4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the environmental consequences, also referred to as impacts or effects, of implementing the alternatives. Considering the existing condition of the environment that would be affected by the Project (Chapter 3) and imposing the descriptions of the alternatives (Chapter 2), the types of impacts were identified and quantified to the extent practicable for the purposes of this Environmental Impact Statement (EIS). Impacts are defined as modifications to the environment over existing conditions (the No Action Alternative) that are caused by a proposed action. Potential impacts considered in this chapter include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems) aesthetic, historical, cultural, economic, social, and health (40 Code of Federal Regulations §1508.8 [40 CFR §1508.8]) impacts. General impacts of wind energy facilities to resources and resource uses are described in the *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States* (Bureau of Land Management [BLM] 2005); this document is incorporated by reference.

The impact analysis is designed to show relative differences in alternatives as they pertain to specific resources, resource uses, or social and economic features. It is not intended to predict the exact amount, timing, or location of effects that could occur should the alternative be selected for implementation. The numbers generated and used for comparison of impacts are approximated and intended for analysis purposes only. The exact location of Project features cannot be determined until a final design is completed. Therefore, the exact areas of impact on specific resources, resource uses, or social and economic features are estimates based on the best available information at the time of this writing.

The ecology, data collection, and management of ecosystems are a complex and constantly evolving discipline. However, basic ecological relationships are well established, and a substantial amount of credible information about ecosystems in the study region is known. The alternatives were evaluated using the best available information about these ecosystems. While additional information may add precision to estimates or better specify relationships, new information would be unlikely to appreciably change the understanding of the relationships that form the basis for the evaluation of effects.

The depth and breadth of the impact analyses presented in this chapter is commensurate with the level of detail presented in Chapter 3, and on the availability and/or quality of data necessary to assess impacts. The potential impacts of Alternatives A, B, C, and D, and discussions of cumulative impacts, are described in this chapter using the same order of resource topics presented in Chapter 3. The organization for Chapters 3 and 4 allows the reader to compare existing resource conditions (Chapter 3) to potential impacts (Chapter 4) for the same resources. Discussions of cumulative impacts, irreversible and irretrievable commitment of resources, unavoidable adverse impacts, and the relationship between local short-term uses and long-term productivity conclude the chapter (Sections 4.16 through 4.19).

4.1.1 <u>Impact Analysis Approach</u>

Impacts associated with the alternatives are discussed in a section for each resource, resource use, or social and economic feature. Mitigation measures that are identified in the resource sections include reference to the project description mitigation measures as provided in Chapter 2 and the BMPs from the Final Programmatic EIS on Wind Energy Development of BLM Administered Lands in the Western States, as described in Appendix B. Any additional mitigation measures not included as applicant-committed measures, including those outside the jurisdiction of BLM or Reclamation (such as Mohave County requirements) are described in individual resource sections, as applicable. The Project Area includes the locations proposed for the Wind Farm Site (turbine corridors, access roads, operations and maintenance (O&M) building, laydown areas, meteorological (met) towers, substations, switchyard, and collector lines), the primary access road from US 93 to the Wind Farm Site, the materials source (for construction), the temporary pipeline carrying water from existing wells to the temporary batch plant, and the distribution line (for powering construction activities and the O&M building). The Project disturbance area consists of all areas where the surface would be disturbed as a result of the Project (refer to Table 2-7). From this description, an area of impact analysis was specified for each topic and impact duration definitions (short-term, long-term) were assessed where applicable.

As described in Section 2.5.2.8, selection of the 345-kV interconnection option would result in the need for Western to replace the existing 345/230-kV transformer and associated breakers, switches, and other equipment at Mead Substation with two new 345/230-kV transformers and similar related equipment. All of this activity would be within the previously developed and disturbed substation area, which has been graded and surfaced with aggregate. Mead Substation is a heavily industrialized area with a large number of transmission lines entering and exiting the facility, and the new equipment would replace existing equipment within a large substation that already has numerous pieces of similar electrical equipment. Since the potential environmental impacts of the activities at Mead Substation would be negligible, they are not discussed further in this chapter.

The analysis methods in each section describe how the impact analysis was conducted and includes a description of the data used in the analysis. Where applicable, quantitative models, relevant scientific literature, and previously prepared environmental documents used in the analysis are identified. This section also presents the underlying assumptions that were used when analyzing impacts of the Project on a specific resource, resource use, or social and economic feature, including information gathered during the scoping. Following a discussion of analysis methods, each resource section presents impacts analysis of the alternatives. Impacts on resources and resource uses are analyzed and discussed in detail commensurate with resource issues and concerns identified throughout the process. Impacts are sometimes described using ranges of potential impacts or in qualitative terms. In the absence of quantitative data, impacts are described based on the professional judgment of the interdisciplinary team of technical specialists using the best available information. Text is provided to identify where the impact analysis is based on incomplete or unavailable information. Geographic information system (GIS) analyses and data from field investigations were used to quantify effects where possible. In each section, the potential environmental impacts from the implementation of Alternative A, B, or C are evaluated by comparing the current conditions described in Chapter 3 to the expected conditions resulting from each alternative.

Chapter 4 uses the terms “impacts” and “effects” interchangeably, and the terms “increase” and “decrease” are used for comparison purposes. For the purposes of the impact analyses, the impacts are described in terms of their expected duration, which refers to the permanence and longevity of the impacts. Duration of impacts is considered within the following time frames (where applicable to the resource):

- **Temporary impacts** occur during Project construction and/or decommissioning and persist for less than or equal to 2 years.
- **Short-term impacts** persist up to 5 years after construction is complete.
- **Long-term impacts** persist for more than 5 years after construction.
- **Permanent impacts** persist beyond Project decommissioning and continue for a reasonable period after Project reclamation.

4.1.2 Impact Analysis Assumptions Common to All Resources and Resource Uses

There are several assumptions used in the impact analysis that apply to all of the resources, resources uses, or social and economic features; these assumptions include:

- Application of design features would reduce impacts.
- Addition and reconstruction of Project roads may result in increased use of the area. Increased use of the area would result in additional indirect impacts on resources.
- Construction activity, including hauling within the Project Area, generally would occur only during daylight hours, although some operations (such as turbine assembly and concrete pouring) could occur at night when wind speeds are often lower and temperatures are cooler.
- Construction would occur over a period of approximately 12 to 18 months for any alternative.
- Blasting could occur anywhere ground disturbance is proposed, although the amount, location, and intensity of blasting are not known.
- Revegetation efforts would be successful. The success criteria for revegetation efforts would be defined in the Reclamation Plan that would be approved by BLM and Reclamation. Construction would not be deemed complete until the regulatory agencies acknowledge that restoration was complete under the approved success criteria.
- Revegetated areas would include the additional road width area and staging/laydown areas that would be needed for construction.
- Decommissioning would begin at the end of the right-of-way grant (approximately 30 years after commissioning the Project after which it may no longer be cost effective to continue operations).
- Blasting would not be used during decommissioning unless required for demolition of foundations.

Additional assumptions specific to individual resources, resource uses, or social and economic features are listed in each section.

4.2 CLIMATE AND AIR QUALITY

4.2.1 Analysis Methods

This analysis evaluates estimated emissions of regulated air pollutants and greenhouse gases (GHG) from construction, operation, and decommissioning of the proposed wind farm. Although air pollutant emissions are generated during the construction of wind energy facilities, operating wind facilities contribute relatively low levels of air pollution compared to fossil fuel fired power plants. Information presented includes:

- Short-term effects from fugitive dust (PM_{10}), criteria air pollutants (PM_{10}, nitrogen oxides [NO_x], carbon monoxide [CO], volatile organic compounds [VOCs], sulfur dioxide [SO_2]) and GHG emissions (reported in carbon dioxide [CO_2] equivalents, or "CO2*e*") from earth-moving activity, vehicles and equipment during construction of the wind farm, transmission lines, switchyards, substations, access roads and temporary cement batch plants, for each alternative.
- Fugitive dust, criteria air pollutant, and GHG emissions from vehicles and equipment due to operations and maintenance of the wind farm, including employee travel to and from work, and resulting from land use changes, from native desert to a developed facility.

Quantitative air quality emissions were calculated using information contained in the Plan of Development (POD) (BP Wind Energy 2011a) such as the proposed construction schedule, acreage to be disturbed, specifications for proposed access roads, vehicle and equipment utilization, workforce planning, transportation needs, facility operating equipment and schedule, and best management practices to be implemented to reduce impacts. These data, along with published emission factors and equations, were used to develop the estimates. Sources are referenced in the footnotes of each emission table.

Wind power projects do not involve the combustion of fuels to generate electricity, so these projects have considerably lower operational impacts on air quality when compared to fossil fuel-fired generating facilities. The air quality impacts occurring during construction of the Project would be temporary and include tailpipe emissions from construction vehicles and equipment; earthmoving operations; sand and gravel mining at Detrital Wash; operation of a crushing, screening and wash plant (CSWP) to produce the clean sand, gravel, and crushed stone to make the concrete for the tower foundations; two portable concrete batch plants; power generators; and fugitive dust generated during the duration of construction.

The air quality impacts of temporary construction projects involving large land areas, similar to the proposed action, often do not need to be quantified in terms of predicted ambient concentrations of emitted air pollutants, because of the inherent complexities associated with transient emission sources; (construction activities and equipment move from site to site fairly quickly and readily). Accordingly, for purposes of providing the reader with an adequate perspective of the anticipated impacts, the quantified Project air pollutant emissions are compared to similar emission sources that are more familiar to a larger segment of the human population.

4.2.1.1 Identification of Issues

The following is a list of issues that were identified during Project scoping relating to climate, air quality, and climate change; these issues form the basis for the assessment of potential impacts:

- Potential impacts on air quality from fugitive dust from construction and increased traffic,
- Potential impacts from construction-related traffic emissions,
- Potential cumulative effects from emissions on regional air quality,
- Potential impacts from concrete dust, and
- Potential for climate change to influence the proposed Project, specifically within sensitive areas, and exacerbate projected impacts.

4.2.1.2 Protected Areas

Grand Canyon National Park is a Class I Area under the Clean Air Act (CAA) and air quality at the park is protected by the Prevention of Significant Deterioration (PSD) Program. Lake Mead National Recreation Area (NRA), a Class II Area, is also protected under the CAA although requirements are generally less stringent than for Class I areas. The Project Area is designated as Class II.

4.2.2 <u>Alternative A – Proposed Action</u>

4.2.2.1 Construction Emissions

Construction of Alternative A would occur over a period of 12 to 18 months and result in a total area of ground disturbance of an estimated 1,474 acres. This alternative includes the installation of as many as 203 to 283 turbines depending on the turbine size chosen. During construction, particulate matter would be emitted, along with pollutants from combustion equipment, including NO_x, VOC, CO, SO_2, and GHG. Sources of dust or particulate matter emissions would include: site clearing and grading for all ground-disturbing activities, including but not limited to, planned locations for substations, the interconnect switchyard, O&M building, laydown yards, transmission line structures, and temporary and permanent access roads; wind erosion from those areas where vegetation would be removed and from material storage piles; active earthmoving or groundbreaking activities such as digging, blasting, and ground contouring; activities associated with setting foundations for the substation structures, switchyard, O&M building, and transmission line structures; construction traffic on unpaved roads, and potentially tracked out soil material re-suspended by paved road traffic. Two temporary concrete batch plants and one CSWP would also be located on site. Combustion products would be emitted in the exhaust from internal combustion engines associated with the Project, including mobile construction equipment, stationary engines such as generators and construction support equipment, and vehicles transporting workers and delivering materials and equipment to and from the Project site.

Table 4-1 summarizes the estimated criteria pollutant emissions for the construction phase of Alternative A. The estimates use accepted emissions factors and are based on schedules, acreage values, and other pertinent information from the POD. Some of the emission factor sources used were the Midwest Research Institute's "Estimating Particulate Matter Emissions From Construction Operations," 1999; "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition," EPA/420-R-10-018, July, 2010; Chapter 5 of the "2002 Periodic Ozone Emission Inventory," Maricopa Association of Governments (MAG); and the ADEQ General Permit for Concrete Batch Plants.

Table 4-1 Estimated Construction Emissions (tons) for Alternative A

Type of Emissions	VOC	CO	NO_x	PM_{10}	SO_2
Earthmoving Activity (grading, trenching and excavation for foundations, roads, etc.)	-	-	-	429.9	-
Sand & Gravel Mining, CSWP Operations, and Delivery of Materials to Batch Plants	2.2	5.8	27.1	13.6	1.8
Operation of Concrete Batch Plants	2.4	6.5	30.1	15.6	2.0
On-site Vehicle and Equipment Tailpipe Emissions	24.0	165.3	139.8	404.4	19.6
Delivery of Major Project Components to Site	5.5	36.0	5.5	2.2	0.1
Local Construction Employee Commuting	2.7	36.0	2.7	0.2	0.2
Total Estimated Construction Emissions	**36.8**	**249.6**	**205.2**	**865.9**	**23.7**

As the data in the table demonstrate, earthmoving activity at the site (including excavation of tower foundations, construction of roads, trenching and grading) would contribute approximately 50 percent of the particulate emissions during construction. On-site construction vehicle and equipment tailpipe emissions would contribute approximately 46.7 percent of particulate emissions during construction, and the remainder would be attributable to sand and gravel mining at Detrital Wash, operation of crushing and screening equipment, operation of two concrete batch plants, delivery of major components to the Project site, and construction employee commuting. Windblown dust could also increase since existing vegetation would be removed and/or disturbed during construction. On-site construction vehicle and equipment tailpipe emissions would be the primary source of gaseous air pollutants, including NO_x, CO, VOCs, and SO_2.

If the total PM_{10} emissions are divided by the number of acres that are anticipated to be disturbed for this alternative (865.9 tons/1474 acres), the result is 0.59 tons per acre. As a comparison, the average annual wind erosion for cultivated cropland in Arizona from the 2007 Natural Resources Inventory was 14.7 tons/acre/year (range: ±6.7 tons/acre/year) (NRI 2009).

The construction schedule for the approximate 12 to 18 months (maximum) would consist of 10 hours per day, five days per week. Thus construction activity would occur during up to approximately 3,900 hours.

Based on the maximum timeframe construction schedule and duration, average pound per hour (lb/hour) emission rates were calculated, as follows:

> Average hourly emissions (lb/hour) = (Total Project emissions (tons) * 2000 lb/ton) / 3,900 hours

The resultant average site-wide emission rates for each pollutant are as follows:

VOC:	18.88 lb/hour
CO:	128.01 lb/hour
NOx:	105.18 lb/hour
PM_{10}:	444.09 lb/hour
SO_2:	12.19 lb/hour

On any particular day, these estimated average site-wide emission rates would occur intermittently across several active construction areas within the proposed Project Area, thus emissions from any one such area would be a small fraction of these values. Emissions would typically be limited to daylight hours on active working days, although there could be some emissions at night when construction workers are taking advantage of low-wind conditions or cooler temperatures.

Fugitive dust tends to settle out within a few miles of its origin. The effect of this is most notable within a few yards of unpaved roadways, where dust caused by vehicle traffic settles onto vegetation and ground surfaces. Over time, the dust can accumulate to the extent that the coatings on plant surfaces are noticeable. These accumulations would be partially or completely removed by periodic rainfall and wind events. Specific measures to minimize the generation of dust caused by vehicle traffic on unpaved roads are included in Section 4.2.6, Mitigation Measures.

GHG emissions from internal combustion engines were also estimated, but on the basis of types of vehicles and equipment, fuel type (diesel vs. gasoline), total operating hours for each type, and average engine horsepower for each type, rather than the broad construction activity categories described above for estimation of criteria pollutants. The maximum total Project GHG emissions over the 18 month construction effort were estimated to be 1,113,880 tons of "CO_2 equivalent" (CO_2*e*). Table 4-2 lists the totals for the three GHGs included in this total, along with the global warming potential (GWP) values, as applicable.

Table 4-2 Breakdown of Estimated GHG Emissions for Alternative A

Carbon Dioxide (CO_2) (tons)	**Methane (CH_4) (tons)**			**Nitrous Oxide (N_2O) (tons)**			**Total Carbon Dioxide Equivalent (CO_2e) (tons)**
		GWP of 21	**CO_2e**		*GWP of 310*	**CO_2e**	
897,906.08	**10,291.58**		**216,123**	**61.48**		**19,059**	**1,133,088**

GWP = global warming potential

The EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks estimates a total of 6,633.2 million metric tons (MMT) of CO_2e was emitted from sources within the United States in 2009 (EPA 2010(d)). (1 MMT is equivalent to 1.1 million U.S. tons.)

With regard to cement emissions, cement handling operations would occur at each of two concrete batch plants, located along the western and northern portions of the Wind Farm Site. The cement storage silos and the concrete mixing chambers in each batch plant would be equipped with baghouses to control approximately 99.5 percent of cement dust emissions during cement handling activities. Concrete batch plant operations are anticipated to occur 10 hours per day, five days per week, for a total of 39 weeks; (i.e., each batch plant would operate for 1,950 hours). Based on the foregoing, the maximum hourly and annual emissions of dry cement powder from cement transfer to the storage silos (deliveries to the batch plant) and from the storage silos to the weigh hopper (as concrete is being mixed) for the two batch plants combined were calculated, as follows:

Hourly cement emissions:	0.102 pounds
Daily cement emissions:	1.02 pounds
Total Project cement emissions:	426 pounds (0.213 tons)

Assuming each batch plant produces the same amount of concrete, the total estimated cement emissions from each during the Project would be 213 pounds, roughly equivalent to three 75-pound sacks. The emission outlets on the batch plant cement silo baghouses would be located approximately 20 to 25 feet above the ground. Over the course of 39 weeks, winds would be likely to occur from all directions, although several specific directions would likely dominate. Based on the foregoing, the cement emissions from the baghouses would likely be distributed, and settle to the ground, within a radius of a few miles from the location of each batch plant. Cement is strongly alkaline, but the caustic effects usually do not occur until the cement gets wet. The amount accumulated in any one area has not been quantified, but would be anticipated to be very small and have negligible effects on plants in the area.

4.2.2.2 Operational Emissions

Throughout the operating phase of the wind farm, relatively small amounts of air pollutants would be emitted from mobile sources (primarily passenger vehicles) and stationary equipment at the facility. Wind farms require limited maintenance and include only small sources of combustion emissions, such as generators for emergency power and comfort heating/cooling equipment for support buildings. Periodically, it may be necessary to perform major overhauls and repairs, requiring the use of a crane and larger trucks. There would also be small quantities of VOCs emitted during routine changes of lubricating and cooling fluids and greases. The BLM Wind Energy Final Programmatic Environmental Impact Statement concludes that “the operation of a wind energy development project would not adversely impact air quality” (BLM 2005).

4.2.2.3 Decommissioning Impacts

Decommissioning activities would result in air emissions similar to those caused by initial construction of the facility. The wind turbines, towers and support equipment would be removed. Since at least a portion of the turbine foundation would be removed, these areas would need to be restored and revegetated in a manner consistent with the surrounding desert land. After the vegetation is restored, particulate matter emissions from the site would be similar to that of the area prior to construction of the Project.

Equipment decommissioning would generate dust from travel on the area roads and from earthmoving during removal of foundations and from site restoration. Vehicle and heavy equipment emissions would occur during the operation of cranes, trucks, and earthmoving equipment. Similar to construction emissions, these impacts would be temporary. To minimize the levels of particulate in the air during decommissioning, dust suppression would be utilized along with other Best Management Practices (BMPs), such as reduced travel speeds.

4.2.2.4 Summary

Since Alternative A represents the largest Project footprint and the installation of the greatest number of wind turbines, impacts on air quality for the construction of this action would be greater than those from Alternatives B, C, and D. Temporary, localized impacts to visibility on or near the Project site could occur if dust control BMPs (described in Section 4.2.6) are not implemented consistently.

4.2.3 Alternative B

Air pollutant emissions for Alternative B would be lower than for Alternative A because 166 to 208 turbines would be installed, or about 75 fewer turbines than with Alternative A. Temporary disturbance for Alternative B is estimated at 1,186 acres, or approximately 288 fewer acres of land disturbance than with Alternative A.

Emissions from the operating wind farm would be very similar to those for Alternative A because the turbines are not a substantial source of emissions. Emissions during decommissioning would be less than for Alternative A because fewer turbines would be removed and fewer acres of land would be disturbed.

4.2.4 Alternative C

The footprint of the Project Area for Alternative C is similar in size to the footprint for Alternative B. It is estimated that up to 1,180 acres would be temporarily disturbed during construction. The maximum planned number of turbines for Alternative C is 208, which is the same as Alternative B and 75 fewer than for Alternative A. Construction emissions for Alternative C would be nearly the same as for Alternative B and less than for Alternative A.

As described in Alternative B, operating emissions for the wind farm under this alternative would be very low. Emissions during decommissioning would be very similar to those for Alternative B and lower than those generated from decommissioning the larger number of turbines planned for Alternative A.

4.2.5 Alternative D – No Action

If the proposed wind farm is not constructed, there would be no emissions related to construction, operations, or decommissioning activities. The acreage in the Project Area would not be disturbed.

Greenhouse Gases

A potential consequence of the No Action alternative is an increase in GHG and criteria pollutant emissions, assuming that the regional demand for electricity would result in the proposed capacity of 500 megawatts (MW) being met using a non-renewable technology. It is also possible that the demand would be met without increasing emissions through the development of another renewable energy project.

Wind energy is categorized as a renewable technology because the supply of wind does not diminish over time. Wind-generated electricity is produced without consuming fossil fuels. As a result, less air pollution, including GHG, is emitted per kilowatt of energy produced than the amount of air pollution emitted from electricity generated by burning fossil fuels. As a part of the International Atomic Energy Agency's (IAEA) program on Comparative Assessment of Energy Sources, an advisory group was tasked with developing a set of GHG emission factors for a variety of electricity generation technologies. The outcomes of this work were published in an IAEA bulletin titled, "Greenhouse Gas Emissions of Electricity Generation Chains, Assessing the Difference" (IAEA 2000). Figure 4-1 depicts the emission factors developed for renewable energy sources and newer generation (2005-2020) fossil fuel-fired sources. The emission factors are presented in units of grams of carbon-equivalent per kilowatt-hour of electricity generated (gC_{eq}/kWh). The term carbon equivalent means that emissions of methane (CH_4), nitrous oxide (NO), hydrofluorocarbons, perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) are weighted using each compound's global warming potential and added CO_2 emissions. For example, the grams of CH_4 emitted by a specific generation technology would be multiplied by methane's global warming potential of 21 to convert the emissions to a CO_2 equivalent value.

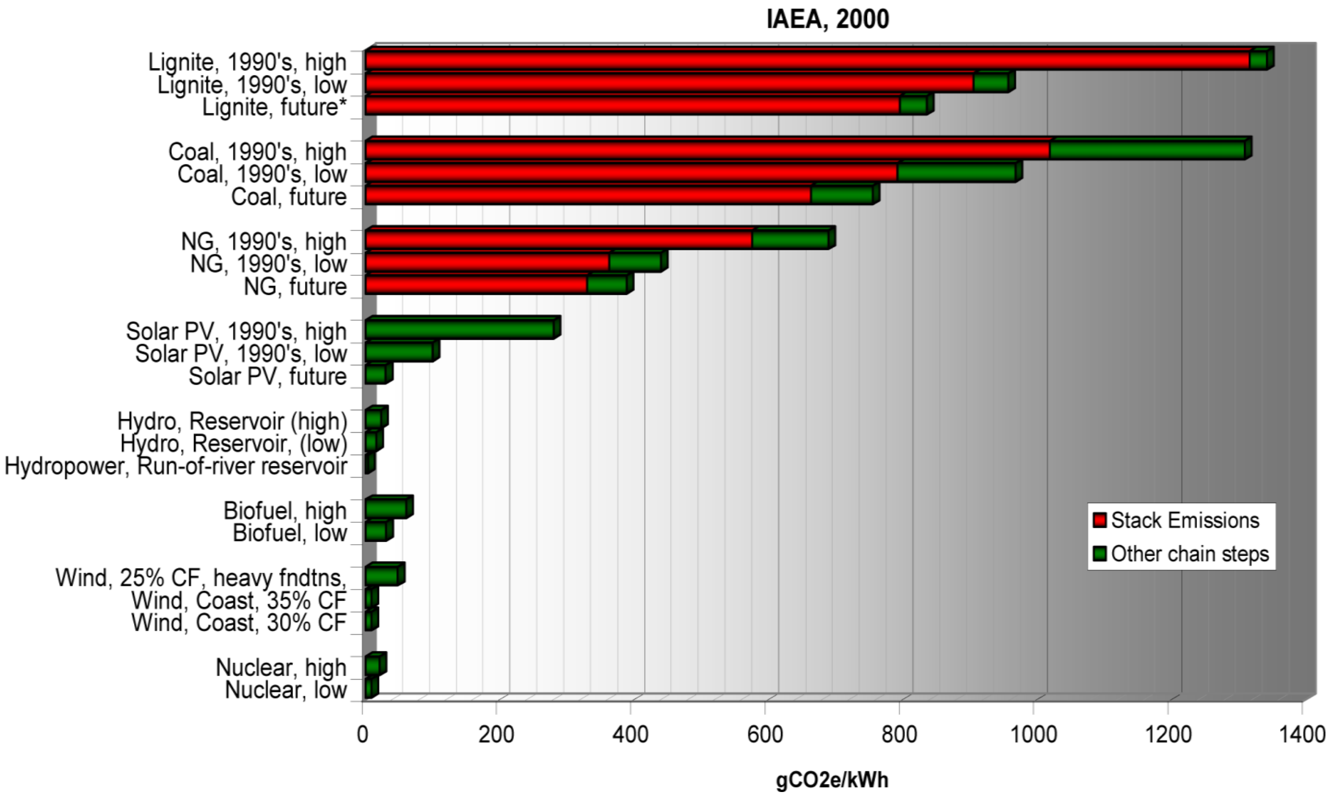

Figure 4-1 Range of Life Cycle Emissions for All Technologies

Although this work was conducted prior to 2000, the approach anticipated improvements to existing generating technologies and incorporated those more efficient systems in the 2005-20 technology categories. The emission factors include emissions directly associated with the power generating equipment and more indirect emissions resulting from acquiring the fuel source (if applicable), transporting materials, constructing the facility, decommissioning the facility, etc.

The IAEA report includes an analysis of factors that contribute to emission rates for specific generating technologies. For wind energy, the contributing factors include the energy needed to manufacture the turbine blades and install the turbine towers and foundations, construction regulations that vary depending upon the location of the facility, and the annual yield or capacity factor (CF) for the wind farm, which is primarily based on average sustained wind speeds in the area (IAEA 2000).

4.2.6 Mitigation Measures

The proposed Project would implement BMPs in accordance with the POD (see Appendix B) and the BLM Wind Energy Final Programmatic EIS. Examples of BMPs that would be required to minimize dust generated during construction include:

- Minimizing surface area disturbance, controlling erosion, applying dust suppression practices, and returning disturbed areas as close as possible to the original condition, including grade and vegetation.

- Using aggregate materials on access roads and internal Project roads and designing the roads using natural contours and avoiding excessive grades.
- Restricting travel within the Project site to the roads developed for the Project and enforcing posted speed limits on those roads to minimize the generation of dust. The magnitude of the limits would be based on the localized soil stability conditions and would not exceed 25 miles per hour (mph).
- On-site wind speed monitors would be monitored during windy periods. Earthmoving activity would be minimized and vehicle speeds would be reduced if sustained winds exceed 22 mph, or if gusts exceed 30 mph.
- Reducing the wind profile of stockpiled materials and covering or watering materials that could become a source of fugitive dust.
- Utilizing dust abatement techniques, such as the application of water or appropriate palliatives (as pre-approved by BLM and/or Reclamation), prior to and during blasting activities, excavation, and surface clearing.
- Employing blasting techniques that minimize the ejection of material into the air.
- Placing cobble beds at egress points to minimize "trackout" onto paved roads.
- Comply with the parameters of the ground Transportation and Traffic Plan (Appendix C) with regard to projected road use, traffic volume minimization, and road maintenance.
- Using trained personnel to observe dust-prone areas to ensure implementation of emission control and other mitigation measures.

4.2.7 Unavoidable Adverse Impacts

No long-term unavoidable adverse impacts are anticipated with proper implementation of mitigation measures. There would be increased emission of particulate matter (dust) as well as vehicular emissions during construction of the facility.

4.3 GEOLOGY, SOILS, AND MINERALS

4.3.1 Analysis Methods

The geologic setting and geologic hazards assessment for the Mohave County Wind Farm Project was based on a review of data gathered from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the Arizona Geological Survey (AZGS), the Arizona Department of Water Resources (ADWR), the U.S. Geologic Survey (USGS), and general professional knowledge of soils in Arizona. The analysis area for geology, soils, and minerals is defined in Section 3.3 as the Project Area.

