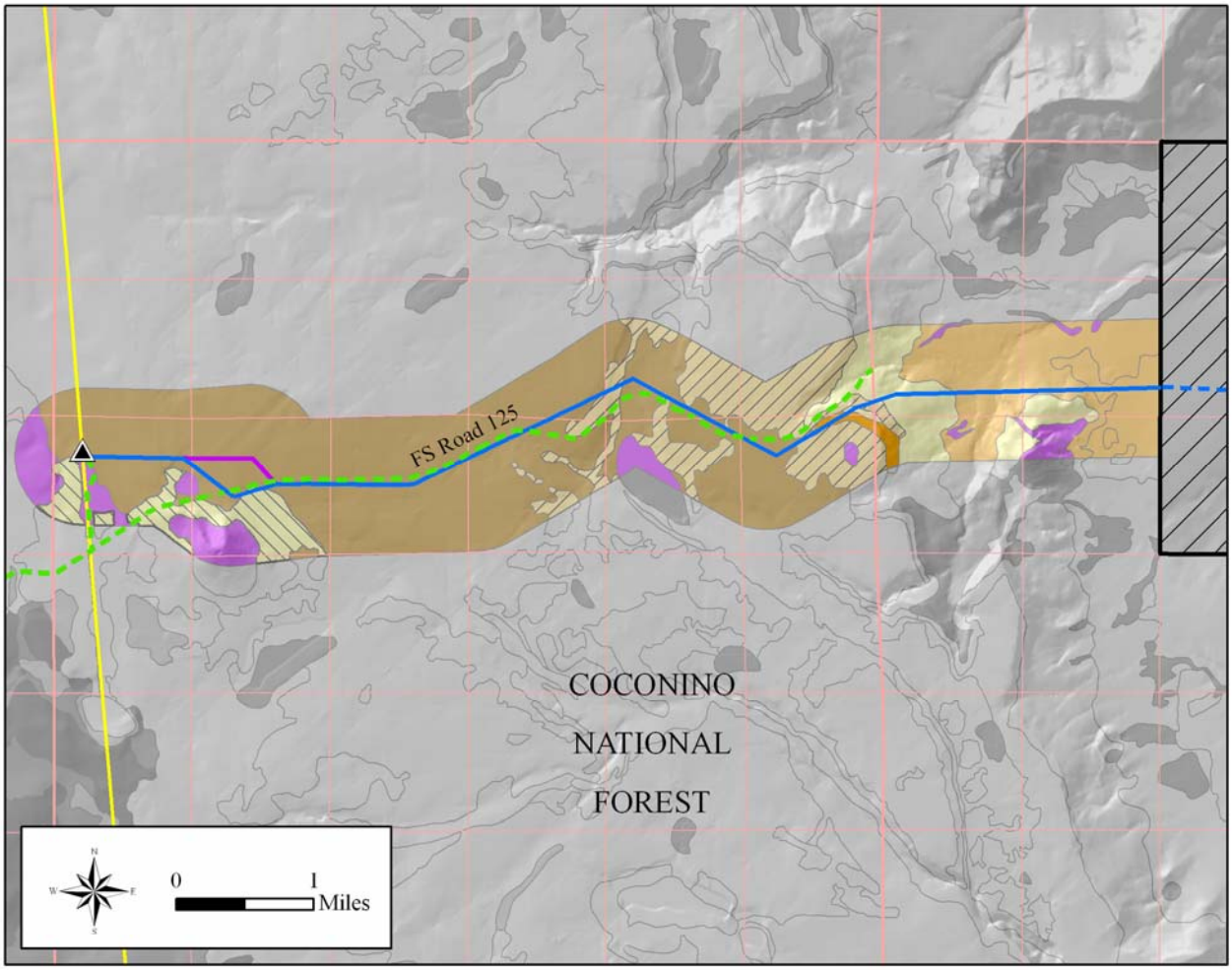

ARIZONA
Project Area
Flagstaff 30 Miles
40
Winslow 14 Miles
Meteor Crater Rd
Meteor Crater
Mormon Lake
Lake Mary Rd
COCONINO NATIONAL FOREST
87
0 2 4 Miles
Legend
Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-line-Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Line
Soil Types that Comprise More than 90% of Evaluation Area
10 Deama gravelly loam, 2-15% slopes
11 Deama Stony loam, 1-15% slopes
13 Deama-Toqui complex, 0-8% slopes
18 Epikom complex, 0-15% slopes
60 Winona gravelly loam, 0-8% slopes
61 Winona stony loam, 0-8% slopes
62 Winona-Boysag gravelly loams, 0-8% slopes
64 Winona-Rock outcrop complex, 15-30% slopes
65 Winona-Rock outcrop complex, 30-70% slopes
66 Winona-Tusayan association, gently sloping
Other
Soil Data from USDA, NRCS, 2009
Soils Map
Wind Park
Study Area
Grapevine Canyon
Wind Project

FIGURE 3.4-2



Legend

- Proposed Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Alternative 345-kV Tie-line Alignment
- Proposed Interconnection Switchyard
- Existing Site Access Road
- Existing Western 345-kV Transmission Line
- 0436 & 0437 Lithic & Calcic Ustochrepts
- 0439 Typic Haplustalfs
- 0453 Vertic & Typic Haplustalfs
- 0465 Typic & Vertic Haplustalfs
- 0523 Mollic Eutroboralfs
- 0524 Typic Argiborolls & Mollic Eutroboralfs
- Other Soils Not Evaluated

Soils Map
Tie-line and Switchyard
Grapevine Canyon Wind Project

Soil Data from USDA, Forest Service, Coconino National Forest, 2009

FIGURE 3.4-3

3.4.2 Environmental Consequences

This section evaluates the potential impact of the project on geological and soils resources. The primary concern is the potential for ground disturbance or erosion that would reduce the condition or the productivity of soils.

3.4.2.1 Standards of Significance

Impacts to geological and soils resources would be considered significant if any of the following conditions occur:

- Project development would cause appreciable, accelerated soil erosion and loss of productivity or slope failure.
- Soil disturbance, erosion, or compaction would cause long-term, negative impacts to rangeland or wildlife habitat.
- Mineral resources not available elsewhere would be altered or consumed.

3.4.2.2 Applicant's Proposed Project and Proposed Federal Actions

The proposed project would have no effect on prime farmland and/or agriculture, or proposed land uses, because neither of these resources exists within the evaluation area.

Wind Park

The proposed wind park would necessarily disturb soil and bedrock resources to establish a primary access road, service roads, collection transmission system, step-up substation, construction staging areas, and WTG foundations. A total of approximately 2,050 to 2,193 acres would be temporarily disturbed leading to approximately 555 to 570 acres of permanently altered grades and soils of which approximately 450 acres would include new service roads (refer to Table 2.2-4).

Measures would be taken to confine vehicle traffic to existing roads per the RPMs outlined in Section 2.7. This would minimize potential soil compaction resulting from project-related travel on public and private roads to reduce the likelihood the proposed wind park would create adverse soil conditions, erosion, or slope failure that would degrade public land or roads. Significance thresholds for geology and soils would not be exceeded.

Over 90 percent of the wind park study area is covered with Deama and Winona soils that have a high potential for runoff and erosion from water once disturbed (refer to Table 3.4-1). Deama soils are gravelly, stony, shallow, loamy soils with 19 to 23 inches to bedrock. They are not susceptible to compaction but are low in rangeland productivity. However, there are several thousand acres of Winona-Tusayan soils (map key 66 in Figure 3.4-2) at the confluence of Grapevine Canyon and Canyon Diablo that are productive for rangeland forage and susceptible to compaction, runoff, and erosion from water. Winona loams in general (map key 60-62, and 66 in Figure 3.4-2) are shallow, productive, and have high potential for runoff and erosion from water. Soil disturbing activities, such as removing the soil protective cover or compacting the natural soil structure, could directly reduce rangeland forage. They also could potentially introduce a cycle of soil loss and introduction of aggressive non-native species that out compete and further reduce desirable forage species.

The proposed wind park would increase soil erosion and decrease soil productivity during the construction phase. The proposed wind park would permanently remove less than one percent of soil and geology resources in the geology and soils evaluation area from other land uses by converting them to access and service roads, crane pads, parking, and foundations. It could contribute to ongoing soil erosion if drainage structures and soil cover were not well maintained at foundation sites and along service roads.

In order to minimize soil erosion, compaction, loss of soil productivity, and the spread of noxious weeds, the Applicant has proposed RPMs outlined under Geology and Soils in Table 2.7-1. With application of these measures, soil disturbance, erosion, or compaction would not cause long-term impacts to rangeland or wildlife habitat, and applicable significance thresholds for geology and soils would not be exceeded.

One or more borrow pit locations would be selected during final wind park design so that road base material and aggregate could be sourced and crushed on site. Disturbance for each borrow pit would be two to four acres. Sand and gravel are common resources and their use in the quantities required to complete construction of the proposed wind park and tie-line would not substantially reduce their supply in the area; therefore, no unique mineral resources would be altered or consumed.

Tie-line

Table 2.2-6 provides estimates of the extent of ground disturbance along the transmission tie-line corridor including Federal, State trust, and private land. The total temporary disturbance is between 345 and 413 acres, with between 196 and 234 acres on National Forest System lands. This estimate of construction disturbance on National Forest System lands includes the construction staging area, transmission tie-line right-of-way, and access roads. Following construction, areas of permanent disturbance would remain at structure foundations and for access and spur roads to foundation pads where needed. Total permanent ground disturbance would be between 19 and 25 acres, with between 11 and 14 acres located on National Forest System lands.

The proposed tie-line right-of-way would require the use of approximately six miles of existing FS 125, FS 9483g, and new spur roads to access individual transmission structures (see Figure 2.2-14). FS 125 does not descend Anderson Mesa, so a new access road would be constructed within the proposed 200-foot right-of-way, adjacent to a drainage that is tributary to Yaeger Canyon. This portion of the transmission tie-line would follow an existing cattle trail west out of the wind park study area to minimize new land disturbance. This new access road would extend approximately 2.5 miles from FS 125 to the Forest Service boundary, then up to approximately 6.5 miles to the step-up substation. The total area of potential ground disturbance for road construction and maintenance would be between 18 and 24 acres with roughly between 10 and 13 acres on National Forest System lands.

Most of the soils along the proposed tie-line are loams that are moderately or highly erodible and have severe limitations for development as unsurfaced roads. On private and State trust lands, Deama and Winona loams have high runoff potential and high hazard for erosion from water (map keys 10, 61 in Figure 3.4-2). There is also a rock outcrop with 15-30 percent slopes located within the proposed right-of-way (map key 64 in Figure 3.4-2). On National Forest System lands, soils are primarily Ustochrepts (map keys 436, 437 in Figure 3.4-3), and Haplustalfs found in the tributary to Yaeger Canyon from Anderson Mesa (map keys 439, 465 in Figure 3.4-3). Both soil types have moderate hazard of erosion and severe limitations for road development. The Haplustalfs soils would compact, pond, and displace if disturbed while wet. Flowing water creates sheet and rill erosion when soil protective materials are removed. These soils resist revegetation due to their high clay content.

Construction of the tie-line would increase soil erosion and reduce soil productivity for a relatively small area. The access roads and structure foundations would permanently remove between 19 and 25 acres of soil and geology resources from other land uses, and could contribute to ongoing soil erosion if soil cover and drainage structures were not well maintained. To minimize impacts, RPMs identified in Table 2.7-1 under Geology and Soils would be implemented and impacts to geology and soils as a result of the proposed tie-line would not cause appreciable, accelerated soil erosion and loss of productivity or slope failure nor cause long-term, negative impacts to rangeland or wildlife habitat. Applicable significance thresholds associated with soils would not be exceeded.

Western's Switchyard

A total of 24 acres would be temporarily disturbed by Western during construction of the proposed Switchyard. Switchyard construction would temporarily disturb approximately 20 acres of National Forest System lands and an additional four acres would be temporarily disturbed during the installation of new tie-in dead-end structures on the Glen Canyon-Pinnacle Peak transmission lines leading into the new switchyard. Temporary use areas would be reclaimed prior to operations. The switchyard and staging area would be located on Haplustalf soils, which are deep, cobbly clay loams formed on elevated plains (map key 453 in Figure 3.4-3). These soils have a moderate erosion hazard, and maintenance of vegetative groundcover is essential to prevent accelerated sheet and rill erosion and reduce seasonal surface cracking that accelerates drying of the subsoil. The success of revegetation is limited by soils with clayey textures at or near the surface. Haplustalf soils have severe limitations for unsurfaced roads because they are shallow and easily eroded.

The proposed switchyard would result in the permanent conversion of approximately 15 acres of National Forest System lands with productive soils to industrial use. Construction activities would have an additional impact on Forest soils resources beyond those described for the tie-line and access roads due to the nature of the site's soils. RPMs, as outlined in Section 2.7 for the proposed switchyard, would be applied to avoid spreading subsurface soils over, or mixing them with, surface soils. With the application of these RPMs, impacts to geology and soils as a result of the proposed switchyard would be minimized and significance criteria listed in Section 3.4.2.1 would not be exceeded.

3.4.2.3 Alternative Transmission Tie-line Corridor

The alternative tie-line would permanently disturb between 20-26 acres, or one more acre than the proposed tie-line, of which between 12-15 acres would be on National Forest System lands. Although the length of the alternative tie-line is approximately the same as the proposed tie-line, the alternative tie-line alignment requires approximately three-quarters mile more access roads to be constructed because it does not maximize the use of existing roadways. It would require establishing a new corridor within one-half mile of the proposed tie-line which parallels FS 125 and FS 9483g. The alternative tie-line alignment would be located on Haplustalf soils (map key 453 in Figure 3.4-3). These soils have a moderate erosion hazard. Maintaining vegetation, rock fragments, and other soil cover is essential in preventing accelerated erosion. These soils are problematic for revegetation activities due to clayey soils near the surface that shrink in response to dryness. Haplustalf soils are also problematic for developing unsurfaced access roads because they are shallow and erode easily. RPMs, as outlined in Section 2.7, would be applied and impacts to geology and soils would not cause appreciable, accelerated soil erosion and loss of productivity or slope failure nor cause long-term, negative impacts to rangeland or wildlife habitat. Applicable significance thresholds for geology and soils would not be exceeded.

3.4.2.4 No Action Alternative

Geology and soil resources would not be disturbed or otherwise affected under the No Action Alternative. Under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The wind park, tie-line, and switchyard would not be constructed and geology and soils would remain unchanged.

3.5 AIR QUALITY

3.5.1 Affected Environment

3.5.1.1 Resource Evaluation Area

This section addresses ambient regional air quality conditions, and discusses potential air quality impacts related to the proposed wind park, transmission tie-line, and Western switchyard and alternatives. Since there are no Class I airsheds or designated air quality nonattainment areas in the vicinity of the proposed facilities, the air quality evaluation area includes all of Coconino County.

3.5.1.2 Characterization

Climate and meteorological information was gathered from the Western Regional Climate Center (WRCC) and the National Oceanic and Atmospheric Administration (NOAA). Ambient air quality data were collected from the U.S. Environmental Protection Agency (EPA) Air Quality Database. Further rules and regulations were gathered from the ADEQ. Meteorological conditions can affect the extent to which air pollutants are dispersed. Winds as reported at the Winslow, Arizona monitoring station are generally from the southwest and average approximately 6.7 miles per hour in December up to 11.7 miles per hour in April. An overview of these and other meteorological conditions is provided in Section 3.6 (Water Resources) of this Draft EIS.

Air Quality Standards and Existing Air Quality

The Clean Air Act (CAA) of 1970, as amended in 1990, required the EPA to develop standards for pollutants considered harmful to public health or the environment. Two types of National Ambient Air Quality Standards (NAAQS) were established (EPA 2008c). Primary standards protect public health, while secondary standards protect public welfare, by including protection against decreased visibility, and damage to things such as animals, crops, landscaping and vegetation, or buildings. NAAQS have been established for six "criteria" pollutants:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Ozone (O_3)
- Particulate matter (PM_{10} and $PM_{2.5}$)
- Lead (Pb)

The CAA uses the Statewide Implementation Plan process, whereby plans are developed by individual States, approved by the EPA, and then implemented by the State. ADEQ is the State agency responsible for ensuring air quality regulation, and has adopted the NAAQS for Arizona. Areas are classified as attainment, nonattainment, or unclassified. Attainment is achieved when monitored ambient air quality data is in compliance with the NAAQS for a specified pollutant. Non-compliance with a standard will result in nonattainment designation, and an unclassified designation indicates that insufficient data are available to determine compliance for that pollutant.

The nearest current nonattainment area is associated with the Phoenix metropolitan area located approximately 100 miles from the wind park study area, which is in nonattainment for O_3 and PM_{10}. The nearest air quality monitor to the wind park study area is located in Flagstaff, approximately 23 miles northwest of the western edge of the wind park study area. Monitors in Coconino County only collect information on $PM_{2.5}$, PM_{10}, and O_3, for which monitored levels are below NAAQS. Monitors for other criteria pollutants are not located in Coconino County.

The EPA has developed standards for ambient air concentrations of criteria pollutants. Coconino County is currently within attainment or unclassified status for all criteria pollutants (EPA 2008a).

The CAA includes measures to Prevent Significant Deterioration (PSD) of air quality in areas where air quality is better than the national standards established by the EPA. One of the purposes of the PSD program is "to preserve, protect, and enhance air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special natural, recreational, scenic or historic value." The PSD program divides areas into two classes based on the potential for degradation due to air quality. Class I areas receive heightened protection through more stringent requirements and include some national parks, monuments, and wilderness areas. All other areas are designated as Class II. The wind park study area, proposed tie-line, and Western switchyard are located within Class II areas. The nearest Class I areas are located in the Sycamore Canyon Wilderness Area, approximately 30 miles to the west and Mazatzal Wilderness Area, approximately 40 miles to the south of the wind park study area.

To implement Federal air quality standards, ADEQ evaluates pollutant emissions from various types of facilities and determines if regulatory operating permits are required. Pollutant-specific emissions thresholds are used to determine whether a new Class II Air Quality Permit would be required for an emissions source. Class II General Permits have also been developed for categories of sources, such as rock crushers and concrete batch plants. A source is considered "major" if it has the potential to emit 250 tons per year (tpy) or more of any criteria pollutant from non-fugitive emissions while located in an attainment area. Additionally, a source would be considered major if it would increase ambient pollutant levels by 1 micrometer^3 (μ/m^3) within 10 kilometers of a Class I area.

Hazardous Air Pollutants

The Federal Hazardous Air Pollutants (HAP) program considers a source major if it has the potential to emit at least 10 tpy of a single HAP or 25 tpy of a combination of HAPs. A minor source would emit 1 to 10 tpy of a single or 2.5 to 25 tpy of a combination of HAPs.

Climate Change/Greenhouse Gas

The Arizona Climate Change Advisory Group (ACCAG), established in 2005, has conducted greenhouse gas (GHG) emissions and projections through 2020. In 2000, electricity production accounted for approximately 40 percent of Arizona's GHG emissions. Projections indicate that if current trends continue, emissions from electricity production will be 75 percent above 2000 levels. The ACCAG developed a climate change action plan with recommendations for reducing GHG emissions in Arizona. The recommendations included mandates and support for renewable energy production.

On December 7, 2009, the EPA Administrator signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

- *Endangerment Finding*: The EPA Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases (i.e., carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6)) in the atmosphere threaten the public health and welfare of current and future generations.
- *Cause or Contribute Finding*: The EPA Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action is a prerequisite to finalizing the EPA's proposed greenhouse gas emission standards for light-duty vehicles, which were jointly proposed by EPA and the U.S. Department of Transportation's National Highway Safety Administration on September 15, 2009 (EPA 2009a).

3.5.2 Environmental Consequences

3.5.2.1 Standards of Significance

Air quality impacts would be considered significant if any of the following conditions were met:

- Emissions generated by construction or operation of the project components would violate any air quality standards.
- Emissions would compromise the attainment status of the area.
- Emissions would cause the significant deterioration of a Class I airshed.
- Project implementation would result in a long-term HAP major source.

Air quality impacts would be greatest during the construction period, and would include emissions from internal combustion engines during equipment operation, fugitive dust from vehicle travel and site grading activities, and operation of a rock crushing plant and concrete batch plant. Operational impacts would be restricted to dust and internal combustion engine emissions due to periodic maintenance vehicle traffic. WTGs do not have emissions.

3.5.2.2 Applicant's Proposed Project and Proposed Federal Actions

This section discusses potential air quality impacts from emissions of pollutants during construction and operation the proposed wind park, tie-line, and switchyard. Direct impacts could be associated with construction, operation, and maintenance of any of the proposed project components (WTGs, meteorological towers, new access roads, collection lines, step-up substation, rock crusher, concrete batch plant, O&M facility, transmission tie-line, and Western's proposed switchyard). Air quality impacts beyond the immediate study area are not predicted, because vehicular dust generation and pollutants from combustion engines are relatively localized at the point of origin and are not permanent.

Construction

Air quality impacts from construction activities would be temporary and limited to the construction period. These temporary impacts would include fugitive dust, vehicle and equipment emissions, and operation of the concrete batch plant and rock crusher.

Fugitive Dust

Construction activities would produce fugitive dust from the following general operations:

- Construction-related traffic on unpaved site roads.
- Ground disturbance from clearing and road and site grading activities.
- Excavation activities, including blasting if required, for on-site borrow pits, WTG foundations, tie-line foundations, and substation equipment foundations.
- Rock crusher and concrete batch plant operations.

The batch plants proposed for use would emit less than 250 tpy of any criteria pollutant and would not require a major source permit. Other fugitive dust expected as a result of construction activities would be mitigated as proposed by the Applicant for construction of the proposed wind park and portions of the tie-line on private and State trust lands, by the Forest Service for portions of the tie-line that crosses National Forest System lands and the proposed switchyard, and by Western for construction of the proposed switchyard (see Section 2.7 under Air Quality). With implementation of the mitigation, construction activities are not expected to violate air quality standards, and air quality significance thresholds would not be exceeded.

Vehicle and Equipment Emissions

Vehicles are considered a mobile emissions source and are not regulated or subject to air quality permit requirements. Construction activities would cause vehicle emissions from the following sources:

- Exhaust from the diesel construction equipment used for site preparation, grading, excavation, and construction of wind park structures, tie-line, and switchyard.
- Exhaust from diesel trucks used to deliver equipment, fuel, and construction supplies to the construction sites.
- Exhaust from vehicles used to transport water, rock, top soil, and concrete.
- Exhaust from water trucks used to control construction dust emissions.
- Exhaust from vehicles used to transport workers and materials to and from and around the construction site.
- Exhaust from various other equipment, including diesel-powered welding machines, electric generators, air compressors.

Mitigation has been proposed by the Applicant for vehicle and equipment use during construction of the proposed wind park and portions of the tie-line on private and State trust lands, by the Forest Service for portions of the tie-line that crosses National Forest System lands and the proposed switchyard, and by Western for vehicle and equipment use during construction of the proposed switchyard (see Section 2.7 under Air Quality). With implementation of the mitigation, vehicle and equipment use during construction are not expected to violate air quality standards, leading to significant impacts. No additional mitigation would be required to minimize vehicle use air impacts.

Concrete Batch Plant and Rock Crusher

Temporary equipment at the proposed wind park would include a portable concrete batch plant and a portable rock crusher, which would be in operation during road building and foundation construction phases, approximately six to eight months in duration for approximately 10 to 12 hours per day, up to six to seven days per week. It is assumed that both the batch plant and rock crusher would use diesel-powered generators during operations. The batch plant would provide concrete and material for the WTG foundations and roads and the tie-line structure foundations.

Dust control systems would be in place and maintained in good operating condition during all periods of crusher and batch plant operation. Emissions controls for stationary processing equipment would include cyclones, fabric filters, and/or wet spray systems. A water mist would be applied as needed near all emission points along the crushing circuit to control dust. As described in Section 2.7, operation of the rock crusher and concrete batch plants would require a minor source permit from ADEQ. The construction contractor would obtain authorization to operate under the general permits available for these facilities and would comply with all terms and conditions of the permit(s). As a result of the temporary use of these facilities, the dust suppression activities and the best management practices associated with the necessary permits, air quality impacts from the concrete batch plant and rock crusher would not violate air quality standards. Applicable air quality significance thresholds listed in Section 3.5.2.1 would not be exceeded.

A material and concrete source for Western's proposed switchyard has not been identified. Typically, the construction contractor selected by Western to construct a switchyard would be responsible for securing material and concrete for the construction. Western would require that any new sources be reviewed and cleared for use in accordance with regulatory requirements before authorizing materials for construction.

<u>Operation</u>

Impacts to air quality as a result of operation of the proposed wind park, tie-line, and switchyard are expected to be negligible (BLM 2005). The proposed WTGs and tie-line would produce no air emissions,

because no fuel would be burned to produce energy. Other facilities such as the O&M building would use electricity or propane to heat and cool the structure, producing some air emissions on an intermittent basis. Operation of the wind park would have a net benefit to air quality, as wind energy produces no air emissions, substantially less than other energy generation sources, such as a coal fired power plants, which would average 2,249 lbs of CO_2 (the most commonly measured greenhouse gas) per megawatt hour produced.

Operational traffic is expected to consist mainly of commuter vehicles and pickup trucks traveling between the WTGs, O&M facility and tie-line structures for inspection and maintenance. Routine maintenance activities would include road maintenance and lubricant changing, which could generate emissions related to combustion from vehicle travel, fugitive dust, and small amounts of volatile organic compounds (VOC) during periodic lubricant replacement. Major maintenance activities could include replacement or repair of major wind park components. This could require the operation of heavy machinery, depending on the specific activity required. Impacts would be temporary and limited to combustion from equipment and fugitive dust from road travel and potential earth moving activities. Routine and major maintenance activities are temporary and site specific, so only minimal impacts would be expected. Therefore, operation of the wind park would not negatively impact air quality.

Western's proposed switchyard and the proposed step-up substation may include sulfur hexaflouride (SF_6) gas-filled circuit breakers. Sulfur hexafluoride is another GHG listed in EPA's endangerment finding. Since 2000, Western has had an aggressive program to identify and repair leaks throughout the transmission system to reduce SF_6 emissions. Western personnel would monitor the use, storage, and replacement of SF_6 to minimize any releases to the environment. The likelihood for accidental release is low, as SF_6 gas is supplied in sealed units and is factory-certified not to leak. During operation of the new switchyard, authorized Western personnel would conduct periodic inspections and service equipment as needed. Properly trained maintenance personnel would monitor and manage the use, storage and replacement of SF_6 to minimize any releases to the environment. During inspections, equipment would be monitored for detection of leaks, and repairs would be made as appropriate.

Western's proposed switchyard would include a backup generator. The size of the backup generator would be determined during the design phase for the switchyard, but it is expected to be under 325 horsepower and exempt from ADEQ permitting requirements (ADEQ 2009a). The generator would be used during periodic testing and in the event of a power outage at the switchyard, since station service would be provided through a proposed station service transformer. The generator's engine would cause periodic air emissions, but below any thresholds that would violate air quality standards.

3.5.2.3 Alternative Transmission Tie-line Corridor

Air quality impacts associated with construction and operation of the alternative tie-line would be similar to those described for the Applicant's Proposed Project. The alternative would have slightly more (approximately one acre) permanent ground disturbance from the construction of an additional mile of access road resulting in an incremental increase in fugitive dust and vehicle emissions.

3.5.2.4 No Action Alternative

No short or long term air quality impacts would result through implementation of the No Action Alternative. Under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The wind park, tie-line, and switchyard would not be constructed and the air quality of the area would remain unchanged.

3.6 WATER RESOURCES

3.6.1 Affected Environment

3.6.1.1 Resource Evaluation Area

The surface area for this analysis extends one mile beyond the boundaries of the wind park study area, the transmission tie-line right-of-way, and the proposed switchyard. However, drainages and aquifers were surveyed for downstream conditions in order to understand the potential for indirect project impacts. Maps, data, and publications about local water resources were gathered from websites maintained by ADEQ, Arizona Department of Water Resources (ADWR), University of Arizona, and NOAA. These were reviewed for information pertinent to evaluating the potential impacts on water resources from the proposed project components.

3.6.1.2 Characterization

Climate

The water resources evaluation area is located in the Plateau Uplands Hydrogeologic Province of Arizona, which is a high desert plateau region where landforms are dominated by deeply incised canyons, high isolated mesas and buttes, and volcanic peaks (Cooley 1963; Montgomery and Harshbarger 1989). While much of the water resources evaluation area is semi-arid, portions closer to the Mogollon Rim receive higher amounts of rainfall. Annual precipitation averages between 10 and 18 inches (ADWR 2009a). Precipitation is variable year to year, and decadal swings of 10 to 20 years between drought and wet conditions are typical (ADWR 2009a). The driest months are April, May, and June and most moisture occurs in July and August (WRCC 2009a). Table 3.6-1 depicts typical monthly weather conditions 20 miles from the project site in Winslow, Arizona.

TABLE 3.6-1
HISTORICAL CLIMATE STATISTICS FOR WINSLOW, ARIZONA

Month	Daily Max Temp[1]	Daily Min Temp[1]	Normal Precip[2]	Max Snow, Ice, Hail[2]/Year of Occurrence	Wind Information		
					Mean Speed[2]	Predominant Direction	Fastest Mile[3]/ Year
January	45	19	0.5	11.3/1987	7.1	ESE	56/1951
February	53	25	0.5	10.7/1973	8.5	SW	63/1971
March	61	30	0.6	11.0/1973	10.6	SW	58/1975
April	70	37	0.3	4.8/1977	11.3	SW	56/1957
May	80	45	0.3	0.6/1978	10.9	SW	53/1950
June	91	54	0.3	0	10.6	SW	52/1953
July	94	63	1.2	0	9.0	SW	59/1954
August	91	61	1.4	0	8.4	ESE	43/1966
September	84	53	0.9	T/1945	8.2	SW	40/1950
October	72	40	0.9	8.2/1961	7.6	ESE	49/1970
November	58	29	0.6	7.4/1952	7.3	SE	46/1964
December	46	20	0.6	39.6/1967	6.7	SE	52/1966
Year	70	40	8.0	39.6/1967	8.8	SW	63/1971

[1] degrees Fahrenheit; [2] inches; [3] miles per hour
Source: Western Regional Climate Center 2009a

Most of the annual precipitation in Arizona occurs in late summer and mid-winter. Precipitation is provided by winter storms of the Pacific Ocean system and annual summer monsoon storm systems originating in the southern Pacific Ocean and the Gulf of Mexico (Jones 1993). Late summer monsoons provide intense rainstorms, generally of relatively short duration. Winter precipitation includes longer duration rains and snowfall. Losses of rainfall and snow to evapotranspiration and sublimation are high in the region.