4.3.2 Alternative A – Proposed Action

4.3.2.1 Construction

Geology

Surface and subsurface disruption could impact geological resources during preconstruction and construction activities (described in Sections 2.5.1 and 2.5.2, respectively) associated with Alternative A. Preconstruction activities that could cause permanent surface and subsurface disturbance include coring, trenching, blasting, clearing, and grading. Construction activities that could result in long-term geological impacts include construction of access roads, wind turbine pads, underground collection facilities, substations, transmission lines, met towers, switchyard, and O&M facilities. Construction activities could also result in bedrock disturbance. The type and magnitude of bedrock disturbance would be different for each construction item and would be contingent on the location of the individual item. Excavations for foundations and trenches for collector lines may encounter rock, and hard-rock excavation methods may be required. Hard-rock excavation methods could include ripping, hoe-ramming, and/or blasting. Construction activities could have temporary geological impacts on a maximum area of approximately 1,474 acres and permanent geological impacts on a maximum area of approximately 339 acres out of approximately 47,059 acres in the Project right-of-way (ROW).

Soil

Prior to and during construction of Alternative A, maximum temporary and long-term soil disturbance would be approximately 1,474 acres and 339 acres, respectively. The temporary impact of construction activities would include removal and disruption of surface soils over a broad area, including drilling activities, test pits, equipment and material staging areas, access roads, trenches for electrical/fiber optic systems, and the facility footprint. Construction areas, such as laydown/staging areas, would be cleared of topsoil and soils to a depth of 8 to 12 inches and replaced with fine gravel (100 percent passing the #4 sieve) hauled from the Detrital Wash Materials Pit, which is the proposed Materials Source (subject to a sales contract with BLM). Areas of temporary disturbance would be restored as near as possible to prior conditions and in accordance with the Reclamation Plan that would accompany the complete POD. Excess soil would be used as fill material where needed in the Project Area to achieve desired road grades or for Project reclamation, such as recontouring to avoid potential soil erosion from stormwater runoff. Erosion from wind and water would be the major potential impact to the soil during construction. Construction of foundations, wind turbines, and other facilities could create erosion-related problems in areas where erosion is not currently present from the localized removal, loosening, and possible compaction of soils. Indirectly this could affect local topography, the amount of vegetative cover, and sediment transport inform wind and during stormwater runoff. Soil removal would be kept to a minimum (see Section 2.5.1), although certain construction activities – including leveling, grading, and recontouring – would permanently relocate soil. These activities would utilize soil (likely from the foundation excavations) as fill and then be top-dressed with salvaged high-quality topsoils to aid in reclamation. In all cases, topsoil would be salvaged when possible and stockpiled for later use in reclamation. BMPs (Appendix B), Dust and Emissions Control Plans, a Stormwater Pollution Prevention Plan (SWPPP), and Mohave County requirements under the Grading Permit would be implemented and utilized to minimize the potential for water and wind erosion impacts.

Long-term impacts on soils would be the localized removal of soils from the construction of turbine foundations. These steel-reinforced concrete foundations are expected to extend at least 10 feet below the existing ground surface. This could result in the long-term localized loss of soils from excavation and construction activities for turbine foundations.

Minerals

Although there are mineral deposits and mining operations near the Project Area, favorability for mineral mining is low and there are no known mineral or mining features within the Project ROW. Additionally, the BLM published a Notice of Segregation of Public Lands in Federal Register / Volume 77, No. 42 / Friday, March 2, 2012 / Notices / Pages 12874 and 12875 for the purpose of processing the ROW application (Section 2.5), and the land addressed in the wind farm application is segregated from appropriation for a period of 2 years starting March 2, 2012. The operation of the Materials Source on 320 acres located west of the proposed Project ROW would not be segregated and mining of the 500,000 cubic yards of material as described in the Mine Plan of Operations would continue. Aside from the expected use of approximately 120,000 to 210,000 cubic yards of aggregate material for access roads and concrete from the Materials Source, future mineral resources are expected to be unchanged from the current conditions within the Project Area and nearby vicinity. This is due to the low favorability of the area for mineral mining.

4.3.2.2 Operations and Maintenance

Geology

During O&M activities (as described in Section 2.5.4), there would be minimal to no impacts to the geology, as O&M activities primarily include work to be done to the wind turbines and generators.

Soil

O&M activities would have minimal impact to the soils within the Project Area. The expected impact is primarily related to maintenance of access roads and any erosion control activities that may be required during operation.

Minerals

It is unclear at this time whether BLM or Reclamation would allow mining between turbine corridors during the operations phase of the Project; however, the low favorability of the area for mineral mining and the Project features on the landscape make future interest in exploration unlikely. Other impacts to minerals and mining are expected to be the same as those stated in Section 4.3.2.1.

4.3.2.3 Decommissioning

Geology

Decommissioning activities, which would include removal of wind turbines, met towers, electrical systems, structural foundations, and access roads are anticipated to have minimal impact to the geology at the time of decommissioning. These components would be removed from the site and replaced with native rock purchased from nearby sources if surface rock is prevalent in the immediate area. Soil excavated during construction would likely be used in the event there is no surface rock.

Soil

The decommissioning activities associated with the Project are anticipated to impact the soil within the Project Area. The removal of wind turbines, electrical systems, structural foundations, and access roads would have the potential to temporarily increase the risk of stormwater-related erosion and blowing dust as a result of disturbance or damage to vegetation and minor recontouring of disturbed areas. Though not expected to be severe, the consequences of stormwater-related erosion include the creation of new or deepening of old runoff channels, the transport of fertile soil to other areas, and the washing away of plants with shallow root systems. Decommissioning activities that would mitigate stormwater-related erosion and blowing dust concerns are regrading, recontouring, and revegetating the disturbed areas, and other BMPs that would be included in the SWPPP. The entire depth of all shallow foundations and the top 36 inches of all deep foundations would be removed when decommissioning commences. The foundation portions below 36 inches are composed of non-leaching/natural elements that should not present a hazard to soils.

Minerals

Impacts to minerals and mining are expected to be the same as those stated in Section 4.3.2.1. Interest in future exploration for mineable minerals may be affected by the portions of turbine foundations left in place. Concurrent reclamation of the Materials Source would continue as described in the Mine Plan of Operations. Disturbed areas would be recontoured to the extent feasible to meet conditions prior to disturbance and once mining operations have ceased, final reclamation would include reseeding with a BLM-approved seed mix.

4.3.3 <u>Alternative B</u>

4.3.3.1 Construction

Geology

Construction activities included in Alternative B are expected to impact geology in manners similar to those described for Alternative A. The primary difference is in the quantity of disruption associated with the reduced area of the Project (approximately 34,720 acres) for this alternative. The maximum temporary and permanent areas of disruption are approximately 1,186 acres and 280 acres, respectively.

Soil

Construction activities included in Alternative B are expected to impact soil in a similar manner to those described for Alternative A. The main difference is in the quantity of disruption associated with the reduced area of the Project for this alternative. Alternative B is expected to result in 288 fewer acres of temporary disturbance and 59 fewer acres of long-term disturbance compared to Alternative A.

Minerals

Impacts to minerals and mining are expected to be the same as those stated in Section 4.3.2.1.

4.3.3.2 Operations and Maintenance

Impacts to geology, soil, and minerals are expected to be the same as those stated in Section 4.3.2.2.

4.3.3.3 Decommissioning

Impacts to geology, soil, and minerals are expected to be the same as those stated in Section 4.3.2.3.

4.3.4 <u>Alternative C</u>

4.3.4.1 Construction

Geology

Construction activities included in Alternative C are expected to impact geology in manners similar to those described for Alternatives A and B. The primary difference would be in the quantity of disruption associated with the area of the Project (approximately 35,302 acres) for this alternative. The maximum temporary and permanent areas of disruption would be approximately 1,180 acres and 276 acres, respectively.

Soil

Construction activities included in Alternative C are expected to impact soil in a similar manner to those described for Alternatives A and B. The amount of temporary disturbance would be 296 fewer acres and the long-term disturbance would be 63 fewer acres than Alternative A. Temporary and long-term disturbance would be about 3 and 6 percent higher, respectively, than Alternative B.

Minerals

Impacts to minerals and mining are expected to be the same as those stated in Section 4.3.2.1.

4.3.4.2 Operations and Maintenance

Impacts to geology, soil, and minerals are expected to be the same as those stated in Section 4.3.2.2.

4.3.4.3 Decommissioning

Impacts to geology, soil, and minerals are expected to be the same as those stated in Section 4.3.2.3.

4.3.5 Alternative D – No Action

Alternative D has no construction, operations and maintenance, or decommissioning activities; therefore, there would be no impacts to the current geology, soil, or minerals in or near the Project Area.

4.3.6 Mitigation Measures

Erosion from wind and water, decreased soil productivity, and slope instability may develop as a result of construction. Implementing BMPs and a Dust and Emissions Control Plan, including applying water to the ground surface and instituting a 25 mph speed limit, would help to minimize erosion and prevent soil loss. To prevent localized landslides resulting from slope instability, disturbed areas would be recontoured with salvaged topsoil and soil removed during construction and later revegetated while rock slopes would be cut back to a stable grade and to the extent practicable, the locations of roads, turbines, and other structures would be chosen in an attempt to avoid placing them near unstable areas. Excavation at the Materials Source as described in the Mining Plan of Operations and the Detrital Wash Pit Mine Plan of Operations to reduce grades would minimize the amount of disturbance associated with obtaining borrow material and help maintain slope stability.

4.3.7 Unavoidable Adverse Impacts

Construction at the Project site would likely result in several unavoidable adverse impacts. Road grading and foundation excavation would have the highest short- and long-term impacts during the construction phase while the abandonment of turbine foundations would likely impact the site after decommissioning. Under all action alternatives, impacts on geological resources could result from surface and subsurface disturbing activities. Both surface and subsurface geology could be fractured or destroyed in areas where Project construction activities disturb bedrock such as coring, trenching, blasting, clearing, and grading. Blasting, coring, and trenching would locally fracture and permanently alter bedrock resulting in minor irreversible and irretrievable impacts on geology and surficial water flow. The type and extent of bedrock disturbance would be different for each of the Project features and site-specific conditions. Each action alternative would have the potential to impact geology on all, or portions of areas associated with the construction each Project feature.

Though unlikely, access to mineral resources discovered within the Project footprint could be restricted until decommissioning. The ability to mine any future discoveries could be hampered by the presence of turbines and related power transmission lines. Future possible mining activities would be precluded for two years by the segregation notice published in the March 2, 2012 Federal Register, and preceded by and subject to the operation of the Project.

4.4 WATER RESOURCES

This section describes the potential effects on water quality, water supplies, and the physical characteristics of water features. Information on existing water resource conditions from Section 3.4 of this EIS was used as a baseline to identify and quantify potential impacts associated with each alternative. The analysis area for water resources is defined in Section 3.4 as the three regional watersheds; the Lower

Detrital Wash, Middle Detrital Wash, and Trail Rapids Wash-Lower Colorado River (see Map 3-5, Water Resources).

Water resource issues relevant to the Project were identified through the agency and public scoping process. These issues include the potential for sedimentation and increases in salinity in tributaries to the Colorado River; modification to the hydrologic system by decreasing infiltration and increasing storm water runoff; consumptive water use during Project construction and operation; potential impacts to wells, wetlands and floodplains; and potential for water quality impacts due to accidental spills of fuels or hazardous substances.

4.4.1 Analysis Methods

The water resources assessment for the Project was based on a review of data gathered from the POD (BP Wind Energy 2011a), Mining Plan of Operations (Barr 2011), Preliminary Jurisdictional Delineation Report (EcoPlan 2011), and regulatory agencies including ADWR, Arizona Department of Environmental Quality (ADEQ), and the U.S. Army Corps of Engineers (USACE). The POD provided information on the Project design and configuration that was used to evaluate the location and magnitude of potential impacts on water resource. The Mining Plan of Operations provided information on anticipated mining activities at the Materials Source. Specific information from the Mine Plan that was incorporated into the analysis included production water quantities for concrete mixing and dust control, as well as reclamation procedures that would be implemented by BP Wind Energy after mining was completed. As the potential impacts on water resources, including quality and quantity, are not often directly measurable, the impact analyses have been based on indicators that can be measured. For example, storm water runoff may vary in quantity or quality during Project construction, but such a change is not quantifiable at this time; however, the acres of surface disturbance serves as a way to measure the changes in water quality in downgradient washes. Table 4-3 lists the indicators and approach to address these types of potential impacts on water resources.

Table 4-3 Approach to Evaluation of Water Resources

Type of Impact	Indicator	How Is This Measured?
Physical impacts on surface water features	Physical changes to an existing surface water feature, including but not limited to streams that meet the definition of a Water of the U.S. ("jurisdictional waters" that include ephemeral washes)	Acres of surface disturbance with the potential to affect jurisdictional and non-jurisdictional waters
Changes in quality or quantity of storm water flow	Changes to water quality in downgradient washes due to sediment transport	Acres of surface disturbance
Impact on flooding potential	Changes to projected frequency, extent, and duration of flooding	Increased impervious surfaces in the Project Area, presence of facilities within a floodplain, and proximity of surface disturbance to water features
Impact on surface water or groundwater quality	Potential for spills and leaks that might impact water quality	Presence of equipment, fuels, or hazardous materials on site, and proximity of these materials to wells or surface water features
Impact on groundwater supply	Decreased groundwater in storage beneath the site	Amount of groundwater required for construction and operation relative to total groundwater currently in storage and existing groundwater demands

In order to compare effects associated with the alternatives, these indicators were considered both independently and in conjunction with one another. BMPs or mitigation measures that would reduce potential impacts are described in Section 4.4.6.

Temporary disturbance areas refer to those areas impacted only during construction activities, such as lay-down areas for construction supplies. Long-term disturbance areas refer to areas with aboveground structures or that would otherwise be impacted consistently during operation of the Project. A key assumption in this analysis is that temporary water requirements for construction would be met using three existing off-site water wells at the Materials Source, and that longer-term water requirements throughout operation of the Project would be met via a water well developed near the O&M building with a pumping capacity comparable to a residential use well.

4.4.2 Alternative A – Proposed Action

4.4.2.1 Construction (Surface Water Impacts)

Construction of Alternative A would cause temporary and potentially permanent impacts on the physical nature of the unnamed washes running through the site due to constructing access roads, grading, and placement of foundations for turbines. It is possible that up to 74 miles (93.839 acres) of jurisdictional waters could be affected by construction of the Project, based on the preliminary jurisdictional delineation within the Project Area (detailed maps are provided in the jurisdictional delineation prepared by EcoPlan 2011). However, when the final technology and turbine locations are identified, it is expected that the actual disturbance of jurisdictional waters would be less because BP Wind Energy would avoid to the extent possible jurisdictional waters when siting turbine locations (EcoPlan 2011). Residual impacts on jurisdictional waters would be mitigated through the implementation of BMPs and mitigation measures as described in Section 4.4.6. BP Wind Energy intends to comply with the conditions of the USACE Nationwide Permit 51 to avoid the necessity of submitting a pre-construction notification, which requires impacts of less than 0.1 acre to any single jurisdictional water. Prior to any construction activities, the USACE would conduct a review of potential impacts on jurisdictional waters and the USACE may require additional mitigation measures, or determine that a permit is required for this Project in accordance with the Clean Water Act. As of December 2011, the Preliminary Jurisdictional Delineation Report had been reviewed by BLM and Reclamation and was pending submittal to USACE for a determination.

Construction activities that disturb the surface, such as clearing, grading, trenching, and excavation to build turbine foundations, could increase the potential for sediment erosion and transport by removing stabilizing vegetation and increasing runoff during storm events. Alternative A would have the largest surface disturbance footprint of the alternatives; as described in Table 2-7, about 1,474 acres would be temporarily disturbed during construction. The majority of this disturbance would occur within the Lower Detrital Wash watershed. Water quality in Detrital Wash and its tributaries may be degraded by the addition of suspended sediments or dissolved constituents in storm water. Water quality impacts are often associated with sediment eroded from road surfaces, road cuts, and fill-slopes into the drainage network. The sediment can include both coarse- and fine-grained material that affects channel substrates, surface water turbidity, and dissolved solids concentrations. Sediment eroded into ephemeral tributaries of Detrital Wash would be flushed downstream during storm events and flash flooding, and could indirectly increase the influx of sediment into Lake Mead.

Temporary construction facilities, such as laydown/staging areas or concrete batch plants, would remain a source of eroded sediment until the disturbance area has been successfully reclaimed. Successful reclamation may require several growing seasons given the arid climate of the Project Area. This could prolong water quality impacts from increased sediment deposition in ephemeral washes. However, impacts would be mitigated by retaining cut vegetation and spreading it as mulch during reclamation to promote seed growth and help control erosion, and other erosion control measures as would be designated in the SWPPP.

Indirect surface water impacts could also occur from physical disturbance during construction and maintenance next to ephemeral washes that carry occasional, storm-related surface water. The delivery of sediment to washes would be expedited near roadways or where an insufficient buffer exists between cross-drainage outlets and the wash channels. Roadside ditches and road surfaces provide a direct conduit to streams for the transport of sediment and other pollutants that may be attached to or washed from the road surface by runoff. Locations where roads and water or drainage features intersect, or are in close proximity to one another, create areas of potential concern. The possibility for these types of impacts may be limited by low precipitation levels in the area, but may be greater in areas with more pronounced slopes. Mitigation of construction activities near named washes, such as Trail Rapids Wash, would be particularly important to ensure activities upstream (in the Project Area) do not indirectly affect water quality downstream. These impacts would be mitigated through the implementation of BMPs and measures listed in Section 4.4.6, including sedimentation and erosion control measures. These standards are mandated by the Arizona Administrative Code (A.A.C.) Title 18, Chapter 11, and enforced by ADEQ.

Floodplain impacts are not anticipated from the wind turbines under Alternative A because no turbines or associated facilities would be constructed within 1 mile of a mapped 100-year floodplain. However, materials for Project construction that are sourced from the existing Materials Source would impact the floodplain of Detrital Wash in Section 23, Township 28 North, Range 21 West. Much of the southern portion of Section 23 has been previously mined; it is anticipated that new mining activity would expand the mine to the north. Floodplain impacts would occur as sand and gravel is excavated from the banks and channel of Detrital Wash. The excavations would temporarily decrease the floodplain capacity of the wash by widening and deepening the stream channel. To process aggregate, BP Wind Energy would utilize the existing processing area, which is outside the limits of any wash or stream (Barr 2011). No permanent aboveground structures would be constructed in the Detrital Wash floodplain.

Following Project construction, areas of the Materials Source that have been affected by the Project would be reclaimed in accordance with the competitive sale permit from BLM to extract materials from the quarry, which could include removing mining and processing equipment, re-contouring the processing and parking areas, replacing overburden over the flatter portions of the site, and reseeding with the required seed mix. These reclamation practices would help avoid long-term floodplain impacts by returning the stream bed and banks of Detrital Wash back to their existing baseline condition.

Potential spills and leaks during construction and operation could occur due to the use of vehicles and motorized equipment. A SWPPP and a Spill Prevention, Control, and Countermeasures (SPCC) Plan would be prepared for the Project in compliance with applicable regulations. Successful implementation of these plans would help prevent surface water quality impacts from accidental spills of fuels and other chemicals.

4.4.2.2 Operations and Maintenance (Surface Water Impacts)

After construction and associated mitigation is complete, about 339 acres of permanent ground disturbance would remain under Alternative A. Operations and maintenance activities could increase sediment production by eroding surficial sediments that are easily transported by runoff and surface water flow. Increased sediment production could indirectly affect water quality in downstream ephemeral washes. Routine road maintenance would include grading and filling of ruts as necessary to maintain road usability. However, road maintenance could also temporarily increase erosion rates by renewing the supply of loose sediment on the road surface.

4.4.2.3 Decommissioning (Surface Water Impacts)

The potential impacts from decommissioning the Project would be similar to the construction phase, but the effects on surface water could be less if turbine foundations remain in place. Ground disturbed to remove aboveground structures, turbine foundations, and other Project facilities could contribute to sediment erosion and sedimentation until reclamation effects have stabilized the disturbed areas.

4.4.2.4 Construction (Groundwater Impacts)

Water requirements for Project construction would be met using groundwater from three off-site wells at the Materials Source located along the access road from US 93. The wells, located on BLM-administered land near the Materials Source, are permitted for industrial withdrawals. Groundwater from these wells would support operation of the mine, provide batching water for concrete production, and be used for dust suppression. One of the wells, registration number 531378, has a permitted pumping rate of 60 gallons per minute. This well alone should be sufficient to meet most of BP Wind Energy's daily water needs during construction. Any water demands that surpass what well 531378 supplies would be met using the other permitted industrial water supply wells at the Materials Source.

As described in BP Wind Energy's Mining Plan of Operations (Barr 2011), approximately 25,000 gallons of water per day would be needed for mixing concrete at peak production. The batch plant would also require up to 1,500 gallons per hour to support operations such as truck washing and hydrating aggregate prior to mixing. These additional uses could consume between 3,000 and 15,000 gallons of water per day (assuming a maximum 10 hour work day); thus, it is expected that average daily water use at the batch plant would range from 28,000 to 40,000 gallons. The concrete batch plant would be operated five days a week for approximately 25 weeks, depending on the period of wind turbine foundation and facilities construction (Barr 2011). Total water use requirements for the batch plant are presented in Table 4-4 based on the 40,000 gallon daily water use estimate. As shown in the table, cumulative water use to support the batch plant may be as much as 5.0 million gallons (15.3 acre-feet) over the life of the plant.

Table 4-4 Estimated Water Use during Project Construction

	Water Use			Total	
Activity	**Daily Requirement (gal)**	**Weekly Requirement (gal)**	**Duration (weeks)**	**gal**	**acre-ft**
Mixing concrete	25,000	125,000	25	3,125,000	9.6
Truck washing, hydrating aggregate	15,000	75,000	25	1,875,000	5.8
Subtotal	**40,000**	**200,000**	**---**	**5,000,000**	**15.3**
Dust Suppression	100,000	500,000	39	19,500,000	59.8
Grand Total	**140,000**	**700,000**	**---**	**24,500,000**	**75.2**

NOTES: gal = gallons, ft = feet
Calculation assumes a 10-hour work day and 5-day work week.
The sum of individual quantities may not match reported totals exactly due to rounding.

The groundwater wells at the Materials Source would also supply water for dust suppression during Project construction at an estimated rate of 100,000 gallons per day, five days a week, for 39 weeks (Barr 2011). This equates to a total usage of 19.5 million gallons of water, or 59.8 acre-feet (Table 4-4). Combined water use for the batch plant and dust suppression would therefore reach approximately 75.2 acre-feet during construction.

While water would be used to suppress dust in most cases, palliatives pre-approved by BLM and/or Reclamation may potentially be used in high-traffic areas. Palliatives that have the potential to effect water quality, such as magnesium chloride, would not be used.

Currently, the Detrital Valley Basin-Fill aquifer is in a steady state condition, with the amount of recharge that occurs in mountain front areas approximately equal to the amount of groundwater discharging to Lake Mead. Both recharge and discharge fluxes have been estimated at 1,400 acre-feet per year (Garner and Truini 2011). The one-time construction water use for this Project of 75.2 acre-feet could be supplied by either capturing natural recharge, capturing natural discharge, or by removing groundwater from storage. However, groundwater storage appears to be the most likely source to meet construction water demands because the Project water supply wells are located in the central valley area (Township 28 North, Range 21 West), several miles from the mountain fronts where recharge occurs, and at least 17 miles from the springs and discharge areas along Lake Mead (see Map 3-5).

As described in Section 3.4.3.5, the Basin-Fill aquifer contains an estimated 239,000 to 637,000 acre-feet of potentially recoverable groundwater in the township and range where the existing Project water supply wells are located. If it is conservatively assumed that groundwater storage in this township is closer to the low end of this range, total pumping withdrawals for dust control and concrete production represent approximately 0.03 percent of recoverable groundwater. This percentage of depletion is unlikely to affect the overall groundwater supply, and would be replenished over time by natural groundwater recharge. The annual aquifer recharge rate (1,400 acre-feet per year) is 18 times higher than estimated construction water use, suggesting that the aquifer would be replenished quickly, and would remain in a near-steady state condition during Project construction. Other groundwater uses would not be impacted by the Project because there are few groundwater demands in Detrital Valley. According to two recent studies, current pumping in the Detrital Valley Basin is comparable to historic pumping, with municipal use averaging less than 300 acre-feet per year in the entire valley during the years 2001-2005 and 2007-2008 (ADWR 2009; Garner and Truini 2011). There are currently no recorded industrial or agricultural water demands in the basin.

Groundwater quality beneath the site could be impacted by spills and leaks during construction due to the use of vehicles and motorized equipment. The SPCC Plan developed for the Project would help mitigate groundwater impacts from accidental spills. In the event that a spill went undetected, potential groundwater quality impacts could also be avoided due to the relatively deep water table. A map presented by Anning et al. (2007) shows water levels for several wells near the Project site in Township 28 North, Range 19-21 West. In 2006, the shallowest depth to water recorded at this subset of wells was 160 feet below ground surface. Thus, if any chemicals are spilled and remain undetected for some period of time, they are unlikely to infiltrate the full distance to groundwater without encountering clay or another fine-grained layer that would impede further vertical migration. Spilled chemicals would also disperse, degrade, and/or volatilize to some extent along the long migration pathway. The treatment of spills, including chemicals, is discussed in detail in Section 4.13.

4.4.2.5 Operations and Maintenance (Groundwater Impacts)

Potable water would also be needed throughout the life of the Project to support drinking water and sanitation needs for employees at the O&M building. It is anticipated that a well would be installed near the O&M building that would be comparable to a well for residential use. Groundwater would be pumped from this well at an estimated rate of 100 gallons per day or 36,500 gallons (0.1 acre-feet) per year.

4.4.2.6 Decommissioning (Groundwater Impacts)

Water usage for decommissioning would be similar to the amount of water used for dust suppression during construction (Table 4-4). An appropriate source of water would be identified in coordination with

BLM and Reclamation during planning for the decommissioning process because available sources may change by the time the Project is decommissioned.

4.4.2.7 Project Options

The options for transmission line interconnection locations could influence water resource impacts if ground disturbance results in changes to sediment transport that affect water quality. The primary distinction between the transmission line options is the amount of temporary and long-term ground disturbance. Connection to the 500-kilovolt (kV) Mead-Phoenix line would require approximately 37 acres of construction-related disturbance for the switchyard. This temporary disturbance area is approximately three times greater than the anticipated temporary disturbance needed for switchyard interconnection to the 345-kV Liberty-Mead line (12 acres). The larger area of the Mead-Phoenix line switchyard could result in a greater potential for indirect water quality impacts from increased sediment loads in ephemeral washes during construction. These impacts would be temporary and would subside once the switchyard was constructed and any land not needed for operation of the facility was successfully reclaimed. After reclamation and mitigation, the Mead-Phoenix and Liberty Mead options would result in 31 and 8 acres of long-term surface disturbance, respectively. Surface disturbance-related impacts (as described above under *Surface Water Impacts*) resulting from the construction of the on-site transmission line to connect the switchyard to the mainline would be the same regardless of the transmission option selected.

With Alternative A, it is anticipated that a portion of the collector lines would be installed overhead on support structures versus burying all the collector lines in trenches; however, both options would be feasible. Any reduction in the amount of trenching would slightly reduce overall indirect water quality-related impacts.

4.4.3 <u>Alternative B</u>

4.4.3.1 Construction (Surface Water Impacts)

Compared to Alternative A, Alternative B would eliminate two wind turbine corridors on the north end, one corridor on the south end, and four corridors along the northwestern part of the Wind Farm Site. In addition, eight corridors on the eastern side of the Project site would be shortened to minimize the proximity of turbines to private property that may potentially be developed for residential use. About 1,186 acres of temporary, construction-related ground disturbance and 280 acres of long-term ground disturbance would be anticipated under Alternative B. This reduction in the Wind Farm Site footprint compared to Alternative A (1,474 acres of temporary and 339 acres of long-term ground disturbance) would decrease direct construction-related impacts to ephemeral washes. Locally, the smaller temporary disturbance area under Alternative B would reduce the amount of erosion and excess runoff caused by the Project, helping to limit surface water quality impacts from eroded sediment.

Surface water impacts from roads crossing wash or drainage channels would decrease compared to Alternative A since fewer miles of access roads would be constructed with the lower number of wind turbine corridors. The potential to impact jurisdictional waters would be similar to Alternative A, although the smaller development area associated with Alternative B would avoid jurisdictional waters in areas where turbines would not be constructed. In addition, potential water quality impacts from accidental spills would be reduced or eliminated where the Project Area footprint has been scaled back.

4.4.3.2 Operations and Maintenance (Surface Water Impacts)

Surface water impacts from operations and maintenance of the wind farm facility would be similar to Alternative A. However, the long-term disturbance area would be roughly 17 percent less than for

Alternative A so there would be fewer Project features influencing surface water drainage patterns with Alternative B.

4.4.3.3 Decommissioning (Surface Water Impacts)

The smaller Wind Farm Site associated with Alternative B would result in fewer turbines and access roads to remove and reclaim when the Project is decommissioned. Therefore, temporary disturbance and short-term, indirect effects on water quality from storm-water runoff would be less than with Alternative A. However, following reclamation, the long-term effects of decommissioning would be comparable to Alternative A.

4.4.3.4 Construction (Groundwater Impacts)

Under Alternative B, impacts on groundwater would be reduced compared to Alternative A. Less groundwater would need to be pumped for the concrete batch plant because approximately 25 percent fewer wind turbine foundations would be constructed (153 to 208 turbines for Alternative B vs. 203 to 283 turbines for Alternative A). With fewer access roads needed, groundwater requirements for dust suppression also would be reduced. If it is assumed that water usage requirements during Project construction would be approximately 25 percent less than Alternative A due to the reduction in wind turbines and access road lengths, total water usage under Alternative B would be around 56.4 acre-feet. This value represents approximately 0.02 percent of the total groundwater available in storage in the township and range where the planned water supply wells are located.

Although Alternative B would have a smaller footprint, the potential for accidental spills to contaminate groundwater would be similar to the other Project alternatives. Measures to prevent and respond to spills would be implemented for all Project alternatives. The relatively deep water table beneath the site also suggests that, in the event that a spill remains undetected for some period of time, the Project would have a low probability of impacting groundwater quality.

4.4.3.5 Operations and Maintenance (Groundwater Impacts)

Groundwater needs for operations and maintenance would be the same as for Alternative A.

4.4.3.6 Decommissioning (Groundwater Impacts)

Water needed for dust suppression during the decommissioning phase would be expected to be about 25 percent less than with Alternative A because the Project would be smaller and have fewer features to remove. The water source would be determined in coordination with BLM and Reclamation during the decommissioning phase of the Project.

4.4.3.7 Project Options

Impacts from the Project options would be the same as Alternative A.

4.4.4 <u>Alternative C</u>

4.4.4.1 Surface Water Impacts

There are few practical differences in water resource impacts between Alternatives C and B. The total number of planned wind turbines (up to 208) would be the same, and the overall Project footprint would also be similar. The main difference between the two alternatives is the distribution of development. However, direct and indirect construction-related impacts to ephemeral channels would still be similar to Alternative B.

Aside from redistributing impacts, other surface water effects related to construction, operation, and maintenance of the Project would be the same as Alternative B.

4.4.4.2 Groundwater Impacts

Groundwater impacts from construction, operation, and maintenance of the Project are expected to be the same as Alternative B.

Project Options

Impacts from the Project options would be the same as Alternative A.

4.4.5 Alternative D – No Action

Hydrology, water quality, and water supplies would be not be impacted by Project construction, operation, or decommissioning activities under the No Action Alternative. The primary actions and features that are currently affecting water quality and hydrology within the area are wash crossings, motorized vehicle use, livestock use, wildfire, roads, and other surface disturbing activities. Existing hydrologic processes including erosion and sedimentation would continue to occur from these actions and features. As described in Chapter 3, the natural condition of the site is erosive and natural erosion would continue under this alternative and the action alternatives. However there is no data estimating the amount of natural erosion.

4.4.6 Mitigation Measures

The objective of mitigation measures is to maintain the quality of waters presently in compliance with Federal and state water quality standards. Implementing and complying with the following required measures that are based on regulations would reduce impacts on water resources.

- Develop and implement a SPCC Plan that outlines procedures to prevent the release of hazardous substances into the environment, thereby avoiding water resource contamination. The SPCC Plan would include containment measures that would be implemented in areas where chemicals, fuel, and oil are stored. Spill response kits containing items such as absorbent pads would be located on equipment and in the on-site temporary storage facilities to respond to accidental spills.
- Prepare and implement a SWPPP to control sediment (expected to be the primary nonpoint source contaminant), and to manage the collection, conveyance, and/or storage of storm water runoff at the Project site.
- During operations, inspect site access roads monthly and after heavy rainfall events to identify and repair eroded areas or blocked culverts. This would help prevent degradation of road conditions that could contribute to stream sediment loading if left uncorrected.
- Obtain and comply with necessary permits in accordance with the Clean Water Act Section 404 (dredge and fill) and Section 401 (water quality) from the USACE.
- Comply with all Federal and state laws related to control and abatement of water pollution. All waste material and sewage from construction activities or Project-related features would be disposed of according to Federal and state pollution-control regulations including the Clean Water Act, Arizona Surface Water Quality Standards (AAC Section R18-11-107) and Aquifer Water Quality Standards.
- Control erosion per the Reclamation Plan that would accompany the complete POD.

4.4.7 Unavoidable Adverse Impacts

The mitigation measures described in Section 4.4.6 would help prevent and/or lessen many of the potential surface water and groundwater impacts associated with the Project. However, some potentially adverse effects would be unavoidable, particularly modifications to the natural surface drainage network and removal of groundwater from storage. The drainage network may be modified by grading the site to divert storm-water flow away from ephemeral washes, or by re-routing drainage channels through culverts at road crossings. These modifications could alter peak flow dynamics and change the way sediment is transported through the surface water system, ultimately affecting water quality.

Groundwater pumping for Project construction activities would remove up to about 75 acre-feet from storage in the Basin-Fill aquifer of the Detrital Valley. These withdrawals would be irretrievable since they would either be used for consumptive purposes, such as mixing concrete, or would be applied for dust control and lost to evapotranspiration. Projected withdrawals represent a very small portion (0.03 percent) of potentially recoverable groundwater in the township where the pumping wells are located. The pumping withdrawals would be replenished over time by natural recharge that occurs in mountain-front areas. As such, the consequences of this impact on the Detrital Valley Basin-Fill aquifer would be nearly imperceptible.

4.5 BIOLOGICAL RESOURCES

This section describes the potential effects on biological resources within the Project Area, including local resident species and species that may temporarily use the Project Area during migration or during some seasons of the year. Information on existing biological resources from Section 3.5 of this EIS was used as a baseline to identify and quantify potential impacts associated with each alternative. The analysis area for biological resources is defined as the Project Area, with the exception of raptors which is the Project Area plus a 10-mile radius around the Project Area.

4.5.1 Methods

Assumptions

The impact assessments for biological resources assume that construction of the proposed Project would involve heavy construction equipment, traffic, excavation, trenching, noise, airborne particulate matter, detonation of explosives (blasting), and vibration. Operation or maintenance activities would involve short-term site visits by employees in the turbine area, possible repair of the turbines with cranes, and regular work at the O&M building. The operational duration of the Project would be about 30 years. Decommissioning of the Project would involve construction equipment, traffic, noise and vibration, re-grading, and demolition activities. This analysis also assumes the following description of wind power Project functions:

- Wind speeds are variable across the landscape.
- Each turbine moves independently of the others, according to the wind speed and direction at its location.
- An observer would normally see that some turbines are turning and others are not turning at any given time.
- Rarely would all the turbines be generating at full capacity or turning at the same rate. Thus, it is difficult to predict at what time, speed, duration of, and how long any one turbine would be turning.

Assessment

The impact assessment was based on baseline field surveys for biological resources that were conducted between 2007 and 2011, published literature, and electronic records review through the USGS National Gap Analysis Program (Southwest ReGAP), AGFD, and USFWS. The biological resource surveys provided presence/absence data for general plant and wildlife species and quantified use estimates and relative abundance data to estimate the impacts for species with known concerns relative to wind energy facilities. These detailed surveys included surveys for bats, migratory birds, nesting raptors, and golden eagles. Electronic agency records from AGFD and USFWS provided non-specific locality data, though allowed for a qualitative estimate of the potential impacts on sensitive resources or special status species. Acres of vegetation removal were derived from the acreages of disturbance found in Table 2-7. Facility features were then mapped and combined with Southwest ReGAP data, which were used to estimate acreages of vegetation and land cover types disturbed in the Project Area. Based on these aggregated data, analyses were conducted based on proportions and the likelihood of disturbance from siting the turbines to estimate the proportional impacts on resources within the turbine corridors; however, where possible, direct impacts on resources have been analyzed where Project features and resource data are available.

The impact analysis assumes that the study area is in an environment chronically disturbed with human activity, noise, roads, invasive plant species, and a variety of recreational pursuits in the region. Impacts from the Project are not easy to discriminate from the background disturbance, particularly when these involve behavioral responses of wildlife. In some situations different species or individuals within a species may be more sensitive or less sensitive depending on the type of stimulus. Despite this problem, impacts are discussed in the context of the specific literature to the type of impact, which would be similar to the types of disturbances related to the Project.

Other assumptions to the analysis presume that reclamation would meet success criteria for restoration of plant communities, which would be defined in the Reclamation Plan and would be approved by BLM and Reclamation. Construction would not be complete until the regulatory agencies acknowledge that restoration was complete under the approved success criteria. Also weed control measures would be effective at controlling the spread of noxious weeds or invasive plants so that any establishment of these remains local and short-term. The impact analyses for the Project alternatives are described in the following sections.

Indicators of Project impacts on biological resources that were considered in the analysis include:

- Decline in the quality or quantity of habitat for wildlife or plants
- Reduction of plant or animal populations below a level needed to sustain itself
- Establishment or expansion of noxious weeds or introduced plants
- Reduction of a special status species, bat, raptor, or migratory bird population
- Obstruction of the movement of any resident or migratory wildlife species
- Change to the return interval and severity of wildland fire (fire regime or condition class)
- Disruption of normal animal behavior due to noise or other human activity

The magnitude of impacts was based on the following criteria:

- **Minor:** The effect on an indicator is detectable but not readily apparent or strong enough to change an indicator substantially.

- **Moderate:** The effect on an indicator is apparent. Project activities could change the indicator over a small area or to a lesser degree.
- **Major:** The effect on an indicator is large and highly noticeable. Project activities that result in major effects would change over a large area or to a large degree.

The types of impacts were categorized as direct or indirect, defined as:

- **Direct** impacts occur at the time and place of a disturbance or project activity.
- **Indirect** impacts are those that occur later in time or space from a project activity.

In many situations a project activity may have direct impacts in the short-term but indirect impacts that persist in the long-term. With wildlife, project-related noise from vehicles may initiate a direct behavioral change in the short-term but chronic noise from wind turbines may lead to indirect impacts that persist in the long-term, such as lost breeding opportunities, smaller populations, or fewer species in the vicinity of wind turbines. In some circumstances there is no clear-cut point at which short-term or direct impacts would become long-term or indirect ones. To the extent possible, the duration and type of impact are described in the impacts analysis.

4.5.2 Alternative A – Proposed Action

4.5.2.1 Vegetation and Land Cover Types

Construction

Installation of facilities would result in removal of approximately 561 acres of vegetation, with the greatest direct loss of vegetation occurring in Sonoran-Mojave creosotebush-white bursage desert scrub (creosotebush desert scrub) (Table 4-5). However, this is the most abundant vegetation community in the Project Area. Post-construction reclamation would include revegetation of most of the disturbed land surrounding the turbines, which would result in long-term loss of approximately 17 acres of vegetation altogether (Table 4-5). After reclamation of disturbed areas, long-term recovery to pre-disturbance plant cover and biomass would take decades (Abella 2010). Mohave Desert plant communities can take 50 to 300 years for natural recovery due to unpredictable precipitation in this environment (Lovich and Bainbridge 1999), but revegetation improves the possibility of success and shortens the recovery period (Abella et al. 2007). For comparison, vegetation disturbances left to recover naturally are still apparent in creosote desert scrub used for World War II training near Yuma, Arizona (Kade and Warren 2002).

The other components of the Project would have the short-term direct impact of removing an additional 913 acres (a total of 1,474 acres for the Project) after construction and would predominantly impact creosotebush desert scrub (Table 4-5). The long-term disturbance from these other components would reduce to 322 acres (a total of 339 acres for the Project) after post-construction revegetation. The recovery period to pre-disturbance plant cover and biomass would be long-term. The types of disturbed vegetation associated with new access roads and the met towers cannot be determined because final siting is not complete (Table 4-5). However, these could be sited all or mostly in creosotebush desert scrub.

Table 4-5 Potential Vegetation Impacts from Project Features, Alternative A

Project Feature	Affected Vegetation or Land Cover Type	Short-term Disturbance (Acres)	Long-Term Disturbance (Acres)
Wind Turbines	Inter-Mountain Basins Big Sagebrush Shrubland	0.1	< 0.1
	Inter-Mountain Basins Semi-Desert Shrub Steppe	0.8	< 0.1
	North American Warm Desert Bedrock Cliff and Outcrop	4.8	0.1
	North American Warm Desert Volcanic Rockland	16.7	0.5
	Mojave Mid-Elevation Mixed Desert Scrub	18.4	0.6
	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	520.2	15.8
	Turbine Totals	***561***	***17***
Two Temporary Laydown/Staging Areas	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	20	0
Two Substations	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	10	10
Transmission Line to Switchyard Interconnecting to Mead-Phoenix 500-kV line or Interconnecting to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	29	0.1
Switchyard for an interconnection to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	12	8
Switchyard for an interconnection to Mead-Phoenix 500-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	37	31
Operations and Maintenance Building and associated facilities such as parking	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	5	5
Improvements to Existing Roads, including collector line trenches and any utility or communication lines to the O&M building	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	20	0
Development of New Access Roads, including collector line, utility lines, communication lines, and crane paths	Undetermined	747	266
Temporary Met Towers (assumes 20 total, including potential pre-construction power curve testing temporary met towers, if required)	Undetermined	37	0
Permanent Met Towers (assumes up to 4)	Undetermined	3.3	1.6
	Total Disturbance	**1,474**	**339**

SOURCES: USGS National Gap Analysis Program (Southwest ReGAP) 2004, BP Wind Energy 2011a (Acreages from Southwest ReGAP were not field verified)

Fugitive dust generated during construction would deposit on plants adjacent to turbine sites and Project roads and could affect photosynthesis, respiration, transpiration, and reproduction (Farmer, 1993; Trombulak & Frissell, 2000). This could result in minor long-term changes to plant composition next to these areas. Dust suppression practices and reducing travel speed to 25 mph would lessen the impact, but watering to reduce fugitive dust could increase the likelihood of establishing or spreading noxious weeds and invasive plants along Project roads.

Soil compaction from heavy equipment and removal of topsoil for Project facilities, roads, and turbines would alter soil structure and function (Prose et al. 1987, Lei 2007). In the long-term, this could have the indirect impact of altering the ability of disturbed sites to support the original baseline vegetation after reclamation.

The option in which collector lines that run partly underground and partly above ground could provide flexibility in avoiding ground disturbances in some areas with sensitive plant resources and habitats. In those areas where these sensitive vegetation resources occur, the above-ground collector lines could span the sensitive resource area, where feasible, without disturbing it. The fully buried collector line option may create greater ground disturbance, although collector lines would be within disturbance areas for access roads, so differences between the two options may be minimal.

The short-term use of a small proportion of the groundwater in the area for construction (mixing concrete, dust control, etc.) would not result in any changes to vegetation.

The total direct short-term impact to vegetation would include 1,474 acres where plants would be cleared for construction, which is about 3 percent of the vegetation within the Project Area of Alternative A. Re-vegetation would restore all but about 339 acres in the long-term to reduce the direct impact. The recovery period to pre-disturbance plant cover and biomass would be long-term. Overall, the acres of vegetation removed would result in a moderate impact to vegetation that would reduce in the long-term as reclaimed vegetation develops. Indirect impacts on vegetation resources from proliferation of invasive plants and noxious weeds could occur in the disturbed areas; these impacts are described in a separate subsection.

Operations and Maintenance

Impacts associated with the operations and maintenance of Alternative A are not expected to result in any additional direct disturbance to vegetation and land cover types. About 339 acres of land disturbed during construction would continue to be in use and unavailable to support vegetation through the operational phase, while the remaining 1,135 acres of vegetation would be undergoing recovery after reclamation treatment. These disturbances from the construction phase would remain apparent in the long-term throughout this operations and maintenance phase. Travel along Project roads for facility maintenance would periodically generate small amounts of fugitive dust, which would be minor compared to the construction phase and would not likely affect adjacent plant community composition.

Decommissioning

Decommissioning of Alternative A would result in some redisturbance (vegetation removal, compaction of soil, fugitive dust) where turbines, facilities, utility and collector lines are removed and land that had been reclaimed and revegetated is disturbed in the process of removing the Project facilities.

Some decommissioning options could create more or less disturbance than others. Buried collector lines that are dug up and removed would create a larger disturbance than if these could be cut and pulled-out with minimal ground disturbance. Leaving collector lines in place would result in no additional ground disturbance and no additional disturbance to vegetation. Partial removal of the top portion of turbine foundations would create less surface disturbance to vegetation than complete removal. Removal of the O&M yard, substations, and switchyard would disturb the footprints of these areas but would allow the sites to be reclaimed and revegetated. Specific techniques for the removal of facilities would be planned to incorporate technologies available at the time of decommissioning and would be coordinated with the BLM, Reclamation, and Western. Following demolition and reclamation, the sites should resemble the original vegetation community at an early stage of ecological succession. The recovery of vegetation to pre-disturbance conditions after reclamation would remain as a long-term impact, in which plant composition and cover could deviate from baseline conditions for decades (Lovich and Bainbridge 1999). The reintroduced disturbance from decommissioning would be minor, because it is assumed that the impacted acres would be smaller than those impacted during the construction phase.

4.5.2.2 Noxious Weeds

Construction

Moving construction equipment onto the Project Area without it being washed and inspected would have the indirect impact of increasing the risk of introduction of noxious weeds and invasive plant species into the area. Development of the various Project features would disturb approximately 1,474 acres in the short-term, with long-term disturbance reduced to about 339 acres after post-construction revegetation that would be guided by provisions of the Reclamation Plan and Weed Management Plan that will accompany the complete POD. Disturbed ground would be prone to infestation by noxious weeds and invasive plant species that can degrade native vegetation communities (Brooks and Pyke 2001). Known problem species in the Project Area include Sahara mustard (*Brassica tournefortii*), which could proliferate in disturbed sandy areas, and red brome (*Bromus rubens*), cheat grass (*Bromus tectorum*), Mediterranean grass (*Schismus barbatus*), Malta star thistle (*Centaurea melitenis*), Russian thistle (*Salsola tragus*), and red-stem filaree (*Erodium cicutarium*), which have broad habitat adaptations and could proliferate throughout much of the disturbed area. The indirect impact of an increase of these species would lead to further indirect, long-term impacts that would degrade habitat for wildlife and increase the frequency and intensity of wildland fire in the Project Area.

Vehicle traffic into the Project Area could introduce seed or propagules of noxious weeds or invasive plant species. The construction period would have the greatest amount of truck travel, with an average of 150 one-way trips per day and a peak of 240 one-way trips per day from off-site locations into the Project Area. Personal vehicle travel could bring in these plant materials from a wide range of areas, depositing seeds or plant parts from the access point at US 93 to the laydown yard. Trucks delivering materials to the Project Area from a range of localities could travel along the internal routes and could introduce noxious weeds or invasive plant species throughout much of the Project Area. With successful mitigation to limit the introduction and spread of noxious weeds or invasive plant species during construction and post-construction reclamation in the short-term, the impacts would be moderate and localized during this phase of the Project.

Operations and Maintenance

The potential for the indirect impact of introducing and spreading noxious weeds would persist at a lower level in the long-term during the operation phase of the Project. Most travel into the area would occur between US 93 and the O&M building/yard. Trips would involve personal vehicles traveling to the work site and trucks delivering materials and removing solid wastes from the site. Plant materials introduced through these routes could spread farther into the Project Area by vehicles traveling along Project routes for maintenance activities. Maintaining standards to manage noxious weeds and invasive plant species throughout the life of the Project would help to limit the potential spread of these plants in the Project Area to maintain the impacts at a moderate level.

Decommissioning

The possibility of introducing and spreading noxious weeds and introduced plant species during the decommissioning period would be similar to that of the construction period. Personal vehicles and haul trucks would be the possible conveyances of plant material into the Project Area. Ground disturbance caused by removal of turbines and the other support infrastructure would create additional areas that would be vulnerable to infestation with invasive plants or noxious weed species. The additional impacts from re-disturbance and the potential to introduce or spread invasive plants or noxious weeds would be moderate with applied mitigation measures. Mitigation measures will be defined in a weed management plan to help to limit or prevent weed infestations during this phase of the Project.

4.5.2.3 Wildland Fire

Construction

Development of the Project would have the direct and indirect impact of altering the potential for wildland fires in the area. In the short-term, land clearing would have the direct impact of removing the fuel source on approximately 1,474 acres where vegetation is cleared for construction. In the long-term, as shrub-scrub vegetation returns after reclamation, the current fire regime (Regime IV: 35-100+ year frequency, stand replacement severity) would return. The time to recovery to post-disturbance plant composition and cover would require several decades, but re-vegetation would decrease the time and improve the likelihood of success (Abella et al. 2007). Weed management practices that are followed to conform to the weed management plan would control the spread of noxious weeds (an indirect impact) in the Project Area by maintaining discontinuous fuels, which would aid in retaining the current condition class (Class 2: fire regimes on these lands have been moderately altered from their historical range by either increased or decreased fire frequency; Section 3.5), and fire regime (Regime IV) outside of disturbed areas.

Increased human activity in the Project Area could have the direct impact of introducing a higher likelihood for ignitions that could increase the frequency of fire and could contribute toward altering the current fire regime (Regime IV). A potential source of ignition could come from running vehicles that park over dry vegetation, in which the catalytic converter contacts and starts an ignition. Another possible source would come from people who intentionally or unintentionally start fires in the area (e.g., smoking, welding sparks, or flames from torches). The risk of impact would change with the amount of traffic and activity. Traffic and human activity and the potential for human sourced ignitions would rise considerably in the short-term during construction.

During construction, changes to wildland fire would primarily occur in areas disturbed by development and construction of the wind facility, which is only about 3 percent of the total Project Area. Due to the small percentage of the affected area, but with the potential for invasive plant species and noxious weeds and wildland fire to affect areas outside the disturbance footprint, the overall impacts during this phase would be moderate.

Operations and Maintenance

Wildland fire management would not change with implementation of the Project. Suppression would remain the preferred method of management. The need for suppression would increase as a direct impact because of the addition of built structures in the Project Area, but new access roads in the Project Area could aid in suppression efforts of wildland fires that could ignite in the region. The direct impact of human sourced ignitions would decrease during operations and maintenance because the volume of human traffic in the area would be substantially less than during construction. Continuing to follow weed prevention measures during this phase would help to retain discontinuous fuels in the Project Area, which would help to retain the fire regime (Regime IV) and condition class (Class 2) in the long-term.

During operations and maintenance, impacts to wildland fire could affect areas outside the disturbance footprint. Impact levels largely hinge on controlling the establishment and spread of noxious weeds and invasive plant species. The known invasive plant species in the region are difficult to control and are major agents of intensifying wildland fires. With successful mitigation to limit the introduction and spread of noxious weeds or invasive plant species during construction and post-construction reclamation in the short-term, the long-term impacts would be moderate and localized during this phase of the Project.

Decommissioning

The additional impacts from re-disturbance during decommissioning would alter the potential for wildland fire by disrupting fuel sources and increasing the potential to introduce or spread invasive plants or noxious weeds. Revegetation or recovery of disturbed areas in the long-term would re-establish desert shrubland that has fuel types resembling the pre-disturbance condition. Long-term reclamation would be required for re-establishment of vegetation that resembles baseline cover and plant composition. Following the same measures as applied during the construction phase to limit ignition sources from vehicles or people would aid in retaining the current fire regime in the Project Area by maintaining the fire return frequency (35 to 100+ years). Continuing to follow weed prevention measures during this phase would help to retain discontinuous fuels in the Project Area, which would help to retain the fire regime (Regime IV) and condition class (Class 2) throughout the Project Area in the long-term. Impacts would remain moderate but depend on the ability to prevent or control noxious weeds and invasive plant species in the long-term.

4.5.2.4 Wildlife

Small Mammals

Construction

Although the body of knowledge on the effects of wind farms on bats and big game is growing, the effects on most mammals are poorly understood (Arnett et al. 2007). The main direct impact to terrestrial small mammals would occur from the long-term loss and fragmentation of habitat, which includes 1,474 acres where vegetation would be cleared for construction of Project facilities, turbines, and access roads. In the long-term revegetation would reestablish habitats that are similar to the existing conditions on all but about 339 acres that would be needed for Project facilities and operations. An indirect long-term impact from the development of the Project infrastructure could lead to reduced population densities of small mammals in the vicinity of infrastructure ranging from a few meters for small rodents and generally scaling in distance with body-size for larger species (Benítez-López 2010). Those species inhabiting creosote scrub in the Project Area would be affected the most, due to the Project primarily impacting this vegetation type (more than 1,400 acres). Project roads and turbines could impact 50 acres or less of rocky outcrops and mountainous habitats as well. Table 4-6 lists small mammal species potentially impacted in these habitats. With about 3 percent of the available habitat being degraded or lost to construction, the total impact would be minor to moderate.

Other impacts on small mammals could occur from the Project during construction. Individual mammals; primarily rodents, rabbits, and hares; could be injured or killed on a localized basis, a direct impact, when land is cleared for turbines, transmission lines, collector lines, switchyard, substations, laydown yard, and O&M facility or when vehicles travel in the Project Area. Weed infestations that could occur after land is disturbed, could have the indirect impact of degrading existing habitats and food resources for the small mammal species enumerated above. Some individual mammals could be trapped in trenches dug for buried collector lines, but mitigation measures to prevent entrapment would minimize or eliminate entrapment.

Impacts from vehicle collisions and entrapment would be minor due to few if any individuals harmed by these activities. Land clearing and weed infestations would have moderate impacts, because loss of individuals (clearing) or degradation of habitat (weeds) could be evident but not extensive throughout the Project Area, affecting about 3 percent of the available habitat.

Table 4-6 Small Mammal Species Affected by Project Development According to Habitat Type

Creosotebush Desert Scrub Species	
Desert shrew (*Notiosorex crawfordi*)	Desert pocket mouse (*Chaetodipus penicillatus*)
Desert cottontail (*Sylvilagus audubonii*)	Western harvest mouse (*Reithrodontomys megalotis*)
Black-tailed jackrabbit (*Lepus californicus*)	Cactus mouse (*Peromyscus eremicus*)
Harris' antelope ground squirrel (*Ammospermophilus harrisii*)	Southern grasshopper mouse (*Onychomys torridus*)
Round-tailed ground squirrel (*Spermophilus tereticaudus*)	Desert woodrat (*Neotoma devia*)
Botta's pocket gopher (*Thomomys bottae*)	Kit fox (*Vulpes macrotis*)
Arizona pocket mouse (*Perognathus ampulus*)	American badger (*Taxidea taxus*)
Rocky Outcrops or Mountainous Species	
Rock squirrel (*Spermophilus variegatus*)	Canyon mouse (*Peromyscus crinitus*)
Rock pocket mouse (*Chaetodipus intermedius*)	Ringtail (*Bassariscus astutus*)
Western white-throated wood rat (*Neotoma albigula*)	Cliff chipmunk (*Neotamias dorsalis*)

SOURCE: Hoffmeister 1986

Operations and Maintenance

Although not fully understood, the effects of chronic noise, an indirect impact from the operation of the turbines could mask communication, impede detection of predators, and increase vigilance behavior in small mammals (Barber et al. 2009). Some species may adapt to the ambient noise from the turbines, but, overall, the added noise in the environment could exacerbate the effects to habitat disturbance and human presence in the Project Area (Barber et al. 2009), which could add to the indirect impact of displacement of individuals in and near turbine corridors (Arnett et al. 2007). Species-specific impacts for the small mammal species that inhabit the Project Area are not available; impacts would be minor to moderate depending on the number of species that could be impacted and the total area of noise impacts.

Vehicles traveling within the Project Area could collide with small mammals (primarily rodents), during the operations and maintenance phase. The likelihood of collision would be minor due to fewer required trips into the Project Area compared to the construction phase.

Reclamation and revegation of disturbed areas would result in recovery of disturbed small mammal habitat in the long-term. During this period, small mammal diversity could increase in the reclaimed sites, with no apparent difference to undisturbed areas (Patten 1997) in the Project Area.

Decommissioning

The impacts on mammals during the decommissioning period would be similar to that of the construction period. Ground disturbance caused by removal of turbines and the other support infrastructure would create areas of degraded habitat that would be of marginal value until these areas recover or are revegetated. Revegetation efforts may take several decades (a long-term habitat impact) for structure and composition to resemble baseline conditions, due to the small amount of precipitation and slow growth rates of desert scrub. However, recovery of the mammal community could occur sooner than the plant community (Patten 1997).