Temperatures in Arizona have risen since the mid-1970s. Since 1976, the average annual temperature increased by 2.5 degrees Fahrenheit (F). Going forward, average annual temperature in the Southwest is projected to rise by five to eight degrees F by the end of the century (Lenart 2007).

Groundwater

The water resources evaluation area lies over the Little Colorado River Plateau Groundwater Basin. The basin is comprised of consolidated crystalline and sedimentary rocks and three regional aquifers. The shallowest aquifer, the Coconino Sandstone, which is part of the C-aquifer system, is beneath the project site. The C-aquifer generally extends from the Mogollon Rim in the south, northeast into New Mexico, and west beyond the Little Colorado River. Groundwater in the aquifer generally flows north and west from a primary recharge area along the Mogollon Rim and Defiance Plateau.

The regional aquifers are relatively deep (generally several hundred feet to more than 1,000 feet below land surface) and occur in sandstone and limestone units that are gently folded and exhibit relatively shallow regional dips. Groundwater movement in these aquifers occurs chiefly via fracture zones, which are most abundant along major fault systems (Montgomery et al. 2000). The land surface over most of the study area consists of fractured limestone, which provides for rapid infiltration of precipitation and results in meager surface water runoff (Montgomery and Harshbarger 1989). As a result, the Plateau Uplands Province has a small number of perennial streams and rivers. The principal source of groundwater recharge in the water resources evaluation area is infiltration of precipitation in areas of higher topographic altitude and abundant fracturing of the aquifers and overlying rocks, such as along the Mogollon Rim to the south and Anderson Mesa to the west. Summer precipitation is believed to provide limited groundwater recharge due to high rates of evapotranspiration. Winter rains and snowmelt provide most of the groundwater recharge to the aquifers in the area (Montgomery and Associates 2005).

Saturated thickness of the C-aquifer is about 1,000 feet in the Lake Mary well field (the primary water source for the City of Flagstaff) northwest of the evaluation area (Montgomery and Associates 1993) and about 600 feet along the Little Colorado River Valley north of the evaluation area (Bills et al. 2007). Saturated thickness decreases to the northwest as groundwater in the C-aquifer gradually drains to deeper aquifers; the C-aquifer is completely drained in the Cameron area. The major discharge from the Little Colorado River Plateau Groundwater Basin is at Blue Springs along the lower Little Colorado River. While an estimated 413 million acre-feet of water is stored in the C-aquifer, recharge rates are estimated to be 319,000 acre-feet per year (ADWR 2009).

Local aquifers in the water resources evaluation area are important sources for smaller water supplies. These may occur in alluvial deposits along washes and stream channels (ADWR 2009a) and in small, thin, and discontinuous perched groundwater zones in the Toroweap and Kaibab Formations. Municipal, industrial and agricultural activities withdrew around 105,000 acre-feet from the groundwater basin annually from 2001 to 2005 (ADWR 2009a).

A records inventory for 20 registered wells within or in the immediate vicinity of the water resources evaluation area is given in Table 3.6-2. All of these wells are associated with the ranch lands to the east of Anderson Mesa; no wells were identified within one mile of the transmission tie-line alignment on

National Forest System lands. Well locations are shown on Figure 3.6-1. Water levels in the C-aquifer where it is penetrated by wells in the Flying M Ranch area are between 500 and 1,000 feet below land surface. Reported well yields range from 5 to 50 gallons per minute (gpm). Most of the groundwater use is for stock and domestic purposes. AGFD, ASLD, and the Hopi Tribe have registered drill holes in the area (ADWR 2009b). Inspection of sparse hydrograph data for wells in the evaluation area indicate that groundwater levels have raised tens of feet during the past several decades (Montgomery and Associates 2005). Table 3.6-2 identifies six wells owned by Flying M Ranch, four of which have been identified as potential production wells for construction.

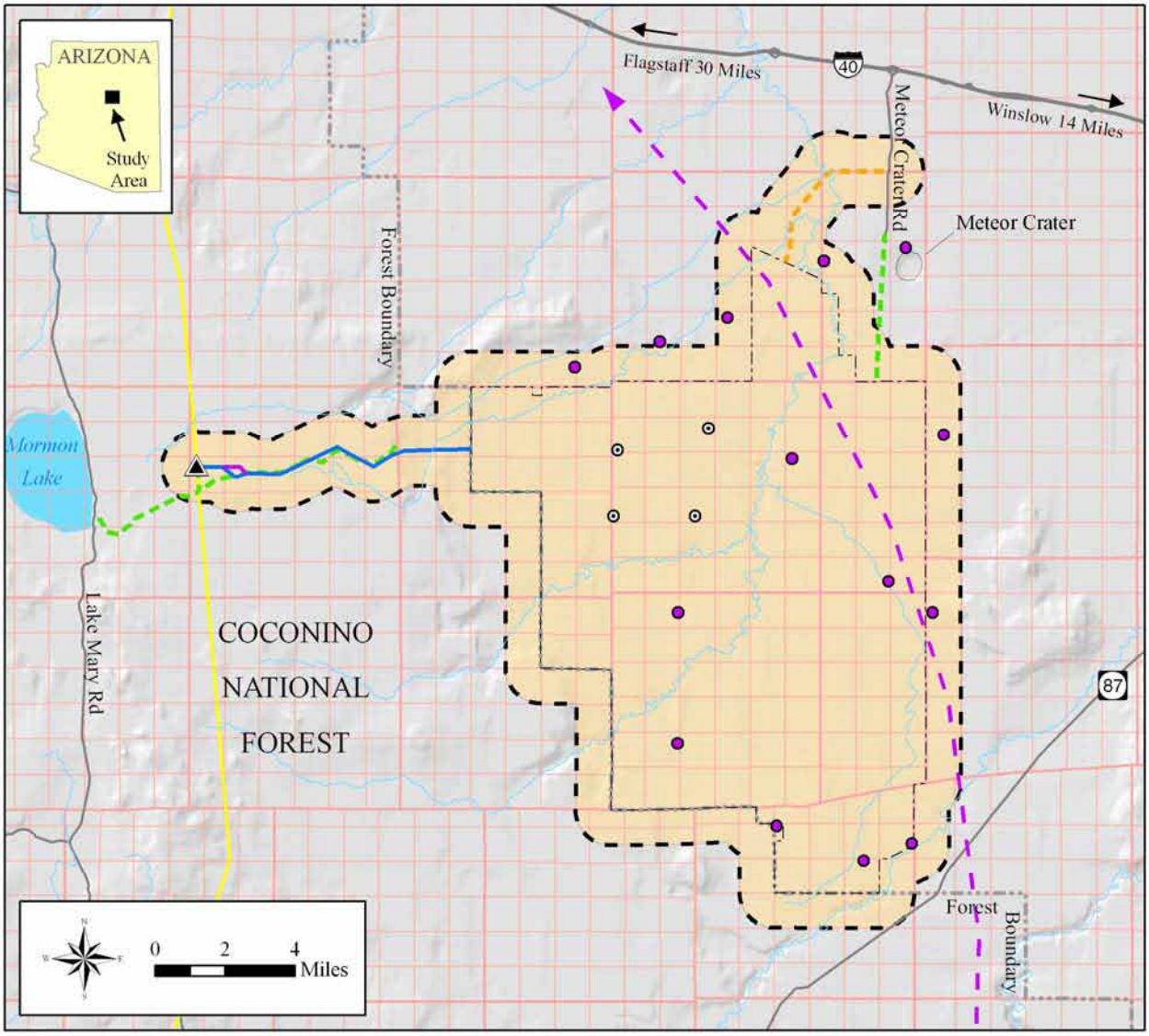
TABLE 3.6-2
SUMMARY OF RECORDS FOR REGISTERED WELLS IN THE WATER RESOURCES EVALUATION AREA

ADWR Reg No./ Local Identifier	Well Use	Water Use	Install Date	Well Depth (ft, bls)[1]	Water Level at Time of Install (ft, bls)[1]	Casing Depth (ft, bls)[1]	Casing Diamtr (inches)	Pump Rate (gpm)[2]	Tested Rate (gpm)[2]	Draw Down (ft)	Owner[3]
55-631362/ A16012009BBB	Water production (exempt)	Stock	1930	1,000	946	8	8	15	15	—	BT
55-208785/ A16012012DAA	Monitor	Monitoring	—	—	—	—	—	—	—	—	SR
55-208786/ A16012012DAA	Monitor	Monitoring	2005	42	9	37	4	—	—	—	SR
55-649925/ A16012014ABB	Water production (exempt)	Irrigation, stock, domestic	—	600	560	—	8	35	35	—	HE
55-646325/ A17012005DAA	Water production (exempt)	Stock, domestic	1947	940	850	20	10	5	5	—	FM*
55-547017/ A17012029ADA	Water production (exempt)	Stock	—	930	—	20	8	—	—	—	FM*
55-606821/ A17013007CBA	Water production (exempt)	Stock	1971	800	760	40	8	12	—	—	HT
55-509618/ A18012007CCD	Water production (exempt)	Stock	1985	1,045	960	20	0	25	25	20	FM*
55-509619/ A18012009ADB	Water production (exempt)	Stock	1985	790	670	20	0	25	25	40	FM*
55-631371/ A18012013BBD	Water production (exempt)	Stock	1930	900	680	12	8	15	15	—	CT
55-509620/ A18012019CCB	Water production (exempt)	Stock	1985	1,010	910	20	0	25	25	30	FM*
55-509617/ A18012021CDA	Water production (exempt)	Stock	1985	900	810	20	0	25	25	30	FM*
55-631359/ A18012535DAD	Water production (exempt)	Stock, domestic	1945	680	590	12	8	15	15	—	CT

TABLE 3.6-2
SUMMARY OF RECORDS FOR REGISTERED WELLS IN THE WATER RESOURCES EVALUATION AREA

ADWR Reg No./ Local Identifier	Well Use	Water Use	Install Date	Well Depth (ft, bls)[1]	Water Level at Time of Install (ft, bls)[1]	Casing Depth (ft, bls)[1]	Casing Diamtr (inches)	Pump Rate (gpm)[2]	Tested Rate (gpm)[2]	Draw Down (ft)	Owner[3]
55-509228/ A18013018000	Mineral exploration	None	—	—	—	—	—	—	—	—	RM
55-560612/ A19011035ADD	Water production (non-exempt)	Irrigation, stock	1997	1,140	1,000	1140	10	40	30	60	AZ
55-522224/ A19012027BAC	Abandoned	Stock	1988	370	—	—	—	—	—	—	AZ
55-522652/ A19012027BAC	Water production (non-exempt)	Stock	1988	776	590	776	6	42	50	60	AZ
55-628232/ A19012029CD0	Water production (exempt)	Irrigation, stock	1945	753	710	753	9	13	13	—	AZ
55-631852/ A19012513BAD	Water production (exempt)	Stock, domestic	1949	690	610	690	5	28	28	—	MG
55-631374/ A19012515CBB	Water production (exempt)	Stock	1950	760	531	12	8	15	15	—	CT

[1] feet below land surface
[2] gallons per minute
[3] AZ=Arizona Game and Fish Department; BT=Bar T Ranch, Inc.; CT=Chilson Family Trust; FM=Flying M Ranch, Ltd.; HE=Hasten and Eckles; HT=Hopi Tribe; MC=Meteor Crater; RM=Rocky Mountain Energy.
– not available
* Flying M Ranch Well



Legend

- Wind Park Study Area
- Water Resources Evaluation Area
- Proposed 345-kV Tie-line Alignment
- Alternative 345-kV Tie-line Alignment
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Line
- Flying M Ranch Registered Well
- Other Registered Well
- Direction of Subflow in "C" Aquifer
- Consolidated Crystalline and Sedimentary Rocks

Groundwater Conditions and Well Locations

Grapevine Canyon Wind Project

Source: ADWR 2009
Montgomery & Associates 2010

FIGURE 3.6-1

Surface Water

The water resources evaluation area is located within the Little Colorado River watershed. There are no perennial steams or riparian areas associated with intermittent streams within the water resources evaluation area. In addition, no springs or seeps were identified within the water resources evaluation area. The primary drainage is Canyon Diablo (USGS hydrological unit 15020015), and its tributary, Grapevine Canyon. The two ephemeral streams associated with these features drain a large portion of the wind park study area from the southwest to northeast. Yaeger Canyon, also ephemeral, drains the northwest corner of the wind park study area. The southern portions of the wind park study area drain toward Jack's Canyon, an intermittent stream just beyond the wind park study area boundary. Numerous other named and unnamed ephemeral streams and drainages are found within the wind park study area, generally flowing only during storm events and for short periods of time.

Unnamed ephemeral drainages are also located along the proposed transmission tie-line corridor on National Forest System lands. These drainages are typically small in size and not deeply incised. These drainages are not riparian in character as they only have water during storm events for short periods of time. No springs or seeps were identified within the tie-line corridor.

The largest body of water in the water resources evaluation area is the 88-acre Yaeger Lake located at the top of Yaeger Canyon on the Coconino National Forest. The proposed tie-line would pass within one-quarter mile of the lake. Two other water bodies cover five acres (east of Yaeger Lake) and four acres (southwest of Grapevine Well) in size. Other stock ponds or catchments are an acre or less in size (USFWS 2009a). Artificial surface water catchments, or stock tanks, are numerous within the wind park study area. There are over 36 tanks for watering livestock (ADWR 2009b). In total, surface water diversions consumed 51,000 acre-feet annually from 2001 to 2005 (ADWR 2009a). Figure 3.6-2 depicts the water resources evaluation area's surface water conditions.

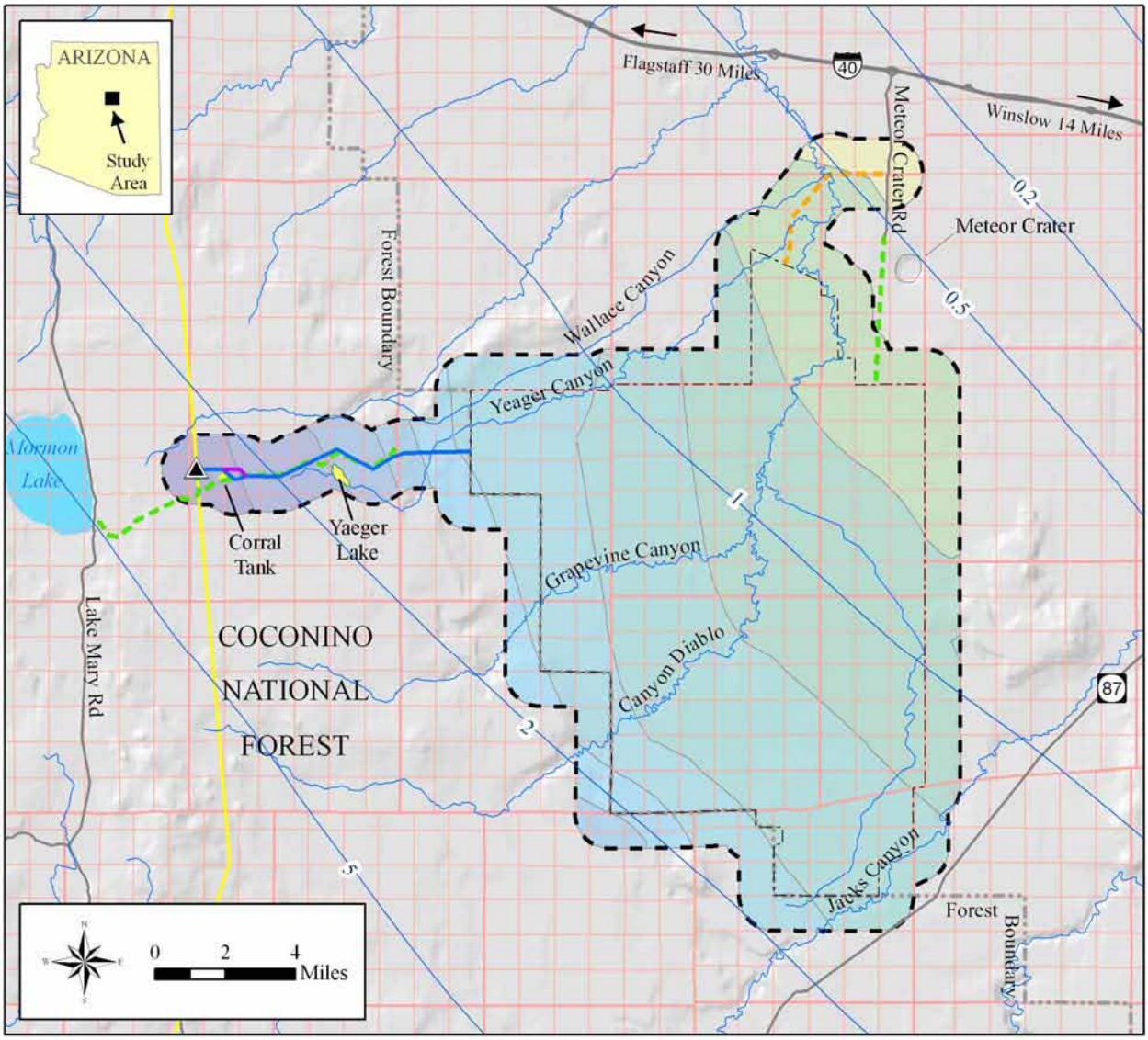
The drainages within the water resources evaluation area are part of a very rural and sparsely settled landscape. They have not been studied for flooding hazards by the Federal Emergency Management Agency (FEMA) and are, therefore, described as "areas of undetermined, but possible, flood hazard" (Aber 2009). No impaired surface waters have been identified in the water resources evaluation area, although several reservoirs to the west beyond the water resources evaluation area were added to the statewide list of impaired waters because fish tested positive for mercury (ADEQ 2009b).

Wetlands and Waters of the United States

Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (USACE) has authority to regulate the discharge of dredged and fill material into waters of the U.S. Waters of the U.S. include non-navigable tributaries that typically flow year-round or have flow at least seasonally (e.g., typically three months).

Wetlands, which are special aquatic sites, can be jurisdictional under Section 404 as a subset of waters of the U.S. Wetlands, as defined by the EPA and the USACE in the Wetland Delineation Manual (U.S. Department of Army, Corps of Engineers, Environmental Laboratory 1987), are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Field review of the water resources evaluation area and a review of National Wetlands Inventory maps did not identify wetlands in the vicinity of the proposed project components.

The Forest Service has identified and inventoried wetlands on National Forest System lands. In addition to Yaeger Lake, the Forest Service identified a second wetland within one mile of the proposed tie-line and switchyard. It is Corral Tank, an 11 acre seasonal water tank, located immediately north of FS 125 near Pine Hill.



Legend

Wind Park Study Area
Water Resources Evaluation Area
Proposed 345-kV Tie-line Alignment
Alternative 345-kV Tie-line Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Line

Annual Precipitation in Inches
8-10
10-12
12-14
14-16
16-18
18-20
20-22
22-24
24-26
26-28

Wetland/Reservoir
Ephemeral Stream
2 Runoff Contour

Surface Water Conditions
Grapevine Canyon Wind Project

Source: ADWR 2009
Montgomery & Associates 2010

FIGURE 3.6-2

3.6.2 Environmental Consequences

This section evaluates the proposed project components' potential impact on both limited surface water resources and on groundwater resources. Potential impacts to groundwater resources were evaluated by compiling a well inventory from ADWR records, reviewing pumping test results for the Lake Mary well field, and using data for the proposed water production wells to estimate water level drawdown impacts on the aquifer and the nearest wells of record.

3.6.2.1 Standards of Significance

The proposed project components and alternatives would have significant adverse effect on water resources if they:

- Substantially degrade or contaminate surface water quality.
- Substantially deplete groundwater resources, including interfering with groundwater recharge.
- Cause a violation of the terms and conditions of a Federal, State, or local permit, including the loss or degradation of wetlands in violation of a USACE permit.
- Alter surface drainage patterns or stream channel morphology to the extent that vegetation communities and habitats are degraded or productivity is reduced for current resident species.
- Substantially alter the normal flow of a water body or normal drainage patterns and runoff, or impede or redirect flood flows from the placement of a proposed project component within a 100-year flood hazard area.

3.6.2.2 Applicant's Proposed Project and Proposed Federal Actions

The Applicant estimates that up to approximately 100 million gallons (307 acre-feet) of water would be required for constructing the proposed transmission tie-line and wind park, if fully built out to 500 MW. A concrete batch plant would consume 27-54 million gallons (83-166 acre-feet) of the total, with the remainder used for dust abatement (watering the roads, rock crusher, etc.). One or more of the four on-site wells identified on Figure 3.6-1 are candidates to provide construction water for the proposed wind park.

Very little water would be used during wind park operations. The only water use during the operational phase of the wind park would be for "residential"-type functions at the operations and maintenance building (e.g., bathroom, sink). Water demand at the operations and maintenance building would be limited and be sourced from an existing on-site well or be delivered to the building by truck.

Water or another approved dust suppressant would be used to suppress dust during grading of the proposed switchyard. Other than using water for dust suppression, the proposed switchyard would not use additional water or have a permanent water supply.

Each criterion, or standard, of significance cited in Section 3.6.2.1 was evaluated to determine potential impacts from project implementation.

Degrade or contaminate surface water quality. Sound water and soil conservation practices would be maintained during construction, operation, and maintenance of the Applicant's proposed project to protect topsoil and adjacent water resources and minimize soil erosion. As described in the RPMs in Section 2.7, efforts would be made during wind park and transmission tie-line construction activities to minimize disturbance to vegetation, drainage channels, and stream banks. The Applicant and Western would apply standard Forest Service and Stormwater Pollution Prevention Plan (SWPPP) Best Management Practices (BMPs) during construction of the proposed wind park, tie-line, and switchyard. Applicable Forest Service BMPs are provided in Appendix C. Furthermore, the Applicant or construction contractors

would obtain any and all necessary Federal and State permits required for storm water run-off, including an Arizona Pollutant Discharge Elimination System (AZPDES) permit. For the proposed tie-line, if required, the Applicant would apply for a Nationwide Permit No. 12 for utility line activities administered under section 404 of the Clean Water Act, which contains general and permit-specific mitigation conditions for areas where proposed access roads and utility lines would impact waters of the U.S. Potential impacts to waterways from spills of chemicals or fuels used during construction or operation activities would be minimized by complying with the Forest Service and SWPPP BMPs. A Spill Prevention, Control, and Countermeasures (SPCC) Plan would also be implemented and followed. Spill containment materials would be available at all construction sites, and crews would be trained in spill response and cleanup. As a result, construction and operation activities associated with the wind park and transmission tie-line would only result in minimal, short-term degradation or contamination of surface water and should meet State Water Quality Standards even though surface water is not monitored by the State. Thus, no substantial degradation or contamination of surface water quality would occur.

For the proposed switchyard, Western would require its construction contractors to manage waste concrete and washing of concrete trucks, provide measures to prevent and respond to spills of hazardous and non-hazardous substances, comply and implement appropriate identified Forest Service BMPs, and obtain an AZPDES permit associated with construction of its proposed switchyard. In addition, during the design of the switchyard, a determination would be made on the need for secondary oil containment for the proposed station service transformer. Based on these requirements, construction of Western's switchyard would not degrade or contaminate surface water quality.

<u>Degrade or deplete groundwater quantity</u>. As described in Chapter 2, the Applicant's Proposed Project would require about 307 acre-feet of groundwater. Potential impact of proposed groundwater pumping for construction was projected using an analytical groundwater flow model THWELLS with available data for wells and aquifer parameters (Victor 2010). THWELLS is an analytical model based on the Theis equation that computes water level drawdown for multiple pumping wells. For this analysis, it was assumed that the four Flying M Ranch wells identified as potential production wells for construction on Figure 3.6.2 would be equipped with pumps to provide groundwater for construction. These wells were each simulated to pump continuously at about 23.8 gpm for two years (to simulate the highest potential water pumping, which would only be in effect if the wind park is fully built out to 500 MW over two consecutive years); total continuous pumping rate was modeled at about 95 gpm for two years. Other assumptions for the simulation included:

- *Aquifer Transmissivity*: Transmissivity is a measure of the ability of an aquifer to transmit groundwater. Transmissivity is defined as the rate of groundwater movement under a 1:1 hydraulic gradient through a vertical section of an aquifer one foot wide and extending the full saturated thickness of the aquifer (Theis 1935). Units for transmissivity are gallons per day per foot (gpd/ft) width of aquifer. Transmissivity is estimated by multiplying the reported specific capacity for the four wells by 1,500, which is a standard conversion factor used for non-artesian aquifer conditions. This conversion resulted in estimated transmissivity ranging from 938 to 1,875 gpd/ft. This range is below the range of values calculated for C-aquifer production wells in the Lake Mary wellfield (3,000-24,000 gpd/ft, Montgomery and Associates 1993) and, therefore, is considered to be conservative. The harmonic mean of the estimated project area transmissivity values is 1,250 gpd/ft and was used in the simulation for the C-aquifer. The harmonic mean of a set of values is a method of calculating the average value and is typically appropriate where the average of rates is desired. The harmonic mean is less than the arithmetic and geometric mean values and, therefore, provides a conservatively low estimate.

- *Specific Yield*: Specific yield describes the amount of recoverable groundwater stored in an aquifer under "water table" or non-artesian conditions. It is defined as the volume of water that would

drain under gravity from a unit volume of aquifer material and is a unitless ratio. The value of 0.05 used for the Lake Mary wellfield model for the C-aquifer (Montgomery and Associates 1993) was also used for this simulation.

- *Aquifer Saturated Thickness*: Saturated aquifer thickness for the four wells ranges from 85 to 120 feet, which represents a small fraction of the total saturated thickness for the C-aquifer beneath the project site. A saturated thickness value of 100 feet was used in the simulation.

Maximum simulated water level drawdown in each pumped well was only 52 feet after two years of continuous pumping. The cone of depression (or drawdown) caused in the water table by each well has maximum depth at each well and decreases radially away from the well. During this same timeframe, the five-foot water level drawdown contour extends less than 800 feet from each well used for construction, and would be negligible for wells more than one-half mile away. Therefore, the projected impacts at other existing wells in the vicinity are minimal and are not expected to affect the existing groundwater users' ability to continue their existing uses. After project construction, groundwater levels would be expected to return quickly to pre-project conditions, so construction activities would not substantially deplete groundwater resources, or interfere with groundwater recharge. Furthermore, no long-term effects to area springs and seeps would be expected.

The construction of Western's switchyard would require the use of water, or an approved dust suppressant, during grading and concrete pouring activities. Less than ten acre feet of water would be required at the substation site, assuming no dust suppression would be required for road improvements to the substation. Based on the low volumes of water required for substation construction and the lack of any permanent water usage, Western's substation would not deplete groundwater or other water sources.

<u>Degrade or eliminate wetlands or waters of the U.S</u>. Potential impacts to waters of the U.S. or wetlands identified by the Forest Service that result from construction, operation and maintenance of the proposed wind park and transmission tie-line would be minimized through implementing the RPMs listed in Section 2.7. They would be further minimized by adhering to regulations and permits governing storm water pollution prevention and sediment control such as a General Construction Storm Water Permit, 404 permit, AZPDES permit, and SWPPP. The BMPs outlined in the SWPPP and by the Forest Service would minimize the potential for accelerated soil erosion and sediment transport, protect water quality downstream and within wetlands. Implementation of the included RPMs would ensure that potential impacts to surface water flows, drainage patterns, quantity and quality are less than significant during wind park and transmission tie-line construction, operation, and maintenance activities.

Western's proposed switchyard would not be constructed within waters of the U.S. or near a Forest Service-identified wetland. Western would ensure that surface water is protected from pollution caused by construction activities, and require its construction contractor to obtain the appropriate permits. Therefore, it would not degrade or eliminate any wetlands or waters of the U.S.

<u>Alter surface drainage patterns or stream channel morphology</u>. The majority of both temporary and permanent disturbances associated with the proposed wind park and transmission tie-line would be on land currently used for rangeland and agriculture with low representative slopes. The primary exception to this associated with the proposed tie-line as it extends up the slope of Anderson Mesa. Construction within the wind park study area and along the transmission tie-line would result in grading, excavation, and exposure of soil, some of which may occur within or adjacent to existing streams or drainages. As described in the RPMs in Section 2.7, the Applicant would avoid, to the extent possible, placing temporary or permanent facilities in floodplains and washes and ensure that all construction activities minimize disturbance to drainage channels and stream banks. Construction methods would minimize erosion and would include installation of cross drains, placement of water barriers adjacent to roads, and

the application of other BMPs. As a result, alteration of flow patterns is not anticipated and would be avoided wherever possible.

The site proposed for Western's switchyard is not within an area where substantial alteration of the surface drainage patterns would be required. All surface drainage would be designed to flow around the switchyard site and left in a condition to facilitate natural revegetation and prevent erosion.

Impede or redirect flood flows within a 100-year flood hazard area. On-site or off-site flooding would not result from construction, operation, or maintenance of the proposed project components. Flood hazard zones have not been identified within or adjacent to the proposed project components. The final engineering design for the wind park and transmission tie-line would evaluate site conditions and use the RPMs listed in Section 2.7 associated with applicable permits to address potential flooding. As a result, construction and operation of the proposed wind park and transmission tie-line would not would impede or redirect flood flows, and applicable water resources significance thresholds would not be exceeded.

The proposed Western switchyard would not be located within a floodplain or an area prone to flooding.

3.6.2.3 Alternative Transmission Tie-line Corridor

The alternative transmission line alignment would result in similar impacts as described for the proposed transmission tie-line. No ground or surface water resources are site specific to the location of the alternative tie-line alignment.