Bats

Construction

Direct impacts on bats would occur during the construction process. Potential loss of foraging habitat (areas where bats hunt for insects or other prey items) would include 1,474 acres where vegetation would be cleared for construction. Species inhabiting or potentially inhabiting the Project Area, such as the pallid bat, big brown bat, spotted bat, and canyon bat have broad foraging habits (Western Bat Working Group (WBWG) 2005), could forage over the entire Project Area, and would experience loss of available foraging habitat across all disturbance areas, which is about 3 percent of the available habitat in the Project Area. The California myotis, California leaf-nosed bat, Townsend’s big eared bat, long-eared myotis, and cave myotis would likely concentrate their foraging along vegetated washes (WBWG 2005), which would experience little loss of available acreage (primarily where access roads cross washes). The greater western mastiff bat and Mexican free-tailed bat mostly forage at higher altitudes and longer distances (WBWG 2005) and would likely be unaffected by loss of vegetation in the Project Area. The big free-tailed bat may employ this same foraging strategy based on similar flight and wing-shape characteristics as the two other molossid bats. Although Allen’s big-eared bat roosts near the Project Area, the species likely forages at higher elevations in surrounding mountains (WBWG 2005) and not in the Project Area, and thus this bat species would not be affected by vegetation removal in the Project Area. The Yuma myotis, fringed myotis, little brown bat, and long-legged myotis are likely seasonal residents that would forage in association with ephemeral water sources. These species likely would be unaffected by vegetation removal due to the limited available habitat in the Project Area. The hoary bat, western red bat, and silver-haired bat are likely uncommon or rare seasonal migrants that move through the Project Area (WBWG 2005) and are not reliant on the vegetation, which lacks a forest or woodland structure. Re-vegetation would restore foraging habitats on all but about 339 long-term disturbed acres, but recovery to baseline conditions would take several decades.

Mine roost sites that were identified outside the Project boundary would not be impacted by the Project, but crevice roost sites in mountainous terrain in the vicinity (largely in the vicinity of Squaw Peak) could be disturbed if blasting for turbine foundations occurs near a roost site. Of the 20 possible species that utilize the study area, the hoary bat, little brown bat, western red bat, and silver-haired bat are the only bat species that do not roost in rock crevices (WBWG 2005). The remaining species utilize rock crevices for roosting to different degrees. The canyon bat, western mastiff bat, big free-tailed bat, and spotted bat utilize rock crevice roost sites to the greatest degree or exclusively (WBWG 2005) and would be the most affected species. The remaining 12 species primarily utilize mines, caves, trees, or other cavernous areas for roosts more often than crevice sites (WBWG 2005) and could be affected by blasting. However these 12 species are more adaptable in their roost preference, and would be impacted by blasting to a lesser degree.

Operations and Maintenance

During the operations phase, potential impacts would occur to bats that encounter turbines. Bats could be killed by colliding with wind turbines, by barotrama, or a combination of the two (Baerwald et al. 2008, Grodsky 2011, Cryan and Barclay 2009). Barotrauma is a condition in which the lungs of bats are fatally damaged from the negative pressure created around operating turbines (Baerwald et al. 2008). The causes of fatal interactions are poorly understood (Cryan and Barclay 2009), but observations indicate that migratory tree bats and free-tailed bats are most susceptible to wind-turbine fatalities due to their flight characteristics and foraging ecology (Arnett et al. 2008). Of the 11 bat species that Thompson et al. (2011) documented in the survey area as described in Section 3.5.2.1, all could occur within the study area, and these include species that are more susceptible to fatal interactions with wind turbines than others.

Of the 20 possible species that could occur in the Project Area, nine of these have been documented as fatalities at wind farms including the long-legged bat, little brown bat, western red bat, big brown bat, silver haired bat, Mexican free-tailed bat, western long-eared bat, hoary bat, and big free-tailed bat (Thompson et al. 2011). Based on flight characteristics and foraging ecology (Thompson et al. 2011); the Mexican free-tailed bat, big-free tailed bat, hoary bat, silver-haired bat, and possibly Allen's big-eared bat would be more susceptible to fatal interactions. Mexican free-tailed bats, big free-tailed bats, and western mastiff bats are vulnerable because their high foraging altitudes (WBWG 2005) include rotor swept heights of 77 to 492 feet (23.5 to 150 meters) above ground level. The big brown bat also is known to forage at higher altitudes that include the lower end of the rotor swept heights (Menzel et al. 2005), which also makes it somewhat vulnerable to fatal interactions. Of the species positively identified during baseline acoustic surveys for this Project, the western mastiff bat, Allen's big-eared bat, and big free-tailed bat were detected at raised survey stations within the rotor swept area, 162 feet (49 meters) above the ground (Thompson et al. 2011). The hoary bat, silver-haired bat, and western red-bat are species of migratory tree bats that are among the most common group of bats with wind turbines fatalities (Arnett et al. 2008). The bats previously described as foraging along wash habitats typically forage near the ground or at the height of the vegetation canopy (WBWG 2005). These species would have little susceptibility to fatal interactions with wind turbines. If the spotted bat were to occur in the Project Area, it also could be somewhat susceptible to turbine fatality. It is known to forage at heights ranging from 10 feet to 164 feet (3 meters to 50 meters) above the ground (Rodhouse et al. 2005). Based on the likely relative abundance and susceptibility, Mexican free-tailed bats could comprise the majority of fatalities associated with wind turbines in the Project Area (Thompson et al. 2011).

Based on use frequency data during the monitoring studies and statistical comparison to two other wind energy sites (the Dry Lake facility in Navajo County, Arizona and the Dillon facility in Riverside County, California), Thompson et al. (2011b) projected that this Project could result in between 2.17 (Dry Lake fatality rate) and 4.29 (Dillon fatality rate) bat fatalities/MW/year (1,085 to 2,149 bat deaths per year operating at a maximum of 500MW). However, preconstruction surveys that measure relative abundance are not reliably correlated to post-construction fatalities of other wind farm sites, because the factors that contribute to bat deaths at wind farms are complex, poorly understood, and can be site-specific (NWCC 2010). Therefore, the projected fatalities for this Project are only the best available estimates. The proportional effects on the bat species populations cannot be predicted with certainty, but turbine deaths do not seem to be a source of population decline at existing wind facilities. However, they could be as more facilities come on-line in the future (NWCC 2010). Post-construction monitoring will be necessary to quantify the actual turbine-related impacts on bats from this Project. Although the individual fatalities would be detectable and measureable, the population-level impacts from the Project are unknown but would be expected to be minor according to the best available scientific information.

For this Project, Thompson et al. (2011) also concluded that the fatality rate could be lower than projected, due to the spatial and temporal patterns of bats using the Project Area and the small incidence of migratory tree bat species that occurred during spring and fall migration (Thompson et al. 2011). The Project Area had peak bat use during the spring, and fatality rates are far less common during the spring and most common during the late summer and fall at most wind farm sites in the country (Thompson et al. 2011). Also the comparable wind farm, the Dillon facility in southern California, had a similar seasonal pattern and has a smaller fatality rate (2.17 fatalities/MW/year). Thompson et al. (2011b) also presented data that spatial use of the Project Area may not be even. Based on acoustic monitoring, about a quarter of all bat activity occurred on the west slope of the mountains near Squaw Peak. It is unknown whether or not fatalities would be higher or lower in this area, because there is no evidence to suggest particular turbine locations within a wind farm or within a string of turbines are more likely to cause fatalities than others.

Emerging evidence suggests that increasing the cut-in speeds (the wind speed at which blades begin to operate) of rotors during the night can lessen the possibility of bat fatalities with little impact to energy production (Baerwald et al. 2009). Low wind speed tends to correlate with higher bat activity and higher turbine-related deaths (NWCC 2010), but the underlying processes causing this pattern are poorly understood (Arnett et al. 2011). Experiments that have shown promising results include wind farms in Pennsylvania (Arnett et al. 2011, Arnett et al. 2009) and western Canada (Baerwald et al. 2009) and involve tree roosting species, some *Myotis* species, and the big brown bat. This type of mitigation could be applicable to the Mohave wind farm site due to the Project involving some of the same species. However, curtailment has not been investigated in the deserts of the Southwest where the overall composition of species and habitat are different from the investigation sites in Pennsylvania and western Canada. The applicability to the Project Area is unknown.

The noise generated from operating turbines could impede echolocation of bats (Schaub et al. 2008, Carr 2010), which could decrease foraging efficiency of resident bats in the Project Area. There is some evidence that background environmental noise can reduce the foraging efficiency and foraging success of bats (Schaub et al. 2008, Carr 2010). However, the magnitude of the impact of commercial scale turbine noise on foraging bats is unknown.

Decommissioning

The impacts on bats during the decommissioning period would be similar to that of the construction period. Ground disturbance caused by removal of turbines and the other support infrastructure would create additional areas that would reduce foraging opportunities until disturbed areas are revegetated. The impacted species would most likely include the pallid bat, big brown bat, spotted bat, and canyon bat because these species have broad foraging habitats and can forage throughout the Project Area. However, the re-disturbed land would be small compared to the total available in the Project Area. Crevice roost sites in mountainous terrain in the Project Area could be disturbed if partial or full removal of turbine foundations occurs near a roost site. Decommissioning turbine foundations in rocky outcrops and mountainous terrain during parts of the year when bats are scarce would minimize potential roost disturbances.

Big Game

Impacts on big game species would principally involve mule deer. Desert big horn sheep would be extremely rare or absent from the Project Area, because suitable habitat is limited or lacking. Pronghorn are uncommon in the Project Area, as would be mountain lions, due to their naturally large home range size and low population density (Armstrong et al. 2011). Impacts would be inconsequential to all big game species, since their use areas are large and the area of disturbance small at the scale they use the landscape. The impacts described in the following sections could apply to any of these species but focuses on impacts on mule deer.

Construction

Direct impacts on mule deer would occur during the construction process. Potential loss or degradation of habitat would include about 1,474 acres where vegetation in creosotebush desert scrub would be cleared for construction. Revegetation would reclaim foraging habitats on all but about 339 long-term disturbed acres. However, the revegetation process to baseline conditions for cover and plant composition could take decades (Arnett et al. 2007). Loss or modification of habitat for mule deer would be inconsequential because only about 3 percent of the available habitat for this common species in the Project Area would be impacted.

Indirect, behavior-related impacts on mule deer also would occur during construction of the Project. Vehicles traveling in the Project Area and noises from blasting and other construction actions could initiate alert or flight responses in mule deer. Noises and human activity also could lead to displacement of individuals, which could restrict movement and could result in larger avoidance areas and smaller populations in the Project Area (Arnett et al. 2007). Beyond this phase of the Project, mule deer could habituate to the higher noise and activity levels in the long-term. The degree to which these animals would adapt is uncertain (Barber et al. 2010), particularly because the Project Area already experiences noise and human activity from off-highway vehicle (OHV) use and other recreational activities to which they may have habituated. Behavior-related impacts would be moderate because the mule deer population may noticeably decrease during this phase of the Project due to avoidance.

Operations and Maintenance

The indirect behavior-related impacts on mule deer from human activity and vehicular traffic would likely decrease within the Project Area during the operations phase. Noise from turbines and avoidance of infrastructure could reduce the effective useable area of habitat for mule deer, but available data seem to suggest that mule deer and other large ungulates are not displaced in the long-term during the operations phase (Arnett et al. 2007). The impact would therefore be negligible, due to mule deer likely being pre-conditioned to other human and infrastructure disturbances in and near the Project Area.

Decommissioning

During the decommissioning phase, behavior-related impacts would continue, when noises and actions would be similar to those during the construction period. Decommissioning also would reintroduce ground disturbance that again would create ground disturbance impacts that would be similar to the construction phase.

Wild Burros

Construction

The extent to which wild burros utilize the Project Area is unknown; however, wild burros occur in the Black Mountains Habitat Management Area to the west of Project Area and could utilize the Project Area occasionally. Impacts on wild burros would be similar to the impacts on big game. Should burros utilize the Project Area, individuals could be temporarily displaced from the site with the influx of humans, vehicular traffic, heavy construction equipment, and blasting.

Operations and Maintenance

Burros may be less likely to utilize the Project Area because of the human activity, vehicular traffic, turbine movement, and the associated noise disturbance. However, the level of human activity would be less than during the construction or decommissioning phases and burros may habituate to the turbine movement and noise.

Decommissioning

The impacts on wild burros would be the same as during the construction phase.

Birds

Resident and Migratory Birds

Construction

Direct impacts on resident and migratory birds would occur during the construction process. Potential loss or degradation of habitat would include 1,474 acres where vegetation would be cleared for construction.

Revegetation would restore habitats on all but about 339 acres needed for Project features. These impacts would not impact all species equally due to differences in habitat use in the Project Area.

Behavior-related impacts on resident and migratory birds also would occur during construction of the Project. Vehicles traveling in the Project Area and noises from blasting and other construction actions could initiate alert or flight responses or interfere with vocal communication and breeding success. Noises and human activity also could lead to displacement of individuals of some species (Arnett et al. 2007). In the long-term resident and migratory birds could habituate to the higher noise and activity levels, but the degree to which these animals would adapt is uncertain (Barber et al. 2010).

Mortality of resident and migratory birds could occur during construction from multiple sources. Vehicles and construction equipment traveling in the Project Area could collide with birds that flush. However, the 25 mph speed limit would limit or eliminate such interactions. When land is cleared, nests, eggs, or nestlings could be crushed during the breeding season. However, preconstruction surveys could identify occupied nests, and clearing in the vicinity would be avoided to the extent possible until the resident birds fledge or the nest is abandoned or lost by natural means. Also, the impact could be avoided by limiting land clearing to the 7-month non-breeding season (roughly July 1 to February 1 [McCreedy et al. 2009]).

Operations and Maintenance

During the operations and maintenance phase, potential direct impacts would occur to resident and migratory birds that encounter turbines. Resident and migratory birds could be killed by colliding with wind turbines in operation, with stationary blades, or with the support structure (Arnett et al. 2007). Observations indicate that around half the reported fatalities at new generation wind power facilities are of nocturnally migrating birds, primarily passerines, and the other half are resident birds in the area (Arnett et al. 2007). The timing of fatalities at eight western and mid-western wind farms indicate that fatalities can occur in all months of the year but peak during spring and fall migration in some parts of the country (Arnett et al. 2007).

Thompson et al. (2011b) concluded that passerines made up a large proportion of the birds observed during the baseline studies and would be expected to make up the largest proportion of fatalities at this wind facility. The exposure risk for passerines and other small bird species was considered to be low, based on the bird exposure index, which is used as a relative measure of how often birds fly at heights similar to operating blades of modern wind turbines (Thompson et al. 2011). Only the northern rough-winged swallow (*Stelgidopteryx serripennis*) had an exposure index greater than zero (meaning the bird flight patterns may coincide with the rotor heights and making them more vulnerable to turbine collisions). This was the only small bird species that was observed flying within the rotor swept height (Thompson et al. 2011). It was observed twice and was observed both times flying at rotor swept height. The common raven (*Corvus corvax*) was the only non-raptor and non-passerine that had a exposure index greater than zero (0.07), with more than 86 percent of the observations occurring at rotor swept heights (Thompson et al. 2011). The exposure index was based primarily on observations of resident species, which are typically moving locally and flying at low altitudes, and does not likely capture the risk to nocturnal migrants, which typically fly at greater heights and are at risk when ascending and descending from nightly migration flights (USFWS 1998, Young et al. 2007 *cited in Thompson et al. 2011*). Thompson et al. (2011) concluded that it would be unlikely that non-raptor populations would be adversely affected by direct mortality from the operation of the wind energy facility; the impact would be minimal.

The Project Area is not a known migratory corridor and migrating passerines typically fly well above the turbine rotor sweep area except when landing or taking off (Thompson et al. 2011). Thompson et al. (2011) noted that their studies were not designed to detect nocturnal migrants, but their results indicated that the Project study area does not act as a significant stopover site for nocturnal migrants that would be at risk during takeoff and landing. A total of 15 potential migrant species were observed during baseline surveys with only the sage thrasher (27 total records) having more than three observations (Thompson et al. 2011). Possible migrant species represented only about 7.5 percent of the bird observations, and none had an exposure risk to operating turbines. Consequently, the risk of mortality to nocturnal migrants would be minor due to the infrequent use of the area and possible low exposure risk.

While nocturnal migrants may be attracted by the red aviation warning lights on the turbines and met towers, studies conducted by the University of Michigan indicate that flashing lights, which are proposed in the Project, reduce the attraction and collisions by 50 to 71 percent compared to steady red lights (Gehring et al. 2009). Kerlinger et al. (2010) showed that bird mortality within a wind farm was no different between wind turbines without night lighting and those with flashing night lighting. Consequently, the two color options for wind turbines that vary the number of lights in the wind farm would have a similar impact on nocturnal migrants.

Migratory birds and resident birds also could experience fatal interactions from collision with other man-made objects in the Project Area. The met towers, above ground collector lines (if used), substations and other facilities, and fences in the Project Area would increase the risk of fatal collisions. The Project option of burying all collector lines would slightly reduce the possibility of fatal collisions with other infrastructure. Any impact would be minimal to these species.

The noise generated from operating turbines could lead to the indirect impact of displacing birds or impeding local breeding of resident songbird species by masking courtship breeding songs (Barber et al. 2010). The magnitude of the impact is unknown (Arnett et al. 2007), but the effects would likely remain localized near turbine corridors and dissipate further from the corridors. Noise and human disturbance during maintenance activities could initiate flight responses and disrupt normal behavior in the short-term; however, these incidents would be periodic and would minimally affect bird behavior in the long-term operation of the facility.

Decommissioning

The impacts on migratory birds during the decommissioning period would be similar to that of the construction period. Ground disturbance caused by removal of turbines and the other support infrastructure would create additional areas that would slightly reduce the quality and quantity of habitat until disturbed areas are revegetated. Behavioral responses and reduced use of the facility could result from the increased noise and human disturbance during this period.

Raptors

Construction

Direct impacts on raptors (excluding golden eagles, which are discussed separately below) would occur during the construction process. Potential loss or degradation of habitat would include 1,474 acres potential foraging habitat, where vegetation would be cleared for construction. Revegetation would restore habitats on all but about 339 long-term disturbed acres, but recovery of prey in reclaimed areas would be long-term. This could reduce prey populations in the localized areas of disturbance and reduce local foraging efficiency. Consequently, raptors could be forced to forage over a larger area, but the literature suggests that avoidance or displacement would be uncommon (Arnett et al. 2007). Red-tailed hawk would be the most common raptor impacted, based on relative abundance documented during baseline surveys (Thompson et al. 2011). The overall impacts on habitat would be minimal.

Behavior-related impacts on raptors also could occur during construction of the Project. Vehicles traveling in the Project Area and noises from blasting and other construction actions could initiate alert or flight responses, and inhibit vocal communication (direct impacts). However there is little evidence to suggest that indirect behavioral impacts influencing breeding success or leading to displacement occurs regularly (Arnett et al. 2007). In the long-term, raptors could habituate to the higher noise and activity levels (Barber et al. 2010), and numerous studies indicate that hawks, and particularly red-tailed hawks, are tolerant of human activities (Romin and Muck 1999).

Operations and Maintenance

During the operations and maintenance phase, raptors would potentially encounter turbines and could be killed by rotating blades (Arnett et al. 2007). Thompson et al. (2011b) concluded that raptor use of the Project Area was small. The authors estimated a fatality rate of less than 0.01 fatalities/MW/year, or less than 5 raptor fatalities per year if the facility operates at a 500 MW capacity. Thompson et al. (2011b) concluded that because red-tailed hawks are the most common species occurring in the area throughout the year, and because this species has higher exposure index than other raptor species, red-tailed hawk fatalities would be more likely than other raptor species found in the Project Area. The impact from collisions would be moderate for red-tailed hawk, because the number of annual fatalities to individuals would be detectable in the project area but would not likely translate to differences in the larger surrounding population. The annual fatalities of other raptor species would be minor, because the number of fatalities would not be readily apparent in the Project Area or surrounding population.

To date, turbine deaths do not seem to be an important source of mortality for raptors at most wind energy facilities in the country, but fatalities could increase as more facilities are developed in the future (NWCC 2010). Post-construction monitoring will be necessary to quantify the actual turbine-related impacts on raptors from this Project.

It is also possible that raptors could experience fatal strikes with other human-made objects in the Project Area. The met towers, above ground collector lines, substations, transmission lines, switchyard, and fences in the Project Area would increase obstructions in the environment and increase the risk of fatal collisions with this other infrastructure. Collector lines also would increase the potential for electrocution of raptors. Adherence to modern design criteria would follow Avian Power Line Interaction Committee (APLIC) guidelines, which would minimize the likelihood of this impact. The Project option of burying all collector lines would further reduce the potential for fatal collisions and electrocution of raptors at distribution lines.

The noise generated from operating turbines could impede local use of the Project Area (Barber et al. 2010). However, this indirect impact is unlikely to affect raptor use of the Project Area in the long-term (Arnett et al. 2007). Noise and human disturbance during maintenance activities could initiate flight responses and disrupt normal behavior in the short-term; however, these incidents would be periodic and would minimally affect raptor behavior in the long-term operation of the facility.

Decommissioning

The impacts on raptors during the decommissioning period would be similar to that of the construction period. Ground disturbance caused by removal of turbines and the other support infrastructure would create additional areas that would slightly reduce the quality and quantity of forage habitat until disturbed areas are successfully revegetated in the long-term. Short-term behavioral responses could result from the increased noise and human disturbance during this period, which would be similar to the construction period. Impacts would be minimal.

Game Birds

Gambel's quail and the mourning dove are the only game birds documented in in the Project Area (Thompson et al. 2011). This subsection discusses impacts on Gambel's quail. Impacts on the mourning dove would be similar to the impacts described above in the subsection on resident and migratory bird species.

Construction

Direct impacts on Gambel's quail would occur during the construction process. Potential loss or degradation of habitat would include 1,474 acres where vegetation would be cleared for construction. Revegetation would restore habitats on all but about 339 acres that would be needed for Project features. However, only a portion of the disturbance area likely is occupied by Gambel's quail. The species would be most common in the vicinity of wash habitats where vegetation provides a greater amount of cover and food resources. Loss, fragmentation, or degradation of habitat could reduce available forage and decrease escape cover, which would indirectly increase the potential for predation. Increased predation could decrease local populations of the species (Brennan et al. 2005). Exposure to predation and loss of forage would occur in small areas where project facilities cross washes and would not be readily apparent outside of these places. Therefore, the effective loss of habitat for Gambel's quail from the Project would be small enough that local coveys would be conserved with minimal impact.

Ground disturbing activities and increased truck travel in the Project Area could lead to the establishment or increase of invasive plants or noxious weeds, which could have the indirect impact of reducing forage for Gambel's quail. Weed control measures would help to avoid the spread and impacts to forage, and any impacts would be minimal in Gambel's quail habitat.

Indirect, behavior-related impacts on Gambel's quail also could occur during construction of the Project, and would be short-term. Vehicles traveling in the Project Area and noises from blasting and other construction actions could initiate alert or flight responses, inhibit vocal communication and breeding success, or lead to abandonment of nesting areas. In the long-term, Gambel's quail could habituate to the higher noise and activity levels, but the degree to which this species would adapt is uncertain (Barber et al. 2010).

Operations and Maintenance

Thompson et al. (2011b) calculated the exposure index of Gambel's quail in the Project Area. No observations occurred within rotor swept heights, which resulted in the calculation of zero potential of exposure for fatality from wind turbines in the Project Area. Because of the habit of this species for short escape flights is near the ground surface, it would be unlikely for this species to collide with other infrastructure in the Project Area. There would be no direct impact for mortality from turbines or other infrastructure.

The noise generated from operating turbines could have the indirect impact of impeding local use of the Project Area (Barber et al. 2010). However, the long-term magnitude of the impact is unknown on this species. Noise and human disturbance during maintenance activities could initiate flight responses and disrupt normal behavior in the short-term; however, these would be periodic and would not significantly affect local flocks of Gambel's quail in the long-term. Overall noise impacts would be minor to moderate during the operation phase.

Decommissioning

Impacts on the Gambel's quail from the decommissioning activities would be similar to that experienced under construction. The short-term nature of this phase would make this impact minimal.

Reptiles and Amphibians

Construction

The types of direct and indirect impacts on reptiles (desert tortoise is discussed in the special status species subsection) and amphibians would be the same as those described for small mammals. These would include impacts from habitat loss and degradation, injury or death during land clearing activities, weed infestations, collisions with vehicles, and exposure to open trenches. The area of short-term ground disturbance would occur in creosotebush desert scrub (about 1,400 acres) and rocky outcrops or mountainous habitats (less than 50 acres). Impacts on the Sonoran desert tortoise are discussed separately in special status species.

The ground disturbance impacts on amphibians could affect the red-spotted toad and Great Plains toad that could occur in limited areas in creosotebush desert scrub habitats where temporary pools develop. Micrositing could avoid habitats for these species to the extent possible, and direct impacts from lost habitat would be minor due to the limited amount of potential habitat.

Species of reptile that could be impacted in the affected habitats are listed in Table 4-7. Impacts on reptiles in creosote desert scrub would be moderate, because total acres disturbed would be only about 3 percent of the available habitat. However, indirect impacts from weed encroachment could degrade a larger proportion of habitat. Impacts on species in rocky outcrops and mountainous areas would be minor, because less than 50 acres in these areas are likely to be disturbed.

Table 4-7 Reptile Species Potentially Impacted by Habitat Disturbance During Project Construction

Creosote Desert Scrub Species	
Glossy snake (*Arozona elegans*)	Long-nosed leopard lizard (*Gambelia wislizenii*)
Spotted leaf-nosed snake (*Phyllorhynchus decurtatus*)	Desert iguana (*Dipsosaurus dorsalis*)
Coachwhip (*Coluber flagellum*)	Zebra-tailed lizard (*Callisaurus draconoides*)
Gopher snake (*Pituophis catenifer*)	Desert horned lizard (*Phrynosoma platyrhinos*)
Long-nosed snake (*Rhinocheilus lecontei*)	Desert spiny lizard (*Sceloporus magister*) primarily near washes
Desert night snake (*Hypsiglena chlorophaea*) also mountainous	Yellow backed spiny lizard (*Sceloporus magister*)
Western patch-nosed snake (*Salvadora hexalepis*)	Ornate tree lizard (*Urosaurus ornatus*) primarily near washes
Western diamondback (*Crotalus atrox*)	Common side-blotched lizard (*Uta stansburiana*)
Mohave rattlesnake (*Crotalus scutulatus*)	Tiger whiptail (*Aspidoscelis tigris*)
Western banded gecko (*Coleonyx variegatus*)	Desert tortoise (*Gopherus agassizii*) also mountainous, less steep slopes

Rocky Outcrop and Mountainous Species	
Striped whipsnake (*Coluber taeniatus*)	Greater short-horned lizard (*Phrynosoma hernandesi*)
Speckled rattlesnake (*Crotalus mitchellii*)	Desert night lizard (*Xantusia vigilis*)
Great basin collared lizard (*Crotaphytus bicinctores*)	Desert tortoise (*Gopherus agassizii*) also creosotebush scrub
Gila monster (*Heloderma suspectum*)	Desert night snake (*Hypsiglena chlorophaea*) also creosotebush scrub
Common chuckwalla (*Sauromalus ater*)	

SOURCE: Brennan 2008

Operations and Maintenance

Impacts on reptiles and amphibians would be the same as those described for small mammals, which would include indirect impacts from invasive plant species or noxious weeds and exposure to chronic noise. Invasive plants or noxious weeds could degrade habitat but impacts would be moderate to minor depending on the success of weed control and site specific species habitat needs. As has been shown in some frog species (Barber et al.2010), chronic noise could mask breeding calls for the two toad species, and could have the indirect impact of decreasing reproductive success if either the Great Plains toad or red-spotted toad are not able to accommodate increased noise in the environment. The noise levels likely would not be high enough to impact reptiles. The impact to the two toad species would be minor, due to the possible limited exposure; and the impact to reptiles would likely be inconsequential in the Project Area.

Decommissioning

Impacts on reptiles and amphibians would be the same as those described for small mammals. Ground disturbance caused by removal of turbines and the other support infrastructure would create areas of degraded habitat that would have marginal value until these areas are revegetated.