3.6.2.4 No Action Alternative

Under the No Action Alternative, no groundwater would be pumped, maintaining groundwater and surface water quantity and quality similar to current condition. In addition, surface water conditions would not be affected. As a result, no impacts to ground or surface water would be expected.

3.7 SOCIOECONOMICS

3.7.1 Affected Environment

3.7.1.1 Resource Evaluation Area

The socioeconomic analysis focused on an evaluation area that included Coconino and Navajo counties, including the cities of Flagstaff and Winslow. The socioeconomic evaluation area was defined by the regional transportation network and the available labor force within a reasonable distance of the proposed project components. Both distance and geographic features were taken into consideration when determining which communities were to be included in this analysis.

3.7.1.2 Characterization

This section describes existing conditions associated with the economy of the socioeconomic evaluation area including population, economic base, employment, income, housing, and public services.

Population

Population within the socioeconomic evaluation area has grown substantially over the past 20 years. A summary of current and historic population is included as Table 3.7-1.

TABLE 3.7-1 POPULATION TRENDS				
Location	**Population**			**Percent Change 1990 to 2008**
	1990	**2000**	**2008**	
Arizona	3,665,228	5,130,632	6,629,455	80.9
Coconino County	96,591	116,321	135,614	40.4
Navajo County	77,658	97,470	114,780	47.8
City of Flagstaff	45,857	52,894	64,693	41.1
City of Winslow	8,190	9,520	10,194	24.5
Sources: Arizona Department of Commerce 2009a, 2009b, 2009c, and 2009d				

Economic Base, Employment, and Income

The economies of both Coconino and Navajo counties are based largely on educational services, and health care and social assistance. These industries account for approximately one-quarter of the work force in both counties. The construction trade employs 9.6 percent of the work force in Coconino County and 14.5 percent in Navajo County, accounting for approximately 12,194 total jobs (U.S. Census Bureau 2008b and 2008f).

The average annual labor force, including unemployment, for the socioeconomic evaluation area is summarized in Table 3.7-2.

TABLE 3.7-2 LABOR FORCE, 2006 – 2008				
Industry	**Coconino County**	**Navajo County**	**City of Flagstaff**	**City of Winslow[1]**
EMPLOYED				
Agriculture/Forestry/Fishing and Hunting/Mining	789	1,174	384	20
Construction	6,196	5,938	2,894	197
Manufacturing	4,339	1,441	2,977	71
Wholesale Trade	1,107	714	480	29
Retail Trade	8,029	5,269	4,832	449
Transportation and Warehousing/Utilities	3,614	2,480	1,199	361
Information	704	475	488	18
Finance and Insurance/Real Estate/Rental and Leasing	2,592	1,554	1,718	107
Professional/Scientific/Management and Administrative/Waste Management Services	3,366	1,598	1,680	95
Educational Services/Health Care and Social Assistance	16,623	9,787	9,913	752
Arts and Entertainment/Recreation/ Accommodation/Food Services	9,568	4,692	5,737	402

TABLE 3.7-2 LABOR FORCE, 2006 – 2008				
Industry	**Coconino County**	**Navajo County**	**City of Flagstaff**	**City of Winslow[1]**
Public Administration	4,221	3,942	1,657	507
Other Services	3,150	1,934	1,583	151
UNEMPLOYED	3,329	4,910	1,414	196
TOTAL LABOR FORCE	**67,690**	**45,967**	**37,019**	**3,355**
[1] 2000 Data (Sources: U.S. Census Bureau 2000b, 2008b, 2008d, and 2008f)				

The median household income for Coconino and Navajo counties is $49,611 and $39,678, respectively. The median household income for the City of Flagstaff is $49,885, nearly identical to Coconino County as a whole. The median household income for the City of Winslow is $29,741, substantially lower than the median for Navajo County (U.S. Census Bureau 2000b, 2008b, 2008d, and 2008f).

Currently, the primary source of revenue or employment within the wind park study area is cattle ranching. In 2005, Coconino County amended the Coconino County Comprehensive Plan to include the Diablo Canyon RPA. The Diablo Canyon RPA was developed with a primary objective to maintain historic ranching operations, while identifying economic opportunities that would supplement ranching incomes and provide a way to offset the costs of range improvements. The plan specifically identifies five economic activities that would achieve the primary objective, including: 1) value added beef; 2) tourism, recreation, and education; 3) wood products; 4) energy development; and 5) housing.

Housing Market and Property Values

There are over 100,000 housing units in Coconino and Navajo counties. Of these, more than 30,000 are classified as vacant. This number includes vacation homes, popular in Arizona's high country, which are seasonally occupied. A more accurate characterization of available housing is vacancy rates. These rates along with other selected housing data for the evaluation area are summarized in Table 3.7-3.

TABLE 3.7-3 HOUSING DATA, 2006 – 2008				
Description	**Coconino County**	**Navajo County**	**City of Flagstaff**	**City of Winslow[1]**
Owner occupied housing units	27,620	24,725	11,952	1,505
Renter occupied housing units	15,716	9,115	10,908	995
Vacant housing units	15,433	18,548	3,302	451
Homeowner vacancy rate	3.1 %	2.7 %	3.9 %	n/a
Rental vacancy rate	4.9 %	4.1 %	4.8 %	n/a
Median house value	$284,600	$130,800	$331,100	$61,900
Median gross rent/month	$868	$606	$937	$428
[1] 2000 Data (Sources: U.S. Census Bureau 2000a, 2008a, 2008c, and 2008e)				

Public Services and Facilities

Organizing and providing services to a geographically dispersed citizenry is a challenge for rural jurisdictions such as Coconino and Navajo counties. The wind park study area is located within an area with very few residences, and community services are limited. Public services and institutions within the evaluation area are described below:

Schools and Libraries

Two school districts are located within the socioeconomic evaluation area, Flagstaff Unified School District (USD) and Winslow USD No. 1. The Flagstaff USD operates three high schools, four middle schools, nine elementary schools, and four magnet schools. The Winslow USD No. 1 includes one high school, one middle school, and three elementary schools.

Coconino and Navajo counties operate community libraries in the cities of Flagstaff and Winslow, respectively.

Law Enforcement

Law enforcement is provided to unincorporated portions of the socioeconomic evaluation area through the Coconino County Sheriff's Department and the Navajo County Sheriff's Department. The proposed project components would be served by the Coconino County Sheriff's Department, and the nearest Sheriff's Office is located in Flagstaff.

Fire Protection

Multiple fire departments are located throughout the socioeconomic evaluation area in both Coconino and Navajo counties. The proposed project components would be served by the Mormon Lake Fire District, located along the south end of Mormon Lake, near Lake Mary Road. Additional service may be provided, as needed, by the Summit Fire District, on Koch Field Road east of Flagstaff, and the Arizona State Land Department Fire District, on Lake Mary Road in Flagstaff.

Health and Social Services

Two hospitals are located within the socioeconomic evaluation area, Flagstaff Medical Center and Winslow Memorial Hospital. The Flagstaff Medical Center has 270 inpatient beds and 200 physicians on active medical staff. The Winslow Memorial Hospital is smaller and includes 34 inpatient beds.

Water, Wastewater, and Solid Waste

Centralized water and wastewater service is provided by the cities of Flagstaff and Winslow. Unincorporated areas of Coconino and Navajo counties obtain water from private wells and dispose of wastewater through private septic systems. The nearest landfill is the Cinder Lake Landfill, more than 25 miles from proposed wind park, operated by the City of Flagstaff.

3.7.2 Environmental Consequences

This section evaluates the potential impact of the proposed wind park, proposed tie-line, and Western's proposed switchyard on the socioeconomic environment. Overall, the proposed project components would have a beneficial impact on the economies of Coconino and Navajo counties. The proposed wind park would improve local employment and business activity and contribute to local tax revenue.

3.7.2.1 Standards of Significance

Impacts to socioeconomics would be considered significant if any of the following conditions occur:

- Induce population growth that would strain government and community facilities and services from the in-migration of the proposed workforces.
- Result in insufficient existing housing in the evaluation area to meet the needs of in-migrating workers and their families.
- Create the need for a major new utility system, or substantially alter an existing utility system, including power or natural gas, communications systems, water, sewer, or solid waste disposal.

3.7.2.2 Applicant's Proposed Project and Proposed Federal Actions

Construction of the proposed wind park would require approximately 400 temporary workers at peak construction activity for each phase, and each phase would last between 12 and 18 months. Following construction, it is anticipated that 17 to 40 permanent employees would conduct operations and maintenance of the wind park, if fully built out to 500 MW.

Contracts for the construction of the proposed wind park and tie-line would be part of a competitive bidding process for each phase. Local workers and construction firms would have the opportunity to apply for or bid on many of these jobs. It is anticipated that substantial employment efforts would flow through local construction and service firms that successfully obtain contracts through the construction bidding process. Western would issue a separate solicitation for the construction of the proposed switchyard in accordance with Western's contracting requirements.

Particularly during the construction phase, construction employment and activities would benefit the local economy. Personal income from employment would increase local spending through purchases of consumer goods and services, lodging, transportation, and utilities. Local businesses providing construction materials and services, equipment repair, and maintenance services would likely experience increased revenues from each of the proposed project components' construction budget. These direct expenditures would generate additional jobs and revenue at the local, city, and county levels. Due to the availability of construction workers and existing construction and service firms in the socioeconomic evaluation area and the relatively short duration of the construction, construction-related expenditures would not induce population growth that would strain government and community facilities and services from the in-migration of the construction workforce. Once construction is finished, operations would require annual expenditures and payroll that, when spent, would generate additional personal income and employment. In addition, the proposed wind park would supplement the incomes of ranchers currently using the area to raise cattle. Energy development, specifically energy from wind resources, was identified by the Diablo Canyon RPA as a compatible economic pursuit that would meet the plan's primary objective to maintain traditional ranching operations. The wind park would provide new revenues to the ASLD from the lease of State trust lands, optimizing economic return for the trust beneficiaries.

Sufficient existing housing is available within commuting distance of the proposed project components to meet the needs of in-migrating construction workers and their families, as well as permanent workers and their families. More than 30,000 housing units are currently vacant within Coconino and Navajo counties.

The majority of jobs created by the proposed wind park are expected to be temporary. Between 17 and 40 permanent employees would be hired to operate and maintain the proposed wind park if fully built-out to 500-MW, at least some of whom would be hired from the local labor force. This would lead to a slightly greater demand on public facilities, including schools, which would likely be spread across several jurisdictions. However, vacancy rates in housing units suggest capacity is available.

None of the proposed project components, including the O&M facility proposed as part of the wind park, would use public water and sewage systems. Rather, potable water would be supplied from an on-site well or hauled in periodically by a commercial water hauler. In addition, sewage would be disposed of on-site through a septic system that would be installed. The proposed wind park would not directly require the use of public facilities, nor would it substantially induce growth that would increase the demand on public facilities and services, or infrastructure. Thus, there would not be a need to install or alter a major new utility system and significance thresholds would not be exceeded.

3.7.2.3 Alternative Transmission Tie-line Corridor

The alternative transmission tie-line would not alter potential impacts, including beneficial impacts, to socioeconomic resources from those discussed under the proposed transmission tie-line.

3.7.2.4 No Action Alternative

Under the No Action Alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The proposed wind park, tie-line, and switchyard would not be constructed and the beneficial socioeconomic impacts associated with the construction, operations, and maintenance of the wind park would not occur. In addition, the economic objectives of the Diablo Canyon RPA would not be realized as quickly, since no other similar economic development proposals for this area are currently under consideration.

3.8 ENVIRONMENTAL JUSTICE

3.8.1 Affected Environment

3.8.1.1 Resource Evaluation Area

The environmental justice analysis focused on an evaluation area identical to socioeconomics, which included Coconino and Navajo counties. For purposes of this analysis, the affected population is considered to be residents of these two counties.

3.8.1.2 Characterization

EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires that projects and proposals be examined to ensure that negative effects are not disproportionately distributed on at-risk populations including low-income, minority, and elderly.

The wind park study area is located on private and State trust lands with no permanent residences. A few rural ranching residences are located in proximity to the wind park study area, but very few other residences are located within several miles.

The Hopi Hart Ranch, north of the wind park study area, and the Clear Creek Ranch, east of the wind park study area, were conveyed from fee simple land held by the Hopi Tribe to the U.S. in Trust for The Hopi Tribe in December 2008. The Navajo Nation is located more than ten miles north of the proposed wind park.

The proposed tie-line, alternative tie-line, and Western's proposed switchyard are located on Federal lands under the jurisdiction of the Forest Service. National Forest System lands are managed for multiple uses and are open to the public. National Forest System lands in the vicinity of the proposed tie-line and switchyard generally are: leased for grazing; used for dispersed recreation, including hiking, camping, and wildlife viewing; hunting; and gathering firewood.

The population of Coconino and Navajo counties is more racially diverse than the State of Arizona as a whole. In particular, a large Native American population resides within these two counties. In addition, low-income populations are slightly more prevalent within these two counties than the State of Arizona as a whole. Data on minority and low-income populations throughout Coconino and Navajo counties and the cities of Flagstaff and Winslow are summarized in Table 3.8-1. Data for the State of Arizona are provided for context.

TABLE 3.8-1
MINORITY AND LOW-INCOME CHARACTERISTICS OF ENVIRONMENTAL JUSTICE EVALUATION AREA, 2006-2008

Race or Ethnicity	Arizona		Coconino Co.		Navajo Co.		Flagstaff		Winslow[1]	
	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%
White	4,928,000	78	78,675	62	50,204	45	46,860	74	5,004	52
Black	224,000	4	1,549	1	1,261	1	1,205	2	493	5
Native American	285,000	5	35,954	28	50,536	46	8,352	13	2,234	23
Asian	150,000	2	1,650	1	323	0.3	1,163	2	98	1
Other	558,000	9	6,548	5	5,196	5	4,390	7	1,284	13
Hispanic/Latino (of any race)	1,877,000	30	15,454	12	10,865	10	11,001	17	2,746	29
Individuals Below Poverty Level	907,200	14	20,748	16	24,847	22	9,780	15	1,990	20.9

[1] 2000 Data (Sources: U.S. Census Bureau 2000a, 2000b, 2008a, 2008b, 2008c, 2008d, 2008e, 2008f, and 2008g)

3.8.2 Environmental Consequences

The assessment of environmental justice evaluates the impacts to the human environment associated with the proposed project components in context with minority, low-income, and Native American populations within the environmental justice evaluation area. The following definitions are excerpted from EO 12898:

Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

(a) Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death
(b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group
(c) Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

Disproportionately high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

(a) Whether there is or would be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment
(b) Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group
(c) Whether the environmental effects occur or would occur in a minority population, low income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

3.8.2.1 Standards of Significance

Impacts would be considered significant if the following were to occur as a result of the proposed project:

- Disproportionately affect a minority, Native American, or low-income subsistence populations.

3.8.2.2 Applicant's Proposed Project and Proposed Federal Actions

There is no resident population (low-income, minority, Native American, or otherwise) that would be directly affected by construction and operation of the proposed wind park, proposed tie-line, or Western's proposed switchyard.

National Forest System lands in the vicinity, open to the public, are not known to be used in disproportion by Native American, minority, or low-income populations. Therefore impacts, as a result of the proposed tie-line and Western's proposed switchyard, to activities occurring on this portion of the Forest are expected to be very low.

Within the two-county region, the Navajo Nation is located more than ten miles to the north of the proposed wind park, the Hopi Tribe Trust lands and the Hopi Reservation are north and east of the proposed wind park, and the nearest population centers, Flagstaff and Winslow, are located more than 20 miles from the proposed wind park. The proposed wind park, proposed tie-line, and Western's proposed switchyard would not create disproportionately negative impacts on the Navajo Nation, the Hopi Tribe, or on low-income or minority groups. Moreover, the regional socioeconomic impact of the proposed wind park is beneficial in that it would create employment opportunities, economic multiplier effects, and tax revenue that would indirectly, and possibly directly, benefit persons living below the Federal poverty level within the environmental justice evaluation area.

3.8.2.3 Alternative Transmission Tie-line Corridor

Impacts to minority, Native American, and low-income subsistence populations would not differ from those associated with the proposed tie-line if the alternative tie-line were to be constructed and operated.

3.8.2.4 No Action Alternative

If the proposed wind park were not constructed, impacts associated with employment opportunities and tax revenue would not benefit persons living below the Federal poverty level within the environmental justice evaluation area.

3.9 TRANSPORTATION

3.9.1 Affected Environment

3.9.1.1 Resource Evaluation Area

The transportation resource evaluation area for transportation includes an area within one mile of the wind park study area, proposed transmission tie-line, and Western's proposed switchyard. In addition, the primary access routes that would be used for employees accessing the project components and for the delivery of equipment and materials are part of the transportation evaluation area. These include the I-40/Meteor Crater interchange, Meteor Crater Road, and Lake Mary Road near its intersection with FS 125. These primary access routes were determined to be the areas where the potential hazard or risk, including traffic concerns, would be the greatest.

Data was gathered through field verification and the review of various documents and maps. Sources of information include published land use plans and reports including the Coconino County Comprehensive Plan, the Diablo Canyon RPA, the Forest Plan, and various reports available from the Arizona Department of Transportation (ADOT). In addition, contacts were made with jurisdictional and agency personnel and websites were accessed for information. Information on aircraft use within the evaluation area was also collected.

3.9.1.2 Characterization

Ground transportation features are considered to be substantial roads and highways, such as interstate highways, State highways, county and other major roads, and railroads. Interstate or State highways include all dedicated Federal or State highway routes maintained by ADOT. County roads include all major roads maintained by Coconino County that represent major interconnections between interstate, Federal, or State highways with major access routes in rural areas. Regularly maintained and non-maintained Forest Service System roads and roads that cross State trust lands also are present within the transportation evaluation area. The roads are depicted below in Figure 3.9-1. Table 3.9-1 lists existing roads within or adjacent to the transportation evaluation area.

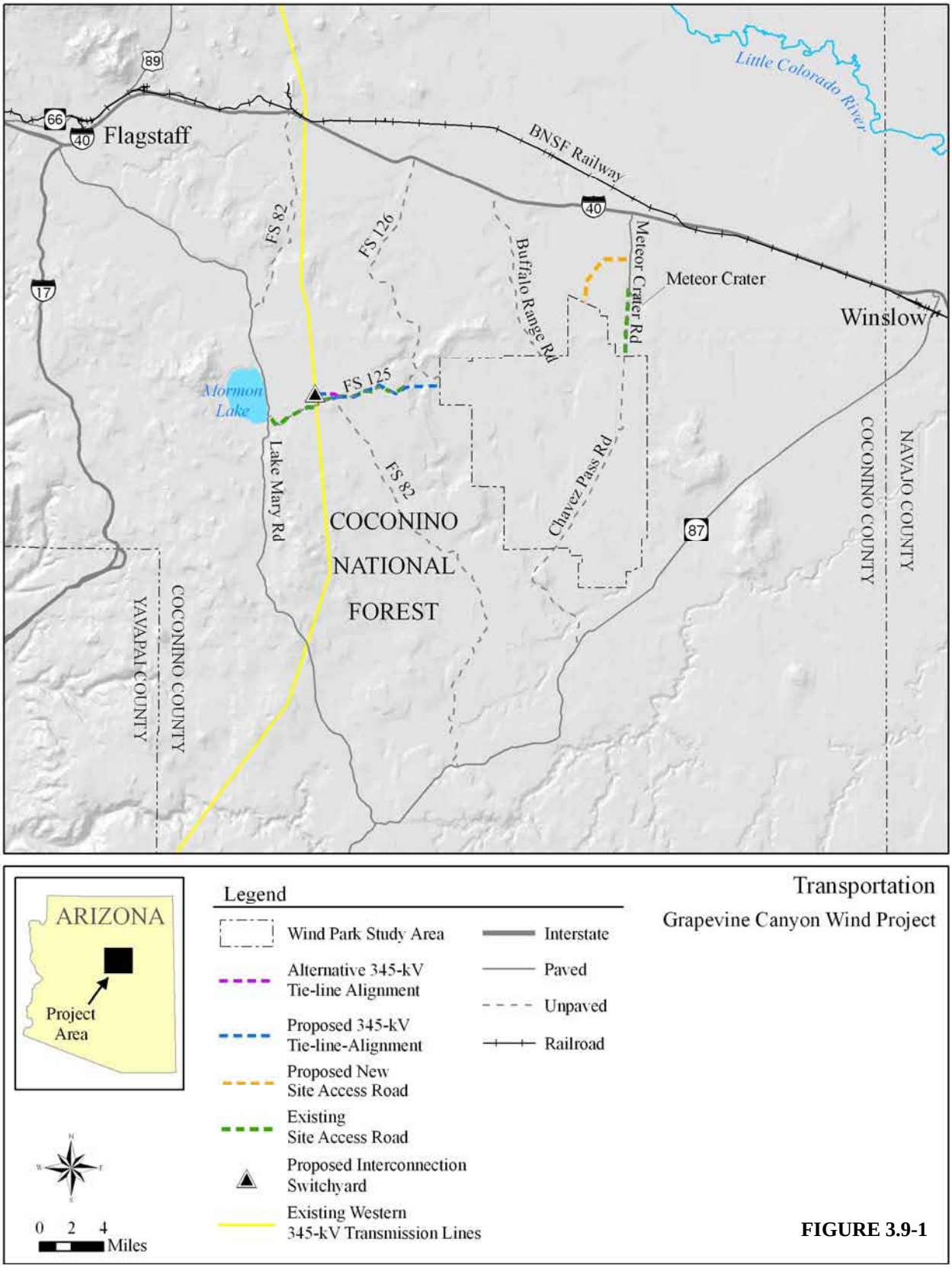

Flagstaff
Winslow
Meteor Crater
Little Colorado River
BNSF Railway
FS 82
FS 126
Buffalo Range Rd
Meteor Crater Rd
FS 125
Mormon Lake
Lake Mary Rd
Chavez Pass Rd
COCONINO NATIONAL FOREST
YAVAPAI COUNTY
COCONINO COUNTY
NAVAJO COUNTY
ARIZONA
Project Area
Legend
Wind Park Study Area
Alternative 345-kV Tie-line Alignment
Proposed 345-kV Tie-line-Alignment
Proposed New Site Access Road
Existing Site Access Road
Proposed Interconnection Switchyard
Existing Western 345-kV Transmission Lines
Interstate
Paved
Unpaved
Railroad
0 2 4 Miles
Transportation
Grapevine Canyon Wind Project

FIGURE 3.9-1

TABLE 3.9-1 SUMMARY OF ROADS WITHIN THE TRANSPORTATION EVALUATION AREA		
Roads	**Surface**	**Jurisdiction**
NORTH-SOUTH ROADS		
State Route (SR) 87	Paved (asphalt)	ADOT
Lake Mary Road (Forest Hwy 3)	Paved (asphalt)	Forest Service/Coconino County/Flagstaff
FS 126 (Twin Arrows Road)	Unpaved (dirt)	Forest Service/Coconino County
Buffalo Range Road	Unpaved (dirt)	Coconino County
Meteor Crater Road	Paved (asphalt)	Coconino County
Chavez Pass Road	Unpaved (dirt)	Coconino County
FS 82	Unpaved (dirt)	Forest Service
EAST-WEST ROADS		
I-40	Paved (asphalt)	Federal Highway Administration/ADOT
FS 125	Paved (gravel)/unpaved (dirt)	Forest Service

Surface transportation features within and adjacent to the transportation evaluation area include Federal and county jurisdictional roads. I-40 is the principal arterial within the transportation evaluation area and is under the jurisdiction of the ADOT. Lake Mary Road is a major road which provides local access to Flagstaff, as well as to Lake Mary and Mormon Lake, among many other recreation areas on National Forest System lands. FS 125 and FS 126 (Twins Arrows Road) provide access to National Forest System lands, and FS 125 and FS 82 provide access to Kinnikinick Lake and other recreation areas.

Meteor Crater Road is a paved road that extends from I-40 to Meteor Crater. Buffalo Range Road (which does not connect to the wind park study area) and Chavez Pass Road are both considered primitive local roads and are not maintained regularly by the county. Signage on these roads warns vehicle operators that they are taking a risk driving on the roadways. Other roads within the transportation evaluation area include dirt ranch roads and jeep trails allowing access to rural development in the area, low-maintenance roads across State trust lands and National Forest System lands, and illegal/non-system roads created by recreation users with all-terrain vehicles (ATVs) and other off-highway vehicles (OHVs).

Traffic volumes for the roadways located within the transportation evaluation area are shown below in Table 3.9-2**.** The majority of motor vehicle traffic is limited to local commuters, ranchers, recreationists, and tourists.

TABLE 3.9-2 TRAFFIC VOLUME ON HIGHWAYS AND ROADS IN TRANSPORTATION EVALUATION AREA						
Route	**Start**	**End**	**Length (miles)**	**AADT[1]**	**POS[2]**	**NEG[3]**
I-40	Exit 211 Winona Rd	Exit 219 FS 126 (Twin Arrows Rd)	8.41	14,676	6,802	7,872
I-40	Exit 219 FS 126 (Twin Arrows Rd)	Exit 225 Buffalo Range Rd	5.47	16,600	7,763	8,930

TABLE 3.9-2
TRAFFIC VOLUME ON HIGHWAYS AND ROADS IN TRANSPORTATION EVALUATION AREA

Route	Start	End	Length (miles)	AADT[1]	POS[2]	NEG[3]
I-40	Exit 225 Buffalo Range Rd	Exit 230 Canyon Diablo Road/ Two Guns	5.41	16,002	7,783	8,217
I-40	Exit 230 Canyon Diablo Rd/ Two Guns	Exit 233 Meteor Crater Rd	3.42	15,340	7,167	8,175
I-40	Exit 233 Meteor Crater Rd	Exit 239 Dennison Rd/ Meteor City Rd	5.78	16,089	n/a	n/a
Lake Mary Rd*	South of Upper Lake Mary	—	n/a	1,239	n/a	n/a
SR 87	Lake Mary Rd	SR 99	50.31	700	n/a	n/a
Meteor Crater Rd	I-40	End/Chavez Pass Rd	n/a	830	n/a	n/a
Chavez Pass Rd	Meteor Crater Rd	SR 87	n/a	21	n/a	n/a

[1] AADT – Annual Average Daily Traffic volume estimate (bi-directional)
[2] POS – Annual Average Daily Traffic volume estimate, increasing highway milepost numbers
[3] NEG – Annual Average Daily Traffic volume estimate, decreasing highway milepost numbers
n/a – data not available

Source: ADOT 2009; Coconino County Public Works Department. * From: Traffic Resource and Analysis, Inc., taken July 2007.

Generally traffic is free flowing on both County and ADOT maintained roads and there are no major traffic congestion concerns within the transportation evaluation area.

Cross-country travel of motorized vehicles are currently allowed on National Forest System lands for recreational activities, such as sightseeing, camping, hiking, hunting, and fishing. Motorized travel is permitted, except in areas that are signed as closed or restricted to seasonal use. Regulations in effect today on National Forest System lands are explained in the Off-Highway Vehicles Policy brochure (AGFD 2009b). The number of OHV users has increased as the demand for recreational opportunities has increased. OHVs are also used on National Forest System lands for administrative and commercial activities, such as logging, grazing, maintaining utilities, special uses, outfitter and guide services, and other multiple uses.

On November 9, 2005, the Forest Service published final travel management regulations governing OHVs and other motor vehicle use on national forests and grasslands. Under the new rules, known as the Travel Management Rule (TMR), OHVs must remain on designated roads and trails systems while on National Forest System lands. The Forest Service is currently preparing its Motorized Travel Management Plan which will comply with the TMR by closing cross-country travel and designating a roads system. This Travel Management Plan is anticipated to be complete by the end of 2011.

The Burlington Northern Santa Fe Railway provides regional rail freight service. The railway is located approximately ten miles north of the wind park study area, traveling in an east-west direction mostly parallel to I-40 (Pearsell 2002).

No regional or municipal airports are in the immediate vicinity of the transportation evaluation area; however, the AGFD conducts wildlife surveys in the area using low-flying aircraft. The closest airports are in Flagstaff and Winslow, both of which are approximately 25 miles from the wind park study area.

Western uses a helicopter to patrol the existing 345-kV transmission lines. The lines are patrolled quarterly to look for damaged transmission line insulators and other transmission structure maintenance needs. Western's helicopter flies at low levels over the transmission line rights-of-way.

3.9.2 Environmental Consequences

3.9.2.1 Standards of Significance

Implementation of the proposed wind park, tie-line, and Western's proposed switchyard would have a significant and adverse effect on transportation if it would:

- Result in the permanent disruption of regional or local vehicle traffic.
- Result in the destruction of existing road or railroad infrastructure.
- Encroach upon an FAA-designated air safety zone around an existing airport or create an air safety hazard.

3.9.2.2 Applicant's Proposed Project and Western's Proposed Switchyard

Construction

Project construction activities would temporarily increase traffic volume on roadways within the transportation evaluation area as a result of both commuting construction workers and the transportation of equipment and materials.

Heavy equipment, construction materials and supplies, and labor required for the proposed project components would access the site from I-40 at Meteor Crater Road or Lake Mary Road. From these roads, there are three potential site access routes into the project area. The primary point of access for the proposed wind park and for the eastern-most portion of the tie-line would be along a newly constructed access road extending from Meteor Crater Road for approximately 8.5 miles into the proposed wind park. The second, an existing access road to the proposed wind park for future phases would utilize Chavez Pass Road, located just south of Meteor Crater Road. This road extends into the wind park study area and is expected to require no improvements outside of the existing right-of-way. Access to the western-most portion of the proposed tie-line and Western's proposed switchyard would occur from Lake Mary Road along existing FS 125. This road may need improvement with the existing roadway near Lake Mary Road.

It is anticipated that several types of light, medium, and heavy-duty construction vehicles would travel to and from the project area, as well as private vehicles used by construction personnel. Overweight and/or oversized loads associated with the delivery of construction equipment, WTG components, transmission line structures, and switchyard equipment would be via semi-truck trailers. If one crane capable of erecting the WTG towers and attaching the blades is onsite, about 10 to 13 semi-truck loads could be transported to the wind park site per equipment delivery day for the duration of construction. If two cranes are onsite, 20 to 26 semi-truck loads could be transported and unloaded within the wind park study area per equipment delivery day over a 12 to 18 month construction period per project phase. Construction traffic associated with the proposed tie-line and switchyard would be approximately ten trucks per day, occurring over a period of six to ten months.

The number of anticipated passenger vehicle trips per day that would occur during construction would vary depending on the construction stage and the number of carpool vehicles. It is anticipated that the majority of the workforce for construction would travel to the site from Flagstaff, Winslow, and nearby cities and towns within a 50-mile radius. For the wind park construction, the worst case scenario is where all workers commute in vehicles with only one occupant, yielding a peak trip generation of approximately

400 inbound trips during the morning peak period and another 400 outbound trips during the evening peak hour for peak construction activity periods for the proposed wind park. Construction and associated traffic is expected to occur over a period of 12 to 18 months. Worker traffic associated with the tie-line and switchyard construction is expected to be approximately 25 vehicles per day, occurring over a period of six to ten months.

The movement of equipment, materials, and workers during construction would cause a short-term increase in the level of service of local roadways. Equipment, materials, and workers transport to the proposed wind park would not be expected to cause a substantial disruption to traffic or to level of service along I-40, but overweight and/or oversized loads may result in temporary road closures or detours and traffic delays at the I-40/Meteor Crater Road interchange and along Meteor Crater Road during transport of large construction equipment and WTG components. These disruptions would be expected to occur during the peak construction periods when delivery of equipment and construction for the foundation and tower assembly would take place. The vast majority of traffic along Meteor Crater Road is associated with visitation to Meteor Crater. This site attracts approximately 230,000 visitors a year, which correlates to an average of about 315 vehicles per day (Arizona Office of Tourism 2007). In addition, small amounts of other local traffic use the road to access private land in the vicinity or to travel along Chavez Pass Road to access SR 87. The limited amount of traffic utilizing the I-40/Meteor Crater Road interchange and Meteor Crater Road, combined with the Applicant's commitment to develop a traffic control plan for the interchange and road, would not result in permanent traffic disruptions or safety concerns at the I-40/Meteor Crater interchange and Meteor Crater Road.

Increased traffic impacts for the proposed transmission tie-line and Western's proposed switchyard would occur near the Lake Mary Road/FS 125 intersection. Some restriction or temporary closure of FS 125 may also occur during the delivery of equipment and materials to the proposed tie-line right-of-way or to the proposed switchyard site. These would be intermittent and temporary and would only occur for a portion of the expected 12 to 18 month construction period. Construction traffic would be limited and occur at the beginning and the end of the day.

Construction traffic associated with proposed wind park, tie-line, and Western's proposed switchyard would not result in the permanent disruption of regional and local traffic, and thereby would not have a significant impact.

Shipments of overweight and/or oversized loads might require fortification of culverts and temporary removal of obstructions to accommodate overweight or oversized shipments. The need for such actions would be determined on a site-specific basis. In the event a road is damaged during construction of the proposed project components, the roadway would be repaired to pre-construction conditions as detailed in Section 2.7, resulting in a minimal, but temporary, impact. Applicable significance thresholds to transportation would not be exceeded.

The proposed wind park, tie-line, and Western's proposed switchyard are not expected to use rail for the transport of project-related equipment. Furthermore, the Burlington Northern Santa Fe Railroad tracks would not be crossed by construction or passenger vehicles.

Operation and Maintenance

Traffic associated with operation of the proposed wind park is expected to be minimal. During operations, the wind park is expected to be attended by a small maintenance and operation crew. Consequently, transportation activities would be limited to a small number of daily trips by pickup trucks, medium-duty vehicles, or personal vehicles. It is possible that large components may be required for equipment replacement in the event of a major mechanical repair. However, such shipments would be expected to be infrequent.

Traffic associated with the operation of the proposed tie-line and Western's proposed switchyard would be more limited. Maintenance crews would occasionally drive the transmission line access roads to inspect the transmission line. Western's proposed switchyard would be visited periodically by Western's maintenance personnel to conduct inspections and test equipment. Access to the tie-line and/or switchyard by heavy equipment may be required on occasion if repairs are needed.

Thus, operation and maintenance of the proposed wind park, tie-line, and Western's proposed switchyard would not result in a permanent disruption of regional or local vehicle traffic and would not exceed significance thresholds listed in Section 3.9.2.1.

No regional or municipal airports are in the transportation evaluation area. The closest airports are located approximately 25 miles from the wind park study area, in both Flagstaff and Winslow. As a result, the proposed project components would not impact an FAA-designated air safety zone around an existing airport.

The FAA regulates obstructions to navigable airspace (14 CFR 77, or FAA Part 77). The Applicant is required to notify the FAA Administrator of any proposed construction "of facilities more than 200 feet in height above the ground level at its site (Section 77.13[a][1])." The height of towers and length of blades proposed for the wind park have a combined height of approximately 424 feet, exceeding the FAA notice threshold. The Applicant would coordinate with the FAA and meet requirements for lighting as outlined in the RPMs (Section 2.7). Thus, the proposed towers would not create an air hazard.

The AGFD's use of low-flying aircraft in the area is needed to conduct wildlife surveys; however, such use creates the potential for dangerous incidents to occur between towers, turbines, transmission lines, and aircraft. The proposed wind park and tie-line would comply with the recommendations for tower and turbine construction and safety to aircraft pilots, as outlined in the AGFD's *Guidelines to Reducing Impact to Wildlife from Wind Energy Development in Arizona*. Adherence to these guidelines, in addition to the required FAA lighting, would help to keep pilots and personnel safe and eliminate any air hazards with towers, turbines, and associated transmission lines. The construction and operation and maintenance of the proposed project components would, therefore, not create an air hazard, and significance thresholds applicable to aviation would not be exceeded.

3.9.2.3 Alternative Transmission Tie-line Corridor

Transportation impacts associated with construction and operation of the alternative tie-line would generally be the same as those described for the proposed tie-line. The alternative tie-line would require the construction of a new access road over a distance of approximately three-quarters mile. This new access road may lead to an increase in off-road vehicular traffic on this particular portion of National Forest System lands and may require that new access roads are signed closed if illegal use becomes an issue.

3.9.2.4 No Action Alternative

Under the No Action Alternative, transportation would not be affected. Under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The wind park, tie-line, and switchyard would not be constructed and transportation would remain unchanged.

3.10 HEALTH, SAFETY, AND SECURITY

3.10.1 Affected Environment

3.10.1.1 Resource Evaluation Area

The resource evaluation area for health, safety, and security includes the wind park study area, tie-line, and Western switchyard and an area within one mile of each of these project components. In addition, primary access routes are included as part of this evaluation area. These include the I-40/Meteor Crater interchange, Meteor Crater Road, and Lake Mary Road near its intersection with FS 125. These areas were determined to be the areas where the potential hazard or risk, including traffic concerns, would be the greatest.

3.10.1.2 Characterization

The health, safety, and security resource evaluation area is rural in nature with low population density. One residence associated with the Flying M Ranch winter headquarters is located immediately to the west of the wind park study area. The predominant activities are ranching and dispersed recreation.

This section describes the existing health, safety, and security issues in the resource evaluation area. These include potential risks associated with wildfire and high-voltage transmission lines. Existing conditions related to vehicular traffic and aviation are discussed under the transportation section.

Wildfire Hazard

Fire risks are present in the health, safety, and security evaluation area, especially near the proposed tie-line and Western's proposed switchyard located on National Forest System lands. No fires have occurred in the vicinity of the proposed tie-line or switchyard in recent history but because the resource evaluation area around the proposed facilities is generally arid rangeland with a predominant groundcover of grasses, cacti, small shrubs, and trees, the greatest risk of fire would be during the hot, dry summer season. Once started, a range fire could spread rapidly. The rate, extent, and direction of spread would be dependent on the location of the fire, available fuel, temperature, wind speed and direction, presence or absence of fire breaks, and response time and capability of emergency responders. Fire safety and emergency response services are provided by local emergency response agencies. Although these services are available in incorporated areas within the County, they are not universally available in rural unincorporated areas (Coconino County 2003). The nearest serving emergency response teams are the Mormon Lake Fire Station in Mormon Lake, the Summit Fire District, east of Flagstaff, and the Forest Service fire departments located in Flagstaff.

High-Voltage Transmission Lines

Western's proposed switchyard would intersect with two existing Western 345-kV electrical transmission lines at the far western side of the health, safety, and security evaluation area. The existing lines extend north to south and carry electricity from the Navajo Generating Station near Page, Arizona, and Glen Canyon Dam on the Colorado River to the metropolitan Phoenix area.

Existing electrical transmission lines create the potential for electrical safety hazards in the immediate vicinity of the lines and the potential for personal injury, property damage, or fire in the event of transmission line fault, lightning strike, or structure collapse. Electrical transmission lines present a safety risk from electrocution, although no safety issues associated with the existing 345-kV transmission lines have been reported. Statewide, six deaths were recorded in 2008 with the Industrial Commission of Arizona as a result of contact with objects and equipment associated with electrical generation and transmission (Industrial Commission of Arizona 2008).

Potential health risks from electric and magnetic fields (EMF) associated with the existing 345-kV transmission lines are less clear. Both current and voltage are required to transmit electrical energy over a transmission line. The current, a flow of electrical charge measured in amperes (A), creates a magnetic field. The voltage, the force or pressure that causes the current to flow measured in units of volts (V) or thousand volts (kV), creates an electric field. Both fields occur together whenever electricity flows; hence, the general practice of considering both as EMF exposure.

The possibility of deleterious health effects from EMF exposure has been a public concern for many years about living or spending time near high-voltage lines. The available data from hundreds of studies conducted over more than 25 years have not revealed any conclusive evidence that EMF exposure from power lines poses a hazard to animal or human health. However, while such a hazard has not been established from the available evidence, the same evidence does not serve as proof of a definite lack of a hazard. Overhead power lines usually emit a stable EMF that fluctuates widely as current changes in response to the changing electrical load. These EMFs are highest under the transmission lines and drop off quickly as distance from the line increases (Western Area Power Administration 2005). Given the rural nature of the existing transmission line rights-of-way, and the fact that no residences are located immediately adjacent to, or in the vicinity of, the existing transmission lines, no human health or safety issues associated with EMF are currently present within the health, safety, and security evaluation area.

3.10.2 Environmental Consequences

This section examines concerns for health, safety, and security of workers and the public that could arise from the construction or operation of the proposed wind park, transmission tie-line, and Western switchyard.

3.10.2.1 Standards of Significance

The proposed project components and alternatives would have significant and adverse effect on public and occupational health, safety, and security if:

- Construction and operation of the proposed project components would result in a substantial increase in health and safety risks or serious injuries to workers, visitors to the area, or area land users.
- EMF levels would substantially increase near sensitive land uses.
- Construction, operation, and maintenance activities would impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan.
- Construction or operation of the proposed project components would cause substantial changes in traffic patterns resulting in hazardous driving conditions for motorists.
- Project implementation would violate local, State, or Federal regulations regarding handling, transport, or containment of hazardous materials.

3.10.2.2 Applicant's Proposed Project and Proposed Federal Action

Potential public health and safety hazards are greatest during the construction phase, but they can be effectively minimized by complying with applicable Federal and State occupational safety and health standards, and with application of the RPMs listed in Section 2.7. On December 1, 2006, the Secretary of Energy issued a memorandum concerning the "Need to Consider Intentional Destructive Acts in NEPA Documents." This section of the EIS addresses the threat of "intentional destructive acts" (i.e., acts of sabotage or terrorism).

Occupational Hazards

Wind Park, Tie-line, and Switchyard Construction

In general, human health and safety concerns associated with the construction of the proposed project components include the movement of large construction vehicles and equipment and materials, falling overhead objects, falls into open excavations, and electrocution. These concerns are most relevant to construction personnel who would be working on-site.

The Applicant, Western, and the Forest Service are committed to enforce the applicable health and safety practices identified in Section 2.7. Application of these RPMs would minimize occupational hazards associated with construction and would not result in a substantial increase in health and safety risks or serious injuries to workers, visitors to the area, or area land users.

Wind Park Operations and Maintenance

Operational hazards of the proposed wind park would include the possibility of tower collapse, blade failure, or ice shedding. The advancement of turbine technology has eliminated much of the potential for impacts to workers or public safety and security. Technological improvements and mandatory safety standards for turbine design, manufacturing, and installation have largely eliminated occurrences of tower collapse and blade failure. Modern utility-scale turbines are certified according to international engineering standards, which include ratings thresholds for withstanding different levels of hurricane-strength winds and other criteria. Due to the climate of northern Arizona, turbine icing would be expected to occur at times during operation. However, any ice that accumulates on the rotor blades would likely cause an imbalance or otherwise alert turbine sensors, which are designed to shut down. As the ice begins to thaw, it would typically drop straight to the ground. Any ice that remains attached to the blades as they begin to rotate could be thrown some distance from the tower; however, such a throw would usually result in the ice breaking into small pieces and falling near the tower base. For security and safety reasons, signs would be posted at the entrance of wind park access roads to alert the public and maintenance workers of potential ice shedding risks. With the advancements in turbine technology, combined with the limited number of workers and members of the public expected during the operational phase, the proposed wind park would not result in a substantial increase in health and safety risks or serious injuries to workers, visitors to the area, or area land users due to any tower collapse, blade failure, or ice shedding.

Tie-line and Switchyard Operations and Maintenance

Operation of the proposed tie-line and switchyard would result in increased EMF levels in the immediate vicinity of the facilities. Public exposure to EMF specific to transmission line and switchyard operation would be unlikely, however, due to the fact that no residences are located within the vicinity of the proposed facilities; the residence at the Flying M Ranch is over one-half mile from the proposed tie-line, and several miles from the proposed switchyard.

Regardless, EMF created by the tie-line would be reduced through the incorporation of low-EMF designs as detailed in Section 2.7. Based on these RPMs, the operation of the tie-line would not substantially increase EMF levels near sensitive land uses, and significance thresholds associated with EMF would not be exceeded.

EMF would also be produced within the switchyard, but due to the spacing of electrical equipment measured field strengths would be low outside the fence line. In general, EMF close to a switchyard is produced mainly as a result of entering power lines. Western would comply with Federal and industry standards for designing and installing electrical equipment related to the switchyard. As a result, low EMF levels would result from the operation of the proposed switchyard.

Public Safety and Site Security

Wind Park, Tie-line, and Switchyard Construction

Potential hazards to public safety as a result of the construction of the proposed project components are generally limited to increased construction traffic (e.g., over-width, slow-moving vehicles on smaller roadways; increased vehicular traffic from construction personnel) and possible route detours and/or closures.

Public exposure to health or safety problems from general construction activities would be unlikely because of the implementation of safety regulations and plans, and because the area is lightly populated with only one residence near the western boundary of the proposed wind park. Additionally, the general public would not be allowed near the proposed wind park, transmission tie-line, and switchyard construction areas.

The general public could be exposed to construction-related hazards due to the passage of large construction equipment on area roads. Increased traffic impacts during the wind park construction would most likely occur near the I-40/Meteor Crater interchange, along Meteor Crater Road and Chavez Pass Road. Transport of WTG components and other large project components via semi trailers would vary depending on available cranes for assembly, but the Applicant has indicated that, at peak construction, up to 26 semi-truck loads could be transported and unloaded within the wind park per equipment delivery day. In addition, approximately 250 to 400 workers would add traffic to local roadways as they commute to and from the work site. Approximately 315 vehicles per day use Meteor Crater Road to visit Meteor Crater and small amounts of local traffic also use the road. The Applicant would develop a traffic control plan in consultation with the Coconino County Public Works Department prior to the start of construction. This limited amount of traffic utilizing the I-40/Meteor Crater Road interchange and Meteor Crater Road, combined with the traffic control plan for the interchange and road, is not expected to cause substantial changes in traffic patterns resulting in hazardous driving conditions for motorists. Applicable significance standards to public safety from transportation related to the construction of the wind park would not be exceeded.

Increased traffic impacts for the proposed tie-line and Western's proposed switchyard would occur near the Lake Mary Road/FS 125 intersection. Some restriction or temporary closure of FS 125 may also occur during the delivery of equipment and materials to the tie-line right-of-way or to the proposed switchyard site. These would be intermittent and temporary, and would be managed with approved traffic control plans, which would be developed by the Applicant in consultation with Coconino County Public Works Department. Thus, substantial changes in traffic patterns resulting in hazardous driving conditions for motorists would not occur.

Road detours or closures would have the potential to affect emergency services. To avoid a negative consequence, construction managers would coordinate with local fire and emergency service personnel and with land management agencies to ensure that they are aware of where various construction activities are occurring in order to avoid potential conflicts between construction activity and the provision of emergency services.

Wind Park Operations and Maintenance

Potential hazards to public safety as a result of the operations and maintenance of the proposed wind park includes wildfires and risk to pilots during low-level aerial flights. Intentional destructive acts, such as an attack of terrorism, are also considered.

The installation of WTGs and met towers would create a potential for collisions with low-flying aircraft. Safety hazards to aircraft as a result of the proposed wind park are disclosed in Section 3.9 (Transportation).

In order to minimize the risk of wildfires, the electrical components of the proposed wind park would be inspected for system and grid safety prior to being brought on line. This inspection, along with implementation of built-in safety systems, minimizes the chance of fire occurring. However, fire at these facilities could result from a lightning strike, short circuit, or mechanical failure/malfunction. The SCADA system would sense any of the above occurrences and report to the wind park control center. Such a centralized system would monitor the condition of the wind park's equipment, alert service technicians to any fault or alarm conditions, and automatically shut down equipment, as necessary.

Generally, any fire or other emergency situations at a WTG site, step-up substation, or other wind park facility that are beyond the capabilities of the local service providers would be the responsibility of the facility operator. Construction and maintenance personnel would be trained and have the equipment to deal with emergency situations that may occur at these facilities; therefore, such an incident would generally not expose local emergency service providers or the general public to any public health or safety risk. Furthermore, the Emergency Response Plan developed for the wind park and transmission tie-line would contain emergency fire precautions, notification procedures, and emergency response sequences; comply with standards published by the National Fire Protection Association; and be reviewed and approved by the Coconino County Fire Marshall prior to issuance of a building permit for the wind generating facility.

To reduce safety and security concerns during operations and maintenance, public access to the proposed wind park would be limited by the terms and conditions established by affected land owners and management agencies. If granted by the landowner and the wind park owner/operator, the public may have a right of access over portions of the wind park on which the wind turbines and other wind facility components are located. There is no plan to gate the entire wind park, although access to, and within, the wind park site may be controlled. It is expected that signs would be posted at the wind park to warn of the potential hazards associated with the wind park, but the public would still have access to these areas for dispersed recreation. Year-round access to the wind park would be maintained so operators can monitor the facilities and equipment and quickly respond to any unforeseen condition that might impact the safety of the operations staff or the public.

Certain wind park facilities, including the step-up substation at the wind park site and the O&M facility, would be fenced with warning signs and have security lighting. The wind park is designed in such a way, as described in Chapter 2, to reduce potential sabotage and terrorism-related impacts. Some of these design characteristics include fencing at the switchyard and step-up substation and warning signs on locks and equipment. Western and the Forest Service believe that the wind park presents an unlikely target for an act of terrorism, with an extremely low probability of attack. The potential for the wind park to be targeted in terrorism-related activity would be negligible. All authorized personnel would be issued specific keys and/or access codes to regulate entry into wind park facilities, including the step-up substation, O&M faclity, and individual WTGs. These measures would limit access and deter intruders.

Tie-line and Switchyard Operations and Maintenance

The proposed tie-line would include towers less than 200-feet tall. Likewise, Western's proposed switchyard would include a communications tower and several new transmission structures that would be less than 200-feet tall. Safety hazards to aircraft as a result of the proposed tie-line and Western switchyard are disclosed in Section 3.9 (Transportation).

In order to minimize the risk of wildfires, the electrical components of the proposed tie-line and Western's proposed switchyard would be inspected for system and grid safety prior to being brought on line. This inspection, along with implementation of built-in safety systems, minimizes the chance of fire occurring. However, fire at these facilities could result from a lightning strike, short circuit, or mechanical failure/malfunction. Western's proposed switchyard would be monitored and controlled from Western's control center through its SCADA system. The system would respond to any condition that could cause fire-related hazards.

The proposed tie-line right-of-way would not be fenced, but public vehicle access along the right-of-way may be controlled or restricted on National Forest System lands if illegal use becomes an issue. Western's proposed switchyard would be fenced with a locked gate and posted with signs. Access to the switchyard would only be for Western employees and approved contractors. Western and the Forest Service believe that the proposed tie-line and switchyard present an unlikely target for an act of terrorism, with an extremely low probability of attack. The potential for the tie-line or switchyard to be targeted in terrorism-related activity would be negligible.

Environmental Hazards

Wind Park, Tie-line, and Switchyard Construction

Chemicals or other potentially hazardous materials used during construction would include diesel fuel, lubricants, and hydraulic fluids. These hazardous materials are used for operating construction equipment and are transported in small amounts, making public or environmental exposure unlikely and limited in severity. Implementation of RPMs identified in Section 2.7 would ensure applicable spill and hazardous waste requirements are met and significance standards would not be exceeded.

Wind Park, Tie-line, and Switchyard Operations and Maintenance

Western's proposed switchyard and the proposed step-up substation would include transformers with oil. Implementation of RPMs identified in Section 2.7 would ensure applicable spill and hazardous waste requirements are met and significance standards would not be exceeded. If required, secondary containment would be installed within the switchyard to prevent the migration of oil from the switchyard site.

3.10.2.3 Alternative Transmission Tie-line Corridor

Health, safety, and security impacts associated with construction and operation of the alternative tie-line would be the same as those described for the proposed transmission tie-line.

3.10.2.4 No Action Alternative

The No Action Alternative would result in no new impacts to human health, safety, and security because under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The wind park, tie-line, and switchyard would not be constructed.

3.11 NOISE

3.11.1 Affected Environment

3.11.1.1 Resource Evaluation Area

The resource evaluation area for noise impacts conservatively included an area up to one mile from the wind park study area, transmission tie-line, interconnection switchyard, and primary access roads, to incorporate any nearby sensitive receptors such as residences, schools, businesses, or public buildings.

3.11.1.2 Characterization

Fundamentals of Sound and Noise

People perceive sounds through sensations in the ear that are caused by pressure variations. Sounds can be distinguished by a loudness (sound pressure) component, measured in decibels, and a frequency component, measured in Hertz. Sound travels through the air as waves of air pressure fluctuations caused by vibration. Because energy contained in a sound wave is spread over an increasing area as it travels away from the source, loudness decreases with distance.

A decibel (dB) is the unit used to describe the amplitude of sound. Sound level measurements that are weighted to how humans perceive them are called A-weighted and are denoted by the unit dBA. The dBA scale reflects the response of the human ear by filtering out some of the noise in the low and high frequency ranges that the ear does not detect well. The primary assumption is that the dBA is a good correlation to a human's subjective reaction to noise. The A-weighted scale is used in most noise ordinances and standards. The dBA scale is logarithmic; therefore, individual dBA ratings for different sources can not be added directly to calculate the sound level for combined sources. For example, two sources, each producing 50 dBA will, when added logarithmically, produce a combined sound level of 53 dBA. In general, a 3-dBA increase in sound level is considered barely noticeable to humans; a 5-dBA increase is clearly noticeable, and a 10-dBA increase is considered a doubling of the sound level.

One of the most common ways of describing noise levels is in terms of the continuous equivalent sound level (Leq) over a monitoring period. Leq is the most commonly used descriptor in noise standards and regulations. The Leq is defined as the average noise level for a stated period of time (such as hourly or daily). The one-hour Leq is noted as Leq(1); the Leq over 24 hours is written as Leq(24). The Leq is weighted because loud and infrequent noises have a greater effect on the resulting level than quieter, more frequent noises. The Leq tends to weight the higher sound levels. The 24-hour Leq with a 10 dBA "penalty" for the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. is known as Ldn (day-night noise level). The Ldn attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

Noise Standards

There are no Federal or State noise standards that regulate wind parks, nor does Coconino County have local regulations or ordinances for noise. The EPA has, however, developed guidelines for evaluating noise impacts that are generally accepted and used in noise analyses (EPA 1974). As a standard for residences and other noise-sensitive receptors, the EPA recommends a Ldn of 65 dBA, or 55 dBA (Leq) averaged over 1 and 24 hour periods.

Noise Sensitive Receptors and Background Conditions

The noise evaluation area is generally rural and undeveloped with few, and widely scattered, residences (refer to Figure 3.1-4 for map of existing land uses). The only residence in the vicinity of the noise evaluation area is part of the Flying M Ranch, located near the wind park study area's western boundary,

off of FS 126. Flying M Ranch consists of a primary residence and numerous other structures located approximately 350 feet west of the wind park study area boundary. This ranch consists of historic homesteads which date back as early as 1914, located on private and State-leased lands (Diablo Canyon Trust 2005). Structures associated with the Raymond Ranch Wildlife Area are located just over one mile north of the wind park study area. No other residence, school, business, or public building is found within one mile of the noise evaluation area. Other land uses in the area include dispersed recreation and camping, which occur primarily near Pine Hill on Anderson Mesa, within one mile of the proposed tie-line and switchyard.

Baseline noise measurements were not conducted for this EIS. For assessment purposes, the baseline noise levels were assumed to be similar to those outlined by EPA for common noise sources (Table 3.11-1). The rural nature of the area would correlate to average noise levels in the 40 to 50 dBA range. Ambient noise in rural areas is commonly made up of rustling vegetation, ranching activities, airplanes, and infrequent vehicle pass-bys. Higher ambient noise levels, typically 60 to 65 dBA, may exist near the Meteor Crater Visitor Center as a result of vehicle traffic and tourism activities. Table 3.11-1 depicts noise levels associated with common everyday sources, and is provided here as context for interpreting the magnitude of noise levels discussed in this EIS.

TABLE 3.11-1
COMMON NOISE SOURCES AND LEVELS

Noise Source	**Average Noise (dBA)**	**Loudness (relative to normal conversation = 1)**	**Range of Noise (dBA)**
Ambulance siren (100 feet)	100	16	95-105
Motorcycle (25 feet)	90	8	85-95
Typical construction site	85	6	80-90
Single truck (25 feet)	80	4	75-85
Urban shopping center	70	2	65-75
Single car (25 feet)	65	1.5	60-70
Within 100 feet of a highway	60	1	55-65
Normal conversation (5 feet apart)	60	1	57-63
Residential area during day	50	0.5	47-53
Recreational area	45	0.4	40-50
Residential area at night	40	0.3	37-43
Rural area during day	40	0.3	37-43
Rural area at night	35	0.2	32-37
Quiet whisper	30	0.1	27-33
Threshold of hearing	20	0.06	17-23

Source: EPA 1974

3.11.2 Environmental Consequences

3.11.2.1 Standards of Significance

The effects of noise on people fall into three general categories: 1) subjective effects of annoyance, nuisance, and dissatisfaction; 2) interference with such activities as speech, sleep, and learning; and 3) physiological effects such as startling and hearing loss. In most cases, environmental noise produces effects in the first category only. However, residents who live close to roads and industrial facilities may experience noise effects in the second and third category.

A significant effect from noise would occur if project implementation would result in:

- Exceeding the EPA guidelines recommending a day-night average sound level of 65 dBA (Ldn) or 55 dBA averaged over 1 and 24 hour periods for sensitive receptors.

3.11.2.2 Applicant's Proposed Project and Western's Proposed Switchyard

This section evaluates potential noise impacts that could result from construction, operation, and maintenance of the proposed wind park, tie-line, and switchyard.

Construction

Noise levels associated with construction of a wind park, tie-line, and switchyard would vary greatly depending on the type of equipment, construction schedule, and condition of the area being worked. Construction activities would primarily be limited to daytime hours; nighttime construction activities within the wind park study area and along the tie-line would only occur with approval of the land management agencies or landowners. All construction activities would occur within the boundaries of the wind park study area, along new access roads, within the 200-foot-wide right-of-way and along proposed spur roads for the tie-line, and within the proposed staging and footprint areas for Western's proposed switchyard and new dead-end structures.

Noise would also be generated from vehicle traffic. On-site vehicular traffic would include hauling of materials in and out of the construction site, movement of heavy equipment, and worker traffic. Construction and worker vehicle access to the proposed project components would occur along the proposed primary wind park access road (located off of Meteor Crater Road), Chavez Pass Road, and FS 125. To access these roads, however, construction vehicles may be traveling over interstate, regional, and local roads as well. The number of truck trips associated with construction would vary, depending on the construction stage, but overall, the total traffic volume along local roads would increase during high activity periods of the construction phase. Noise increases would be common during the construction phase along the primary wind park access roads.

Activities associated with site development, transportation, construction, equipment installation, and startup and testing would emit noise during the hours of on-site activity. Table 3.11-2 presents noise levels of various types of construction equipment and activities at distances of 50 feet, 500 feet, and 1,500 feet.

TABLE 3.11-2 NOISE LEVELS FROM POTENTIAL CONSTRUCTION EQUIPMENT AT VARIOUS DISTANCES			
Construction Equipment	**Typical Sound Pressure at 50 Feet (dBA)**	**Typical Sound Pressure at 500 Feet (dBA)**	**Typical Sound Pressure at 1,500 Feet (dBA)**
Dozer (250-700 hp)	88	68	58
Front end loader (6-15 cu. yards)	88	68	58
Trucks (200-400 hp)	86	66	56
Grader (13 to 16 ft. blade)	85	65	55
Shovels (2-5 cu. yards)	84	64	54
Portable generators (50-200 kW)	84	64	54
Derrick crane (11-20 tons)	83	63	53
Mobile crane (11-20 tons)	83	63	53
Concrete pumps (30-150 cu. yards)	81	61	51
Tractor (3/4 to 2 cu. yards)	80	60	50
Concrete batch plant	83	n/a	n/a
Source: EPA 1971; Barnes et al. 1976; FHWA 2006.			