4.5.2.5 Wildlife Movement Corridors

To date, no specific wildlife corridors have been identified in or near the Project Area. Disturbing blocks of contiguous vegetation would reduce local habitat connectivity, which could impede movement of wildlife within the Project Area. Pronghorn, mule deer, desert tortoise and reptile movement would all be impeded during the 18 months of construction; 339 acres of habitat connectivity would be impaired in the long-term where facilities exist on the landscape, and about 1,474 acres would be altered in the short-term, until the natural vegetation pattern can be restored. Restoration can take several decades in the desert, where plants are slow growing. Wildlife linkages are known to be affected by roads, urbanization, railroads, energy corridors and increased human activities (ADOT 2006). Habitat fragmentation is well documented as a barrier that isolates wildlife populations and disrupts ecological functions such as gene flow, predator-prey interactions, and migration (ADOT 2006). Impacts from disturbance and infrastructure would affect about 3 percent of the available habitats in the Project Area during the long-term, which could minimally impair wildlife movement in the long-term. No regionally important wildlife movement areas would be impacted.

4.5.2.6 Special Status Plants

Federally Listed Plants

There are no Federally listed plant species or habitats in the Project Area or surrounding vicinity (Flaig 2009, Werner 2011), and the USFWS determined that no plant species Federally listed as threatened or endangered or with designated critical habitat would be affected by the project. Therefore, there would be no direct or indirect impacts on Federally listed plant species from any of the Project alternatives.

BLM Sensitive Plants

Construction

Silverleaf sunray is the only BLM sensitive plant that could occur in the Project Area, but no individual plants or populations were identified during baseline native plant surveys (Flaig 2009, Werner 2011). Due to its general habitat requirements of dry slopes, sandy washes, clay, and gypsum cliffs, the disturbance to suitable habitat for this species is based on the entire extent of ground disturbance in the Project Area. The potential loss or degradation of habitat for the silverleaf sunray would include 1,474 acres where vegetation would be cleared during construction; however, only a portion of the Project Area contains the general habitat requirements and could be suitable for this species. Trampling suitable habitat also could occur and result in direct impacts from the damage or loss of potential habitat. Impacts on individual plants could be short-term and minor if only portions of the plant were damaged, however, loss of individual plants and disruption of the seed bank in the soil would be long-term. Reclamation and revegetation using conserved topsoil would restore suitable habitats on all but about 339 acres. Although subsequently reclaimed, the previously disturbed areas may not be able to support this species. This would result in an indirect minor long-term impact from the loss of suitable habitat. Preconstruction surveys to detect populations of the species would identify sensitive areas to avoid disturbance where practicable, however in site-specific areas where this is not possible, individual plants could be transplanted and seed collected for distribution at a suitable site within the Project Area.

Indirect impacts on suitable habitat for species would involve the potential spread of noxious weeds and introduced plant species and their potential to alter wildland fire regime and return intervals. These long-term indirect impacts could degrade suitable habitat however, development of and adherence to a weed management plan could minimize these impacts resulting in minor indirect impacts on suitable habitat for this species.

Although most collector lines would be in areas disturbed for short-term access roads, the Project option of using a combination of underground and aboveground collector lines in comparison to all underground collector lines would provide greater flexibility of siting collector lines. This would offer more potential to avoid suitable silverleaf sunray habitat, should this species occur within the disturbance footprints.

Operations and Maintenance

Potential indirect impacts on suitable silverleaf sunray habitat from noxious weeds and introduced plant species would persist during the operations and maintenance phase. The potential long-term minor impact could decrease if human activities decreased in the Project Area and as revegetated areas mature.

Decommissioning

Similar to the indirect impacts described under the construction phase, disturbance of suitable habitat for the silverleaf sunray would occur during decommissioning from ground disturbance. Any known populations would have been avoided during the construction and operations and maintenance phases, to the extent practicable. Ground disturbance to remove Project facilities and turbines could result in long-term minor indirect impacts on suitable habitat for this species. However, because the Project Area contains suitable habitat and populations could shift geographically during the life of the Project, the potential for long-term indirect impacts likely would occur during this phase.

Ground disturbance during this phase would reintroduce the potential impact of spreading noxious weeds and introduced plant species that could degrade habitat for the silver-leaf sunray. This long-term indirect impact would continue to be minimized due to adherence to reclamation and weed management procedures resulting in minor effects on suitable habitat for this species.

Protected Arizona Native Plants

Construction

Las Vegas bear poppy, cottontop cactus, straw-top cholla, and Navajo Bridge cactus are protected native plants that occur or potentially occur in the Project Area based on HDMS review (AGFD 2010b). Cottontop cactus is the only one of these that has been documented in the Project Area (Flaig 2009). Other salvage restricted species such as cactus, Joshua tree, Mohave yucca, and ocotillo also occur in the Project Area but were not identified in the HDMS review (Flaig 2009). Direct impacts on these species during construction would be similar to those described in the previous subsection for the silverleaf sunray except there could be the loss of individual cottontop cactus and other salvage restricted plants. This would result in a minor direct impact if it reduced the number of individual plants within the Project Area. The only appreciable difference between these species and the silverleaf sunray is that salvage restricted species can either be avoided to the extent possible, transplanted, or salvaged on site for future revegetation and reclamation in the Project Area, or payment of a fee may be made based on A.R.S. § 3-903(B)(2) (Franson 1995, Matthews 1994). Preconstruction surveys to identify populations of these species could identify avoidance areas where practicable; however in site-specific areas where this is not possible, individual plants could be transplanted to a suitable site within the Project Area. Direct impacts would be mitigated by following native plant salvage measures developed in a plant salvage plan for the Project. Reclamation, plant salvage and revegetation would reduce long-term indirect impacts on individual plants and their habitat.

Operations and Maintenance

Potential long-term, minor indirect impacts from noxious weeds and introduced plant species would persist during the operations and maintenance phase. The potential long-term minor indirect impact could decrease if human activities decreased in the Project Area and as revegetated areas mature.

Decommissioning

Similar to the direct and indirect impacts described under the construction phase, disturbance of suitable habitat for the protected Arizona native plants would occur during decommissioning from ground disturbance. Any known populations would have been avoided during the construction operations and maintenance phase, to the extent possible, and ground disturbance to remove Project facilities and turbines could result in minor direct and indirect impacts. However, populations could shift geographically during the life of the Project, and thus the potential for long-term minor direct and indirect impacts likely would occur during this phase.

Ground disturbance during this phase would reintroduce the higher potential impact of spreading noxious weeds and introduced plant species and indirectly degrade habitats for protected Arizona native plant species. This impact would continue to be minimized due to adherence to reclamation and weed management procedures resulting in long-term minor indirect impacts on suitable habitat.

4.5.2.7 Special Status Wildlife

Federally Listed Wildlife

No Federally listed threatened or endangered wildlife species or designated critical habitat occurs in the Project Area. The California condor periodically utilized the region in the early 2000s, but has since trended its use north and east of the region. Furthermore, the USFWS determined that no animal species Federally listed as threatened or endangered or designated critical habitat would be affected by the Project. No impact on the California condor or other animal species currently listed as Federally threatened or endangered animal is anticipated during the life of the Project. Reintroduced California condors have been expanding their foraging range to the north and northeast of their release site near Grand Canyon and have not utilized areas south of the Grand Canyon since about 2000 (USFWS 2010b).

Construction

The Sonoran desert tortoise (or Morafka's desert tortoise) is a Federal candidate species that inhabits the Project Area. Direct and indirect impacts on this species could occur throughout all phases of the Project under all Project alternatives.

The long-term indirect impact from the potential loss or degradation of desert tortoise habitat would include 1,474 acres where vegetation would be cleared for construction. Dispersal of desert tortoises within their home ranges along vegetated washes would experience minor local habitat loss where access roads cross washes. The development of access roads and utility corridors would reduce the integrity of existing tortoise habitat in the Project Area and could increase the potential for direct long-term impacts on individuals from vehicle-caused mortality. Long-term, the reduction in habitat integrity could result in minor indirect impacts on the tortoise population if it reduced habitat quality within the home range of an individual tortoise. The loss of individual tortoises, burrows, and habitat integrity could result in a minor long-term reduction in the number of desert tortoises with home ranges in the Project Area (Baxter 1988, Grover and DeFalco 1995, and Boarman 2002). The development of Project features such as roads, and foundations for turbines or other facilities could result in new areas for the construction of burrows. In the long-term, this minor effect could indirectly help maintain burrow sites and the tortoise population within the Project Area (Lovitch 2000). Indirectly, the development of roads in the Project Area could increase opportunities for the public to handle or collect tortoise. In the long-term, this minor effect could indirectly reduce the tortoise population within the Project Area (Lovitch 2000).

Reclamation and revegetation would restore habitats on all but about 339 acres that would be required for Project features. Mitigation is possible by avoiding high quality habitat for the species, which would be determined through presence-absence surveys to determine the local density and spatial distribution of the species in the Project Area. Preconstruction surveys would be used to prevent the loss of individual tortoises that could be in the path of ground clearance activities. Tortoises found in these situations would be handled according to Arizona Game and Fish Department (AGFD) guidelines for handling tortoises on construction projects.

Indirect impacts on habitat would involve the potential spread of noxious weeds and introduced plant species and their potential to alter wildland fire regime and return intervals. These impacts could reduce the quality of local food resources and, in the event of fire, reduce habitat quality from the loss of forage or potentially harm individual tortoises. However, development of and adherence to a weed management plan could minimize direct and indirect impacts on individuals and habitats over the life of the Project.

Although most collector lines would be in areas disturbed for access roads, the Project option of using a combination of underground and aboveground collector lines in comparison to all underground collector lines would provide greater flexibility of siting collector lines. This would offer more potential to avoid tortoise habitat and reduce long-term minor indirect effects on habitats.

Blasting for turbine foundations or access roads could occur in or near tortoise burrows. The shock from blasting could cause collapse of this type of burrow resulting in short-term direct impacts. However, preconstruction surveys near where blasting activities could occur would locate burrows and subsequently any tortoises or burrow and the contents would be removed. This would reduce mortality and direct impacts on individuals and would help maintain existing populations in the long-term. Active or good quality burrows can be reinforced with wadded paper prior to blasting, which would minimize the possibility of burrow collapse (USFWS 2007). This procedure would be conducted by a permitted biologist trained to handle tortoises and work with burrows.

Vehicles traveling along Project roads could crush and kill individual tortoises resulting in direct impacts on the individuals and indirectly reducing the population of tortoises in the Project Area. However, the 25 mph speed limit would allow operators to identify tortoises in roadways and to avoid collisions reducing the direct impact on individual tortoises and long-term indirect impacts on populations in the Project Area. Using full-time, qualified, tortoise biological monitors to escort vehicles would reduce vehicle collisions and the direct loss of individual tortoises.

Operations and Maintenance

Long-term indirect impacts on tortoise habitat could occur from the possibility of noxious weed infestation and would persist during the operations and maintenance phase. Areas infested with noxious weeds would indirectly reduce the quality of tortoise habitat, but the magnitude would reduce to negligible as reclamation progresses, and as revegetated areas mature.

The possibility for collisions with vehicles could occur along Project roads resulting in a direct loss of individuals and indirectly reduce the population of tortoises in the Project Area. However, the 25 mph speed limit would still apply and the amount of operations and maintenance traffic could be reduced compared to the construction phase.

Decommissioning

The direct and indirect impacts on desert tortoises and habitat during the decommissioning phase would be similar to that of the construction phase. Collisions with vehicles during decommissioning would result in the direct loss of individual tortoises, and a long-term reduction of tortoise populations in the Project Area. Ground disturbance caused by removal of turbines and the other support infrastructure would indirectly reduce the quality of habitat surrounding those areas until reclaimed and revegetated. Prior to decommissioning, the disturbance areas from removal of all infrastructure, including turbine foundations, would be searched for burrows and individual tortoises by a trained tortoise monitor to prevent injury or death to individual tortoises.

Ground disturbance during this phase would reintroduce the higher potential impact of spreading noxious weeds and introduced plant species and would indirectly degrade tortoise habitats long-term. But the long-term indirect impact would be minor due to adherence to reclamation and weed management procedures.

Similar to the construction phase, removal of turbine foundations could reestablish the possibility of earthen burrows collapsing due to ground vibrations in the surrounding area. Applying the same mitigation measures as during the construction phase would reduce this impact.

BLM Sensitive Wildlife

Construction

Five bat species documented in the Project vicinity or that could occur in the Project Area are categorized as BLM sensitive species. These include Allen's big-eared bat, California leaf-nosed bat, greater western mastiff bat, spotted bat, and Townsend's big-eared bat. There would be a long-term loss of a minor amount of foraging habitat for the California leaf-nosed bat, Townsend's big-eared bat, and spotted bat in wash habitats that are intersected by Project roads. Foraging habitat for Allen's big-eared bat and greater western mastiff bat are not tied to vegetation in the Project Area, and would not be affected by construction.

Mine roost sites that were identified outside the Project boundary would not be impacted by the Project, but crevice roost sites in mountainous terrain in the Project Area could be disturbed if blasting for turbine foundations occurs near a roost site. The mountains surrounding Squaw Peak have the most suitable habitat of this type in the study area. The greater western mastiff bat is the only species among these that exclusively uses crevice sites for roosting, and the spotted bat primarily uses crevice roost sites (WBWG 2005). These two species could be impacted to the greatest degree. The California leaf-nosed bat and Townsend's big eared bat typically roost in caves and mines, and would be undisturbed by blasting during construction. The impact could be mitigated by avoiding areas with potential roost sites to the extent possible or by blasting during periods of the year when bats are scarce. Impacts on bats are detailed in Section 4.5.2.4.

BLM sensitive bird species that were documented or that potentially occur in the study area include the western burrowing owl, gilded flicker, American peregrine falcon, and golden eagle. Impacts on these species would include loss or degradation of habitat, which would be minimal because 3 percent or less of the habitat for each of these species would be affected by ground disturbances. These impacts are detailed in Section 4.5.2.4 for migratory birds and raptors. Potential impacts on the golden eagle are discussed below in this subsection.

Operations and Maintenance

Impacts on the sensitive bat species would not differ from those described in Section 4.5.2.4, including the long-term potential for fatal interactions with wind turbines, which were described as small by Thompson et al. (2011b). The greater-western mastiff bat, Allen's big-eared bat were documented during baseline studies as flying at heights within the rotor sweep area.

BLM sensitive bird species that were documented or that potentially occur in the Project Area include the western burrowing owl, gilded flicker, American peregrine falcon, and golden eagle. Impacts on these species would not differ from those described in Section 4.5.2.4 for migratory birds, raptors, and eagles, including the potential for collisions with wind turbines that were described as small by Thompson et al. (2011b). The gilded flicker and burrowing owl didn't show any elevated risk for collisions (Thompson et al. 2011). The peregrine falcon did not occur in the Project Area during baseline surveys, and it would be an extremely rare species if it were to; its potential for collision relative to the Project would likely be zero. Potential impacts on the golden eagle are discussed below.

Decommissioning

The impacts on BLM sensitive wildlife during the decommissioning period would be similar to those during the construction period.

Arizona Wildlife of Concern

Construction

The big free-tailed bat was documented in the Project Area. This is the only bat species in the Project Area that is categorized by AGFD as one of greatest conservation need and that has no other special status label. Impacts on this species would not differ from those described for this species in Section 4.5.2.4. This includes some potential for loss of roost sites that could occur in the mountains surrounding Squaw Peak in the northwestern corner of the Project Area.

Twenty birds listed as AGFD species of greatest conservation need were observed as part of baseline surveys in the Project Area. Five of those were priority species and included the golden eagle, Abert's towhee, burrowing owl, gilded flicker, and savannah sparrow. The golden eagle, burrowing owl, and prairie falcon were the only raptors among the species documented during baseline surveys for the Project. The ferruginous hawk also has been found about 10 to 15 miles east of the Project Area, based on HDMS inquiries for the Project (AGFD 2009).

Direct impacts on these species would include loss or degradation of habitat, which would be minimal because 3 percent or less of the habitat for each of these species would be affected by ground disturbances. Nesting habitat and habitat for prey species of the burrowing owl could be removed by development of croesotebush desertscrub. Abert's towhee, the savannah sparrow, and gilded flicker could be impacted to a small degree by removal of vegetation, but these species were represented by single individuals during baseline surveys, and impacts would be inconsequential to minimal due to the likely extremely limited use of the Project Area. Because the majority of sensitive bird species appear to occur in relatively small numbers, and there is a large amount of habitat that would remain available within and adjacent to the proposed wind farm site (Thompson et al. 2011), sensitive bird species would have no or minimal impacts through habitat loss or degradation.

The banded Gila monster, an Arizona protected species, could be directly and indirectly affected by the Project. Impacts would be similar to those described for the desert tortoise; however the direct loss of individuals could be less because this species spend most of their time underground in burrows (AGFD 2002). Direct long-term impacts from vehicle mortality could occur, as well as the long-term indirect impact from the potential loss or degradation of habitat. The long-term indirect impact on habitat includes about 21 acres of rocky habitats in mountainous terrain from the installation of wind turbines, and about 20 acres of other upland habitats in mountainous terrain that could be used by the banded Gila monster. Disturbance of habitat could result in long-term direct impacts from the loss of individual banded Gila monsters and burrows. Indirectly the loss of individuals, burrows, and habitat integrity could result in a minor long-term reduction in the total populations of banded Gila monsters in the Project Area. Preconstruction surveys could identify high-quality habitat areas for the species, thus allowing for avoidance of these areas and reducing long-term impacts on habitat. Revegetation is also possible in Gila monster habitat, but re-creation of suitable rocky habitat would be limited.

Operations and Maintenance

Long-term impacts on the big free-tailed bat during this phase would not differ from those described in the general bat section, including the potential for fatal interactions with wind turbines that were described as small for the collective bat species by Thompson et al. (2011b). These impacts are detailed within Section 4.5.2.4. The big free-tailed bat may have a slightly higher risk of fatality, because it feeds at heights that include the rotor swept area. However, because this species would be uncommon in the Project Area, the long-term impact would be minimal to moderate.

Of the twenty birds listed as AGFD species of greatest conservation need (with the exception of golden eagles), the exposure risk of collisions to prairie falcons is considered to be very small based on baseline field surveys, and the Project would not be expected to significantly impact prairie falcon populations (Thompson et al. 2011). The exposure risk to the ferruginous hawk would be very small because this species is likely extremely rare in the region based on HDMS queries, and its exposure would be small, with most of its activities being near the ground (Bechard and Schmutz 1995). Exposure risk and potential impacts on non-raptors would be considered small, as the majority of the species either occur in very low abundance in the Project Area or exhibit behavior that makes them less at risk of direct impacts (i.e., they spend very little if any time at rotor swept heights) (Thompson et al. 2011). These and other impacts would be the same as those described in the subsections for migratory birds, raptors, and eagles. These impacts are described within Section 4.5.2.4 for migratory birds and raptors. Potential impacts on the golden eagle are discussed below in this section.

Direct and indirect impacts on banded Gila monsters would be similar to those described for the desert tortoise. However, there could be fewer direct long-term impacts on individual banded Gila monsters from vehicle caused mortality because of the greater amount of time spent in burrows.

Decommissioning

The impacts on bats, migratory birds, raptors, and banded Gila monsters during the decommissioning period would be similar to that of the construction phase.

Golden Eagles

Construction

Direct impacts on golden eagles would occur during the construction process. Removal of vegetation would remove about 1,474 acres of foraging habitat in creosotebush desert scrub habitat in the short term. Revegetation would restore habitats on all but about 339 acres in the long term. This could reduce local foraging efficiency for golden eagles. However, the short-term loss would be only about 3 percent of the available foraging habitat in the Project Area and would be minor.

Indirect, short-term behavior-related impacts on golden eagles also could occur during construction of the Project. Vehicles traveling in the Project Area and noises from blasting and other construction actions could initiate alert or flight responses. In the long-term, golden eagles could habituate to the higher noise and activity levels, but the degree to which they would adapt is uncertain (Barber et al. 2010).

Operations and Maintenance

During the operation phase, potential impacts would occur to golden eagles that encounter turbines, which could be killed by rotating blades (Arnett et al. 2007). Observations indicate that raptor fatalities at wind farm sites are not a significant source of human caused mortality (Fielding et al. 2005, Arnett et al. 2007, de Lucas et al. 2008). Erickson et al. (2001) compiled mortality data for the United States and reported that only about 2.7 percent of avian turbine fatalities outside of California were raptors. Among those, only 54 golden eagle fatalities have been recorded outside of Altamont Pass, California (Pagel et al. 2011). Nest survey data and bird survey data for this Project indicate infrequent use by golden eagles in and near the Project Area with an associated small risk for mortality (Thompson 2011).

Only two of twelve potential nesting territories in the Project study area were considered occupied in 2011, based on the presence of adult golden eagles in the vicinity of nest sites (Thompson 2011). No successful golden eagle nests were documented in 2011 within 10 miles of the Project Area (Thompson 2011). Currently, there are no data to determine breeding trends in the survey region for the Project. However, baseline survey results in 2011 suggest the breeding potential of the species in the region is likely limited, which could be related to annual weather trends or prey population cycles in the region (Thompson 2011, BP Wind Energy 2011b). In 2012, AGFD is conducting follow-up surveys to better understand the breeding locations and trends of golden eagles surrounding the Project Area. The results will provide the best known and available scientific information to be incorporated into the Eagle Conservation Plan (ECP) for the Project.

The distribution of potential golden eagle territories in the region showed that two possible, unoccupied territories were within 1.0 mile (1.6 km) of proposed turbine corridors (Thompson 2011). Other nests were from about 3 .0 to 10.5 miles (4.8 to 16.9 km) from the nearest turbine corridor. The two likely occupied territories in 2011 were about 8.5 miles (13.7 km) south and 9.5 miles (15.3 km) west of the nearest proposed turbine corridors.

Thompson et al. (2011b) concluded that potential exposure risk to turbine fatality to golden eagles in the Project Area was small based on the small numbers of observed eagles and the small proportion of flights within rotor swept heights. Thompson et al. (2011b) determined that impacts on golden eagles were expected to be small due to small use estimates and relatively low density of occupied golden eagle breeding territories near the Project Area. However, the authors stated that direct mortality due to turbine collisions to a few golden eagles is possible over the life of the Project. Based on raptor fatality estimates for the Project (Thompson et al. 2011) and the proportion of golden eagles observed during baseline wildlife surveys, approximately 5 to 10 golden eagles could be killed in the Project Area during the life of the Project. The level of impact due to collision would be minor to moderate, and would depend on the number of eagles killed in the long-term life of the Project.

Post-construction monitoring will be necessary to quantify the actual turbine-related impacts on golden eagles from this Project. To date, turbine deaths do not seem to be a population level impact for golden eagles at most wind energy facilities in the country, but fatalities could increase as more facilities are constructed in the future (NWCC 2010). Among the known deaths from turbines, only 54 golden eagle fatalities have been recorded outside of Altamont Pass, California (Pagel et al. 2011).

Golden eagles also could be exposed to the direct impact of collision or strikes with other human-made objects in the Project Area. The met towers, above ground collector lines, substations, transmission lines, switchyard, and fences in the Project Area increase the risk of fatal collisions. Transmission lines would have conductor to ground spacing that would prevent electrocution; however, collector lines would be at distribution voltage levels and could be an electrocution risk. APLIC guidelines on the gen-tie transmission line and collector lines would be followed, which would minimize or eliminate this impact. The Project option of burying collector lines would eliminate the possibility of collision with the collector lines, but would have no effect on the potential for fatal collisions with other infrastructure. Overall this impact would be minimal.

The noise generated from operating turbines could impede local use of the Project Area (Barber et al. 2010). Available studies in the United States indicate that golden eagles are not displaced in operational wind farms (Johnson et al. 2000, Madders and Whitfield 2006). Therefore, this indirect impact is unlikely to affect golden eagles in the area. Noise and human disturbance during maintenance activities could initiate flight responses and disrupt normal behavior in the short-term; however, these incidents would be periodic and would minimally affect golden eagle behavior in the long-term operation of the facility.

BP Wind Energy is preparing an ECP that will follow USFWS ECP guidance. The ECP would help to offset any mortality of golden eagles caused by the Project and is part of a larger Avian Conservation Strategy (ACS) and a Bat Conservation Strategy being prepared for the Project. The ECP will contain avoidance, minimization, and compensation measures to address potential impacts on golden eagles. The ECP will also summarize the results of ongoing 2012 nest surveys and statewide surveys by AGFD. The

ECP is being developed based on collaboration between BP Wind Energy, agency team members with raptor expertise, and the USFWS.

Decommissioning

The impacts on golden eagles during the decommissioning period would be similar to that of the construction period. Ground disturbance caused by removal of turbines and the other support infrastructure would create additional areas that would reduce the quality and quantity of habitat for forage species until disturbed areas are revegetated. Behavioral responses and reduced use of the facility could result from the increased noise and human disturbance during this period, which would be similar to the construction period.

4.5.3 Alternative B

4.5.3.1 Vegetation and Land Cover Types

Construction

Compared to Alternative A, Alternative B would reduce the direct impacts on vegetation resources by reducing the number or size of corridors and reducing the potential number of wind turbines at the northwestern, northeastern, and southern margins of the wind farm. The types of direct construction impacts on vegetation resources would be the same as Alternative A. There would be slightly fewer acres of vegetation removed but similar proportions of the same landcover and vegetation types would be disturbed (Table 4-8).

The potential magnitude for impacts on vegetation and landcover would be reduced slightly compared to Alternative A from all Project facilities. In the short-term, 1,186 acres would be disturbed with Alternative B (Table 4-8), which is about 288 fewer acres than with Alternative A. The long-term disturbance would reduce to about 280 acres (Table 4-8), which is about 59 acres less than Alternative A.

Operations and Maintenance

The impacts on vegetation during this phase would not differ from Alternative A.

Decommissioning

The impacts on vegetation during this phase would not differ from Alternative A.

Table 4-8 Potential Vegetation Impacts from Project Features, Alternative B

Project Feature	Vegetation or Land Cover Type	Short-term Disturbance (Acres)	Long-Term Disturbance (Acres)
Wind Turbines	Inter-Mountain Basins Big Sagebrush Shrubland	0.1	< 0.01
	Inter-Mountain Basins Semi-Desert Shrub Steppe	0.4	0.01
	North American Warm Desert Bedrock Cliff and Outcrop	1.1	0.03
	North American Warm Desert Volcanic Rockland	5.6	0.17
	Mojave Mid-Elevation Mixed Desert Scrub	10.7	0.33
	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	407.0	12.45
	Turbine Totals	**425**	**13**

Project Feature	Vegetation or Land Cover Type	Short-term Disturbance (Acres)	Long-Term Disturbance (Acres)
Two Short-term Laydown/Staging Areas	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	20	0
Two Substations	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	10	10
Transmission Line to Switchyard Interconnecting to Mead-Phoenix 500-kV line or Interconnecting to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	29	0.1
Switchyard for an interconnection to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	12	8
Switchyard for an interconnection to Mead-Phoenix 500-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	37	31
Operations and Maintenance Building and associated facilities such as parking	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	5	5
Improvements to Existing Roads, including collector line trenches and any utility or communication lines to the O&M building	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	18	0
Development of New Access Roads, including collector line, utility lines, communication lines, and crane paths	Undetermined	597	211
Short-term Met Towers (assumes 20 total, including potential pre-construction power curve testing short-term met towers, if required)	Undetermined	32	0
Long-term Met Towers (assumes up to 4)	Undetermined	3.26	1.63
	Total Disturbance	**1,186**	**280**

SOURCES: USGS National Gap Analysis Program (Southwest ReGAP) 2004, BP Wind Energy 2011a (Acreages from Southwest ReGAP were not field verified)

4.5.3.2 Noxious Weeds

Construction

The types of impacts from noxious weeds that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for impacts from noxious weeds and invasive plant species would be reduced slightly compared to Alternative A, with about 288 fewer acres subject to ground disturbance than Alternative A. With fewer acres disturbed, the potential for establishment of noxious weeds would decrease under Alternative B in comparison to Alternative A.

Operations

The types of impacts from noxious weeds that would occur during operations would not differ between Alternative A and B. However, the potential magnitude for impacts from noxious weeds and invasive plant species would be reduced slightly compared to Alternative A. The long-term disturbance would reduce to about 280 acres, which is about 59 acres less than Alternative A. With fewer acres disturbed, the potential for establishment of noxious weeds would decrease under Alternative B in comparison to Alternative A.

Decommissioning

The types of impacts from noxious weeds that would occur during decommissioning would be the same as those occurring during construction.

4.5.3.3 Wildland Fire

Construction

The types of impacts from wildland fire that would occur during construction would not differ between Alternative A and B. However, the potential for impacts from wildland fire would decrease slightly compared to Alternative A, due to fewer acres being disturbed. The short-term disturbance acres would reduce to 1,186 acres, which is about 288 acres less than Alternative A.

Operations and Maintenance

The types of impacts from wildland fire that would occur during operations would not differ between Alternative A and B. However, the potential for impacts from wildland fire would decrease slightly compared to Alternative A, due to fewer disturbance acres. The long-term disturbance would reduce to about 280 acres, which is about 59 acres less than Alternative A. With fewer acres disturbed, the potential for wildland fire would decrease under Alternative B in comparison to Alternative A.

Decommissioning

The types of impacts from wildland fire that would occur during decommissioning would be the same as those occurring during construction.

4.5.3.4 Wildlife

Summary

For all types of wildlife (mammals, bats, big game, wild burros, migratory birds, raptors, upland game birds, reptiles, and amphibians), the differences between Alternatives A and B would be similar. Therefore, impacts for all wildlife are summarized for each phase of the Project.

Construction

While the types of direct and indirect impacts on wildlife that would occur during construction would not differ between Alternatives A and B, the potential magnitude for impacts associated with ground disturbance and loss of habitat would be less with Alternative B. The area subject to ground disturbance with Alternative B is estimated at 1,186 acres, which is about 288 acres less than Alternative A. The configuration of this Project boundary would largely avoid mountainous habitat in the northwestern part of the Project Area near Squaw Peak and rocky uplands in the northeastern part of the Project Area. Impacts on rock dwelling wildlife would be reduced or eliminated under Alternative B. Sensitive resources include cliff and crevice roost sites for bats and two unoccupied nest sites for golden eagles; and a potential use region for bats, small birds, falcons, and golden eagles.

Operations and Maintenance

The types of direct and indirect impacts on wildlife that could occur during operations would not differ between Alternatives A and B, but the magnitude of the effects would be less. The long-term disturbance area would be about 280 acres, which is about 59 acres less than with Alternative A.

For birds, bats, and raptors, the potential for fatal collisions with wind turbines also would decrease under Alternative B. The Project could accommodate a maximum of about 166 to 208 turbines depending on turbine size chosen under this alternative, which would be about 75 fewer than for Alternative A. Avoiding potential use areas for bats and birds near Squaw Peak and the northeastern part of the Project Area would further decrease the potential for turbine fatalities for these species groups compared to Alternative A.

The option of using gray instead of the standard white or light off-white colored turbines would not present an additional impact to birds, bats, or raptors. The additional day-lighting required on the gray turbines likely would not affect birds, bats, or raptors because the white strobes do not seem to appreciably attract flying species in wind farms (Arnett et al. 2007).

Decommissioning

The types of impacts on wildlife that would occur during decommissioning would be the same as those occurring during construction for Alternative B.

4.5.3.5 Special Status Plants

Federally Listed Plants

There are no Federally listed plant species in the Project Area or surrounding vicinity. Therefore, there would be no direct or indirect impact on Federally listed plant species.

BLM Sensitive Plants and Protected Arizona Native Plants

Construction

The direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for indirect impacts from ground disturbance would be reduced slightly compared to Alternative A. The short-term indirect impacts from disturbance to suitable habitat would be 1,186 acres, which is about 288 acres less than Alternative A. The configuration of the Project boundary under this alternative would also avoid potential habitat for the Las Vegas bear poppy and silver leaf sunray near Squaw Peak. The overall impact from disturbance would be slightly smaller than under Alternative A.

Operations and Maintenance

The direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during operations would not differ between Alternative A and B. However, the potential magnitude for long-term indirect impacts from noxious weeds and invasive plant species to suitable habitat areas would be reduced slightly compared to Alternative A. The long-term impact from ground disturbance would reduce to about 280 acres, which is about 59 acres less than Alternative A. With fewer acres disturbed, the potential for establishment of noxious weeds would decrease under Alternative B in comparison to Alternative A.

Decommissioning

The direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during decommissioning would be the same as those occurring during the construction phase.

4.5.3.6 Special Status Wildlife

Federally Listed Wildlife

Construction

The types of impacts on the Sonoran desert tortoise that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The short-term disturbance area would be 1,186 acres, which is about 288 acres less than Alternative A.

Operations and Maintenance

The types of impacts on the Sonoran desert tortoise that would occur during operations would not differ between Alternatives A and B. However, the potential magnitude for long-term indirect impacts from noxious weeds and invasive plant species to suitable desert tortoise habitat areas would be reduced slightly compared to Alternative A. The long-term impact from ground disturbance would reduce to about 280 acres, which is about 59 acres less than Alternative A. With fewer acres disturbed, the potential for establishment of noxious weeds would decrease under Alternative B in comparison to Alternative A.

The long-term disturbance would be reduced to about 280 acres, which is about 59 acres less than Alternative A. Utilizing mitigation measures to avoid or reduce impacts would further reduce the impacts on this species.

Decommissioning

The types of impacts on the Sonoran desert tortoise that would occur during decommissioning would be the same as those that would occur during the construction phase.

BLM Sensitive Wildlife

Construction

The types of direct and indirect impacts on BLM sensitive birds and bats that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The short-term disturbance area would be 1,186 acres, which is about 288 acres less than Alternative A.

The configuration of the Project boundary in Alternative B would largely avoid mountainous habitat in the northwestern part of the Project Area near Squaw Peak and rocky uplands in the northeastern part of the Project Area. Sensitive resources include cliff and crevice roost sites for bats and two nest sites for golden eagles, and a potential use region for bats, small birds, falcons, and golden eagles. Impacts on BLM species of concern would be less than those under the Alternative A Project boundary configuration.

Operations and Maintenance

The types of direct and indirect impacts on BLM sensitive birds and bats that would occur during operations would not differ between Alternatives A and B. The long-term disturbance would occur to about 280 acres of habitat, which is about 59 acres less than Alternative A.

The potential for fatal interactions with wind turbines also would decrease under Alternative B. The Project would avoid potential use areas near Squaw Peak and mountainous habitat in the northwestern part of the Project Area and could accommodate a maximum of 208 turbines, depending on the turbine size chosen, which is about 75 fewer turbines than under Alternative A.

Decommissioning

The types of direct and indirect impacts on BLM sensitive birds and bats that would occur during decommissioning would be the same as those occurring during construction.

Arizona Wildlife of Concern

Construction

The types of impacts on Arizona wildlife of concern (big free-tailed bat and 20 birds) that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The short-term disturbance area would be 1,186 acres, which is about 288 acres less than Alternative A. Also the configuration of the Project boundary in Alternative B would largely avoid mountainous habitat in the northwestern part of the Project Area near Squaw Peak and rocky uplands in the northeastern part of the Project Area, which are known use areas for bats and birds and which would further decrease the impacts on these species.

The potential impact to habitat of the Gila Monster would be considerably smaller under Alternative B. Potential disturbance or loss of habitat could total about 18 acres under Alternative B compared to about 40 acres under Alternative A. Avoiding rocky upland areas during the siting process could avoid this impact altogether.

Operations and Maintenance

The types of direct and indirect impacts on birds and bats of concern that would occur during operations would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The long-term disturbance area would be about 280 acres, which is about 59 acres less than Alternative A. The potential for fatal interactions with wind turbines also would decrease under this alternative due to the Project configure-tion, which avoids potential use areas for birds and bats in the northwest and northeast parts of the Project Area. The Project could accommodate maximum number of 208 turbines under this alternative, depending on the turbine size chosen, which would be about 75 fewer than under Alternative A.

Decommissioning

The types of direct and indirect impacts on sensitive birds, bats, and the Gila monster that would occur during decommissioning would be the same as those occurring during construction.

Eagles

Construction

The types of direct and indirect impacts on golden eagles that would occur during construction would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The short-term disturbance area would be 1,186 acres, which is about 288 acres less than Alternative A.

Operations and Maintenance

The types of direct and indirect impacts on golden eagles that would occur during operations would not differ between Alternatives A and B. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A. The long-term disturbance area would be about 280 acres, which is about 59 acres less than Alternative A.

The potential for fatal collisions with wind turbines also would decrease under this alternative. The configuration of the Project boundary in Alternative B would avoid two nest sites and a potential use area near Squaw Peak, and could accommodate a maximum of about 166 to 208 turbines, depending on the turbine size chosen, under Alternative B, which would be about 75 fewer than under Alternative A.

The option of using gray instead of the standard white or light off-white colored turbines would not present an additional impact to golden eagles. The additional day lighting required on the gray turbines likely would not affect golden eagles, because the white strobes do not seem to appreciably attract birds in wind farms (Arnett et al. 2007). The other Project options would not be influential on golden eagles in the Project Area.

Decommissioning

The types of direct and indirect impacts on golden eagles that would occur during decommissioning would be the same as those occurring during construction.

4.5.4 Alternative C

4.5.4.1 Vegetation and Land Cover Types

Compared to Alternative A, Alternative C would reduce indirect impacts vegetation resources by reducing the number or size of corridors and reducing the potential number of wind turbines at the northwestern, northeastern, and southern margins of the wind farm. The type of direct construction impacts on vegetation resources would be the same as Alternatives A and B. There would be slightly fewer acres and similar proportions of the same landcover and vegetation types being disturbed compared to Alternatives A and B (Table 4-9).

The potential impacts on vegetation and landcover would be reduced slightly compared to Alternative A from all Project facilities, but would differ little from Alternative B. The short-term disturbance area would be about 1,180 acres, which is about 294 acres less than Alternative A and 6 acres less than Alternative B. The long-term disturbance would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

Table 4-9 Potential Vegetation Impacts from Project Features, Alternative C

Project Feature	Vegetation or Land Cover Type	Short-term Disturbance (Acres)	Long-Term Disturbance (Acres)
Wind Turbines	Inter-Mountain Basins Big Sagebrush Shrubland	0.1	< 0.01
	Inter-Mountain Basins Semi-Desert Shrub Steppe	0.3	0.01
	North American Warm Desert Bedrock Cliff and Outcrop	1.1	0.03
	North American Warm Desert Volcanic Rockland	5.6	0.17
	Mojave Mid-Elevation Mixed Desert Scrub	6.5	0.20
	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	410.3	12.6
	Turbine Totals	**424**	**13**
Two Short-term Laydown/Staging Areas	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	20	0
Two Substations	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	10	10
Transmission Line to Switchyard Interconnecting to Mead-Phoenix 500-kV line or Interconnecting to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	29	0.1
Switchyard for an interconnection to Liberty-Mead 345-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	12	8
Switchyard for an interconnection to Mead-Phoenix 500-kV line	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	37	31
Operations and Maintenance Building and associated facilities such as parking	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	5	5
Improvements to Existing Roads, including collector line trenches and any utility or communication lines to the O&M building	Sonoran-Mojave Creosotebush-White Bursage Desert Scrub	18	0

Project Feature	Vegetation or Land Cover Type	Short-term Disturbance (Acres)	Long-Term Disturbance (Acres)
Development of New Access Roads, including collector line, utility lines, communication lines, and crane paths	Undetermined	589	207
Short-term Met Towers (assumes 20 total, including potential pre-construction power curve testing short-term met towers, if required)	Undetermined	32	0
Long-term Met Towers (assumes up to 4)	Undetermined	4.89	1.63
	Total Disturbance	**1,180**	**276**

SOURCES: USGS National Gap Analysis Program (Southwest ReGAP) 2005, BP Wind Energy 2011a (Acreages from Southwest ReGAP were not field verified)

4.5.4.2 Noxious Weeds

Construction

The types of direct and indirect impacts from noxious weeds that would occur during construction would not differ among the action alternatives. However, the potential magnitude for impacts from noxious weeds and invasive plant species would be reduced slightly compared to Alternative A, but would differ little from Alternative B. The short-term disturbance area would be about 1,180 acres, which is about 294 acres less than Alternative A and 6 acres less than Alternative B.

Operations and Maintenance

The types of direct and indirect impacts from noxious weeds that would occur during operations would not differ among the action alternatives, although the potential magnitude for impacts from noxious weeds and invasive plant species would differ. The long-term disturbance for Alternative C would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

Decommissioning

The types of direct and indirect impacts from noxious weeds that would occur during decommissioning would be the same as those occurring during construction.

4.5.4.3 Wildland Fire

Construction

The types of direct and indirect impacts from wildland fire that would occur during construction would not differ between Alternatives A, B, and C. However, the potential for impacts from wildland fire would decrease slightly compared to Alternative A, due to fewer acres of disturbance, but would differ little from Alternative B. The short-term disturbance area for Alternative C would be about 1,180 acres, which is about 294 acres less than Alternative A and 6 acres less than Alternative B.

Operations and Maintenance

The types of direct and indirect impacts from wildland fire that would occur during operations would not differ among the action alternatives. Having a smaller ground disturbance area, the potential for impacts from wildland fire with Alternative C would decrease slightly compared to Alternative A, but would differ little from Alternative B. The long-term disturbance would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

Decommissioning

The types of direct and indirect impacts from wildland fire that would occur during decommissioning would be the same as those occurring during construction.

4.5.4.4 Wildlife

Summary

For all types of wildlife (mammals, bats, big game, wild burros, migratory birds, raptors, upland game birds, reptiles, and amphibians), the differences among Alternatives A, B, and C would be similar.

Construction

While the types of direct and indirect impacts on wildlife that would occur during construction would not differ among Alternatives A, B, and C, the potential magnitude for impacts associated with ground disturbance and loss of habitat would be the least with Alternative C. The area subject to ground disturbance with Alternative C is estimated at 1,180 acres, which is about 294 acres less than Alternative A and 6 acres less than Alternative B. Like Alternative B, the configuration of the Project boundary under this alternative would also avoid the same potential use and sensitive areas that are near Squaw Peak and in the northeastern part of the Alternative A Project boundary.

Operations and Maintenance

The types of direct and indirect impacts on wildlife that occur during operations would not differ from Alternatives A and B, but the magnitude of the effects would be less with Alternative C. The long-term disturbance area would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

For birds, bats, and raptors, the potential for fatal collisions with wind turbines also would decrease compared to Alternative A and be the same as Alternative B. The Project could accommodate a maximum of about 166 to 208 turbines depending on the turbine size chosen, under Alternative C, which is about 75 fewer than under Alternative A and the same number as Alternative B.

The option of using gray instead of the standard white or light off-white colored turbines would not present an additional impact to birds, bats, or raptors. The impact would be the same as Alternative B.

Decommissioning

The types of direct and indirect impacts on wildlife that would occur during decommissioning would be the same as those occurring during construction for Alternative B.

4.5.4.5 Special Status Plants

Federally Listed Plants

There are no Federally listed plant species in the Project Area or surrounding vicinity. Therefore, there would be no direct or indirect impact to Federally listed plant species.

BLM Sensitive Plants and Protected Arizona Native Plants

Construction

The types of direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during construction would not differ among Alternatives A, B and C. However, with Alternative C, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A, but would differ little from Alternative B. The short-term disturbance area would be about 1,180 acres, which is about 294 acres less than Alternative A and 6 acres less than Alternative B. The configuration of the Project boundary under this alternative would also avoid the same potential habitat for the Las Vegas bear poppy and silverleaf sunray near Squaw Peak as in Alternative B. The overall disturbance impact would be slightly less for these groups of plant species under Alternative C.

Operations and Maintenance

The types of direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during operations would not differ among Alternatives A, B and C. However, the potential magnitude for impacts from ground disturbance with Alternative C would be reduced slightly compared to Alternative A, but would differ little from Alternative B. Alternative C would result in about 276 acres of long-term disturbance, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

Decommissioning

The types of direct and indirect impacts on BLM sensitive plants and protected Arizona native plants that would occur during decommissioning would be the same as those occurring during construction.

4.5.4.6 Special Status Wildlife

Federally Listed Wildlife

Construction

The types of direct and indirect impacts on the Sonoran desert tortoise that would occur during construction would not differ among Alternatives A, B and C. However, the potential magnitude for impacts from ground disturbance with Alternative C (1,180 acres) would be reduced slightly compared to Alternative A (1,474 acres), but would differ little from Alternative B (1,186 acres).

Operations and Maintenance

The types of direct and indirect impacts on the Sonoran desert tortoise that would occur during operations would not differ among Alternatives A, B and C. However, Alternative C would have the least potential magnitude for impacts based on a ground disturbance. The long-term disturbance for Alternative C would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

Decommissioning

The types of direct and indirect impacts on the Sonoran desert tortoise that would occur during decommissioning would be the same as those occurring during construction.

BLM Sensitive Wildlife

Construction

The types of direct and indirect impacts on birds and bats that would occur during construction would not differ among Alternatives A, B and C. However, the potential magnitude for impacts from ground disturbance would be reduced by 294 acres compared to Alternative A, and reduced by 6 acres compared to Alternative B. Like Alternative B, the configuration of the Project boundary under this alternative would also avoid the same potential use and sensitive areas that are near Squaw Peak and in the northeastern part of the Alternative A Project boundary. The overall disturbance impact would be slightly less for these species under Alternative C.

Operations and Maintenance

The types of direct and indirect impacts on birds and bats that would occur during operations would not differ among Alternatives A, B, and C. However, the potential magnitude for impacts from ground disturbance would be reduced slightly compared to Alternative A, but would differ little from Alternative B. The long-term disturbance for Alternative C would be about 276 acres, which is about 63 acres less than Alternative A and 4 acres less than Alternative B.

The potential for fatal interactions with wind turbines also would decrease under this alternative in comparison to Alternative A, but would be the same as Alternative B. Alternative C could accommodate a maximum of about 166 to 208 turbines, depending on the turbine size chosen, which is about 75 fewer than under Alternative A and the same number as Alternative B. Avoiding the same potential use areas for birds and bats near Squaw Peak as in Alternative B would also reduce the potential for turbine fatalities. The overall impact would be slightly less for these species under Alternative C than Alternative A or B.

Decommissioning

The types of direct and indirect impacts on BLM sensitive wildlife that would occur during decommissioning would be the same as those occurring during construction.

Arizona Wildlife of Concern

Construction

The types of direct and indirect impacts on birds and bats would be the same as described above for BLM sensitive wildlife. The potential impact to habitat of the Gila Monster would be reduced under Alternative C compared to either Alternative A or B. Potential disturbance or loss of habitat for this species could total about 14 acres under Alternative C compared to about 40 acres under Alternative A and about 18 acres under Alternative B. Avoiding rocky upland areas during the siting process could eliminate this impact altogether.

Operations and Maintenance

Impacts during the operations and maintenance phase would be the same as described above for BLM sensitive wildlife.

Decommissioning

The types of direct and indirect impacts on Arizona wildlife of concern that would occur during decommissioning would be the same as those occurring during construction.

Eagles

Impacts on golden eagles in all three phases of the Project would be the same as described above for BLM sensitive wildlife.

4.5.5 Alternative D – No Action

Under the No Action Alternative, the Project would not be constructed. There would be no additional impacts on biological resources beyond those associated with the current uses of the Project Area.

4.5.6 Mitigation Measures

BP Wind Energy would develop a number of plans and would follow best management practices and BLM regulations to mitigate impacts on biological resources. A weed management plan would be developed with prescriptions to reduce the impacts from noxious weeds and invasive plant species. A Reclamation Plan and Native Plant Salvage Plan would accompany the complete POD to improve the success of reclamation and lessen the impact of removal of native plant resources. Development of an ACS/ECP and a Bat Conservation Strategy would aid in lessening impacts on bats, birds, and golden eagles. BP Wind Energy would adhere to the AGFD guidelines for desert tortoises during the life of the Project, which would lessen the Project-related impacts on this species. Recommended biological mitigation measures follow:

Wildlife and Other Ecological Resources

- Operators shall review existing information on species and habitats in the vicinity of the project area to identify potential concerns.
- Operators shall conduct surveys for Federal and/or state-protected species and other species of concern (including special status plant and animal species) within the project area and design the project to avoid (if possible) or minimize impacts on these resources.
- Operators shall identify important, sensitive, or unique habitats in the vicinity of the project and design the project to avoid (if possible) or minimize impacts on these habitats (e.g., locate the turbines, roads, and ancillary facilities in the least environmentally sensitive areas; i.e., away from riparian habitats, streams, wetlands, drainages, or critical wildlife habitats).
- The BLM will prohibit the disturbance of any population of Federal listed plant species.
- Operators shall evaluate avian and bat use of the project area and design the project to minimize the potential for bird and bat strikes (e.g., development shall not occur in riparian habitats and wetlands). Scientifically rigorous avian and bat use surveys shall be conducted; the amount and extent of ecological baseline data required shall be determined on a project basis.
- Turbines shall be configured to avoid landscape features known to attract raptors, if site studies show that placing turbines there would pose a significant risk to raptors.
- Operators shall determine the presence of bat colonies and avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies; in known migration corridors; or in known flight paths between colonies and feeding areas.
- Operators shall determine the presence of active raptor nests (i.e., raptor nests used during the breeding season). Measures to reduce raptor use at a project site (e.g., minimize road cuts, maintain either no vegetation or non-attractive plant species around the turbines) shall be considered.
- A habitat restoration plan shall be developed as part of the Reclamation Plan, to avoid (if possible) or minimize negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall require that restoration occur as soon as possible after completion of activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
- Procedures shall be developed to avoid or lessen potential impacts on special status species. Such measures could include avoidance, relocation of project facilities or lay-down areas, and/or relocation of biota.

- Facilities shall be designed to discourage their use as perching or nesting substrates by birds. For example, power lines and poles shall be configured to minimize raptor electrocutions and discourage raptor and raven nesting and perching.

Preparation and Project Design

- Where practicable, avoid and minimize potential impacts to important, sensitive, or unique habitat and biota in the Project Area.
- Avoid or minimize impacts on sensitive wildlife and their habitat during Project planning.

Vegetation/Habitat Impacts

- Microsite turbines, collector lines, and roads to the extent possible within turbine corridors to avoid sensitive biological resources.
- Locate other Project facilities away from sensitive areas or habitats to avoid further impacts on sensitive biological resources.
- Minimize the disturbance footprints and co-locate roads, collector lines, and other linear facilities to the extent possible to minimize disturbance to biological resources.
- Configure access roads and utility corridors to avoid high quality habitats and minimize habitat degradation and fragmentation.
- Minimize the number and extent of drainage crossings to limit impacts on high quality xeroriparian habitats.
- Develop a reclamation plan to identify vegetation, soil stabilization, and erosion prevention measures to be implemented as soon as possible following construction of elements in the Project Area.
- Conserve and redistribute native topsoil and associated seed bank of rare plant species.
- Limit fugitive dust along roads and other disturbed areas by applying water to limit impacts on plants in adjacent areas.
- Where only temporary disturbances are necessary (e.g., for pull sites or temporary construction areas), mow or crush vegetation in favor of land clearing methods where root systems are damaged.
- Limit vehicle and foot traffic to areas within long-term and short-term disturbance sites.
- Develop and present an ecological awareness training program to Project personnel, construction contractors, and guests to the Project Area that discusses biological conservation measures, impact minimization, and acceptable BMPs.
- Employ wildland fire prevention measures including limiting vehicle travel to and within construction areas to only essential vehicles, establishing parking guidelines in remote areas, banning smoking and non-construction flame sources outside of vehicles, and establishing safety guidelines for construction flame and spark sources.

Wildlife Disturbance

- Complete two years of post-construction mortality monitoring for all birds and bats, complete and provide agencies with an annual report, and revisit at the end of the first two years of data collection to determine if any additional measures are needed. Avoid potential bat roost sites to the extent possible.

- Permanent met towers, transmission towers, and other facilities should be designed to discourage use by birds or other wildlife.
- Avoid the use of guy wires on met towers and other structures.
- Design of above ground transmission lines and collector lines would follow established APLIC guidelines to minimize collisions with birds and electrocution of raptors.
- Consider the use of bird flight diverter devices where deemed appropriate.
- Avoid night-lighting for facilities other than mandatory lighting on turbines to minimize attracting nocturnal migrant birds.
- Conduct vegetation clearing during the non-breeding bird season.
- If the bird breeding season cannot be avoided, conduct bird nest surveys in areas to be cleared and flag a non-disturbance area to avoid destroying active nests.
- Develop an Eagle Conservation Plan (ECP) that follows the Draft Eagle Conservation Plan Guidance issued by the USFWS in January 2011. .
- Follow AGFD guidelines for monitoring and handling of desert tortoises on construction projects. Employ qualified/certified desert tortoise monitors during construction and demolition. Include desert tortoise education in the ecological awareness training program.
- Employ BLM's *Strategy for Desert Tortoise Habitat Management on Public Lands in Arizona: New Guidance on Compensation for the Desert Tortoise* (Instruction Memorandum No. AZ-92-46) if the classification of desert tortoise habitat includes categories listed in the Programmatic Agreement. This would include implementation of the standard 100 percent avoidance for desert tortoise and their burrows, as outlined in AGFD guidelines.
- Avoid or minimize impacts on burrowing owls by following AGFD *Burrowing Owl Project Clearance Guidance for Landowners* (AGFD 2009b), to survey for burrowing owls and to institute the appropriate conservation measures for burrowing owls that occupy burrows in or near the construction footprint.
- Monitor or provide internal support (e.g., wadded paper) for tortoise burrows that collapse in blast areas. Inspect, remove and relocate on-site eggs and tortoises from burrows that would be destroyed by land clearing activities. Collapse burrows after removal of contents.
- Fill trenches and holes immediately. If these must remain open overnight, provide escape ramps (at an angle of 45 degrees or less and/or cover to prevent entrapment of wildlife.
- Holes would need to be completely covered when not in use to prevent wildlife from becoming trapped.
- Trenches need to be covered when conditions exist of trenches filling with water, either from rain events or construction activities.

Noxious Weeds and Invasive Plants

- Develop a Weed Management Plan to include noxious weed and invasive plant control in disturbed areas.
- Consistent with the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic* Environmental Impact Statement, only BLM-approved herbicides would be used.

- Develop and implement guidelines to clean and inspect vehicles in an established wash site to prevent propagating reproductive materials of invasive plants and noxious weeds from entering the Project Area.
- Limit access to Project Area to only construction and Project-related vehicles to limit establishing and spreading noxious weeds or invasive plants.
- Utilize fill materials from on-site sources to the extent possible to limit incursion of noxious weeds or invasive plants. Outside sources of fill material shall be from weed-free sources.
- Mulch material and seeds for reclamation shall be certified weed free.
- Use an integrated approach to manage infestations that includes scheduled surveys and reporting of any infestations along Project roads, disturbance zones, and Project facilities. Utilize chemical, mechanical, or biological methods of weed control to limit the spread of noxious weeds and invasive plants and tailor treatments to specific weeds on site.
- Pre-treat reclamation sites to limit germination of noxious weeds or invasive plants in disturbance areas.
- Limit herbicides to non-persistent, immobile types, and apply these in accordance with their application and permit directions and use in terrestrial or aquatic applications.

4.5.7 Unavoidable Adverse Impacts

Unavoidable adverse impacts on biological resources could occur from a number of sources through implementation of the Project. Ground clearing for Project infrastructure would eliminate vegetation resources and wildlife habitat in the short-term, although most would be reclaimed. Established BLM success criteria for reclamation would follow the defined criteria in the Reclamation Plan, which would be approved by BLM and Reclamation. This would help to reestablish ground cover that would be similar, but not necessarily identical, to the original vegetation and habitats.

Areas with sensitive plant and animal resources could be altered over a long-term period. Areas that cannot be avoided and are subsequently cleared and reclaimed may not restore the specific habitat components needed for these species. This could reduce the local populations of the silverleaf sunray, Las Vegas bear poppy, and Gila monster if present.

Other disturbances related to noise, vehicles traveling along roadways, and human activity could behaviorally displace or alter the natural behavior of wildlife. This could reduce the density of local populations of some species. This impact would be most pronounced during the construction and decommissioning phases when human activity would peak in the Project Area.

The operation of wind turbines would unavoidably affect birds and bats by adding a source of mortality to the Project Area. Bird and raptor (including golden eagle) collisions and fatal bat interactions would increase local mortality of the affected species. Due to the small abundance of birds, including golden eagles and other raptors, and bats in the Project Area, mortality is not anticipated to be large enough to affect populations in the long-term. Based on existing data, fatalities of birds and bats associated with wind turbines do not seem to be a source of population decline at existing wind facilities but could be as more facilities are brought on-line in the future (NWCC 2010). Post-construction monitoring will be necessary to quantify the actual turbine-related impacts on these species from this Project.

4.6 CULTURAL RESOURCES

This section discusses potential impacts on cultural resources that could result from implementation of Alternative A, B, C, or D.

4.6.1 Analysis Methods

The assessment of potential effects on cultural resources was based on the studies discussed in Section 3.6.1.3, which include a Class I overview of results from prior surveys in the Project Area and Class III pedestrian surveys. Visual impacts on cultural resources whose settings are an important aspect of their historical values also were considered, as described in Section 4.12. Public and agency scoping and consultation with Indian Tribes identified concerns about potential impacts on two general types of cultural resources, including:

1. Archaeological and historical resources (particularly prehistoric archaeological sites as well as historic sites related to mining, ranching, and transportation)
2. Traditional cultural resources that are significant to tribes that have cultural or historical ties with the area (which may include traditional territories or use areas, sacred sites, and human remains that are sometimes associated with archaeological sites)

Potential impacts of concern for cultural resources included not only direct impacts of turbine construction and development of access roads and other related facilities, but also indirect impacts resulting from soil erosion, increased vulnerability to disturbance and vandalism associated with enhanced access, or visual impacts stemming from the introduction of tall turbine towers into the rural setting of cultural resources in the Project vicinity.