Wind Park

Construction of the proposed wind park would include the following noise-generating activities over the planned 12 to 18 month construction period for each 250 MW phase:

- Site and right-of-way clearing
- Access road construction
- Vehicle movement
- Concrete batch plant operation
- Rock crushing
- Blasting
- Foundation excavation and construction
- Wind turbine structure erection
- Underground electrical collection system installation
- Substation installation
- Site cleanup and restoration

Construction noise levels would be variable and intermittent, as equipment is operated on an as-needed basis. Construction equipment would move from one WTG site to the next, so construction noise levels would not dominate one area, except for the operation of the proposed batch plant. The batch plant and other stationary construction equipment would be sited a minimum of one-half mile from residential structures. Infrequent blasting activities that may occur at the borrow pits or associated with construction of the WTG foundations. If blasting activities are necessary they would be limited in nature and would be conducted in strict compliance with safety and public notification/warning requirements, and in accordance with applicable Federal and State regulations. The primary access route to the wind park

extends southwest from Meteor Crater Road into the wind park study area. Service roads specific to the construction of the wind park would be built in conjunction with the WTGs and collector system and would not be located within one-half mile of any sensitive receptors. Potential noise impacts would be greatest at the highest number of peak-hour trips and total heavy-duty truck trips. Construction workers in light-duty vehicles would typically travel to the site during the morning and afternoon.

Construction activities normally would be limited to daytime hours, and thus would not impact existing background noise levels at night. Construction activities within the wind park would only occur during nighttime with approval of the land management agencies or landowners. At one mile, construction related noise during the day and at night if construction activities are requested and approved, would be comparable to that of background levels in the area.

The only noise-sensitive receptors in the general vicinity of the proposed wind park include the residents of the Flying M Ranch (near the western boundary of the wind park study area) and the Raymond Ranch Wildlife Area (north of the wind park study area). Because both of these areas are located outside of the wind park study area and construction activities associated with the wind park facilities would be located more than one-half mile from residences, noise from construction is expected to be minimal. If it is determined that blasting would be required within one mile of the Flying M Ranch, the owner would be notified. No other features of the wind park, including the staging areas, batch plant, rock crusher, or substation would be located in the vicinity of any residential buildings or other sensitive receptors. No construction equipment traffic associated with the wind park is expected to enter the wind park study area through FS 126, which passes within several hundred feet of the Flying M Ranch winter headquarters.

Construction workers would be protected from adverse noise effects by equipment and procedures dictated by law and project construction specifications. Due to the intermittent and temporary nature of noise impacts of wind park construction and the distance to sensitive receptors, noise levels are not expected to exceed the EPA guidelines recommending a day-night average sound level of 65 dBA (Ldn) or 55 dBA for sensitive receptors. Significance standards related to noise from the construction of the proposed wind park would not be exceeded.

Tie-line and Switchyard

Construction of the tie-line would occur over several months, but noise-generating activities would be intermittent. Noise impacts specific to the construction of the transmission tie-line would result from heavy construction equipment and trucks used along the access roads and right-of-way. Construction equipment would move from one structure site to the next, so construction noise levels would not dominate one area. Blasting with explosives may be used as needed for the structure foundations, based on local geologic conditions. Relatively high peak noise levels in the range of 83 to 88 dBA would occur within 50 feet of the tie-line structure sites and the proposed switchyard. While not anticipated, difficult terrain along the slopes of Anderson Mesa may require some structures and/or conductors to be installed via helicopter. For potential tie-line structure sites where workers or equipment would be delivered by helicopter or sky crane, the approach, landing, and takeoff would be an additional noise source. Noise from medium-lift helicopters typical of those that would be used is in the range of 90 to 100 dBA at 50 to 100 feet (FAA 2004). If helicopter construction is required, helicopter staging areas would be sited a minimum of one mile from residences. Construction access for the transmission tie-line would likely be FS 125 from Lake Mary Road. In eastern sections of the proposed tie-line alignment where FS 125 deviates from the tie-line alignment, a new access road or spur roads would be constructed to or within the 200 foot transmission tie-line right-of-way.

With the exception of the Flying M Ranch, which is approximately 2,000 feet at its nearest point from the proposed transmission tie-line, no other receptors are located within one mile of the proposed transmission tie-line or switchyard. Ranch residents are likely to experience intermittent peak noise

levels above ambient conditions; but due to the distance from noise sources, noise levels are not expected to exceed the EPA guidelines recommending a day-night average sound level of 65 dBA (Ldn) or 55 dBA for sensitive receptors. Significance thresholds related to noise impacts from the construction of the proposed transmission tie-line would not be exceeded.

Construction of the proposed switchyard would occur over approximately seven months, but noise-generating activities would be intermittent and limited to the operation of construction equipment. Construction access for the proposed switchyard would be from FS 125 from Lake Mary Road. There are no residential structures or sensitive noise receptors near Western's proposed switchyard site. Therefore, noise levels from construction would not lead to impacts to sensitive receptors, and significance thresholds for noise would not be met.

The majority of the tie-line and Western's switchyard are proposed on National Forest System lands where recreational uses are intermittent and temporary. Noise impacts to recreationists would most likely be limited to those camping, hiking, hunting, or conducting other forms of dispersed recreation in the vicinity of Pine Hill, near the western end of the tie-line alignment and the proposed switchyard. Construction activities normally would be limited to daytime hours and, thus, would not impact existing background noise levels at night. Construction activities would only occur during night-time hours with approval of the Forest Service. Due to the dispersed nature of recreational activities, it is expected recreationists would pick sites away from areas subject to noise increases from the construction of the proposed tie-line and Western's proposed switchyard.

Operation and Maintenance

Wind Park

Noise-producing components of the wind park during operation and maintenance include the wind turbines, the transformer at the step-up substation, and intermittent vehicle traffic.

WTGs emit perceptible noise when in motion, emanating from the aerodynamic and mechanical functions of each turbine. A turbine's sound power represents the sound energy at the center of the blades, which propagates outward at the height of the hub. Mechanical noise is generated by the turbine's internal gears. Utility scale turbines are usually insulated to prevent mechanical noise from proliferating outside the nacelle or tower (Alberts 2005). Aerodynamic noise is generated by the blades passing through the air. The power of aerodynamic noise is related to the ratio of the blade tip speed to wind speed. Noise levels can vary depending on wind speed and distance of the listener from the turbine. Noise levels would be higher on windy days; there are some circumstances in winter where ice can form on a wind turbine blade, creating temporarily higher levels of turbulence noise.

The Applicant anticipates that the Vestas V100 1.8-MW turbine would be one of the turbines considered for the project. The Vestas V100 brochure (Vestas 2009) indicates that the sound power for this type of turbine would be between 95-107 dBA, which is similar to other 2.0-MW class turbines. Alberts (2005) has measured noise levels at the base of a similar Vestas structure at 58 to 60 dBA.

Most modern industrial wind turbines are designed to keep noise levels at or below 45dB at 1,000 feet, which should drop to 35 to 40dB at a bit over one-half mile (Acoustic Ecology Institute 2007), which is generally consistent with typical night-time ambient noise levels in rural areas. In the U.S., wind facilities often have setbacks to minimize the potential impacts from nearby residents. According to Acoustic Ecology Institute (2007), a one-half mile setback is acceptable if the goal is to minimize impacts on residents, though [preference is for] a one mile setback, which would offer near assurance of avoiding or minimizing noise issues. The closest residence to the proposed wind park, at Flying M Ranch, is located approximately 350 feet west of the wind park study area boundary. The nearest proposed turbine,

however, is expected to be located more than one-half mile away. As a result, noise levels from the operation of the turbines, including routine maintenance, would be minimal for the residents of the ranch, and is not expected to exceed the EPA guidelines recommending a day-night average sound level of 65 dBA (Ldn) or 55 dBA.

Electricity generated by the turbines would be collected by a network of underground and overhead 34.5-kV collection lines and delivered to the wind park's step-up substation. The new step-up substation would include a transformer to step up the voltage of the collection grid from 34.5 kV to 345 kV in order to connect to Western's 345-kV transmission system. This transformer is expected to be the major source of audible noise. The predominant noise from a transformer is a hum, which is approximately 85 dBA. Although electrical equipment has not been specified for the proposed step-up substation, transformer noise emissions would be subject to National Electrical Manufacturers Association (NEMA) standards and, therefore, would be typical for the industry.

The step-up substation and transformer would be located greater than one-half mile away from sensitive receptors, and would not negatively affect them. Occasional noise from routine maintenance at the step-up substation would create traffic noise, but not at levels that is expected to exceed the EPA guidelines recommending a day-night average sound level of 65 dBA (Ldn) or 55 dBA for sensitive receptors.

Tie-line and Switchyard

Audible noise associated with transmission lines is a result of corona discharge and is a function of line voltage. The amount of audible noise is directly related to the level of corona activity, which in turn is affected by the conductor's physical condition and contamination as well as meteorological conditions, most notably rain. Transmission line audible noise is characterized by cracking, frying, sputtering, and low frequency tones, which are best described as humming sounds. Audible noise from transmission lines primarily occur during foul weather conditions. Audible noise increases during dust storms or rain events, although it is generally masked by the background noise of rain and wind. In dry fair weather conditions, the conductors operate below the corona-inception level, and noise effects typically do not extend beyond the right-of-way. Because there are no permanent noise receptors located closer than 2,000 feet from the proposed tie-line, corona noise would dissipate with distance and no impacts would be expected.

The proposed switchyard would also generate noise during operation as a result of corona and occasionally disconnect switches and circuit breakers operations, which create momentary noise. The switchyard facilities would also be subject to NEMA noise standards. Because of its remote location, noise generated at the switchyard would not impact any sensitive noise receptors. Due to the dispersed nature of recreational activities, it is expected recreationists would pick sites away from the switchyard to conduct recreational activity. However, operational noise of the switchyard would dissipate with distance and is not expected to be heard at 2,000 feet and beyond, except for an occasional trip of a circuit breaker due to a transmission line fault.

Occasional maintenance activities on the proposed tie-line and switchyard would be required. Noise impacts from these activities would be intermittent and applicable significance thresholds would not be exceeded.

3.11.2.3 Alternative Transmission Tie-line Corridor

The alternative transmission line alignment would not result in additional noise impacts from that described under the proposed transmission tie-line. The location of the alternative alignment is within one-half mile of the proposed alignment, and no residents or other receptors are located in the area. As a

result, noise impacts would be similar to those described under the Applicant's proposed transmission tie-line alignment.

3.11.2.4 No Action Alternative

Under the No Action Alternative, the proposed project components would not be constructed or operated. Potential noise impacts associated with the construction and operation would not occur. The local noise conditions would continue according to current patterns and the impacts described for the proposed project components would not occur.

3.12 VISUAL RESOURCES

3.12.1 Affected Environment

3.12.1.1 Resource Evaluation Area

The evaluation area for visual resources extends three miles in all directions from the wind park study area and extends north to I-40. In addition, the visual resources evaluation area extends one mile to either side of the proposed tie-line and Western's proposed switchyard. The visual resources evaluation area was selected based on the scale and geographic extent of the proposed project components. This evaluation area was determined in an effort to include areas where the proposed project would be visible to the highest number of viewers, the most prolonged views, and areas where concern for views is considered high. Additionally, the visual resources evaluation area was refined to eliminate areas beyond which the discernible details of the proposed project components begin to vanish.

Visual resources were evaluated through research of existing documents including the Forest Plan, Coconino County Comprehensive Plan, and the Diablo Canyon RPA. Further, information was gathered through aerial photography, geographic information system (GIS) analysis, and a site visit.

The analysis for visual resources was based on the methods outlined in the Scenery Management System (SMS), used by the Forest Service. The wind park study area is not located on National Forest System lands and is not subject to the management objectives of the SMS. The proposed tie-line and Western switchyard are located on National Forest System lands and are subject to the SMS. To be consistent, the SMS was used throughout the proposed project to evaluate the expected visual change in the existing setting.

The SMS was introduced in 1995 and replaced the Visual Management System (VMS). Although one of the specific goals of the Forest Plan is to transition from the VMS to the SMS, it has not yet occurred. The Forest Service is required to begin using SMS to replace concepts and terminology of the VMS used during the Forest planning process. The major difference between the two systems is a more complete discussion of the "Landscape Character" with SMS. The SMS involves characterization and grading of the landscape related to visual resources, and establishment of objectives to ensure that Forest Service decisions are in harmony with the desired visual setting. Because the Forest Plan was completed prior to the introduction of the SMS, it uses terminology from the VMS. In order to be consistent with the Forest Plan, terminology as it relates to Visual Quality Objectives (VQOs) comes from the VMS. The SMS equivalent of a VQO is a Scenic Integrity Level (SIL).

A worksheet translating the language used between the two systems is included as Figure 3.12-1. The SILs (categories from SMS) range over five levels of integrity from very high to very low and are shown on the left side of the worksheet. Corresponding levels of VQOs (categories from VMS) are shown on the right side of the worksheet.

SCENERY MANAGEMENT SYSTEM **Scenic Integrity Levels**		**VISUAL MANAGEMENT SYSTEM** **Visual Quality Objectives**
VERY HIGH	(unaltered)	PRESERVATION

Very High scenic integrity refers to landscapes where the valued landscape character "is" intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.

HIGH	(appears unaltered)	RETENTION

High scenic integrity refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.

MODERATE	(slightly altered)	PARTIAL RETENTION

Moderate scenic integrity refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.

LOW	(moderately altered)	MODIFICATION

Low scenic integrity refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

VERY LOW	(heavily altered)	MAXIMUM MODIFICATION

Very Low scenic integrity refers to landscapes where the valued landscape character "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Unacceptably Low scenic integrity refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used as a management objective.

FIGURE 3.12-1

3.12.1.2 Characterization

Management Guidelines

The Forest Service generally manages all of the lands within the visual resources evaluation area along the western border of the wind park study area and along the proposed transmission tie-line and switchyard. The Forest Service's VQOs were established in the current Forest Plan and have been used since then to guide management decisions on the Coconino National Forest. VQOs of Partial Retention, Modification, and Maximum Modification are located within the visual resources evaluation area (Figure 3.12-2). Each objective is described below as presented in the VMS.

- *Partial Retention* refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.

- *Modification* refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

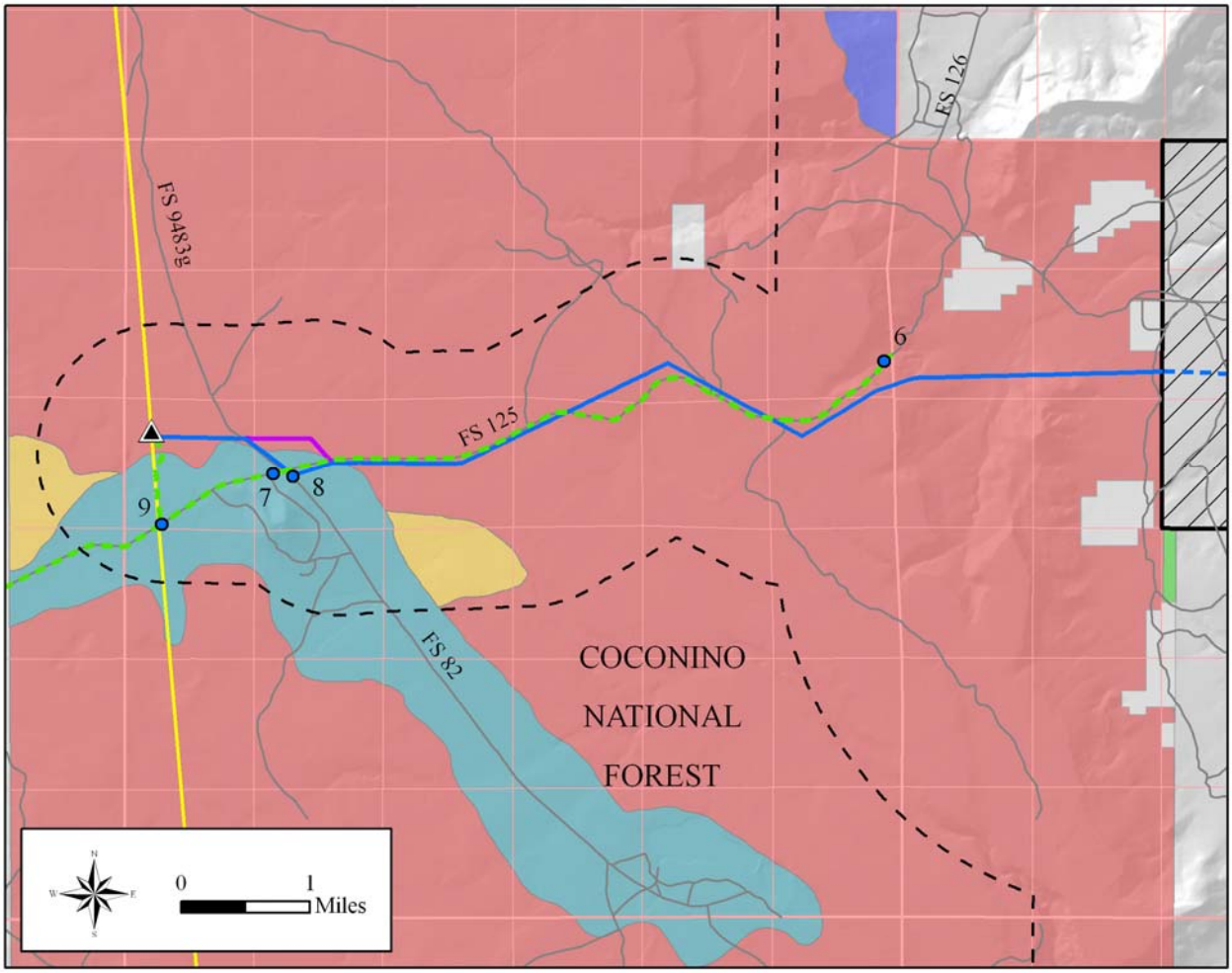
- *Maximum Modification* refers to landscapes where the valued landscape character "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

The goal of the Coconino County Comprehensive Plan, as documented in the Diablo Canyon RPA, is to "facilitate the development of alternative energy projects while maintaining the integrity of the ranches and preserving aesthetics and views." In order to accomplish this goal, two policies are set forth in the Diablo Canyon RPA (Coconino County 2005).

1. Wind projects shall be located at least one mile from major travel corridors, such as I-40 and SR 87.

2. To the extent allowed by the FAA, there shall be a minimum number of lights on the tops of the towers.

Views from major travel corridors of expressed concern include those toward the San Francisco Peaks, the Hopi Mesas, and Anderson Mesa.



Legend

- Visual Resource Evaluation Area
- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Alternative 345-kV Tie-line Alignment
- Proposed Interconnection Switchyard
- Existing Site Access Road
- Existing Western 345-kV Transmission Lines

Visual Quality Objectives

- Modification
- Maximum Modification
- Background Partial Retention
- Foreground Partial Retention
- Middleground Partial Retention
- Key Observation Points

Coconino National Forest
Visual Quality Objectives Map
Grapevine Canyon Wind Project

FIGURE 3.12-2

Regional Landscape Character

The project region is located within the transition zone between the Arizona/New Mexico Plateau Ecoregion which covers much of northern Arizona and northwestern New Mexico. Elevations generally range between 5,500-7,250 feet. The region is fairly level; however, scattered mesas provide variety to the landscape. Anderson Mesa, a geographically delineating feature, creates a drastic rise in topography near the western edge of the proposed wind park, while the Mogollon Rim drops off the edge of the Colorado Plateau south of the proposed wind park.

The highest elevation in the region rises to over 12,000 feet, forming the San Francisco Peaks. The San Francisco Peaks are located northwest of the wind park study area and form one of the most attractive and unique visual elements within Coconino County, as well as the Coconino National Forest. The peaks are the remains of an extinct volcano and rise abruptly from the otherwise flat plateau, creating a regional landmark visible from great distances.

Vegetative communities of the region consist of Great Basin shrublands and grasslands in the lower elevations. The vegetation within the lower and mid elevations consists of Pinyon-juniper and oak. Vegetation at higher elevations consists primarily of dense ponderosa pine forests.

The area around the Mogollon Rim is considered a destination area for outdoor recreation and is an area that provides climatic relief from summer temperatures in the Phoenix and Tucson metropolitan areas. The distinct pine forests offer a wide variety of activities associated with scenic viewing, including photography, hiking, mountain biking, off-highway vehicle use, picnicking, horseback riding, big game hunting, fishing, camping, wildlife, and recreational driving.

Visual Resource Evaluation Area Landscape Character

The majority of the visual resource evaluation area is located on a semi flat valley floor. The valley opens to the north with sweeping hills. The valley is bound on the south and west by Anderson Mesa/Chavez Mountain and is loosely bound by Sunset Mountain and Meteor Crater to the east. A few scattered ranching residences are located in the vicinity and the major land use is ranching. The overall character of the valley is naturally evolving, meaning “the landscape character expresses the natural evolution of biophysical features and processes, with very limited human intervention” (Forest Service 1995b). A few unimproved dirt roads cross through the area. The nearest major roads are I-40 to the north and SR 87 to the south. Local vegetation varies with elevation and aspect, but ranges between sparse vegetation and grasslands in the lower elevations, to dense pinion-juniper woodlands at the edge of the mesa, to scattered ponderosa pine forests and grasslands in the higher elevations on top of Anderson Mesa. Figures 3.12-3, -4, and -5 generally illustrate the vegetation types and landscape character of the evaluation area.

Water is often a factor in evaluating landscape character. It is often considered an amenity to visual resources. Several perennial bodies of water, including Kinnikinick Lake are located just outside of the visual resources evaluation area. Water within the visual resources evaluation area is limited to ephemeral streams or creeks, stock watering ponds, and watering tanks. However, over time water has created distinct landscape features that are apparent throughout the visual resources evaluation area in the form of canyons and draws. Three distinct drainages (Canyon Diablo, Grapevine Canyon, and Jack’s Canyon) traverse the visual resources evaluation area, and in addition to Anderson Mesa, are the most evident landscape features. Canyon Diablo and Grapevine Canyon are the two most evident canyons in the area, but generally do not have flowing water.

FIGURE 3.12-3

Sparse vegetation and grasslands dominate the lower elevations. This photograph is looking west, from the rim of Meteor Crater, across the northern end of the visual resources evaluation area.

FIGURE 3.12-4

Dense pinion-juniper woodlands at the transitional edge of Anderson Mesa and the lower elevations. This photograph is looking north from the southern end of the visual resources evaluation area.

FIGURE 3.12-5

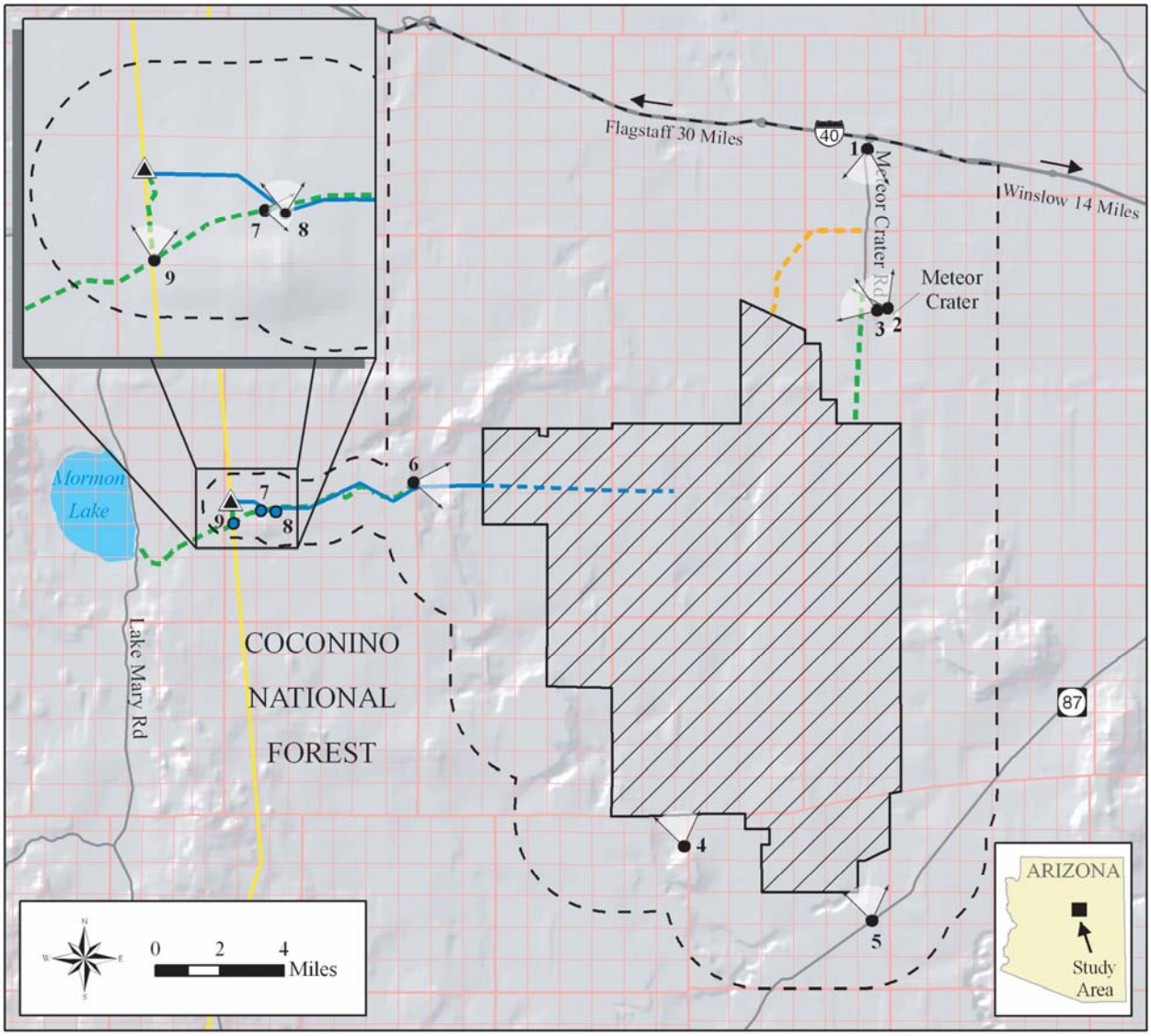
Typical higher elevations above Anderson Mesa. The photograph illustrates scattered ponderosa pine forests and grasslands that are typical in the higher elevations of the visual resources evaluation area for the tie-line.

Meteor Crater, a National Natural Landmark designated by the National Park Service (NPS), is located within the visual resources evaluation area. The crater was formed when a meteorite impacted the site approximately 50,000 years ago. The site is a popular tourist stop, with a visitor's center and guided tour around the rim of the crater. The crater is privately owned and operated. With the exception of the designation, there is no affiliation with NPS, and NPS does not manage the site or surrounding area for visual resources.

Key Observation Points

To assess visual impacts from the proposed wind park, proposed tie-line, and Western switchyard, the most critical viewpoints were selected, known as key observation points (KOPs). KOPs were identified by the NEPA Interdisciplinary Team (ID Team) based on landscape visibility, including: 1) travelways and use areas; 2) viewer concern levels; 3) distance zones; 4) number of viewers; and 5) length of view (time duration). KOPs typically depict prominent or sensitive views. Nine KOPs were identified at the beginning of the visual analysis and are depicted in Figure 3.12-6.

The existing landscape character as seen from each of the KOPs is described below. The first five KOPs are located on private and State trust land. The remaining KOPs are located on National Forest System lands.



Legend

- Visual Resource Evaluation Area
- Wind Park Study Area
- Proposed 345-kV Tie-line Alignment
- Proposed 345-kV Tie-line Alignment (Alignment to Be Determined)
- Proposed New Site Access Road
- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Lines
- Key Observation Points

Key Observation Point Viewing Direction

Grapevine Canyon Wind Project

FIGURE 3.12-6

KOP 1 – Interstate-40

This viewpoint looks from the southeast to the southwest near the turnoff from I-40 and Meteor Crater Road. This KOP is the closest and most heavily traveled area near the wind park study area. Typical speeds along I-40 exceed 55 mph. This turnoff is one of only a few stops along this stretch of I-40 and receives many visitors traveling to Meteor Crater, or the Meteor Crater gas station, convenience store, and RV park. There are few aesthetic elements when looking in this southern direction. The landscape lacks form, has very few lines, and at the season when the site visit occurred, lacked any hues and was monotone. In addition, the textures are very fine and evenly distributed. The viewer's attention is drawn across the rolling hills in the foreground, across the flat valley floor toward the rim of Anderson Mesa in the background. The landscape has rolling hills with low growing vegetation, and there are minimal disturbances to the existing views. There are no distinct elements in the view, and the landscape is indistinctive.

KOP 2 – Meteor Crater Visitor Center Patio Window

This viewpoint looks from the west to the north from the Meteor Crater Visitor's Center at what is described as the "Patio Window." This window is a focal point for tourists visiting Meteor Crater. The window, located on the patio level or courtyard of the visitor center is oriented to the northwest and frames a view of the San Francisco Peaks. Views from within the courtyard are constrained by walls, and topography except from this viewing window. The view is slightly elevated above the mostly flat valley floor. The distinct peaks create an aesthetically pleasing contrast to the flat open valley. The conical shapes of the peaks create dominance and draw attention. The sweeping curves of the road to Meteor Crater create contrast in the otherwise open plains. The elevated view creates a more pleasing view of the open grasslands across the plain. The color harmony is rich within the yellows, browns, and tans.

KOP 3 – Meteor Crater Rim

This view looks from the southwest to the northwest from the rim of Meteor Crater. Aside from the crater, there are few visually enticing elements in the landscape and minimal disturbances to the landscape from this viewpoint. The area is mostly rural, and natural. This KOP is located along an approximate one-half mile guided hike that occurs daily, weather permitting. This KOP is located at one of several planned stops along the tour. From this location the guide directs visitors to look to the west and points to Canyon Diablo in reference to the location where several meteorites were discovered. This viewpoint has open views of the valley toward the north, but views are blocked to the south by the crater itself. The elevated view reiterates the lack of vegetation and water. The indistinctive landscape character offers little-to-no attraction to the viewer from this location. Colors are monotone, there are very few lines to create variations, and there are few forms. The mesa across the valley to the west is mostly flat with few prominent peaks.