The area of analysis for potential impacts on cultural resources was the area of potential effects, as discussed in Section 3.6.1.2 as the area that could be disturbed by construction, operation, and eventual decommissioning of the project. Twenty archaeological and historical sites have been identified within the area of potential effects for direct construction impacts, and 10 of those were evaluated as eligible for the National Register (Section 3.6). Eight traditional cultural resources and eight other cultural resources that could be sensitive to visual impacts were identified within 20 miles of the Project Area.

BLM must make a determination of the effect of the Project pursuant to criteria defined by regulations for Protection of Historic Properties (36 CFR 800), which implement Section 106 of the National Historic Preservation Act. Those regulations define an effect as a direct or indirect alteration to the characteristics of a historic property that qualify it for inclusion in the National Register. Possible effect determinations include no effect, no adverse effect, or adverse effect. Effects are adverse when the alterations diminish the integrity of a property's location, setting, design, materials, workmanship, feeling, or association. Examples of adverse effects include:

- Physical destruction, damage, or alteration of all or part of a property
- Removal of a property from its physical location
- Change of the character of the use of a property or of physical features in the setting of a property that contribute to its historic significance
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the significant historic features of a property (36 CFR §800.5.a.2)

Those criteria were used to assess the effects on each listed or eligible historic property, but because final designs have not been completed, it is not possible to determine if each of the eligible properties could be avoided by construction (as preferred). It is likely that at least one of the larger prehistoric sites could not be completely avoided. The NEPA analysis also considered impacts on a broader range of cultural resources that could be affected by non-construction impacts. The assessment of potential visual impacts on cultural resources was coordinated with the assessment of visual impacts on landscape character and scenic quality conducted in accordance with BLM visual resource management procedures (Section 4.12).

4.6.2 Alternative A – Proposed Action

4.6.2.1 Construction

Archaeological and Historical Resources

Nine prehistoric archaeological sites within the proposed Project Area were determined to be eligible for the National Register for their potential to yield important information (Criterion D) (Section 3.6.1.1). All nine sites are toolstone collecting and knapping locations on public land administered by BLM. The information potential of those sites could be affected by ground disturbing construction activity but would not be affected by visual impacts and they are not the types of sites that are likely to attract the attention of unauthorized collectors or vandals.

Two of those prehistoric archaeological sites, AZ F:3:25 and 26(ASM), are adjacent to segments of existing roads that would be used as access roads/electrical collector lines. Because the roads are unlikely to require substantial widening and those two sites are approximately 130 and 30 feet from existing roads, respectively, they probably can be avoided. The other seven prehistoric sites, AZ F:3:31 through 37(ASM), overlap proposed turbine corridors. Construction activities associated with installation of the turbines and access roads/electrical collector lines could disturb parts of those sites, but more detailed engineering designs are needed to determine specifically how each site could be affected. Six of those sites are relatively small (approximately 2 acres or less) and at least some of those are at the edges or ends of the turbine corridors and might be avoided by tower placement and construction activities, but site AZ F:3:31(ASM) covers about 20 acres and there is less potential for completely avoiding that site. Studies would be conducted to recover and preserve information and artifacts from sites that cannot be avoided, which is expected to adequately mitigate any adverse effects (Table 4-10). BLM would monitor and protect the avoided properties throughout the life of the wind farm. Data recovery and monitoring procedures would be incorporated into a Memorandum of Agreement (MOA) developed to resolve adverse effects in consultation with the State Historic Preservation Office, Federal agencies, tribes, and BP Wind Energy.

Table 4-10 Potential Impacts on Historic Properties[1]

	Site Number, Name	Affiliation, Age	Site Type	Features, Artifact Counts	Site Size	Impact, Treatment
1	AZ F:3:25(ASM)	aboriginal	toolstone collecting and knapping	Features: 1 anvil stone (embedded boulder), Artifacts = 25	less than 0.1 acre	along Temple Bar Back Road but likely to be avoided, no treatment warranted
2	AZ F:3:26(ASM)	aboriginal	toolstone collecting and knapping	Features: none Artifacts: 37	0.1 acre	along Squaw Peak Road but likely to be avoided, no treatment warranted
3	AZ F:3:31(ASM)	aboriginal, Archaic	toolstone collecting and knapping	Features: 1 knapping station Artifacts: 3,000 (estimated)	20.0 acres	in turbine corridor, probable adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
4	AZ F:3:32(ASM)	aboriginal	toolstone collecting and knapping	Features: none Artifacts: 3,000 (estimated)	2.1 acres	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
5	AZ F:3:33(ASM)	aboriginal	toolstone collecting and knapping	Features: 9 knapping stations Artifacts: 113	1.1 acres	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
6	AZ F:3:34(ASM)	aboriginal	toolstone collecting and knapping	Features: none Artifacts: 7,000 (estimated)	1.5 acres	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
7	AZ F:3:35(ASM)	aboriginal	toolstone collecting and knapping	Features: none Artifacts: 2,000 (estimated)	0.7 acre	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
8	AZ F:3:36(ASM)	aboriginal	toolstone collecting and knapping	Features: 5 knapping stations Artifacts: 199	0.8 acre	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
9	AZ F:3:37(ASM)	aboriginal	toolstone collecting and knapping	Features: none Artifacts 8,000 (estimated)	2.3 acres	in turbine corridor, possible adverse effect depending on tower and access road placement, data recovery likely to adequately mitigate any adverse effect
10	AZ F:3:43(ASM) Stone's Ferry Road	Euro-American, late 19th century	historical road with campsites and artifacts	Features: 3 possible campsites Artifacts: scattered along the road	11.5 miles long, 0.1 mile surveyed	main access road would cross the road in a location without associated artifacts and features and would not affect potential to yield information, no treatment

NOTE: [1] All sites have been evaluated as eligible for the National Register under Criterion D for their potential to yield important information. Ongoing consultation could determine that these sites are eligible under additional criteria.

The Stone's Ferry Road, AZ F:3:43(ASM), also has been determined eligible for the National Register. Although the road does not appear to have been graded, it is frequently used. The proposed main access road from US 93 would cross Stone's Ferry Road but there are no historical artifacts or features at the crossing location. Disturbance of a short segment of the road at that location would not adversely affect the potential of the road to yield important information.

Traditional Cultural Resources and Other Cultural Resources Sensitive to Visual Impacts

As discussed in Section 3.6.4, BLM is consulting with 13 tribes regarding potential impacts on traditional cultural resources (see Section 5.2.2.3 for list of tribes). Visibility analysis indicated that the National Register-listed Gold Strike Canyon-Sugarloaf Mountain traditional cultural resource located near Hoover Dam would not be affected because the Project would not be visible from that location (see Section 4.12).

The Hualapai Tribe identified seven natural features as potential key observation points within 20 miles of the Project Area for the assessment of visual impacts on landscape character and scenic quality. Because the Hualapai Tribe indicated that these natural features were places of traditional cultural interest, they were categorized as traditional cultural resources, but as yet the cultural significance of those features has not been determined pending further consultation (Table 4-11). Additional traditional cultural resources could be identified as BLM continues Section 106 consultations with the tribes. Visibility analysis indicated that Red Lake, one of the seven natural features identified by the Hualapai Tribe, would not be affected because the Project would not be visible from that location.

Table 4-11 Potential Visual Impacts on Traditional Cultural Resources

	Site Name/	Description	Distance	Impact, Treatment
1	Mata Thija	traditional Hualapai salt source	possibly in right-of-way (location ambiguous)	BLM is continuing to consult with tribes about visual impacts and potential treatment
2	Squaw Peak	mountain peak, traditional Hualapai cultural resource	in right-of-way	BLM is continuing to consult with tribes about visual impacts and potential treatment
3	Senator Mountain	mountain peak, traditional Hualapai cultural resource	1.4 miles	BLM is continuing to consult with tribes about visual impacts and potential treatment
4	Pilot Knob	mountain peak, traditional Hualapai cultural resource	3.1 miles	BLM is continuing to consult with tribes about visual impacts and potential treatment
5	Wilson Ridge (Wi Gawad)	mountain peak, traditional Hualapai cultural resource	5.6 miles	BLM is continuing to consult with tribes about visual impacts and potential treatment
6	Mount Wilson	mountain peak, traditional Hualapai cultural resource	9.4 miles	BLM is continuing to consult with tribes about visual impacts and potential treatment
7	Red Lake (Mat Kwata)	ephemeral playa, traditional Hualapai cultural resource	16.5 miles	no impacts (not visible), no treatment
8	Gold Strike Canyon-Sugarloaf Mountain	traditional cultural property significant to Southern Paiute, Hualapai, Mojave, Yavapai, Hopi, Navajo, and Zuni; listed in National Register in 2004	16.2 miles	no impacts (not visible), no treatment

Photo simulations were prepared for three other places: (1) Squaw Peak, which is within the Project Area; (2) Mata Thija, a source of salty earth whose location is ambiguous but may be within the Project Area; and (3) Senator Mountain, a peak about 1.4 miles east of the Project Area (see Section 4.12).

Numerous turbines would be visible in all directions from Squaw Peak in foreground-middleground and background views (see photo simulation in Appendix D). Several turbines in a broad arc would be visible to the north of Mata Thija. (Although the location of this feature is uncertain, a photo simulation was prepared from the approximate location of the feature, which was identified by the Hualapai Tribe.) Topography would screen the turbine pads but much of the towers, hubs, and blades would be visible.

Although the foreground setting has been altered by the Liberty-Mead and Mead-Phoenix transmission lines, the turbines would dominate views from Mata Thija (see photo simulation in Appendix D). Simulations indicate that a broad expanse of turbines would be visible in foreground-middleground and background views from an elevated position on Senator Mountain with no topographic or vegetation screening (see photo simulation in Appendix D). Other than a communications tower and associated facilities constructed on the top of Senator Mountain, man-made features visible to the west are limited to Squaw Peak Road and the Liberty-Mead and Mead-Phoenix transmission lines. Flashing red hazard lights used to warn aviator of obstructions would demand attention in night time views from all three locations. In summary, the proximity and size of the turbines and motion of the blades would substantially change the character of the landscape from all three places, but such changes are compatible with the BLM Class IV visual resource management objectives for the area, which allow major modifications that may dominate the landscape character.

The Hualapai Department of Cultural Resources agreed that KOPs near Pilot Knob, Wilson Ridge [Wi Gawad], and Mount Wilson were adequate proxies for considering visual impacts on traditional cultural values of those locations. A photo simulation from KOP 1 (Householder Pass) near Pilot Knob, about 3.1 miles west of the Project Area, indicates that the overall visual contrasts of the project facilities would be moderate during the day and blinking red hazard lights at night would dominate the landscape. Photo simulations were not completed for Wilson Ridge and the Mount Wilson Wilderness (refer to Section 4.12.1.4) but visual impacts on those locations would be less than at Pilot Knob because they are farther away (5.6 and 9.4 miles respectively). BLM has been consulting with the Hualapai Tribe throughout preparation of the EIS and will continue to do so to determine whether traditional cultural values of the identified natural features would be affected by alteration of the landscape.

In addition to the eight locations of traditional cultural interest, eight other cultural resources sensitive to potential visual impacts were identified within 20 miles of the Project Area (Table 4-12). Visibility analysis indicates that three of those resources (Petroglyph Wash, Willow Beach Gauging Station, and Hoover Dam) would not be affected because the Project would not be visible from those locations.

The historic White Hills townsite is on private land about 2 miles south of the Project Area and would not be directly affected. The former mining town has deteriorated into an archaeological site. An associated cemetery is west of the town on public land administered by BLM. A visual simulation was not prepared for this location, but terrain analysis indicates that the hubs of several turbines would be visible from the cemetery and the blade arcs above the hubs of several additional turbines would be seen in a middleground setting. Although visual contrast in the setting of the cemetery would be moderate to strong, the viewshed of the cemetery has been altered by improvement and pavement of the nearby White Hills Road (County Highway 145) and the removal of the buildings from the historic town with which it was associated. The visual impacts of the proposed Project would not affect the potential of the cemetery to yield important information.

The Temple Bar Mission 66 facilities are about 7 miles north of the Project Area. Photo simulations from a visitor kiosk at Temple Bar indicate all or part of perhaps as many as 20 turbines would be visible in background views (refer to photo simulation in Appendix D). The Mission 66 buildings are at a somewhat lower elevation, and terrain would screen most views of the towers from those facilities. Night time aviation obstruction lighting could attract viewer attention. The visual impacts of the proposed Project on the setting of the Temple Bar Mission 66 facilities would result in weak to moderate contrast.

Table 4-12 Other Cultural Resources Sensitive to Visual Impacts

	Site Name/Number	Description	Distance from Project Area	Impact, Treatment
1	Historic White Hills townsite	site of silver mining community, circa 1892 to 1902, few remnants left, cemetery on public land	2 miles	no effect on information potential, no treatment
2	Black Mountains Ecosystem Management ACEC	desert bighorn sheep habitat and wild burro management area, numerous archaeological sites, such as rock shelters (including Bighorn Cave), campsites, pictographs, and mining cabins	5 miles	no effect on information potential of archaeological sites, no treatment
3	Temple Bar Mission 66 Facilities	example of mid-twentieth-century National Park Service program to upgrade facilities	7 miles	weak to moderate visual contrast, but night time aviation obstruction lighting more noticeable, no treatment
4	Petroglyph Wash	concentration of petroglyphs in canyon of Colorado River tributary	10 miles	not visible, no treatment
5	Joshua Tree-Grand Wash Cliffs ACEC	densest stand of Joshua trees in Arizona and 10 miles of scenic 2,000-foot-high cliffs, numerous archaeological sites (many with roasting pits)	12 miles	no effect on information potential of archaeological sites, no treatment
6	Willow Beach Gauging Station, listed in National Register	built in 1934-1935 and operated until 1939 to measure river flows below Hoover Dam, listed in National Register in 1986	12 miles	not visible, no treatment
7	Old Spanish National Historic Trail	trail used for trade between Mexican settlements in northern New Mexico and southern California, circa 1829 to 1840s	16 miles	weak visual contrast (closest segment beneath Lake Mead), no treatment
8	Hoover Dam National Historic Landmark	massive concrete arch-gravity dam built between 1931 and 1936; designated a National Historic Landmark in 1985	17 miles	not visible, no treatment

NOTES: ACEC = Area of Critical Environmental Concern

The Joshua Tree-Grand Wash Cliffs Area of Critical Environmental Concern (ACEC) is about 12 miles east of the Project Area. A visual simulation from a residence along Pierce Ferry Road just west of the ACEC indicates that topography would screen views of the Project and result in low visual contrast. The north end of the Black Mountains Ecosystem Management ACEC is approximately 5 miles southwest of the Project Area, and the Project would not be visible from most of the ACEC. The visual impacts of the proposed Project on the archaeological sites within the ACECs would not affect their potential to yield important information.

The segment of the Old Spanish National Historic Trail closest to the Project Area is inundated by Lake Mead within the Lake Mead NRA. The trail route on the north side of Lake Mead, as designated by the National Park Service based on historic sources, is about 16 miles from the Project Area. No physical remnants of the trail have been identified at that location. The proposed Project would result in weak visual contrasts in the setting of that segment of the Old Spanish Trail, which is dominated by Lake Mead.

Alternative A would use white or off-white turbines that are provided by turbine manufacturers, as opposed to Alternatives B and C which include options for painting turbines Shadow Gray. From some vantage points, the white turbines could be perceived as being more visible than turbines painted Shadow Gray, but the Federal Aviation Administration requires flashing obstruction lights throughout the day and night on turbines that are not white, which might offset any advantage of the gray coloring.

Alternative A, like Alternatives B and C, also could include a combination of buried and aboveground collector lines rather than installing all collector lines underground. This could result in more visual impacts, but impacts of aboveground lines are expected to be a relatively minor increment within the context of the much taller turbines. The extent of ground disturbance would be similar for either option and therefore direct construction impacts would be similar.

4.6.2.2 Operations and Maintenance

Ground disturbing activities associated with operations and maintenance of Alternative A are likely to be confined to areas that were disturbed during construction of the Project are not expected to introduce any additional visual changes to the landscape.

4.6.2.3 Decommissioning

Decommissioning is not expected to disturb areas that were not disturbed by construction of the Project. Removal of the turbines and other facilities would eliminate most of the visual impacts of the Project.

4.6.3 Alternative B

4.6.3.1 Construction

Archaeological and Historical Resources

Compared to Alternative A, Alternative B would reduce visual and noise impacts primarily on the Lake Mead NRA and secondarily on adjacent private property by eliminating 6 turbine corridors and parts of 8 other corridors (about 37 to 75 fewer turbines depending on which turbine model is selected) at the northwestern, eastern, and southern margins of the wind farm (see Maps 2-2 through 2-7). No specific cultural resources sensitive to visual and noise impacts have been identified in those areas adjacent to the boundaries of the Lake Mead NRA and private lands. The direct construction impacts on cultural resources would be very similar to Alternative A because the nine prehistoric archaeological sites and one historical road evaluated as eligible for the National Register are not in the eliminated areas and would be subject to the same types of potential disturbance.

Traditional Cultural Resources and Other Cultural Resources Sensitive to Visual Impacts

Alternative B would eliminate approximately 15 to 20 turbines within 3 miles of Squaw Peak, depending on which turbine model is selected, including all those to the west of the peak and some to the northeast. An estimated 10 or fewer additional turbines would be eliminated between 3 and 5 miles. Alternative B would eliminate approximately 5 or fewer turbines within 1 to 3 miles of Senator Mountain, including those closest to the mountain (none are within 1 mile). An estimated 5 or fewer additional turbines would be eliminated within 3 to 5 miles of the mountain. Many of the approximately 150 to 200 turbines throughout much of the wind farm would still be visible from Squaw Peak and Senator Mountain and visual contrast would remain strong (see photo simulation of proposed Project in Appendix D). The impacts of Alternative B on other cultural resources sensitive to visual impacts would be essentially the same as the proposed Project.

In contrast to the proposed Project, Alternative B includes the option of painting the turbines Shadow Gray, which might decrease their visibility from some vantage points. The Federal Aviation Administration, however, requires obstruction flashing lights throughout the day and night on turbines that are not white, which might offset any advantage of the gray coloring.

4.6.3.2 Operations and Maintenance

Like Alternative A, activities associated with the operations and maintenance of Alternative B are not expected to result in any additional impacts on cultural resources.

4.6.3.3 Decommissioning

Like Alternative A, decommissioning of the Alternative B is not expected to result in any additional impacts on cultural resources.

4.6.4 Alternative C

4.6.4.1 Construction

Archaeological and Historical Resources

Compared to Alternative A, Alternative C would reduce visual and noise impacts on adjacent private property by eliminating 6 turbine corridors and parts of 8 other corridors (about 37 to 75 fewer turbines depending on which turbine model is selected) at the northwestern, east, and southern margins of the wind farm (see Maps 2-2 through 2-4 and Maps 2-8 through 2-10). No specific cultural resources sensitive to visual and noise impacts have been identified in those areas adjacent to the boundaries of the private land and Lake Mead NRA. The direct construction impacts on cultural resources would be very similar to Alternative A because the nine prehistoric archaeological sites and one historical road evaluated as eligible for the National Register are not in the eliminated areas and would be subject to the same types of potential disturbance.

Traditional Cultural Resources and Other Cultural Resources Sensitive to Visual Impacts

Alternative C would reduce the number of turbines in the vicinity of Squaw Peak to the same extent as Alternative B. Alternative C would reduce the number of turbines within 1 to 3 miles of Senator Mountain by approximately 10 or fewer (none are within 1 mile), compared to 5 or fewer for Alternative B. Alternative C would eliminate approximately 5 or fewer additional turbines within 3 to 5 miles of Senator Mountain, which would be the same as Alternative B. Many of the approximately 150 to 200 turbines throughout much of the wind farm would still be visible from Squaw Peak and Senator Mountain and visual contrast would remain strong (see photo simulation of proposed Project in Appendix D). The impacts of Alternative C on other cultural resources sensitive to visual impacts would be essentially the same as the proposed Project.

Alternative C includes the option of painting the turbines Shadow Gray, which might decrease their visibility from some vantage points. The Federal Aviation Administration, however, requires flashing obstruction lights throughout the day and night on turbines that are not white, which might offset any advantage of the gray coloring.

4.6.4.2 Operations and Maintenance

Like Alternatives A and B, activities associated with the operations and maintenance of Alternative C are not expected to result in any additional impacts on cultural resources.

4.6.4.3 Decommissioning

Like Alternatives A and B, decommissioning of Alternative C is not expected to result in any additional impacts on cultural resources.

4.6.5 Alternative D – No Action

Under Alternative D, development of the Project would not be pursued. Cultural resources would not be affected by the Project, but would continue to be subject to impacts of ongoing land uses and any modification of those uses approved in the future.

4.6.6 Mitigation Measures

Section 106 consultations have resulted in a determination of adverse effect for the proposed undertaking, as defined by regulations for Protection of Historic Properties, which implement Section 106 of the National Historic Preservation Act. BLM is consulting with the State Historic Preservation Office, Federal agencies, tribes, BP Wind Energy, and interested parties to develop a MOA to resolve potential adverse effects to historic properties pursuant to 36 CFR 800.6. Under the Section 106 regulations, BLM must seek to develop and evaluate alternatives or modifications to an undertaking that could avoid, minimize, or mitigate adverse effects. The MOA evidences this agreed form of resolution through stipulations that the lead agency must ensure are followed. Elements typically addressed in a MOA include the development of data recovery or other mitigation measures; implementation of monitoring plans, as well as plans for treating and consulting on unanticipated discoveries; provisions for any supplemental surveys or studies needed to identify and evaluate potentially eligible properties; and provisions for public benefits through disseminating the results of studies. The MOA also addresses legal and professional standards and defines review procedures and other responsibilities of the consulting parties.

The MOA will commit the BLM to prepare a cultural resource management plan defining measures to avoid and mitigate potential impacts to historic properties and cultural resources. This plan will follow guidance in BLM *Programmatic Environmental Impact Statement on Wind Energy*, which stipulates that the plan should address mitigation activities to be implemented, establish a monitoring program through the life of the Project, and identify measures to prevent potential impacts, which could include worker training and public education efforts. A variety of treatment measures would be considered to reduce or mitigate any unavoidable direct or indirect adverse impacts, and could include recovery and preservation of artifacts and information, studies to better document ethnohistoric use of the area, and development of educational materials or programs to enhance tribal and local community understanding and appreciation of the affected cultural resources. The plan also would include provisions for conducting supplemental Class III survey if final designs include Project facilities outside the areas that were surveyed for cultural resources during preparation of this EIS. Any additional cultural resources found would be evaluated and treated in accordance with the plan.

4.6.7 Unavoidable Adverse Impacts

As final designs are prepared, consideration would be given to avoiding construction impacts on the National Register eligible archaeological sites where feasible to do so. Preliminary engineering indicates that two of the nine identified National Register eligible sites very likely can be avoided, and it may be possible to avoid some of the other seven sites. Disturbance of significant sites that cannot be avoided by construction activities, as well as diminishment of any significant settings of cultural resources due to visual or noise impacts would be an unavoidable adverse impact.

4.7 PALEONTOLOGICAL RESOURCES

4.7.1 Analysis Methods

Analytical methods include a paleontological records search through the Arizona Museum of Natural History (AzMNH) and a search of pertinent geologic and paleontological literature. Geologic maps of the area were consulted. No pedestrian survey of the area was undertaken. The area of analysis for potential impacts on paleontological resources was the Project Area.

4.7.2 Alternative A – Proposed Action

4.7.2.1 Construction

The paleontological records search (McCord 2010) concluded that no paleontological localities are known within the Project Area or within 10 miles of the Project Area boundaries. However, this absence of evidence must not be equated with a known absence of paleontological resources. A search of pertinent geologic literature yielded no mention of paleontological resources in the Project Area. Within the Project Area are some geologic deposits of a type that could produce paleontological resources. There are 15 known paleontological localities within Mohave County. Geologic mapping (Wilson and Moore 1959; URS 2010a) indicates that Quaternary sands and gravels cover much of the Project Area. Similar deposits have produced significant paleontological resources in other parts of Arizona. Thus, those within the Project Area are judged to have a potential to produce significant paleontological resources. In the Potential Fossil Yield Classification (PFYC) system, the sediments should be classified as 3b – Unknown Potential. Alternative A contains more square miles of Quaternary sediments than the other alternatives. Construction of roads, digging of foundations, and trenching for buried power lines could result in disturbance or degradation of paleontological resources. These effects would be reduced through a monitoring and mitigation program.

4.7.2.2 Operations and Maintenance

No effects on paleontological resources would occur during the operations and maintenance phase for any of the action alternatives because no ground disturbing activities would be expected.

4.7.2.3 Decommissioning

While removal of Project features in the decommissioning phase would include ground disturbing activities, the disturbance would be expected to affect the same areas as in the construction phase. Therefore, no effects on paleontological resources would be expected with any of the action alternatives. However, should suspected paleontological resources be identified during decommissioning activities, work at that location would be stopped until a qualified paleontologist evaluates the site and BLM or Reclamation give clearance to proceed with decommissioning activities in that location.

4.7.3 Alternative B

Under Alternative B there would be fewer square miles of the Quaternary sand and gravel deposits in the Project Area than in Alternatives A and C. However, construction of roads, digging of foundations, and trenching for buried collector lines could disturb or degrade paleontological resources, but to a lesser degree than in Alternatives A and C because of the smaller disturbance area. These effects would be reduced through a monitoring and mitigation program.

4.7.4 Alternative C

Quaternary sands and gravels also occur in much of the area that would be affected under Alternative C. This alternative contains fewer square miles of these deposits than in Alternative A, but more than Alternative B. Construction of roads, digging of foundations, and trenching for buried collector lines could adversely affect paleontological resources, but to a lesser degree than in Alternative A and to a greater degree than Alternative B. These effects would be reduced through a monitoring and mitigation program.

4.7.5 Alternative D – No Action

No impacts on paleontological resources would occur under Alternative D.

4.7.6 Mitigation Measures

If an action alternative is approved, BP Wind Energy would comply with the applicable Federal, state, and local laws, regulations, and policies identified in Table 1-2 pertaining to paleontological resources. In addition, the following actions are recommended:

- Before any construction takes place, qualified paleontologists would undertake a pedestrian survey for paleontological resources of the Tertiary and Quaternary sediments within the Project.
- Construction monitoring by a qualified paleontologist would take place in areas determined to be sensitive (if such areas are present) based on a pre-construction survey. In addition, a plan will be developed to address next steps in the event that sites are discovered during construction.
- A paleontological monitoring plan would be formulated by a qualified paleontologist after the preconstruction survey. The plan would conform to the standards of the Society of Vertebrate Paleontology (SVP 1995, 1996).
- A worker environmental appreciation program for construction personnel would be developed and presented to construction personnel regarding the appearance of possible paleontological resources in the area and procedures to be followed if suspected paleontological resources are encountered.
- Paleontological resources collected during monitoring activities must be stabilized, prepared to the point of identification, and curated in a museum with a permanent paleontological collection.
- A final report would be generated for all monitoring activities to summarize the results of the monitoring efforts, including a list and description of any resources found, and outlining the context and condition of these resources. This report would be submitted to the BLM and/or Reclamation depending on the locations of findings. The final report, maps of the localities and field notes must accompany any collected specimens.

4.7.7 Unavoidable Adverse Impacts

With monitoring and the application of the other mitigation measures, no unavoidable adverse impacts are anticipated from Project construction. However, there is potential for unavoidable adverse impacts should equipment cut through intact paleontological resources or if blasting is required and disturbs previously unidentified resources.

4.8 LAND USE

This section discusses the potential effects to land ownership and planned land uses in the Project Area (see Section 4.10.2.3 for the analysis on impacts to private land ownership). The primary impacts to land use associated with the Project are associated with ROWs, designated utility corridors, residential uses, mining claims, aviation uses, recreation, wilderness, and livestock grazing. Surface or mineral ownership would not be impacted under any alternatives because surface jurisdiction and mineral ownership would not change (see Section 4.3.2.1 for the analysis on impacts to minerals). The analysis area considered for the land use, recreation, and livestock grazing is the same as the Project Area.