KOP 4 – Chavez Pass

This view looks north from an area near the southern end of the visual resources evaluation area known as Chavez Pass. Chavez Pass rises several hundred feet toward the south end of the valley, between Chavez Mountain and Anderson Mesa. Chavez Pass Road travels through the pass and this KOP is located on that road. Views along this section of road are expansive to the north and east. Vegetation in this area is taller and consists of junipers, sages, and grasses. There are minimal disturbances to the existing views. There are few apparent alterations in the area. Remoteness and difficult access limit the number of viewers that would visit this location. This KOP has an abundance of vegetation that creates more color and interest to a viewer. There are still, however, few forms and lines to break up the valley floor.

KOP 5 – State Route 87

This viewpoint is located in the far southern end of the visual resources evaluation area looking to the north. SR 87 supports traffic with speeds exceeding 55 mph. There are few distinct turnoffs or other elements of interest that would stop or detain people along this section of road. The San Francisco Peaks are more than 50 miles away and yet are a dominant element in the landscape. The triangular shapes of the peaks, as well as the rising edge of Anderson Mesa offer the greatest break in the flat skyline. The rolling hills in the foreground and middleground are covered in evenly distributed junipers and help to create some interest in the viewshed by leading the viewer to look toward the background views.

The following KOPs are located on National Forest System lands managed for visual resources.

KOP 6 – Forest Service Road 125

This viewpoint is located on FS 125, along the eastern edge of Anderson Mesa, looking to the east. The KOP is located on National Forest System land that has a VQO of Modification. This view is elevated above the otherwise broad valley to the east. FS 125 starts to descend down the rim of the mesa near this viewpoint and views are generally screened by vegetation. The vegetation transitions from pines to dense junipers as the road descends downward toward the valley floor. The evenly distributed junipers start to diffuse as the hills and mesa flatten out into the broad open plain.

KOP 7 – Forest Service Road 125/Forest Service Road 82

This view looks to the east along FS 125 from a point near the intersection of FS 82/FS 9483g. This KOP is located on National Forest System land that has a VQO of Foreground Partial Retention. This natural appearing view is random with open spots that transition between low to moderately tall vegetation areas, with some isolated trees in between. The conical pines and mounding junipers create a stark contrast to the flat meadows in the area. The vibrant greens and yellows create a pleasing view. There are no designated camp grounds or viewing areas that would create prolonged views of the area.

KOP 8 – Forest Service Road 82

This viewpoint is located along FS 82, south of the intersection with FS 125, looking to the north. This KOP is located on National Forest System land that has a VQO of Foreground Partial Retention. This viewpoint has many aesthetically pleasing landscape features. The shapes in the pines and junipers, as well as some rocks, create interest as do the varying colors and values that are created by the random and varying sized vegetation.

KOP 9 – Forest Service Road 125/Western Electrical Transmission Line Corridor

This viewpoint is located on FS 125, looking to the north, along an existing electrical utility corridor. The KOP is located on National Forest System land that has a VQO of Foreground Partial Retention. Partial Retention implies that the landscape character appears slightly altered. Deviations from the natural setting are to be subordinate to the natural landscape character. This KOP generally looks north along Western's existing Glen Canyon-Pinnacle Peak transmission line corridor. The existing utility corridor creates a funneling effect on the viewer. The vegetation removed along the transmission line corridor creates an abrupt change in the flow of the landscape. The vegetation that is not removed and manipulated is moderate to tall (15-40 feet). The abruptness of the utility corridor is the main evidence of the human disturbances in the area. The unnatural change in form is in direct contrast to the random and isolated vegetation patterns that occur along FS 125. The distinct lines from the transmission lines and conductors are in direct contrast with the soft irregular lines that exist in the naturally evolving plants in the area.

3.12.2 Environmental Consequences

3.12.2.1 Standards of Significance

Impacts to visual resources would be considered significant if any of the following conditions were to occur:

- Reduce the VQO on National Forest System lands more than one classification down. The Forest Plan allows a movement downward of one level in the VQO if the Forest Service decision-maker determines it an appropriate action.
- Conflict with the goals and policies of the Coconino County Comprehensive Plan on private and/or State trust lands.

Visual resources were analyzed for consistency with management objectives and the potential to affect visual receptors within the visual resources evaluation area. Visual receptors within the visual resources evaluation area consist of travelers along the major road corridors, visitors to Meteor Crater and Meteor Crater Enterprise facilities, local recreation users, and ranchers.

This evaluation looks at impacts associated with construction, operations and maintenance of the proposed wind park, transmission tie-line, and switchyard.

Visibility Analysis

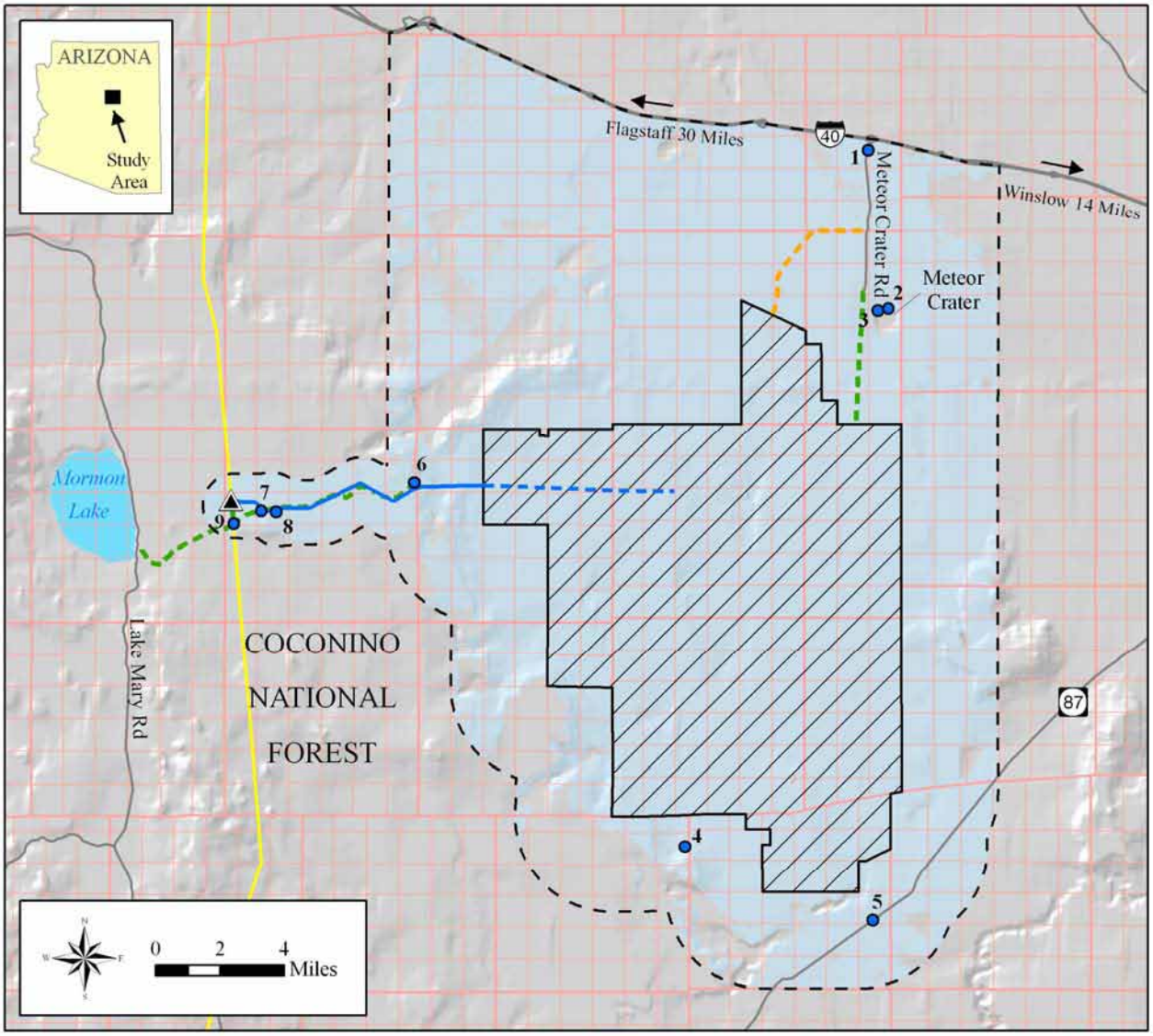
A viewshed analysis was performed using GIS technology and a 90-meter digital elevation model to determine the extent to which proposed project components would be visible from the KOPs.

Figure 3.12-7 illustrates the results of the viewshed analysis. The analysis looked only at those lands within the visual resources evaluation area. Areas depicted in light blue illustrate areas where at least a portion of the proposed project components would be visible, meaning at least one WTG or one transmission structure would be visible. The analysis does not take into account existing vegetation conditions, nor distance, which would potentially limit views.

Distance Zones

Distance plays a key role in visual analysis. As part of the VMS, the Forest Service created distance zones, which are the same under the SMS. Distance zones help in the inventory and analysis process. They are divided into three main categories: foreground, middleground, and background. These three divisions are used to describe the part of a characteristic landscape that is being inventoried or evaluated. A view in which all three distances zones are visible often has the greatest scenic quality. Distance zones are defined as:

- Immediate Foreground: views extend from the viewer up to a distance of 300 feet.
- Foreground: views (within 0.5 mile) are considered to be most sensitive due to the proximity to the viewer, and the ability to perceive detail.
- Middleground: views extend from 0.5 mile to 4.0 miles from the viewer, where one can perceive individual landscape features under clear conditions, but not in great detail.
- Background: views extend beyond 4.0 miles and generally consist of viewing conditions where only broad landforms are discernable and where atmospheric conditions may render the landscape an overall bluish color. In general, the farther away from the project the viewer is, the smaller the impact.



Legend

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- Existing Site Access Road
- Proposed Interconnection Switchyard
- Existing Western 345-kV Transmission Lines
- Visible
- Key Observation Points

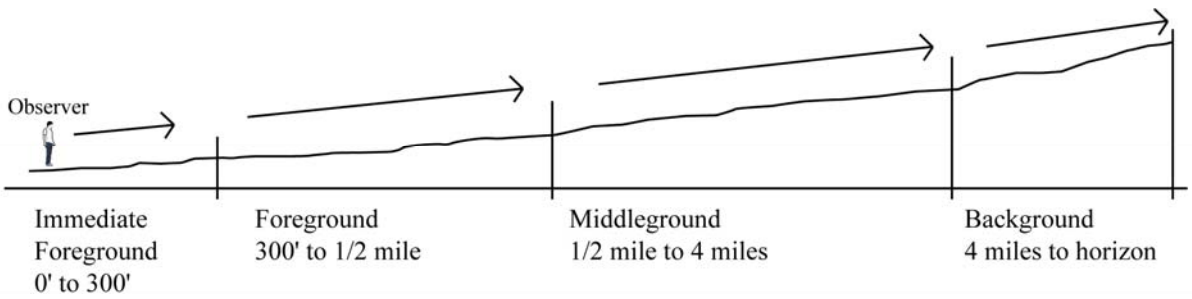
Viewshed Map

Grapevine Canyon Wind Project

FIGURE 3.12-7

Figure 3.12-8 from the Forest Service Scenery Management Handbook, depicts viewing distances from the observer's point of view.

FIGURE 3.12-8
DISTANCE ZONES ILLUSTRATION



3.12.2.2 Applicant's Proposed Project and Proposed Federal Actions

The Forest Service manages for visual resources and has established VQOs for all lands within the visual resources evaluation area under its jurisdiction. In addition, Coconino County has established policies pertaining to private and State trust lands to protect specific views from the effects of utility infrastructure projects. Regardless of land ownership or jurisdiction, the visual resource evaluation involved using the SMS to compare the expected visual change in the existing setting as observed at each of the KOPs. Specifically, the evaluation examined the contrast the proposed wind park, proposed tie-line, and Western switchyard would have on the existing landscape design elements of form, line, color, and texture. Current and potential VQO status is evaluated for KOPs on National Forest System lands.

As part of the evaluation, photographic simulations were created to depict the expected view from each KOP. Vegetation is portrayed in most of the simulations. However, simulations prepared from KOPs located on National Forest System lands were developed with and without vegetation. This was because vegetation is considered ephemeral, meaning that it may or may not be there in coming years. Photographic simulations from each KOP are included in Appendix E.

<u>Wind Park (as viewed from private and State trust lands)</u>

KOP 1 – Interstate-40

Views of the proposed wind park from this viewpoint would be brief and fleeting, limited by distance and topography. The proposed wind park would be the only proposed project component visible from this location. The proposed wind park would be located within background views and visible elements would include multiple straight, vertical lines. These vertical landscape elements would contrast with the gentle rolling hills that are visible in foreground views. In addition, movement created by the rotation of the blades attached to each turbine would further draw the viewer's attention. Distance to the proposed wind park would be more than five miles from this location and minimizes the visual contrast, resulting in a minimal impact. Views towards the San Francisco Peaks and Anderson Mesa would not be obstructed by the proposed wind park from this location. Two simulations of the proposed wind park have been prepared from this viewpoint, one depicting a 500 MW wind park and one depicting an initial phase of up to 250 MW.

KOP 2 – Meteor Crater, Patio Window

Views of the San Francisco Peaks through the framed portion of the Meteor Crater Visitor's Center Patio Window would not be obstructed by the proposed wind park. However, a portion of the proposed wind park, located within middleground views, would be visible. The majority of the proposed wind park would be screened from view by a structure forming the Visitor Center's elevator shaft and by variations in topography forming the rim of Meteor Crater. The proposed wind park would introduce multiple vertical lines that would create a subtle contrast to the generally flat valley. The contrast would be slight in color, form and line, however movement created by the rotation of the blades attached to each turbine would attract the viewers focus to the presence of the WTGs. A simulation of the proposed wind park has been prepared from this viewpoint depicting a 500 MW wind park.

KOP 3 – Meteor Crater Rim

Viewers would have a broad view of the north end of the proposed wind park from this viewpoint. A rock outcrop forming a portion of the rim of Meteor Crater would screen the southern three-quarters of the proposed wind park from view. Views of the proposed wind park would be in middle and background views. Other components of the proposed wind park would not be visible. The proposed wind park would introduce a series of tall vertical lines created by the WTGs that would stand in contrast to the generally flat valley, substantially changing the view. Movement created by the rotation of the blades attached to each turbine, as well as features of the guided tour along the crater rim, would further draw the viewers' focus to the foreign elements. The proposed wind park would create a moderate visual contrast from this viewpoint. Two simulations of the proposed wind park have been prepared from this viewpoint, one depicting a 500 MW wind park and one depicting an initial phase of up to 250 MW.

KOP 4 – Chavez Pass

Views of the proposed wind park along this section of road are expansive to the north and east. Views of the proposed wind park would be in middle and background views, and other components of the proposed project would not be visible. The proposed wind park would introduce a high number of vertical lines that would stand in contrast to the rolling topography of the valley, partially blocking distant background views. This would result in a moderate to high visual contrast from this viewpoint. A simulation of the proposed wind park has been prepared from this viewpoint depicting a 500 MW wind park.

KOP 5 – State Route 87

Views of the proposed wind park would be apparent to motorists along this portion of SR 87. Views of the WTGs would be in the middle and background views. Other components of the proposed project would not be visible. The proposed wind park would introduce a number of vertical structures, standing in contrast to the natural setting in scale, form, line, and color. Movement created by the rotation of the turbine blades would further enhance this contrast and draw the viewer's attention. The more distant the WTGs, the less evident the contrast, as vegetation and topography further screen these structures. Views of the San Francisco Peaks would be partially blocked by some of the closest WTGs. The proposed wind park would create a high visual contrast from this viewpoint; however, the nearest WTG would be located more than one mile from the highway in accordance with current County goals and policies. Two simulations of the proposed wind park have been prepared from this viewpoint, one depicting a 500 MW wind park and one an initial phase of up to 250 MW.

Based on the visual evaluation for the proposed wind park, the proposed wind park would not conflict with current County goals and policies and all WTGs would be located greater than one mile from major travel corridors. Therefore, the proposed wind park would not cause significant impacts to visual resources.

Wind Park (as viewed from Coconino National Forest)

KOP 6 – Forest Service Road 125

This view is different from the other KOPs because it is elevated above the valley and both the proposed wind park and proposed tie-line would be clearly visible within the viewshed. The proposed tie-line is visible within foreground views and the proposed wind park and tie-line are visible in middleground and background views from this viewing location. The proposed wind park and tie-line would introduce elements of form, line, scale, and color that would contrast with the otherwise natural valley floor. In addition, movement created by the rotating blades of the wind turbines would further attract attention. Although views along this travel corridor would be sporadic due to topographical variations and screening from vegetation, the proposed wind park and tie-line would result in a moderate contrast. However, since the current VQO is Modification, the addition of the proposed wind park and transmission tie-line would not change the VQO. A simulation of the proposed wind park and tie-line has been prepared from this viewpoint depicting a 500 MW wind park.

Tie-line

KOP 7 – Forest Service Road 125/Forest Service Road 82

Views of the proposed transmission tie-line would be evident to travelers as the line crosses from the south side of FS 125 to the north side. The proposed tie-line would be located within foreground and middleground views. The proposed wind park and Western's proposed switchyard would not be visible from this viewpoint. The elements of the proposed tie-line would create contrast in form, line, scale, and color. The visual contrast created would be moderate from this location. Two simulations of the proposed tie-line have been prepared from this viewpoint, one with vegetation and one without vegetation. The proposed tie-line would not meet the current VQO of Partial Retention at this site and would result in a movement down one level to a VQO of Modification.

KOP 8 – Forest Service Road 82

The proposed transmission tie-line would be visible in immediate foreground, foreground, and middleground views. The proposed wind park and Western's proposed switchyard would not be visible from this viewpoint. Transmission line structures would be evident in great detail because of their proximity to the viewer. The structures would introduce elements of scale, form, line, color, and texture that would create a moderate contrast to the existing landscape. In addition, the tie-line would partially interfere with views towards the San Francisco Peaks. Two simulations of the proposed tie-line have been prepared from this viewpoint, one with vegetation and one without vegetation. The proposed tie-line would not meet the VQO of Partial Retention at this site and would result in a movement down one level to a VQO of Modification.

Western's Switchyard

KOP 9 – Forest Service Road 125/Western Electrical Transmission Line Corridor

Views of Western's proposed switchyard and the proposed transmission tie-line would be visible in middleground views from this viewing location. The proposed wind park would not be visible. In addition to the existing electrical transmission line structures, the proposed switchyard and tie-line would introduce new structures into the viewshed adding further contrast in form, line, and color. The visual contrast created by the proposed switchyard and tie-line would be low from this viewing location, because new facilities would be similar to existing man-made modifications. The proposed switchyard and tie-line are located outside of the viewshed managed for Partial Retention and would not affect this VQO. Two simulations of the proposed switchyard and tie-line have been prepared from this viewpoint, one with vegetation and one without vegetation.

Temporary Impacts

Short term impacts would result from construction activities. A visual impact not isolated to the visual resources evaluation area could be attributed to construction equipment in transit. Large numbers of construction vehicles carrying turbines and other construction materials would be evident to commuters and other regular highway drivers. Though periodic rather than constant, construction traffic would be seen primarily by others in transit. These impacts are considered temporary and minimal.

Disturbances in vegetation would be evident for the WTG foundations, batch plant operation area, staging areas, and road development. Changes to the soil color and a reduction of the understory vegetation would be evident especially to viewers that would have an elevated view of the proposed project components. In the long-term, some of those disturbances would be softened as the understory vegetation grows back or is otherwise restored.

Construction related impacts are anticipated to be moderate but temporary, and would occur over a 12 to 18 month timeframe for each 250-MW phase. During construction of the proposed 500-MW wind park, tie-line, and Western switchyard approximately 2,419 to 2,630 acres of land would be altered, which would temporarily interfere with the existing visual quality of the site. To minimize visual impacts, both during and after construction, RPMs as outlined in Section 2.7 would be implemented.

Light and Glare

Under FAA guidelines, lighting is required on the WTGs for aircraft safety. The required lighting would be a new visual element introduced to the area's landscape. The lights would be most noticeable during night-time hours. Additionally, security lighting would be required at Western's switchyard and the proposed step-up substation and O&M facility. All project-related lighting would be limited to what is specifically required as outlined in the RPMs (Section 2.7 under Visual Resources), including keeping exterior lighting on the turbines required by the FAA to the minimum number and intensity required to meet FAA standards. With this measure, the proposed wind park would be consistent with the current County goals and policies and significance standards listed in Section 3.12.2.1 would not be exceeded.

Impacts associated with glare from the proposed WTGs would be minimal. Variables to consider include the amount of sunshine and the time of day. The turbines and tie-line towers would create minimal glare under the correct conditions; however this would be minimized to the extent possible by the use of non-reflective paint as outlined in the RPMs (Section 2.7).

3.12.2.3 Alternative Transmission Tie-line Corridor

The alternative transmission tie-line would create less of a visual impact than the proposed tie-line because it would not be located within VQO Partial Retention areas on National Forest System lands, and would be located farther away from the intersection of FS 125 and FS 82. Therefore, the alternative tie-line would not alter the VQOs prescribed by the Forest Plan. KOPs 7 and 8 are located in the vicinity of the alternative tie-line. Two simulations from each of these KOPs have been prepared depicting the alternative tie-line, one with vegetation and one without vegetation. The photographic simulations are included in Appendix E.

3.12.2.4 No Action Alternative

No direct or indirect impacts on existing visual resources would result through implementation of the No Action Alternative. Under this alternative, Western would not approve an interconnection for the Grapevine Canyon Wind Project and the Forest Service would not issue a permit for the tie-line proposed for the wind park. The proposed wind park, tie-line, and switchyard would not be constructed and visual resources would remain unchanged.

3.13 UNAVOIDABLE ADVERSE IMPACTS

Pursuant to NEPA regulations (40 CFR 1502.1) an EIS must consider adverse environmental effects that cannot be avoided. Unavoidable impacts are those that would occur after implementation of all Applicant and agency RPMs and other recommended mitigation measures. Unavoidable impacts do not include temporary or permanent impacts which would be mitigated. They also do not include impacts from speculative events such as hazardous waste spills which are not cleaned up promptly in accordance with accepted mitigating measures.

Construction, operation, and maintenance of the proposed project would result in unavoidable adverse impacts to biological resources, cultural resources, and visual resources within the project study area, as described below. A Biological Assessment (BA) is being prepared under Section 7 of the ESA for federally-listed species. The BA will be used to support a determination on whether or not the proposed Federal actions would adversely affect federally-listed species. If Western determines that the proposed Federal actions may adversely affect listed species, Western and USFWS would enter into formal consultation. Under formal consultation the USFWS will issue a Biological Opinion with conditions and reasonable prudent alternatives to minimize adverse effects. If required, the findings of the Biological Opinion will be summarized in the Final EIS and/or the Records of Decision issued by Western and the Forest Service. Conditions identified in the Biological Opinion will be followed by Western, the Forest Service, and the Applicant.

3.13.1 Wind Park

Construction and operation of the proposed wind park would lead to the loss of some biological resources. Native vegetation and wildlife habitat would be removed in order to accommodate the proposed facilities. Any avian and bat mortalities caused by the operation of the wind park would be an unavoidable adverse impact. Any avian and bat mortalities would be addressed by the Applicant pursuant to its Avian and Bat Protection Plan.

Any unavoidable adverse impacts to cultural resources cannot be determined until the results of the Class III Survey and Traditional Cultural Properties Survey are completed. A Programmatic Agreement (PA) has been developed among Western, Forest Service, SHPO, affected Federal and State agencies, the Applicant, and all interested Native American Tribes in conjunction with preparation of the EIS to ensure that Section 106 requirements are met. The preferred mitigation measure is to avoid identified sites; however, the PA will define a process for addressing any cultural resource sites eligible for or on the NRHP that cannot be avoided during the construction of the wind park.

The construction and operation of the wind park, especially the introduction of the WTGs, would permanently change the visual landscape of the area by introducing broad visual contrast to the natural landscape. The visual change would vary by individual and perspective, but would generally be apparent in all directions, extending for several miles beyond the wind park.

3.13.2 Transmission Tie-line and Switchyard

Unavoidable adverse impacts to biological resources, cultural resources, and visual resources as a result of construction and operation of the proposed transmission tie-line and switchyard would be similar to those described under the wind park. The PA will address a process for addressing any cultural resource sites eligible for or on the NRHP that cannot be avoided during the construction of the proposed transmission tie-line and switchyard.

3.14 SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Pursuant to NEPA regulations (40 CFR 1502.16) an EIS must consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. The impacts and use of resources associated with the proposed project are described in resource sections in this chapter.

The proposed project includes up to 333 WTGs, capable of generating a combined capacity of up to 500 MW of renewable electric power. Electricity generated in this manner results in minimal emissions of pollutants or greenhouse gases to the atmosphere. The anticipated electrical output of the proposed wind park would be collected at the step-up substation, transmitted along the proposed 345-kV tie-line, and connected to the regional grid at the proposed switchyard.

The relationship between the short-term uses of the environment and the maintenance and enhancement of long-term productivity with regard to the proposed project considers the use of the wind to generate electricity and the use of the land and airspace to locate the wind generating facility. The use of the land and airspace to construct and operate a wind generating facility considers its "footprint." In the short term, development of the proposed project would require commitments of resources such as soil, water, vegetation, wildlife populations and habitats, noise, visual resources, and land use for the life of the proposed project. Impacts to transportation resources and social and economic resources would occur primarily during construction. Revenue would likely increase for some local businesses, such as construction suppliers, hotels, restaurants, gas stations, and grocery stores in response to the needs of workers associated with constructing the proposed project.

Construction and operation of the proposed wind park would convert approximately 591 acres of ranchland to utility-related uses for the life of the project, which is estimated for a period of 20 years unless landowner lease agreements are renewed. However, the proposed wind park would result in few changes to existing agricultural practices because grazing would continue in and around the WTGs and other proposed project facilities. As a result, there would be minimal effects on the overall grazing capacity of the area.

Construction and operation of the proposed transmission tie-line and switchyard would convert between 8 and 11 acres of private and State trust land and between 26 and 29 acres of National Forest System lands to utility-related uses within the proposed right-of-way. The alternative transmission tie-line would also convert between 8 and 11 acres of private and State trust lands, but would convert between 27 and 30 acres of National Forest System lands to utility-related uses within the proposed rights-of-way. Existing uses of these lands, including ranching activities and dispersed recreation, would be allowed to continue around the transmission line structures and the switchyard, thus the short-term use for the proposed project would not affect the long-term productivity of the area's grazing and recreational resources.

Compared to other energy types consumed by users in Arizona and other southwestern U.S. states, wind energy makes up a very small fraction the region's total energy consumption. Energy generated by the wind could displace energy generated from other nonrenewable sources (i.e., fossil fuels) that have associated environmental and public health issues, namely air emissions, greenhouse gas generation, fossil fuel extraction, transportation, and spent fuel storage and disposal.

The wind is used as the energy source to move the turbines that generate electricity. Unlike non-renewable sources, wind turbines do not deplete their energy source; energy generation is continuous and dependent on the flow of wind. Based on this fundamental dynamic of wind energy, the long-term productivity, in this case the generation of electricity, would be maintained because of the renewable nature of wind power. While the short-term use of the land to construct and operate the wind facility would displace other uses of the area (i.e., grazing, wildlife habitat, dispersed recreational uses), there

would be benefits to long-term productivity associated with the use of less than 800 acres of private, State trust, and National Forest System lands to generate and transport wind energy. Long-term reductions in the region's reliance on nonrenewable energy sources and air emissions balance the short-term loss of use of this land for ranching, wildlife habitat, dispersed recreation, and other possible uses of the project study area.

If the proposed project is decommissioned, the facilities may be removed and the area of disturbance may be reclaimed. If this were to occur, it would restore the long-term productivity of the land for ranching, wildlife habitat, and dispersed recreation.

3.15 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA regulations (40 CFR 1502.16) dictate that an EIS must consider irreversible or irretrievable commitments of resources. An irreversible commitment of a resource is one which, once committed to the proposed project, would continue to be committed throughout the life of the project and would result in a loss of future options. An irretrievable commitment of resources refers to those resources that, once used, consumed, destroyed or degraded during construction, operation, or decommissioning of the proposed project, would cause the resource to be unavailable for use by future generations. Irretrievable commitment of resources applies to loss of nonrenewable resources such as minerals or cultural resources.

The construction and operation of the proposed wind park, tie-line, and switchyard on Federal, State, and private lands would change the use of directly- and indirectly-affected parcels for the life of the project. Use of natural resources that ordinarily occur in the area would be limited by the dedicated use of the area for wind energy development. Consequently, some loss of production of certain resources such as forage for livestock and wildlife would occur during the time that those lands are out of production. However, because the turbines and other components of the facility could be removed, and the land restored to pre-construction conditions, the commitment of the land would not result in long-term irreversible or irretrievable commitment of resources.

The loss of soil productivity associated with the WTG pads, tie-line structures, and access roads would result in an irreversible commitment of resources. This loss of productivity could be minimized after restoration and revegetation, but this may take a substantial amount of time because of the arid nature of the project study area.

Operation of the wind farm would likely result in some avian and bat mortalities, which would constitute an irretrievable loss of these individuals.

Cultural resources such as prehistoric sites, historic properties, and cultural landscapes, are non-renewable resources. Inadvertent or accidental destruction of cultural resources during construction that might occur despite mitigation actions would be an irretrievable commitment of resources. The preferred mitigation measure is to avoid identified sites; however, the PA will define a process for addressing any cultural resource sites eligible for or on the NRHP that cannot be avoided during the construction of the wind park, tie-line, and switchyard, or discovered during foundation excavations.

Beyond the natural and cultural resource commitments, there have been financial resources already expended by the project proponent, Western, and the Forest Service for the planning and review of the proposed project. The expenditure of funds would continue throughout the permitting and construction phases of the project should the project be approved (e.g., for permitting, site plan approval, building and construction inspections; for research and monitoring programs; and for the large investment in WTGs,

tie-line components, the switchyard and other associated infrastructure). Such financial resources would not be available for other uses.

An undeterminable amount of energy would be spent on fabrication of the components for the proposed project, which would be offset by energy produced by the proposed project. An example would be the energy required to manufacture the WTG towers and blades and the tie-line structures. The proposed project would also result in unknown offsets from other energy development, providing electrical power that would otherwise have to be generated by another generation facility (possibly using non-renewable resources) at another location.

While many of the components of the proposed project could be recycled following decommissioning, particularly the metal components, there would be an irretrievable commitment of some non-recyclable building materials (gravel and cement) and fuel for construction equipment.

The life of the proposed wind park is expected to be 25 years or more, and the wind park owner may elect to renew the land leases at the end of the contracted agreements. The decision to renew the leases versus decommissioning of the facility would be made at that time and would be based on power market conditions and future contracts for sale of electricity from the wind generating facility. Depending on current wind turbine technology, at the end of the lease period, the WTGs may be updated with more efficient components, thereby extending the service life of the proposed wind park. If the WTGs are not upgraded and upon termination of operations, the wind park owner would have the obligation to decommission the facility and perform reclamation as required by the landowners and appropriate land management agencies or jurisdictional authorities.

CHAPTER 4: CUMULATIVE EFFECTS

4.1 INTRODUCTION

"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). Interactive effects may be either: countervailing, where the net cumulative effect is less than the sum of the individual effects; or synergistic, where the net cumulative effect is greater than the sum of the individual effects. The Council on Environmental Quality (CEQ) handbook for considering cumulative effects advises the cumulative effects analysis should "count what counts", meaning the analysis should not consider a long list of issues with little relevance to the effects of the proposed action (CEQ 1997). This analysis focuses on the cumulative effects of the proposed action (wind park, tie-line, and switchyard), alternative action (tie-line alternative), and no action alternative when considered together with other past, present, and reasonably foreseeable future actions that affect the same resources. The goal of the analysis is to provide the decision makers with a "big picture" view of the effects, not only of the proposed action and alternatives but all other actions occurring within the same geographic region, on the future sustainability of important resources.

4.2 CUMULATIVE EFFECTS ANALYSIS AND METHODOLOGY

Thus far, the EIS has focused on the direct and indirect impacts from the project as a whole, including the effects of the proposed wind park, tie-line, and switchyard; tie-line alternative; and no action alternative. RPMs, outlined in Section 2.7, have been incorporated into the design of the proposed project components to minimize the direct and indirect effects of the project and thereby minimize any potential cumulative impacts.

In order to identify and understand the cumulative effects that would result from implementing any of the alternatives under consideration in this EIS, a three step process was followed.

1. Identify other past, present, and reasonably foreseeable future actions that have had, or will have, broad influences on shaping the environmental conditions of the area.
2. Identify the cumulative effects of past, present, and reasonably foreseeable future actions on each resource and the additional incremental effect that would result from implementing each alternative.
3. Determine if the incremental (additional) affect of the proposed project creates a significant cumulative effect.

4.2.1 Identify Past, Present, and Reasonably Foreseeable Future Actions

Spatial and temporal boundaries are important in defining the limits of the cumulative effects analysis. These limits are variable, dependent on the reach of each affected resource, and for purposes of identifying other actions to consider as part of this analysis, are defined by the impact zone of each resource.

Geographic limits of the analysis have been defined for each resource in Chapter 3, with the exception of biological resources, and are defined as resource evaluation areas. Resource evaluation areas include an area as large as Coconino and Navajo counties, to as small of an area no larger than the footprint of the proposed wind park, tie-line, and Western's proposed switchyard.

The geographic limit of the cumulative impacts analysis for biological resources was expanded beyond the evaluation area described in Chapter 3.

The timeframe for considering past activities extends back 50 years. Actions occurring in the more distant past, such as prehistoric and historic settlement, are incorporated into the environmental baseline. The reasonably foreseeable future actions considered are those that can be identified from recent decisions, plans, proposed projects, or from reasonable extensions of current or emerging trends.

Following the identification of past, present, and reasonably foreseeable future actions, these actions were looked at in the context of each resource to determine if the resources have been or would be affected. If an action has not, or will not, occur within the geographic or temporal impact zone of a particular resource it was not considered in the cumulative effects analysis of that resource.

Past, present, and reasonably foreseeable future actions that have had, or will have, broad influences on shaping the environmental conditions of the area are identified and described in Table 4.2-1.

TABLE 4.2-1
SUMMARY OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Action	**Description**	**Affected Resources**
Bar T Bar/Anderson Springs Allotment Management Plan (Future)	The plan describes livestock management practices on the Bar-T-Bar and Anderson Springs Allotments. The plan proposes numerous activities that address livestock management, livestock grazing, waterfowl nesting on wetlands, habitat conditions for pronghorn on summer and winter range, and canopy densities in pinyon-juniper and ponderosa pine vegetation types in areas that have been historical grasslands. Specifically, the plan provides measures to protect wetlands and develop new water sources to replace previously used wetlands; construct new upland stock tanks; maintain and construct new barbwire fences in certain areas and remove barbwire fence to facilitate pronghorn movement in other areas; install cattle guards; and harvest and remove pinyon pine, juniper and ponderosa pine trees in areas that have been historical grasslands.	• Land Use • Biological Resources • Geology and Soils • Water Resources
Community settlement/ development	The communities of Flagstaff and Winslow were established in the late 1800s and continue today. Dispersed settlement and smaller communities have also been established throughout northern Arizona. These communities operate as centers for economic development, learning, and social interaction.	• Air Quality • Water Resources • Socioeconomics • Environmental Justice
Construction and on-going use of utility infrastructure	Utility infrastructure is located throughout developed and undeveloped areas of the region. One example is the twin 345-kV electrical transmission lines operated by Western that are located approximately seven miles west of the wind park study area. Utility infrastructure can be above or underground and typically includes a right-of-way and an access route for routine inspection and maintenance.	• Land Use • Biological Resources • Visual Resources
Ongoing prescribed burning on the Mogollon Rim and Mormon Lake Ranger Districts	Fuels reduction projects are ongoing and are located throughout the Mogollon Rim and Mormon Lake Ranger Districts of the Coconino National Forest. The purpose of these projects is to reduce fire risk and improve forest health. This is accomplished by a variety of treatments including prescribed fire management activities.	• Biological Resources • Air Quality

TABLE 4.2-1 SUMMARY OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS		
Action	**Description**	**Affected Resources**
Operation of the Bar T Bar Ranch	The land that comprises Bar T Bar Ranch has been acquired from several ranches. Bar T Bar extends across approximately 326,200 acres. The ranch is located on private land, ASLD grazing leases, and grazing allotments from the Forest Service.	• Land Use • Biological Resources • Geology and Soils • Water Resources • Socioeconomics
Operation of the Flying M Ranch	Flying M Ranch is a combination of a number of historic homesteads. The ranch covers approximately 90,000 acres, a quarter of which is located on private land, and the remainder of which consists of grazing allotments from the Forest Service and leased from ASLD.	• Land Use • Biological Resources • Geology and Soils • Water Resources • Socioeconomics
Operation of Meteor Crater development	Meteor Crater Enterprises, Inc. operates visitor services and a museum, gift shop, and fast food restaurant near the north rim of Meteor Crater. In addition, Enterprises operates another development located at the Meteor Crater Road exit, south of I-40. The development includes an RV park, convenience market with gas sales, and a fast food restaurant. Business offices for Meteor Crater Enterprises are also located in this development.	• Land Use • Socioeconomics
Recreation and hunting	Recreation opportunities including camping, all-terrain vehicle use, picnicking, hiking, rock climbing, horseback riding, mountain biking, and permitted hunting of big and small game.	• Land Use • Biological Resources • Geology and Soils • Socioeconomics
Sunshine Wind Project (Future)	The proposed Sunshine Wind Park is located just north of the wind park study area. This project received a Conditional Use Permit from Coconino County in 2005 and will advance pending a power purchase agreement. The Sunshine Wind Park is designed to include approximately 40 state-of-the-art wind turbines to provide approximately 60 MW of generating capacity, enough electricity to serve the average annual electricity needs of more than 14,000 homes.	• Land Use • Biological Resources • Cultural Resources • Water Resources • Socioeconomics • Visual Resources
Travel Management Rule (Future)	Identification of a system of roads and trails across the Coconino National Forest to remain open to motorized use. The Travel Management Rule (TMR) also designates camping corridors where off-road travel is permitted a short distance from roads to facilitate camping.	• Land Use • Biological Resources • Geology and Soils • Transportation
Use of I-40 and State highway system	The National Interstate Highway System was formed in 1957, but I-40 was not officially completed in Arizona until 1984. The interstate along with State highways are used heavily for commercial transportation of goods and personal travel.	• Air Quality • Socioeconomics • Transportation

4.2.2 Identify the Cumulative Effects of Other Past, Present, and Reasonably Foreseeable Future Actions

The cumulative effects of other past, present, and reasonably foreseeable future actions on individual resources are provided in Table 4.2-2. In addition, a summary of the incremental effects of the proposed project, alternatives, and no action alternative are included for reference.

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	**Past, Present, and Reasonably Foreseeable Future Actions**	**Proposed Project**	**Alternative Tie-Line**	**No Action Alternative**
Land Use	Present actions have introduced two primary ongoing land uses to the area, including livestock grazing and recreation opportunities. The development of Meteor Crater and utility infrastructure have increased recreational opportunities by providing access through either a developed facility or use of access roads. In addition, utility infrastructure has increased available forage within the rights-of-way by removing overstory vegetation. Future actions would reduce grazing and recreation by reducing the total number of acres available for grazing and range improvements and road closures that would reduce access to recreation sites.	Would result in a permanent conversion of 591-627 acres of land from grazing to other use, but would not incrementally increase cumulative impacts.	Would result in a permanent conversion of 592-628 acres of land from grazing to other use, slightly more than under the proposed tie-line, but would not incrementally increase cumulative impacts.	Would result in no change to existing land uses.
Biological Resources	Grazing affects the habitat of several threatened and endangered species, including southwestern willow flycatcher, bald eagle, Mexican spotted owl, black-footed ferret, Chiricahua leopard frog, and Little Colorado spinedace. In addition, grazing affects the habitat of several species of migratory birds and several Forest Service MIS. Temporary construction impacts on wildlife species as a result of the Sunshine Wind Project would be expected to be similar to those of the proposed project; namely, displacement would be short-term and localized, and individuals could return to the area.	Would result in a permanent conversion of 591-627 acres of land from scrub-shrub, grassland, pinyon/juniper woodlands, and ponderosa pine. This conversion would result in lost habitat for common and special-status species, but would not incrementally increase cumulative impacts.	Would result in a permanent conversion of 592-628 acres of land from scrub-shrub, grassland, pinyon/juniper woodlands, and ponderosa pine. This conversion would result in lost habitat for common and special-status species, but would not be noticeably different than under the proposed project and would not incrementally increase cumulative impacts.	

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	Past, Present, and Reasonably Foreseeable Future Actions	Proposed Project	Alternative Tie-Line	No Action Alternative
Biological Resources (continued)	In general, past and present activities affect plant composition, increase spread of noxious weeds, increase sedimentation in streams, and increase competition for forage. Grazing management plans and the proposed TMR would reduce many of the negative effects of grazing and actually improve habitat. The Sunshine Wind Project would result in ground disturbance and may affect specific special status plant and wildlife species, including birds, raptors, and bats.	Upon completion of construction of the proposed project facilities, the level of impact would not significantly impact populations, even when considered in context of other ongoing or reasonably foreseeable future projects or activities. The long-term effects on wildlife species from the proposed project, in combination with the Sunshine Wind Project, could result in cumulative impacts on wildlife, particularly migratory birds, raptors, and bats. Past, present, and anticipated developments with aerial features, such as wind turbines and transmission lines, could reasonably cause collisions to increase over current conditions. Consideration of the areal extent of these projects and the incorporation of mitigation measures to minimize impacts, however, would result in incremental cumulative impacts to birds, raptors, and bats.	Impacts to common and special status plant and wildlife species would not be noticeably different than under the proposed project. Likewise, cumulative impacts on migratory birds, raptors, and bats would be identical to the proposed project and incremental cumulative impacts to birds, raptors, and bats would occur.	

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	Past, Present, and Reasonably Foreseeable Future Actions	Proposed Project	Alternative Tie-Line	No Action Alternative
Cultural Resources	The Sunshine Wind Project would result in ground disturbing activities in the vicinity of Historic Route 66 and areas known to have been used prehistorically and historically. Ground disturbance could result in the destruction of an NRHP eligible or listed site. In addition to the potential for direct impact to sites, increased access to the area could result in inadvertent disturbance or vandalism to otherwise undisturbed sites. Visual intrusions on TCPs in the region are also likely.	Would directly disturb between 2,419-2,630 acres of land within areas known to have been used prehistorically and historically. Archaeological, Tribal or historical sites listed, or eligible for listing, on the NRHP would be avoided to the extent possible and no significant direct impacts would occur. Visual intrusions on TCPs in the region are likely and would result in indirect adverse impacts. The proposed project would not incrementally increase cumulative effects.	Would directly disturb between 2,420-2,631 acres of land within areas known to have been used prehistorically and historically, slightly more than the proposed project. Impacts would not be noticeably different than under the proposed project. The alternative tie-line would not incrementally increase cumulative effects.	Would have no effect on cultural resources.
Geology and Soils	Ranching and recreation have affected soil protective mechanisms, causing erosion and lost productivity. Grazing management plans and the proposed TMR would lead to increases in ground cover which would decrease erosion.	Would temporarily disturb between 2,419-2,630 acres of land and would permanently remove vegetation from and alter the surface of 591-627 acres of land. This would result in increased erosion and the permanent loss of soils, but not at a level that would result in significant incremental addition to cumulative impacts to soils.	Would temporarily disturb between 2,420-2,631 acres of land and would permanently remove vegetation from and alter the surface of 592-628 acres of land. Impacts would be slightly greater than under the proposed project because the tie-line associated with the alternative action requires a new access road across moderately erosive soils that are difficult to revegetate, but still not a significant incremental increase.	Would have no effect on geology and soils.

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	Past, Present, and Reasonably Foreseeable Future Actions	Proposed Project	Alternative Tie-Line	No Action Alternative
Air Quality	Communities and transportation infrastructure deteriorate air quality through vehicle emission, heating, etc. However, air quality standards are currently being met. Prescribed fires on the Coconino National Forest would contribute short-term smoke into the airshed; however, all prescribed burns are permitted by ADEQ and fall within established air quality limits. Wildfires may create smoke that exceeds air quality standards.	Due to the short duration, air impacts from the proposed project would not incrementally increase cumulative impacts.	Due to the short duration, air impacts from the proposed project would not incrementally increase cumulative impacts.	Would have no effect on air quality.
Water Resources	Water quality is affected by erosion and sedimentation as a result of grazing and other ground disturbing activities. Water is consumed in Coconino County by municipal, industrial and agricultural activities at a rate of approximately 105,000 acre feet of groundwater and 51,000 acre feet of surface water annually. If constructed, the Sunshine Wind Park could increase erosion and sedimentation and would consume a relatively small amount of water during construction.	Construction would require approximately 307 acre feet of groundwater. Operations would require a negligible amount of water. Soil erosion and sedimentation would increase as a result of the temporary disturbance of between 2,419-2,630 acres of land and would the permanent disturbance and removal of vegetation from 591-627 acres of land. With the proposed RPMs, the proposed project would not incrementally increase cumulative water resource impacts.	Construction and operations would require the same amount of water as the proposed action. Between 2,420-2,631 acres of land would be disturbed temporarily and 592-628 acres of land would be permanently disturbed resulting in erosion and sedimentation. Impacts would not be noticeably different than under the proposed tie-line. With the proposed RPMs, the proposed project would not incrementally increase cumulative water resource impacts.	Would have no effect on water resources.

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	Past, Present, and Reasonably Foreseeable Future Actions	Proposed Project	Alternative Tie-Line	No Action Alternative
Socio-economics	Established communities, such as Flagstaff and Winslow, and existing transportation infrastructure have lead to economic activity and an increase in population and employment. Ranching, recreation, and other developments, such as Meteor Crater further contribute to employment opportunities and subsequent population growth. The Sunshine Wind Project would create some jobs and would provide other forms of revenue to the economy.	Would result in the employment of approximately 400 workers during peak construction activities and between 17-40 workers during regular operations if fully built out to 500 MW. In addition, it would create a supplemental source of revenue to ranchers. The proposed project would result in a positive incremental increase to cumulative socioeconomic impacts.	Would be the same as the proposed project.	Would not realize the economic objectives of the Diablo Canyon RPA since no similar economic development proposals are currently under consideration.
Environmental Justice	The region is the historic home to Native American populations, whose current socioeconomic conditions result in higher percentages of persons living below the Federal poverty level. The cities of Winslow and Flagstaff also contain percentages of low-income, minority, and Native American populations.	Since the proposed project would result in additional employment opportunities and tax revenue, the proposed project would not incrementally increase cumulative effects to minority and low-income populations.	Would be the same as the proposed project.	Would have no effect on environmental justice, beneficial or otherwise.

TABLE 4.2-2
SUMMARY OF CUMULATIVE EFFECTS OF PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS AND THE INCREMENTAL EFFECTS OF THE PROPOSED PROJECT

Resource	Past, Present, and Reasonably Foreseeable Future Actions	Proposed Project	Alternative Tie-Line	No Action Alternative
Transportation	Transportation routes, including I-40, SR 87 and a system of County and Forest Service roads have been established and are generally considered adequate. The proposed TMR would designate a road system on the Coconino National Forest and would close the Forest to cross-country travel.	Would result in a short-term (12-18 month) increase in construction related traffic of over 400 two-way vehicle trips each day on I-40 and Meteor Crater Road, and approximately 25 two-way vehicle trips each day on Lake Mary Road and FS 125. It would result in a minimal long-term increase in vehicular traffic on I-40 and Meteor Crater Road. Due to the short duration of construction, the proposed project would not incrementally increase cumulative impacts to transportation.	Would be the same as the proposed project.	Would have no effect on transportation.
Visual Resources	Utility infrastructure has introduced contrasting elements of form, line, and color. The Sunshine Wind Project would further introduce contrasting elements of form, line, and color over a large area and reduce the quality of background views. The development of the Sunshine Wind Project would actually minimize the direct visual impact of the proposed wind park by introducing similar elements in closer proximity to the greatest number of viewers near I-40.	Would result in a visual contrast by introducing contrasting elements of form, line, and color. In addition, the proposed tie-line would be located within an area on National Forest System lands managed with a VQO of Partial Retention. The proposed project would be considered a negative incremental impact to visual resources on National Forest System lands.	Effects would generally be the same as the proposed action, except the tie-line would be routed to avoid the more sensitive area (Partial Retention) on National Forest System lands. Incremental impacts associated with the alternative tie-line would not result in a significant cumulative impact to visual resources.	Would have no effect on visual resources.

4.2.3 Cumulative Effects of the Proposed and Alternative Actions when Added to Past, Present, and Reasonably Foreseeable Future Actions

This third and final step involves determining whether or not the incremental effects of each alternative, when added with the effects of past, present, and reasonably foreseeable future actions, would result in a significant cumulative effect. In other words, would the additional impacts to a resource, resulting from the implementation of the proposed action, alternative action, or no action alternative, when added to the impacts to that resource that have or will result from other past, present, or reasonably foreseeable future actions, push that resource over the edge. The same standards of significance identified for each resource in Chapter 3 are utilized.

Impacts are anticipated to be negligible to air quality, and no relevant past, present, or reasonably foreseeable future actions affecting health and safety, or noise were identified, therefore, incremental impacts to these three resources would not contribute to cumulative effects. In addition, the overall effects to socioeconomics and environmental justice would be beneficial; therefore, these two resources would not contribute adversely to cumulative effects.

The incremental effects to land use, biological resources, cultural resources, geology and soils, water resources, transportation, and visual resources, including a determination of significance, are described in the following paragraphs under separate headings. Information in support of the determination is included in Tables 4.2-1 and 4.2-2.

4.2.3.1 Land Use

The resource evaluation area for land use included the proposed project components and a two mile buffer area extending beyond these components. No past actions were identified within this evaluation area. Present actions affecting land use include construction and on-going use of utility infrastructure, operation of Bar T Bar and Flying M ranches, operation of Meteor Crater and Meteor Crater Enterprises facilities, and recreation and hunting. These actions have introduced two primary ongoing land uses to the area, including livestock grazing and recreation opportunities.

Future actions affecting land use include the Bar T Bar/Anderson Springs Allotment Management Plan, the proposed Sunshine Wind Project and the Coconino National Forest's proposed TMR. These actions would reduce grazing and recreation by: reducing the total number of acres available for grazing; and range improvements and restrictions on cross-country travel that would reduce access to recreation sites.

The proposed action and alternative action would reduce grazing opportunities by permanently converting approximately 591 to 627 acres of land from grazing to other use if the project is built out to 500 MW. The incremental decrease in the amount of grazing land, when added to other actions, would not affect the economic viability of ranching operations, considering the amount of grazing land available and would not result in exceedance of land use significance criteria.

4.2.3.2 Biological Resources

The resource evaluation area for biological resources included the proposed project components and a two mile buffer area extending beyond these components. No past actions were identified within this evaluation area. Present actions affecting biological resources include construction and on-going use of utility infrastructure, operation of Bar T Bar and Flying M ranches, operation of Meteor Crater and Meteor Crater Enterprises facilities, and recreation and hunting. Future actions affecting biological resources are the continued livestock grazing and recreation and the proposed Sunshine Wind Project.

The proposed action and alternative tie-line alignment would result in a permanent conversion of 591-627 acres of land from scrub-shrub, grassland, pinyon/juniper woodlands, and ponderosa pine. This conversion would result in lost habitat for common and special-status species, but when added to other actions, would not result substantial losses of vegetation or habitat considering the amount of similar land cover in the area and region. These incremental losses would not result in significant cumulative effects.

Temporary construction impacts on wildlife species as a result of the Sunshine Wind Project would be expected to be similar to those of the proposed project; namely, displacement would be short-term and localized, and individuals could return to the area. Upon completion of construction of the proposed project facilities, the level of impact to wildlife would be reduced, even when considered in context of other ongoing or reasonably foreseeable future projects or activities. The long-term effects on wildlife species from the proposed project, in combination with the Sunshine Wind Project, could result in cumulative impacts on wildlife, particularly migratory birds, raptors, and bats. Past, present, and anticipated developments with aerial features, such as wind turbines and transmission lines, could reasonably cause collisions to increase over current conditions. The areal extent of these projects and the incorporation of mitigation measures to minimize impacts, however, would minimize possible impacts but still result in incremental cumulative impacts to birds, raptors, and bats. The proposed project, when added to other past, present, and future actions would result in increased cumulative impacts to birds, raptors, and bats, but would not result in exceedance biological resources significance criteria.

4.2.3.3 Cultural Resources

The resource evaluation area for cultural resources included the wind park study area and a three mile buffer, and the proposed tie-line and switchyard along with a 1 mile buffer extending beyond these two components. No past or present actions were identified within the cultural resources evaluation area. One future action affecting cultural resources was identified, the proposed Sunshine Wind Project. This action would result in ground disturbing activities in the vicinity of Historic Route 66 and areas known to have been used prehistorically and historically. If encountered, ground disturbance could potentially result in the destruction of NRHP eligible or listed sites. In addition to direct impact to sites, increased access to the area could result in inadvertent disturbance or vandalism to otherwise undisturbed sites. Visual intrusions on TCPs in the region are also likely.

The proposed project and alternative action would directly disturb between 2,419 and 2,630 acres of land, if the proposed project is built out to 500 MW, within areas known to have been used prehistorically and historically, resulting in the potential for similar impacts to cultural resources as the Sunshine Wind Project. However, the likelihood of this occurring is low because NRHP eligible and listed sites would be avoided to the extent possible as outlined in the PA. If a site were destroyed, it would be considered a significant impact. Because the proposed action is not likely to destroy any NRHP eligible or listed sites, there would be no direct contribution to cumulative effect to cultural resources. However, the visible WTGs from both the Grapevine Canyon Wind Project and the Sunshine Wind Project may be perceived as incremental intrusions on a sacred or historic landscape. This incremental increase in visual effects, when added to other actions, would have a cumulative effect on TCPs. However, the significance of any increase cannot be determined until the completion of consultations outlined in the PA and whether or not there would be an intrusion on a TCP determined to be eligible to the NRHP.

4.2.3.4 Geology and Soils

The resource evaluation area for geology and soils included the footprint of the proposed project components. No past actions were identified within this evaluation area. Present actions affecting geology and soils include operation of Bar T Bar and Flying M ranches, and recreation and hunting. These actions have affected soil protective mechanisms, causing erosion and lost productivity.

Future actions affecting geology and soils include the Bar T Bar/Anderson Springs Allotment Management Plan and the Coconino National Forest's proposed TMR. These actions would lead to increases in ground cover which would decrease erosion.

The proposed project would temporarily disturb between 2,419 and 2,630 acres of land and would permanently remove vegetation from and alter the surface of 591 to 627 acres of land if the project is built out to 500 MW. This would result in increased erosion, and the permanent loss of a minimal volume of soils. This incremental effect on geology and soils would not cause appreciable, accelerated soil erosion or cause long-term, negative impacts to rangeland or wildlife habitat. Applicable geology and soils significance standards would not be exceeded.

The alternative action would temporarily disturb between 2,420 and 2,631 acres of land and would permanently alter the surface and remove vegetation from 592 to 628 acres of land if the project is built out to 500 MW. Impacts would be slightly greater than under the proposed action because the tie-line associated with the alternative action requires a new access road across moderately erosive soils that would be difficult to revegetate leading to increased soil erosion. Though the alternative action would lead to slightly greater soil erosion, the incremental effect, when added to other actions, would not result in appreciable, accelerated soil erosion or cause long-term, negative impacts to rangeland or wildlife habitat, and. applicable geology and soils significance standards would not be exceeded.

4.2.3.5 Water Resources

The resource evaluation area for water resources included the proposed project components and a one mile buffer area extending beyond these components. In addition, drainages and aquifers were included in order to understand the potential for indirect impacts. No past actions were identified within the evaluation area. Present actions affecting water resources include, community settlement and development and the operation of Bar T Bar and Flying M ranches. Water is consumed in Coconino County by municipal, industrial and agricultural activities at a rate of approximately 105,000 acre feet of groundwater and 51,000 acre feet of surface water annually. In addition, these actions affect water quality by increasing erosion and sedimentation as a result of grazing and other ground disturbing activities.

Future actions affecting water resources include the Bar T Bar/Anderson Springs Allotment Management Plan and the proposed Sunshine Wind Project. These actions would increase erosion and sedimentation and would consume a relatively small amount of water.

The proposed project and alternative action would require up to approximately 307 acre feet of groundwater if the project is built out to 500 MW in one or more phases. Project operation and maintenance would require a negligible amount of water. This incremental amount of water, when added to other actions, would not substantially deplete groundwater resources and applicable water resources significance standards would not be exceeded.

The proposed action would temporarily disturb between 2,419 and 2,630 acres of land and would permanently disturb between 591 and 627 acres of land if built out to 500 MW. The alternative action would disturb between 2,420 and 2,631 acres of land and would permanently disturb between 592 and 628 acres of land. The difference in the amount of ground disturbance is negligible between the two. Ground disturbance would lead to an increase in soil erosion and sedimentation. The incremental increase in sedimentation, when added to other actions, would not substantially degrade water quality, and applicable significance standards would not be exceeded.

4.2.3.6 Transportation

The resource evaluation area for transportation included the proposed project components and a one mile buffer area extending beyond these components. In addition, the primary access routes that would be used for employees accessing the project components and for the delivery of equipment and materials are included as part of the evaluation area. No past actions were identified within this evaluation area. Present actions affecting transportation include the use of I-40 and the State highway system. These actions have established a system of County and Forest Service roads that are considered adequate.

One future action was identified that would affect transportation, the Coconino National Forest's proposed TMR. This action would designate a system of roads on the Coconino National Forest and restrict cross-country travel.

The proposed project and alternative action would result in a short-term (12 to 18 month) increase in construction related traffic of over 400 two-way vehicle trips each day on I-40 and Meteor Crater Road during peak construction activity, and approximately 25 two-way vehicle trips each day on Lake Mary Road and FS 125 for a typical project phase of up to 250 MW. Over the long-term the number of vehicles using I-40 and Meteor Crater Road daily for operations and maintenance would increase. This incremental increase in traffic, when added to other actions, would not result in a permanent disruption of local or regional traffic, and applicable transportation significance thresholds would not be exceeded.

4.2.3.7 Visual Resources

The resource evaluation area for visual resources extends three miles in all directions from the proposed wind park and extends north to I-40. In addition, the visual resources evaluation area extends one mile to either side of the proposed tie-line and Western switchyard. No past actions were identified within this evaluation area. Present actions affecting visual resources include the construction and on-going use of utility infrastructure. These actions have introduced contrasting elements of form, line, and color into a naturally appearing setting.

One future action, the proposed Sunshine Wind Project, would affect visual resources within this evaluation area. This action would introduce contrasting elements of form, line, and color over a large area and reduce the quality of background views from I-40. Additionally, the development of the Sunshine Wind Project would actually minimize the direct visual impact of the proposed wind park by introducing similar elements in closer proximity to the greatest number of viewers near I-40.

The proposed project would result in a visual contrast by introducing contrasting elements of form, line, and color over a large area. The incremental effect of the proposed wind park, together with other actions, would result in a substantial visual contrast to the area. This contrast would not conflict with the goals and policies of the Coconino County General Plan. The proposed tie-line would be located within an area on National Forest System lands managed with a VQO of Partial Retention. The presence of the transmission line would not meet the VQO of Partial Retention, as prescribed by the Forest Plan, and would result in a movement down one level to a VQO of Modification. This contrast would be a negative incremental impact to visual resources on National Forest System lands, although applicable visual resources significance standards would not be exceeded.

The alternative tie-line would be routed to avoid the more sensitive area (Partial Retention) on National Forest System lands and would not alter the VQOs prescribed by the Forest Plan. Therefore, incremental impacts associated with the alternative tie-line would be minimal and visual resources significance standards would not be exceeded.

CHAPTER 5: LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS PROVIDED EIS

5.1 FEDERAL AGENCIES

- National Marine Fisheries Service, Habitat Conservationists Division
- U.S. Department of Agriculture, Coconino National Forest, Supervisor's Office
- U.S. Department of Agriculture, National Agricultural Library
- U.S. Department of the Interior, Fish and Wildlife Service, Flagstaff Office
- U.S. Department of the Interior, Office of Environmental Policy and Compliance
- U.S. Department of Transportation, Office of Environment and Energy
- U.S. Environmental Protection Agency, Department of Energy Reviewer, San Francisco, CA
- U.S. Environmental Protection Agency, Office of Federal Activities, Washington, DC
- U.S. Environmental Protection Agency, Region 9
- Western Area Power Administration, Desert Southwest Regional Office

5.2 STATE AGENCIES

- Arizona Department of Environmental Quality
- Arizona Game and Fish Department, Flagstaff Office
- Arizona Game and Fish Department, Phoenix Office
- Arizona State Land Department

5.3 LOCAL AGENCIES

- Coconino County
- City of Flagstaff
- Flagstaff City – Coconino County Public Library
- Winslow Public Library

5.4 NATIVE AMERICAN TRIBES AND COMMUNITIES

- Fort McDowell Yavapai Nation
- The Havasupai Tribe
- The Hopi Tribe
- The Hualapai Tribe
- The Navajo Nation
- The Pueblo of Acoma
- Pueblo of Zuni
- San Carlos Apache Tribe
- San Juan Southern Paiute Tribe
- Tonto Apache Tribe
- White Mountain Apache Tribe
- The Yavapai-Apache Nation
- The Yavapai-Prescott Indian Tribe

5.5 ORGANIZATIONS

- Bar T Bar Ranch, Inc.
- Edison Mission Energy

- Meteor Crater Enterprises
- Northern Arizona University
- Rubestrian Cyberservices

5.6 INDIVIDUALS

- Aaron Alvidrez
- Bill Auberle
- Ken Berkhoff
- Ken Jacobs
- Roger Tungovia
- Sandra Nagiller
- Scott Harger
- Ty Rock
- U.S. Senator Jon Kyl

CHAPTER 6: LIST OF PREPARERS

This EIS was prepared under the supervision of Western with cooperation from the Forest Service and ASLD with technical assistance provided by Transcon Environmental, an environmental consulting firm. Contributors to the EIS include:

TABLE 6.1-1
LIST OF PREPARERS

Name	Responsibilities	Education	Experience (years)
WESTERN AREA POWER ADMINISTRATION			
Mary Barger	NEPA review, Tribal consultation	B.A. Anthropology	27
Matthew Blevins	NEPA Document Manager, NEPA compliance review	M.S. Environmental Engineering, B.S. Chemistry	14
John Bridges	Biological resources	B.S., M.S. Zoology	27
Cathy Cunningham	NEPA compliance review	B.S. Animal Science	
Michael Garcia	Project Manager, switchyard technical review	B.S. Business	30
Dave Swanson	QA/QC, NEPA compliance, technical review	B.A. Biological Sciences	33
Steve Tromly	Tribal consultation	M.A. Anthropology, B.S. Resource Conservation	18
Randy Wilkerson	Public involvement, media relations	B.A. Botany	18
COCONINO NATIONAL FOREST			
Judy Adams	Land Use/Special Uses	B.S. Forestry	24
Jim Beard	Visual resources	B.L.A Environmental Design	31
Debra Crisp	TES Plants and noxious or Invasive Weeds	M.S. Forestry B.S. Biology	28
Mike Dechter	NEPA Compliance	M.S. Environmental Management B.S. Ecology	
Yewah Lau	Forest Planner, NEPA Review	B.A. Biology, M.E.M. Resource Economics/Policy	7
Cecilia Overby	Biological Resources	M.S. Forestry B.S. Biology	22
Christine Paulu	NEPA compliance, technical review	B.S. Mathematics/Environmental Studies, M.S. Forestry	1.5
Peter Pilles	Cultural resources	B.A. Anthropology	43
Henry Provencio	Biological resources	B.S. Wildlife Conservation Biology	10
Rory Steinke	Water resources, geology and soils	B.S. Soil Science	27
TRANSCON ENVIRONMENTAL, INC.			
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Everett Bassett	Cultural resources	Ph.D. Anthropology; B.A. Biology; B.A. History	27

TABLE 6.1-1
LIST OF PREPARERS

Name	Responsibilities	Education	Experience (years)
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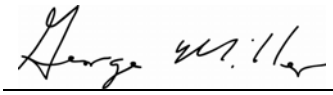
Jan Bush	Water resources, wetlands and floodplains, geology and soils	M.A. Environmental Planning	14
Melanie Collins	Biological review	B.S. Biology	4
Jeff Davis	Visual resources	M.L.A. Landscape Architecture/Environmental Planning; B.S. Conservation Biology: Resource Management	13
Debra Duerr	NEPA compliance, technical review	B.A. Urban Affairs	25
Heather Duncan	Cultural resources	B.A. Anthropology	9
Marlon Haddix	Graphic design	B.A. Graphic Design	5
George Miller	Project Manager, Proposed Action and Alternatives, QA/QC, NEPA compliance, noise	M.A. Urban and Regional Planning, B.A. Environmental Studies	21
Mike McClellan	Visual resources, simulations	B.A. Landscape Architect	1
Myriah Moore	Administrative Record, technical review	B.A. Archaeology	5
Susan Morrison	Land use, transportation	M.S. Planning; B.S. Geography	7
John Papageorgiou	GIS mapping	M.A. Classical Archaeology; B.A. Ancient Civilizations	15
Alfonso Ruiz	Socioeconomics, environmental justice	B.S. Urban Planning	2
Mike Shrum	Biological review, air quality	B.S. Ecology	5

TABLE 6.1-2
APPLICANT'S CONSULTANTS

Name	Responsibilities	Education	Experience (years)
WESTERN ECOSYSTEMS TECHNOLOGY, INC.			
David Tidhar	Biological resources	M.S. Ecology, B.A. History and Political Science	12
David Young	Biological resources	M.S. Zoology, B.A. Biology	20
MONTGOMERY AND ASSOCIATES			
Bill Victor	Water resources	M.S. Hydrology, B.S. Geology	33

Organizational Conflict of Interest Representation Statement

I hereby certify as a representative of my organization that, to the best of my knowledge and belief, no facts exist relevant to any past, present or currently planned interest or activity (financial, contractual, personal, organizational or otherwise) that relate to the proposed work; and bear on whether I or the organization has a possible conflict of interest with respect to (1) being able to render impartial, technically sound, and objective assistance or advice; (2) being given an unfair competitive advantage; or (3) having a financial interest in the outcome of the project.

Signature:  Date: July 8, 2010

Name: George Miller

Title: Vice President

Organization: Transcon Environmental, Inc.

CHAPTER 8: REFERENCES

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CHAPTER 9: GLOSSARY

Aerodynamics: The study of the forces exerted on and the flow around solid objects moving relative to a gas, especially the atmosphere.

Aesthetics: Referring to the perception of beauty.

Affected Environment: Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Aggregate: Mineral materials such as sand, gravel, crushed stone, or quarried rock used for construction purposes.

Air Quality Standards: The level of pollutants prescribed by regulation that may not be exceeded during a specified time in a defined area.

Allotment: The area designated for use by a prescribed period of time.

American Indian Religious Freedom Act of 1978 (AIRFA): This act requires Federal agencies to consult with Tribal officials to ensure protection of religious cultural rights and practices.

Animal Unit (AU): A measure of numbers of livestock equivalent to a mature cow. One A.U. equals 1,000 pounds live weight, or one cow, horse, or mule; five sheep or swine; six goats.

Animal Unit Month (AUM): A measure of forage or feed sufficient to feed one Animal Unit for 30 days; usually expressed relative to acres of land.

Archaeological Resources Protection Act: A Federal law, passed in 1979 (16 USC 1B, Pub. L. 96-95), to protect archaeological resources on public and Indian lands.

Archaeological Site: Any location where humans have altered the terrain or discarded artifacts during prehistoric or historic times.

Archaeology: A scientific approach to the study of human ecology, cultural history, and cultural process.

Area of Potential Effect: The area in which disturbance to cultural resources may occur and within which a systematic cultural resource inventory is required.

Artifact: An object produced or shaped by human workmanship of archaeological or historical interest.

Attainment Area: An area which the U.S. Environmental Protection Agency (EPA) has designated as being in compliance with one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. Any area may be in attainment for some pollutants but not for others.

Average Daily Traffic (ADT): The average volume of vehicles at a given point or section of highway over a 24-hour period.

Avian Monitoring Study: A study done to characterize and monitor the quality of avian species. Avian monitoring studies are used in the preparation of impact assessments, as well as in many circumstances in which human activities carry a risk of harmful effects on avian species natural environment.

Avian Power Line Interaction Committee (APLIC): Committee that works in partnership with other utilities, resource agencies and the public to develop and provide educational resources, identify and fund research, develop and provide cost-effective management options, and serve as the focal point for avian interaction utility issues.

Arizona Pollution Discharge Elimination System (AZPDES) Permit: Federal regulation (40 CFR Parts 122 and 125) administered by the State of Arizona that requires permits for the discharge of pollutants from any point source into the waters of the United States regulated through the Clean Water Act, as amended.

Arizona State Historic Preservation Office (SHPO): The State Historic Preservation Office manages the National Register of Historic Places program of the National Park Service in Arizona. The program surveys, inventories, and registers historical properties; monitors State, Federal, and local government activities which affect cultural and historic resources; provides advice on preservation methods; promotes public education on historical properties; and supports municipal and county historic preservation commissions to advance the State's economic, social, and educational objectives.

Aquifer: A permeable underground formation that yields usable amounts of water to a well or spring. The formation could be sand, gravel, limestone, and/or sandstone.

Array (turbine): The positioning and spatial arrangement of wind turbines relative to each other.

Background: The distant part of a landscape. The landscape area located from four miles to infinity from the viewer.

Bald and Golden Eagle Protection Act: A Federal law enacted in 1940 and amended several times, prohibits anyone, without a permit from the Secretary of the Interior, from “taking” bald and golden eagles, including their parts, nests, or eggs.

Batch Plant: Mixing plant that produces batches of concrete or aggregate-asphalt mixture, offsite or at the site of another plant.

Berm: A mound or bank of earth, used especially as a barrier or to provide insulation.

Best Management Practices: Structural and/or management practices employed before, during, and after construction to protect receiving-water quality. These practices provide techniques to either reduce soil erosion or remove sediment and pollutants from surface runoff.

Biological Assessment (BA): An evaluation of potential effects of a proposed project on proposed, endangered, threatened, and sensitive animal and plant species and their habitats. Information prepared by, or under the direction of, a Federal agency to determine whether a proposed action is likely to adversely affect listed species or designated critical habitat, jeopardizes the continued existence of species that are proposed for listing, or adversely modify proposed critical habitat.

Borrow Pit: A pit or excavation area used for gathering earth materials (borrow) such as sand or gravel.

Breaker: A switching device that is capable of closing or interrupting an electrical circuit under over-load or short-circuit conditions as well as under normal load conditions.

Bus: A set of two or more electrical conductors that serve as common connections between load circuits and each of the phases (in alternating current systems) of the electric power source.

Carbon monoxide (CO): A colorless, odorless gas that is toxic if breathed in high concentrations over an extended period. Carbon monoxide is listed as a criteria air pollutant under Title I of the Clean Air Act.

Clean Air Act (CAA): This act establishes national ambient air quality standards and requires facilities to comply with emission limits or reduction limits stipulated

Clean Water Act (Section 404): The Federal Water Pollution Control Act Amendments of 1972 (33 USC 401 et seq.) is the enabling legislation for protection of waters of the United States by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

Code of Federal Regulations (CFR): A compilation of the general and permanent rules published in the Federal Register by the executive departments and agencies of the United States. It is divided into 50 titles that represent broad areas subject to Federal regulation. Each volume of the CFR is updated once each calendar year and is issued on a quarterly basis.

Color: The property of reflecting light of a particular wavelength that enables the eye to differentiate otherwise indistinguishable objects. A hue (red, green, blue, yellow, and so on), as contrasted with a value (black, white, or gray).

Cone of Depression: A depression in the water table that develops around a pumped well.

Contrast: Diversity or distinction of adjacent parts. Effect of striking differences in form, line, color, or texture of a landscape.

Corona/corona noise: The electrical breakdown of air into charged particles. The phenomenon appears as a bluish-purple glow on the surface of and adjacent to a conductor when the voltage gradient exceeds a certain critical value, thereby producing light, audible noise (described as crackling or hissing), and ozone.

Council on Environmental Quality (CEQ): Established by the National Environmental Policy Act (NEPA), the CEQ consists of three members appointed by the President. A CEQ regulation (Title 40 CFR 1500-1508, as of July 1, 1986) describes the process for implementing NEPA, including preparation of environmental assessments and environmental impacts statements, and the timing and extent of public participation.

Criteria Pollutants: An air pollutant that is regulated by the NAAQS. The EPA must describe the characteristics and potential health and welfare effects that form the basis for setting or revising the standard for each regulated pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter.

Culvert: A pipe or covered channel that directs surface water through a raised embankment or under a roadway from one side to the other.

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Decibel (dB): A standard unit for measuring the loudness or intensity of sound. In general, a sound doubles in loudness with every increase of ten decibels.

Decibel, A-Weighted [dB (A)]: A measurement of sound approximating the sensitivity of the human ear and used to characterize the intensity of loudness of a sound.

Decommissioning: All activities necessary to take out of service and dispose of a facility after its useful life.

Direct Effects: The immediate effects on the social, economic, and physical environment caused by the construction and operation of a highway. These impacts are usually experienced within the right-of-way or in the immediate vicinity of the highway or another element of the proposed action.

Dispersed Recreation: Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are primarily for access and protection of the environment rather than comfort or convenience of the user.

Distance Zones: Landscape areas denoted by specified distances from the observer. Used as a frame of reference in which to discuss landscape attributes or the scenic effect of human activities in a landscape.

Electric and Magnetic Fields (EMF): The invisible lines of force associated with the production, transmission, and use of electric power, such as those associated with high-voltage transmission lines, secondary power lines, and home wiring and lighting. EMFs are present around any electrical device.

Electromagnetic Fields: Electromagnetic fields are generated when charged particles (e.g., electrons) are accelerated. Charged particles in motion produce magnetic fields. Electromagnetic fields are typically generated by alternating current in electrical conductors. They are also referred to as EM fields.

Eligible Cultural Resource: A cultural resource that has been evaluated and reviewed by an agency and the State Historic Preservation Officer and recommended as eligible for inclusion in the National Register of Historic Places, based on the criteria of significance.

Endangered Species: Any species (plant or animal) that is in danger of extinction throughout all or a significant part of its range. Requirements for declaring a species endangered are found in the Endangered Species Act.

Endangered Species Act of 1973 (ESA): This act requires consultation with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service to determine if endangered or threatened species or their habitats will be impacted by a proposed activity and what, if any, mitigation measure are needed to address the impacts.

Environmental Impact Statement (EIS): A document required of Federal agencies by the National Environmental Policy Act for major proposals or legislation that will or could significantly affect the environment.

Environmental Justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Ephemeral Stream: Streams that contain running water only sporadically, such as during and following storm events.

Erosion: The wearing away of the land surface by wind and water.

Federal Land Policy and Management Act of 1976: This act requires the Secretary of the Interior to issue regulations to manage public lands and the property located on those lands for the long term.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas, including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain.

Foreground: The part of a scene or landscape that is nearest to the viewer. Detailed landscape generally found from the observer to one-half mile away.

Form: Structure, mass, or shape of a landscape or of an object. Landscape form is often defined by edges or outlines of landforms, rockforms, vegetation patterns, or waterforms, or the enclosed spaces created by these attributes.

Fugitive Dust: The dust released from activities associated with construction, manufacturing, or transportation.

Gauss (G): The unit most commonly used in the United States to measure magnetic fields.

Groundwater: Water within the earth that supplies wells and springs.

Harmonic Mean: The harmonic mean (formerly sometimes called the subcontrary mean) is one of several kinds of average. Typically, it is appropriate for situations when the average of rates is desired.

Hazardous Material: Any material that poses a threat to human health and/or the environment. Hazardous materials are typically toxic, corrosive, ignitable, explosive, or chemically reactive.

Hertz (Hz): The unit of measurement of frequency, equivalent to one cycle per second.

Historic Properties: Any prehistoric or historic districts, sites, buildings, structures, or objects included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. They include artifacts, records, and remains that are related to and located within such properties.

Immediate Foreground: The detailed feature landscape found within the first few hundred feet of the observer, generally, from the observer to 300 feet away. This distance zone is normally used in project level planning, not broad scale planning.

Indicator Species: A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

Indirect Effects: Effects caused by a given action occurring later in time or farther removed in distance but that are reasonably foreseeable (e.g., induced changes to land-use patterns, population density, and growth rate).

Irretrievable: Applies to losses of production, harvest, or commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports site. If the use is changed, timber production can be resumed.

Irreversible: A term that describes the loss of future options and applies primarily to the effects, or use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Key Observation Point (KOP): An element of the contrast rating system used by Federal agencies to analyze the potential visual impact of proposed projects and activities. The rating is done from the most critical viewpoints, or Key Observation Points. Factors that should be considered in selecting KOPs are: angle of observation, number of viewers, length of time the project is in view, relative project size, season of use, and light conditions.

Kilovolt (kV): The electrical unit of power that equals 1,000 volts.

Landscape Character: Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Ldn: The day-night average sound level. It is the average A-weighted sound level over a 24-hour period that gives additional weight to noise that occurs during the night (10:00 p.m. to 7:00 a.m.).

Lead: A gray-white metal that is listed as a criteria air pollutant. Health effects from exposure to lead include brain and kidney damage and learning disabilities. Sources include leaded gasoline and metal refineries.

Leq: For sounds that vary with time, Leq is the steady sound level that would contain the same total sound energy as the time-varying sound over a given time.

Level of Service: A qualitative measure describing operational conditions in a traffic stream and their perception by motorists and/or passengers.

Line: An intersection of two planes; a point that has been extended; a silhouette of form. In landscapes ridges, skylines, structures, changes in vegetation, or individual trees and branches-may be perceived as line.

Management Indicator Species (MIS): MIS are identified in the Forest Service Land and Resource Management Plans of each national forest and are generally identified to represent species and habitat types that occur within the national forest boundary and/or because they are thought to be sensitive to National Forest System management activities.

Maximum Modification: A Visual Quality Objective meaning man's activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

Megawatt (MW): The electrical unit of power that equals one million watts or one thousand kilowatts.

Middleground: A term used in the management of visual resources, or scenery. It refers to the visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly from the stand.

Migratory Bird Treaty Act (MBTA): Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention for the protection of migratory birds or any part, nest, or egg of any such bird." (16 U.S.C. 703)

Mitigation: The alleviation of adverse impacts on environmental resources by avoidance through project redesign or project relocation, by protection, or by adequate scientific study.

Mitigation Measures: Specific design commitments made during the environmental evaluation and study process that serve to moderate or lessen impacts deriving from a proposed action. In accordance with CEQ Regulations, mitigation includes avoidance, minimization, rectification, reduction, and compensation.

Modification: A Visual Quality Objective meaning man's activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Nacelle: The housing that protects the major components (e.g., generator and gear box) of a wind turbine.

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the Clean Air Act, as amended. The primary National Ambient Air Quality Standards specify maximum outdoor air concentrations of criteria pollutants that would protect the public health within an adequate margin of safety. The secondary National Ambient Air Quality Standards specify maximum concentration that would protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Environmental Policy Act (NEPA): This Act (42 U.S.C. 4341, passed by Congress in 1975) established a national policy designed to encourage consideration of the influences of human activities (e.g., population growth, high-density urbanization, industrial development) on the natural environment. NEPA also established the CEQ. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues in order to facilitate the decision-making process.

National Historic Preservation Act of 1996 (NHPA): This act requires Federal agencies to prepare a detailed statement on the environmental impacts of their proposed major actions significantly affecting the quality of the human environment.

National Forest Management Act: A Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of forest plans and the preparation of regulations to guide that development.

National Register of Historic Places (NRHP): The NRHP is the official list of the Nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources.

National Resources Conservation Service (NRCS): Formerly the Soil Conservation Service, NRCS is a department in the U.S. Department of Agriculture responsible for administering the Farmland Protection Policy Act.

National Wetlands Inventory (NWI): A series of maps produced by U.S. Fish and Wildlife Service (USFWS) to show wetlands and deepwater habitats to illustrate reconnaissance level information on the location, type, and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology, and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

Native American Graves Protection and Repatriation Act: This act established the priority for ownership or control of Native American cultural items excavated or discovered on Federal or Tribal land after 1990 and the procedures for repatriation of items in Federal possession. The act allows the intentional removal from or excavation of Native American cultural items from Federal or Tribal lands only with a permit or upon consultation with the appropriate tribe.

Nitrogen dioxide (NO2): A toxic reddish brown gas that is a strong oxidizing agent, produced by combustion (as of fossil fuels). It is the most abundant of the oxides of nitrogen in the atmosphere and plays a major role in the formation of ozone.

Nonattainment Area: An area that the EPA has designated as not meeting (that is, not being in attainment of) one or more of the NAAQS for criteria pollutants. An area may be in attainment for some pollutants, but not others.

Non-renewable Resources: Resources that are in limited supply, such as oil, coal, and natural gas.

Noxious Weeds: Plant species that have been designated by State or national agricultural authorities as a plant that is injurious to agricultural and/or horticultural crops and/or humans and livestock. Most have been introduced into a foreign ecosystem either by accident or mismanagement, but some are also native species. Typically they are plants that are aggressive growing, multiply quickly, and adversely affect desirable plants, or are somehow injurious to livestock or humans either by contact or when ingested.

Occupational Health and Safety Administration (OSHA): Congress created the Occupational Safety and Health Administration under the Occupational Safety and Health act on December 29, 1970. Its mission is to prevent work-related injuries, illnesses, and deaths.

Ozone (O3): A strong-smelling, reactive toxic chemical gas consisting of three oxygen atoms chemically attached to each other. It is formed in the atmosphere by chemical reactions involving nitrogen oxide and volatile organic compounds. The reactions are energized by sunlight. Ozone is a criteria air pollutant under the Clean Air Act and is a major constituent of smog.

Paleontological Resources: Any remains, trace, or imprint of a plant or animal that has been preserved in the earth's crust since some past geologic time.

Paleontology: The study of plant and animal life that existed in former geologic times, particularly through the study of fossils.

Partial Retention: A Visual Quality Objective which in general means man's activities may be evident but must remain subordinate to the characteristic landscape.

Particulate matter (PM10 and PM2.5): Fine solid or liquid particles, such as dust, smoke, mist, fumes, or smog found in air or emissions. The size of the particulates is measured in micrometers (µm). One micrometer is 1 millionth of a meter or 0.000039 inch. Particle size is important because the U.S. Environmental Protection Agency has set standards for PM2.5 and PM10 particulates.

Perennial Streams: A stream that typically has running water on a year-round basis.

Potable Water: Water that is safe for drinking and cooking.

Programmatic Agreement: A document that records the terms and conditions agreed upon to resolve the potential adverse effects of a Federal agency program, complex undertaking, or other situations in accordance with Section 800.14 (b), "Programmatic Agreements," of 36 CFR Part 800, "Protection of Historic Properties."

Range: Land on which the principle natural plant cover is composed of native grasses, forbs, and shrubs that are valuable as forage for livestock and big game.

Range Management: The art and science of planning and directing range use intended to yield the sustained maximum animal production and perpetuation of the natural resources.

Record of Decision: A concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared, or cooperated in the preparation of an EIS. The ROD is prepared in accordance with the requirements of the CEQ NEPA regulations (40 CFR 1505.2).

Renewable Energy: Alternative energy sources such as wind power or solar energy that can keep producing energy indefinitely without being used up.

Resource Evaluation Area: The geographical region that would be expected to be affected in some way by a proposed action and alternatives.

Resource Protection Measures: Mitigation measures built into a project's design and construction standards that (1) avoid impacts by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) rectify impacts by repairing, rehabilitating or restoring the affected environment; or (4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action.

Right-of-way: Land acquired by purchase, gift, or eminent domain to build and maintain a public road, bridge, railroad, or public utility.

Riparian: Relating to, living in, or located on the bank of a river, lake or tidewater.

Rock Crusher: A machine designed to reduce large rocks into smaller rocks, gravel, or rock dust. Crushers may be used to reduce the size, or change the form, of waste materials so they can be more easily disposed of or recycled, or to reduce the size of a solid mix of raw materials

Rotational Speed: The rate (in revolutions per minute) at which a turbine blade makes a complete revolution around its axis. Wind turbine speeds can be fixed or variable.

Rotor: The portion of a modern wind turbine that interacts with the wind. It is composed of the blades and the central hub to which the blades are attached.

Rotor Diameter: The diameter of the circular area that is swept by the rotating tip of a wind-turbine blade. It is equal to twice the blade length.

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and may eventually enter streams.

Scenery Integrity: State of naturalness or, conversely, the state of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character in a national forest.

Scenery Management: The art and science of arranging, planning, and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

Scoping: An early, open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

Section 7 of the Endangered Species Act (ESA): The section of the Endangered Species Act that requires all Federal agencies, in "consultation" with the U.S. Fish and Wildlife Service, to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

Section 106 National Historic Preservation Act: Section 106 of the National Historic Preservation Act and its implementing regulations (36 CFR 800) require Federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. The purpose of the Section 106 process is to identify, evaluate, and protect cultural resources eligible for listing in the NRHP that may be affected by Federal actions or undertakings (16 U.S.C. §470 et seq.).

Sedimentation: The process of deposition of sediment, especially by mechanical means from a state of suspension in water.

Sensitive Species: Those plants and animals for which population viability is a concern, as shown by a significant current or predicted downward trend in populations or density and significant or predicted downward trend in habitat capability.

Septic Tank: An underground storage tank for wastes from homes having no sewer line to a treatment plant. The wastes go directly from the home to the tank, where the organic waste is decomposed by bacteria and the sludge settles to the bottom. The effluent flows out of the tank into the ground through drains; the sludge is pumped out periodically.

Significant Impacts: Any number of social, environmental, or economic effects or influences that may occur as a result of the implementation of a transportation improvement. "Significant impacts" may include effects that are direct, secondary, or cumulative.

Soil Compaction: An increase in bulk density (weight per unit volume) and a decrease in soil porosity resulting from applied loads, vibration, or pressure.

Specific Yield: The ratio of the volume of water a rock or soil will yield by gravity drainage to the total volume of the rock or soil.

Spill Prevention, Control, and Countermeasures (SPCC) Plan: A plan implemented to help prevent any discharge of oil into navigable waters or adjoining shorelines.

Step-up Substation: A transformer substation in which the outgoing power from the transformers is at a higher voltage than the incoming power.

Storm Water Pollution Prevention Plan (SWPPP): A plan required to be implemented for construction projects disturbing more than one acre of land. Implementation of a SWPPP is a requirement to obtain a State pollutant discharge elimination system permit coverage for storm water discharges.

Substation: A facility where electric energy is passed for transmission, transformation, distribution, or switching.

Sulfur dioxide (SO2): A gas formed from burning fossil fuels. Sulfur dioxide is one of the six criteria air pollutants specified under Title I of the Clean Air Act.

Sulfur hexafluoride (SF6): A colorless, odorless gas considered by the Intergovernmental Panel on Climate Change to be one of the more potent greenhouse gases (GHGs) in the atmosphere. SF6 is used in electrical equipment, such as circuit breakers.

Supervisory Control and Data Acquisition (SCADA): A software program used to communicate directly with individual wind turbines to monitor performance, report energy output, and trouble-shoot technical difficulties.

Surface Water: All bodies of water on the surface of the earth and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, and estuaries.

Switchgear: A group of switches, relays, circuit breakers, etc. Used to control distribution of power to other distribution equipment and large loads.

Switchyard: Facility with circuit breakers and automatic switches to turn power on and off on different transmission lines. Switchyards are typically associated with substations.

Texture: The visual or tactile surface characteristics of something.

Traditional Cultural Property (TCP): A property or site that is eligible for inclusion on the National Register of Historic Places because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important to maintaining the continuing cultural identity of the community.

Transmission Line: The structures, insulators, conductors and other equipment used to transfer electrical power from one point to another.

Transmissivity: The ability of an aquifer to transmit water.

Transformer: A device for transferring electric power from one circuit to another in an alternating current system. Transformers are also used to change voltage from one level to another.

Viewshed: the total landscape seen or potentially seen from all or a logical part of a travel route, use area, or water body.

Visual Management System (VMS): The planning methodology, published in 1974, that guided the management of visual resources on throughout lands managed by the Forest Service until the Scenery Management System was published in 1995.

Visual Quality Objective (VQO): A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Visual Resource: The visible physical features of a landscape.

Waters of the United States: As defined by the Clean Water Act, waters of the United States applies only to surface waters, rivers, lakes, estuaries, coastal waters, and wetlands. Waters of the United States include all interstate waters, intrastate waters used in interstate and/or foreign commerce, tributaries of the above, territorial seas at the cyclical high tide mark, and wetlands adjacent to all the above.

Water Table: The upper surface of groundwater. Below it, the soil is saturated with water.

Wetlands: Areas that are soaked or flooded by surface or groundwater frequently enough or long enough to support plants, birds, animals and aquatic life. Wetlands generally include swamps, marshes, bogs, estuaries, and other inland and coastal areas and are federally protected.

Wind Park: One or more wind turbines operating within a contiguous area for the purpose of generating electricity.

Worst Case Fresnel Zone Study: A study conducted to analyze a project's potential impacts to microwave paths in a given area.

Yaw: Side-to-side movement. For wind turbines, it refers to the angle between the axis of the rotor shaft and the wind direction. As this angle increases, the turbine's ability to capture the wind's energy decreases.