4.8.1 Analysis Methods

The 1995 Kingman BLM Resource Management Plan and the 2010 Mohave County General Plan were considered when evaluating potential impacts on land ownership and use patterns in the Project Area. The land use designation in the Mohave County General Plan for land that includes the Project Area is Rural

Development Area. However, Mohave County has limited authority to apply this designation to Federal (BLM- or Reclamation-administered) land but states in its General Plan that Mohave County should "coordinate its planning efforts with those of state and Federal agencies in order to set and carry out compatible planning and development policies" (Mohave County 2005 and Mohave County 2010b). Based on the existing and allowable uses in the Project Area, along with the existing and planned uses on nearby private land (under jurisdiction of Mohave County), impacts on land use were identified and compared by alternative based primarily on the following criteria:

- Project elements would conflict with adopted plans for the Project Area or surrounding vicinity.
- Project elements would interfere with established and/or approved access to or uses in the Project vicinity, including but not limited to, residential development, mining, recreation, private airstrips, livestock grazing.

4.8.2 Alternative A – Proposed Action

The construction and operation of 203 to 283 wind turbines (depending on the turbine size chosen) and ancillary facilities would be in conformance with the existing BLM Resource Management Plan and would not conflict with the Mohave County General Plan presuming that the County Plan is amended as has been discussed between Mohave County and BP Wind Energy. The Project Area is not located in any BLM protected areas or designated ROW exclusion or avoidance areas. It is located in a BLM Visual Resource Class IV area, which allows major modifications that may dominate the landscape character. Development of a wind farm would not prohibit other permitted uses such as grazing, existing ROWs, and dispersed recreation. Alternative A would also be consistent with the Mohave County General Plan energy goals and implementation measures as described in Chapter 3 (Mohave County 2010b).

4.8.2.1 Construction

The two existing east/west utility corridors located in the southern portion of the Project Area include the 500-kV Mead-Phoenix transmission line and the 345-kV Liberty-Mead transmission line. Alternative A would use either of these existing transmission lines to tie into the electrical grid. The development of facilities other than an overhead power line, are restricted in the existing utility corridors. Using the existing designated utility corridors and transmission lines in the vicinity of the Project Area would not result in a change in land use. Construction of turbines and other Project facilities (including switchyards, met towers, staging areas, operations and maintenance facilities, and access roads) would not impact existing transmission lines or utility corridors.

There are no commercial operations or private lands within the Project Area. However, there are light industrial uses, small mining claims, and residential land uses adjacent to the Project Area that could be affected by the proposed construction of 203 to 283 wind turbines, access roads, and ancillary facilities. Livestock grazing allotments within and adjacent to the Project Area also could be affected by the proposed construction. Access to mining claims and residential areas adjacent to the Project Area could be temporarily restricted during construction in site-specific areas. Such restrictions would be minor because a new access road from US 93 to the Wind Farm Site would be established, but the oversized loads and slow-moving equipment on public roads and highways could result in temporary delays for local users. Dust and noise from construction activities, and additional vehicle traffic, could indirectly impact residences adjacent to the Project Area over the short term; these impacts would be minimized and mitigated through the application of water or other dust suppressants. Any residual impacts would be temporary, occurring for a few months during construction, in specific areas such as the Project access road corridor (see Section 4.9 for discussion on Transportation and Access).

Construction noise impacts are analyzed in Section 4.15 and considered, where identified, temporary. Some construction activities (such as turbine assembly and concrete pouring) could occur at night when wind speeds are often lower and temperatures are cooler. However most use of heavy construction equipment is assumed to occur during daylight hours, and during such time when background sound levels (in general) tend to be higher than nighttime due to the presence or activity of other typical daytime sources (e.g., increased levels of traffic, non-Project commercial/institutional/municipal operations and residential activities, building heating, ventilation, and air conditioning systems, etc., as compared to nighttime). Hence, higher daytime background sound level might be said to help “minimize” the difference between it and the impact-generating predicted construction noise level. In some cases, and depending on location, magnitudes of the contributing sound sources, and other factors, the difference may be imperceptible. Similarly, if background sound was considered generally quieter during weekend daytime hours than those during regular weekday daytime hours, then weekday daytime construction activity could offer this potential to “minimize” noise impacts to residents.

While the Project Area is not known to be used extensively for recreational purposes, the expanse of public land and existing access offers recreational opportunities, including OHV use, camping, and hunting. Regional recreational pursuits also include backpacking, horseback riding, hiking, rockhounding, fishing, mountain biking, and wildlife viewing. The ground disturbance, equipment movements, noise, dust, presence of construction crews, and public safety concerns would generally discourage most recreationists from visiting the Project Area during the construction phase. Ground disturbance and the presence of construction equipment and vehicles could temporarily change the character of the landscape, reduce opportunities for naturalness, and reduce the semi-primitive recreation experience near the Project Area. Public access for recreation (including OHV travel) through the Project Area would be temporarily restricted or delayed during construction for safety and security reasons. Given the unknown amount of recreational use in the Project Area, and the surrounding areas available for similar recreational activities and experiences, impacts on the recreation setting and experience would be minor and short-term during construction.

Impacts on visitors to Lake Mead NRA would be similar to those impacts on recreational users described above, with one notable difference. Disruptions to visitor access along Temple Bar Road would not be expected because this is not a proposed access route, and construction workers would be directed to access the Project Area from the southwest, where the road to the Detrital Wash materials pit would be improved and extended.

Construction related traffic, oversized loads, and slow-moving equipment on public roads and highways could indirectly result in minor, temporary delays for those trying to access Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam.

Construction activities would result in the loss of or damage to vegetation which could indirectly impact livestock forage availability in localized areas in Big Ranch Units A and B. Only a negligible reduction in AUMs would occur from 335 acres of permanent disturbance which represents less than 1 percent of the total area within the Wind Farm Site. Construction vehicle traffic would occur in localized areas and could result in minor short-term livestock displacement. Construction activities and equipment could also increase the potential for the establishment of invasive and noxious weeds that could indirectly affect forage quality. Dust created by vehicle traffic and construction activities could indirectly result in a temporary reduction of forage quality in localized areas. Best management practices (BMPs) would be implemented to control dust and reduce the establishment of invasive species and noxious weeds.

Long-term adverse impacts on land use, recreation, and livestock grazing from construction activities would be reduced by avoidance measures and implementation of BMPs (Appendix B) under all alternatives to ensure disturbed sites are reclaimed and restoration efforts are successful.

4.8.2.2 Operations and Maintenance

Facility operations and maintenance, including the repair of wind turbines, ancillary facilities, and transmission line facilities would not result in impacts on utility corridors or ROWs, although the transmission line interconnection would reduce the capacity to add more power to the selected transmission line from other generation projects. Indirectly, the presence of turbines and operations and maintenance activities could result in a shift in the location or siting of future residential developments on private land. For the life of the Project, BLM and Reclamation may not be able to grant ROWs for conflicting land uses. Certain land uses on adjacent lands, such as another wind farm project, may be subject to set-backs to prevent interference with operation of the Project. Operations and maintenance activities would not result in impacts on accessing mining claims.

The proximity of the Project to Triangle Airpark (a private airstrip), located approximately 0.5 mile northeast of White Hills Road and US 93, could affect flight patterns for aircraft taking off and landing at the airpark. Private airfields are not subject to FAA airfield obstruction regulations. Aircraft would no longer be able to operate at low levels within the airspace over the Project Area because of the obstructions, which could influence take-off and landing patterns. The turbines would add an obstruction to small aircraft that may fly near or over the Project Area. Due to the turbines being taller than 200 feet, the turbines would be marked or lighted per FAA Guidelines (FAA 2007) to provide visible warning to local pilots. In addition, the distribution line that may extend along US 93 and along the primary access road to support the O&M building would add a new obstruction and potential flight safety concern. Because the airpark is not a public airport and this distribution line would be less than 200 feet high, no FAA airspace restrictions or requirements would apply to the distribution line.

The presence of Project components and maintenance vehicles and crews could result in impacts on those seeking a semi-primitive recreation setting and experience in an unmodified landscape for the duration of the Project. However, the Project Area is within the Extensive Recreation Management Area managed by BLM, and as such does not receive management for specific recreational values (such as remoteness, solitude, etc.). Noise created by the turbines could influence the presence of big game and upland game wildlife and indirectly reduce opportunities and the recreation experience for hunting and wildlife viewing. However, wildlife often habituates to routine noises so this may be a short-term effect (see Section 4.5 for discussion on Biological Resources). Because of the presence of the turbines in a previously undeveloped location, recreationists desiring a semi-primitive recreational experience may relocate to other areas, while regional visitors looking to experience man-made wonders may be attracted to the Project Area. The addition of new access roads could improve access for dispersed recreation and hunting because motorized (and non-motorized) vehicle access would be allowed on roads established in the Project Area, except for the switchyard, substations, and O&M building (see Section 4.9 for discussion on Transportation and Access). The presence of the facilities and turbines would create visual contrasts across the landscape and degrade the natural vistas of the recreation setting. The turbines and access roads would result in the greatest visual contrast across the landscape, resulting in moderate long term impacts on the quality of the semi-primitive recreation setting and experience (see Section 4.12 for discussion on Visual Resources).

Impacts on visitors who are accessing Lake Mead NRA from Temple Bar Road would be similar to those impacts on recreational users described above. Those seeking a natural vista setting to have a semi-primitive recreational opportunity may not want to visit areas of Lake Mead NRA where the turbines are visible. Because the turbines would be located closer to Lake Mead NRA with Alternative A, this action alternative would have the greatest impact on visitors to Lake Mead NRA who are seeking natural vistas.

Operations and maintenance activities would not impede access to or result in impacts on Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam.

The development of approximately105 miles of new Project access roads could indirectly provide better access to grazing allotments and livestock, which could improve livestock management. Natural revegetation in areas previously disturbed by construction could improve forage resources for livestock grazing. The volume of vehicle traffic associated with operations and maintenance activities on Project access roads would be substantially less than during construction, but could result in minor localized impacts on livestock and livestock management.

4.8.2.3 Decommissioning

Impacts during decommissioning would be similar to impacts during construction. Access to mining claims and residential areas adjacent to the Project Area could be temporarily restricted during decommissioning in site-specific areas. Oversized loads and slow-moving equipment on public roads and highways could result in temporary delays for local users. Such restrictions would be minor and short-term.

Project features such as turbines, substations, the switchyard, O&M building, and related facilities would be removed at the end of the operational life of the Project. The decommissioning activities would result in short-term ground disturbance and impacts on the recreational setting and experience, similar to construction activities. Recreational activities could occur during decommissioning, subject to localized restrictions for public safety and reclamation efforts. When decommissioning and reclamation is complete, there could be residual, but minor long-term impacts on the recreation setting and experience if access roads are not decommissioned and reclaimed; however, if BLM and Reclamation decide to reclaim the access roads, the landscape could be transitioned to its original, relatively undeveloped character with utilities and access road features. If access roads are left in place, they would provide additional access to some recreational users (e.g., hunters, wildlife watching).

Decommissioning activities and related vehicle traffic could indirectly result in minor, temporary delays in site specific areas for those trying to access Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam.

Decommissioning the Project would have similar impacts on livestock grazing as described for construction. Previously restored areas could be re-disturbed resulting in short-term loss of available forage and decrease in forage quality. Decommissioning and re-vegetating disturbed areas with native soils and plants would improve forage availability in areas where long-term disturbance had occurred and in locations where facilities had been located.

4.8.3 <u>Alternative B</u>

4.8.3.1 Construction

Construction of the transmission line to the switchyard interconnecting to the Mead-Phoenix 500-kV line or Liberty-Mead 345-kV line would result in the same amount of ground disturbance and impacts on existing utility corridors and ROWs as Alternative A.

Alternative B would eliminate certain turbine corridors in the northern and southern portions of the Wind Farm Site and shorten certain corridors on the eastern side of the Project Area to increase the distance between planned development communities and the nearest turbine (see Map 2-3). This would decrease visual and noise impacts during construction. More land could also be available for other future ROWs granted by BLM or Reclamation. Access to mining claims adjacent to the Project Area could be temporarily restricted during construction in site-specific areas. Impacts on mining claims would be the same as Alternative A.

Reducing the number of proposed turbines (to a maximum of 208 turbines) and the number of new access roads and other related Project features would reduce the extent of long-term ground disturbance by 55 acres and short term disturbance by 288 acres compared to Alternative A. This would reduce the impacts on the quality of the recreation setting and experience compared to Alternative A.

Eliminating the three northernmost turbine corridors from the Project Area on Reclamation-administered land near Lake Mead NRA and Temple Bar Road would reduce ground disturbance, maintain more of the natural conditions and recreation setting, and eliminate the introduction of turbines and their associated impacts to this specific area. This alternative would retain the existing distant views from certain viewpoints for those visiting or accessing Lake Mead NRA. The Project boundary would no longer abut to Lake Mead NRA, nor would additional access be provided into this area as a result of access roads that would have been established under Alternative A. Alternative B would also eliminate the southernmost corridor and shorten eight turbine corridors on the eastern side of the Project Area to increase the distance between planned development communities and the nearest turbine. Compared with Alternative A, this would reduce dust and noise from construction activities and reduce impacts to nearby residents and on the existing recreation setting. Reducing the number of turbines from a maximum of 283 under Alternative A to 208 turbines under Alternative B could reduce the amount of construction related traffic, oversized loads and slow-moving equipment on public roads and highways. This could indirectly reduce temporary delays for those trying to access Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam compared to Alternative A.

Though constructing fewer wind turbines in Big Ranch Units A and B would reduce the amount of temporary ground disturbance in localized areas and help retain existing vegetation and forage resources for livestock grazing compared to Alternative A, overall impacts on AUMs would remain negligible.

4.8.3.2 Operations and Maintenance

The operations and maintenance of turbines, access roads, operations and maintenance facilities, and transmission line would not result in any impacts on designated utility corridors, ROWs, or mining claims. Indirectly, reducing the number of turbines and operations and maintenance activities in the northeastern portion of the Project Area could reduce impacts on potential future residential developments on private land compared to Alternative A. Impacts on the airstrip from operations and maintenance activities would be the same as Alternative A.

Reducing the number of wind turbines and new access roads would reduce the extent of area exposed to noise and visual impacts associated with maintenance activities and vehicle traffic. This could maintain opportunities for those seeking a semi-primitive recreation experience in a natural setting over a larger area compared to Alternative A.

Impacts on the Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam from operations and maintenance activities would be the same as Alternative A.

New Project access roads could provide better access for managing livestock and operations in Big Ranch Units A and B (which include both BLM- and Reclamation-administered land). Compared to Alternative A, Alternative B would require fewer access roads (due to fewer turbines) which would reduce livestock displacement since less acreage would be disturbed, however, overall impacts on AUMs would be negligible.

4.8.3.3 Decommissioning

Reducing the number of turbines from a maximum of 283 under Alternative A to 208 turbines under Alternative B could indirectly reduce the amount of vehicle traffic and temporary delays for those trying to access mining claims and residential areas compared to Alternative A.

Decommissioning the Project would result in the same impacts as Alternative A except that fewer turbines would require decommissioning which could reduce the extent of ground disturbance and impacts on the recreation setting and experience compared to Alternative A. Noise and visual impacts from vehicles and equipment used during decommissioning would be reduced near private lands with residential development because of the greater distance between turbines and private land with Alternative B compared to Alternative A.

Decommissioning fewer turbines could indirectly reduce vehicle traffic and temporary delays in site specific areas for those trying to access the Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam compared to Alternative A.

Decommissioning fewer wind turbines in Big Ranch Units A and B would reduce the amount of temporary ground disturbance in localized areas and help retain existing vegetation and forage resources for livestock grazing compared to Alternative A, overall impacts on AUMs would remain negligible.

4.8.4 Alternative C

4.8.4.1 Construction

Construction of the transmission line to the switchyard would result in the same amount of ground disturbance and impacts on existing utility corridors and ROWs as Alternative A and B.

The construction of up to 208 turbines under Alternative C would result in the same impacts as Alternative B but less ground disturbance and impacts compared to Alternative A (203 to 283 turbines). However, the turbine corridors on the eastern portion of the Project Area would be shortened to provide greater separation between planned development communities and the nearest turbines compared to Alternative B. This would decrease visual impacts and noise to a greater extent than Alternatives A and B. Reducing the number of turbines could decrease vehicle traffic and temporary delays during construction for those trying to access mining claims compared to Alternative A. Impacts on mining claims would be the same as Alternative B.

Decreasing the number of proposed turbines to a maximum of 208 turbines and other Project features such as access roads would result in approximately 1,180 acres of temporary ground disturbance under Alternative C. This could reduce noise and visual impacts from construction activities and reduce impacts on the quality of the recreation setting and experience compared to Alternative A, which would have about 294 more acres of temporary ground disturbance (Alternative A would have 63 more acres of long-term disturbance compared to Alternative C). Impacts from construction activities would be similar to Alternative B (Alternative B would have 4 more acres of long-term disturbance compared to Alternative C) except that one additional turbine corridor would be located on Reclamation-administered land which could result in more noticeable visual impacts and reduce the distant naturalness quality of the recreation setting and experience for those visiting Lake Mead NRA.

Reducing the number of turbines from a maximum of 283 under Alternative A to 208 turbines under Alternative C could reduce the amount of construction related traffic, oversized loads and slow-moving equipment on public roads and highways. This could indirectly reduce temporary delays for those trying to access the Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam compared to Alternative A, but result in the same impacts as Alternative B.

Decreasing the number of turbines and acres of temporary ground disturbance under Alternative C could help retain existing vegetation and forage resources over a larger area compared to Alternative A. Impacts from construction activities on livestock grazing would be the same as Alternative B except that disturbance and impacts on livestock grazing would shift from the east side of the Project Area where turbine corridors were shortened to Reclamation-administered land and Big Ranch Unit B due to an additional turbine corridor in that area.

4.8.4.2 Operations and Maintenance

The operations and maintenance of turbines, access roads, operations and maintenance facilities, and transmission line would not result in any impacts on designated utility corridors or ROWs. Under Alternative C, the corridors on BLM-administered land are shortened even further to provide greater separation between private lands and the nearest turbines. This could reduce the visual and noise impacts associated with operations and maintenance activities compared to Alternatives A and B. Impacts on mining claims and the private airstrip from operations and maintenance activities would be the same as Alternatives A and B.

Reducing the maximum number of turbines to 208 and the associated new access roads would reduce the extent of area exposed to noise and visual impacts associated with maintenance activities and thus help to retain the existing recreation setting compared to Alternative A (203 to 283 turbines). The operations and maintenance of 208 turbines and new access roads would result in the same impacts on the recreation setting and experience as Alternative B with the exception that Alternative C would have a greater visual impact on Lake Mead NRA because turbines would be closer to the NRA than Alternative B.

Impacts on the Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam from operations and maintenance activities would be the same as Alternatives A and B.

Compared to Alternative A, Alternative C would require fewer access roads (due to fewer turbines) which would reduce livestock displacement since less acreage would be disturbed, however, overall impacts on AUMs would be negligible. Impacts on livestock grazing from the operations and maintenance of turbines and access roads would have the same impacts as Alternative B.

4.8.4.3 Decommissioning

Decommissioning the Project would have the same impacts as Alternative B except the turbine corridors on the eastern portion of the Project Area would be shortened to provide greater separation between the private lands and the nearest turbines compared to Alternative B. This would decrease visual and noise impacts on residential areas to a greater extent than Alternatives A and B. Reducing the number of turbines from a maximum of 283 under Alternative A to 208 turbines under Alternative C could indirectly reduce temporary delays for those trying to access mining claims compared to Alternative A. Impacts on mining claims would be the same as Alternative B.

The decommissioning of up to 208 turbines, access roads, and related facilities would have similar, though slightly less, ground disturbance and impacts on the quality of the recreation setting and experience compared to Alternative A. Decommissioning up to 208 turbines, access roads, and related facilities would have the same impacts on the recreation setting and experience as Alternative B.

Decommissioning fewer turbines (208 turbines) could indirectly reduce temporary delays in site specific areas for those trying to access Mount Wilson Wilderness Area, NPS proposed wilderness, Lake Mead NRA, and Hoover Dam compared to Alternative A (283 turbines). Impacts on Mount Wilson Wilderness would be the same as Alternative B.

Decommissioning the Project under Alternative C would result in less temporary surface disturbance and loss or damage to available forage for livestock grazing in the northeastern and northwestern part of the Project Area compared to Alternative A. Disturbance and impacts on livestock grazing Reclamation-administered land and Big Ranch Unit B would be greater than Alternative B. However, once reclamation efforts are fully implemented and revegetation has occurred, the long-term effects from decommissioning would be comparable among all action alternatives.

4.8.5 Alternative D – No Action

Land uses within the Wind Farm Site and surrounding vicinity including ROWs, utility corridors, residential areas, mining claims, private airstrip, wilderness, recreational uses, and livestock grazing operations would not change under the No Action Alternative. Recreation would continue to be managed under applicable plans based on land ownership and jurisdiction. There would be no change to the recreational experience for persons visiting Lake Mead NRA.

Management guidelines would remain for the Wind Farm Site and surrounding vicinity, as directed by the BLM Kingman Resource Management Plan, Mohave County General Plan, and Reclamation policies.

4.8.6 Mitigation Measures

The BLM and operators would continue to contact appropriate agencies, property owners, and other stakeholders during the permitting process to identify potentially sensitive land uses, and local and regional land use concerns. This would help maintain conformance with existing land use plans.

Under all alternatives, operators would plan for efficient use of the land and areas disturbed by construction, operation, and decommissioning of the Project (i.e., footprint) through the use of the BMPs described below and in Appendix B.

The Project would utilize existing roads and utility corridors to the maximum extent feasible; this would minimize the disturbance areas for new roads, lay-down areas, and borrow areas. All electrical collector lines would be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance). Overhead lines may be used in cases where burial of lines would result in further disturbance (Appendix B).

Mitigation measures would be in place to manage the growth and spread of noxious weeds and other undesirable plants through implementation of the Weed Management Plan, which could help retain the existing recreation setting and experience, and livestock forage resources. Turbine design elements would include visual uniformity and use of tubular towers to minimize the visual contrast of the Project features across the landscape that could degrade the quality of the recreation setting and experience. If Project access roads are removed after decommissioning and re-graded and revegetated, this could help restore livestock forage resources and the existing recreation setting and experience. In addition, reclamation efforts would use native seed mixtures to further minimize the spread of noxious weeds, provide a better opportunity for successful revegetation, and help the area appear more natural once reclaimed.

4.8.7 Unavoidable Adverse Impacts

Unavoidable adverse impacts could occur for those seeking a more semi-primitive recreation setting and experience within an undisturbed landscape due to the presence of the wind turbines and associated facilities. These impacts would occur over the duration of the wind farm operations; however, many other locations in the region would still afford opportunities for a natural vista setting or semi-primitive recreation experiences.

4.9 TRANSPORTATION AND ACCESS

This section describes the potential impacts on the local transportation network that could result from implementing one of the action alternatives for this Project, and the impacts to the Project Area that would be anticipated under the No Action alternative. Factors analyzed include access, traffic, and vehicle type changes on major highways, local arterial and collector roads, and any new proposed roadways in the area that would be required due to Project design. The analysis areas specific to this section includes the roads that would be used for access to the Project Area, which would be US 93, and unpaved/unmarked access roads within the Wind Farm Site on and around the Project Area and its surrounding vicinity. Travel by Project construction and operational vehicles is not expected on Temple Bar Road; therefore, no impacts on transportation or access on these roads would be anticipated.

4.9.1 Analysis Methods

Assessment of potential effects on transportation and access was based primarily on reviewing the existing Annual Average Daily Traffic (AADT) levels on each respective roadway together with the expected increase on those roads due to construction, operation, and decommissioning of the Project. Data for traffic analyses were obtained from the Arizona Department of Transportation (ADOT). The potential for the Project to result in an increase in vehicular traffic and accidents was analyzed for US 93 between Pierce Ferry Road and the Arizona/Nevada state line. Additionally, the trip count data in the Transportation and Traffic Plan (BP Wind Energy 2011a) that was developed for this Project were used to assess the projected impacts against the projected volume of traffic (Appendix C).

Impacts on local traffic were analyzed for sections of state and Federal highways and local collector roads that provide access to the Project. The primary impacts on the transportation network would result from creating new roads; changing access to, from, and within the Project Area; creating a disruption to local and regional traffic patterns, and a change in the type of vehicles using the transportation network.

4.9.2 Alternative A – Proposed Action

4.9.2.1 Construction

Alternative A would increase vehicular traffic on the Wind Farm Site and in its surrounding areas. Project construction would require both temporary and permanent Project roads; public access to these roads would generally be restricted for safety and security reasons. This would result in short-term impacts to the local transportation network and access to the Wind Farm Site for the duration of construction. Temporary construction roads would include a 56-foot maximum disturbance area for 36-foot wide roads, which would decrease to a 20-foot width upon completion of construction. Per BMPs, a Transportation and Traffic Plan has been developed to address Federal, state, and local requirements based on the proposed Project transport needs, and expected increase in construction traffic (Appendix C).

Alternative A would include site access from US 93 via the road that is currently serving the BLM aggregate pit located in Detrital Wash. The existing road is approximately 1.5 miles long and would be upgraded and include an approximate 3-mile extension to access the Wind Farm Site. On-site access roads, including both new roads and upgrades to existing roads, would be constructed creating a temporary construction disturbance of 767 acres. It is anticipated that the construction timeframe would span 12 to 18 months (52 to 78 weeks) and include varied levels of construction traffic throughout that duration. There are several components associated with construction, and each has a specific transportation requirement associated with delivery or access to the Wind Farm Site. These components are discussed in the following paragraphs and Table 4-13 provides a summary of the transportation requirements.

Table 4-13 Estimated Number of Vehicle Round Trips into the Project Site (During Total Construction Period)

Transport Vehicle Category	Lower Bound Estimate	Upper Bound Estimate	Expected Number of Round Trips
Turbine Components	1,981	4,528	2,830
Aggregate and Water	1,300	6,300	4,300
Concrete Delivery Vehicles	1,300	2,300	1,300
Mobilization	250	500	250
Personnel Transport	23,400	54,600	39,000
Total	**28,231**	**68,228**	**47,680**

SOURCE: Transportation and Traffic Plan, Appendix C

Depending on vendor shipping configuration, each turbine would require 7 to 16 semi-trailer loads of equipment or materials. For Alternative A, there would be a maximum of 283 turbines, which would result in 1,981 to 4,528 round trips for turbine transport vehicles. The majority of turbine vendors require an average of 10 trucks per turbine; therefore, it is expected there would be roughly 2,830 round trips for turbine deliveries.

For this Project, aggregate and water are planned to be obtained from within the Project Area (from the existing BLM aggregate pit along the main access road), and so the trip count primarily reflects the initial arrival of vehicles on site to start the day and their departure at the end of the work day (assuming they leave the site). Assuming eight aggregate and two water trucks are needed per day over a 26 week period (five day work week), 1,300 rounds trips would be required for aggregate and water trucks (which would likely be less as some truck drivers would elect to leave trucks on site overnight). It is planned that the aggregate and water trucks would enter and exit the site only once per day, and that the majority of their movement would be within the Project Area.

The Project would use on-site concrete mixing and batching plants, with the concrete mixed and hydrated at each batch plant. It is assumed that the concrete mixer trucks would make only one round trip per day, arriving at the Project Area in the morning and departing at the end of the shift. Assuming 10 concrete mixer trucks during a 26 week period (five day work week), 1,300 round trips would be required for bringing the concrete mixer trucks to and from the Project Area. Should some truck drivers elect to leave trucks on site overnight, this number of round trips would be reduced accordingly. The majority of the mixer truck movements would be within the Project Area as they haul concrete from the batch plants to turbine or other foundation sites.

Construction mobilization would require one trip to the Project Area. Excluding the trips for the wind turbines, an estimate of 250 trips would be required to deliver construction equipment, substation equipment, electrical and transmission equipment and materials, and miscellaneous facilities equipment.

The number of construction personnel would range from 90 to a peak of 275 people during the 12- to 18-month construction period. However, most workers would not be on site the entire duration of construction and consequently there would usually be less than 275 workers on site on any given day. Assuming for a lower bound estimate an average of 90 worker vehicles on site and a 52-week (five day work week) construction duration, there would be 23,400 rounds trips for personnel transports. Assuming for an upper bound estimate of two persons per vehicle, an average of 140 worker vehicles on site and a 78-week (five day work week) construction duration there would be 54,600 rounds trips for personnel transports. A reasonable estimate for expected personnel transport round trips for this Project is the approximate average of the two, 39,000, spread out over an18-month duration.

Due to the location of the site access road, it is not expected that construction traffic or on-site Project related traffic would negatively impact residential traffic in the surrounding areas. Based on 2011 ADOT AADT along US 93 between the Arizona/Nevada State Line at Pierce Ferry Road, the proposed peak construction schedule would increase daily traffic volume by 4 percent over the existing level. Oversized and slow-moving transport vehicles on US 93 could result in temporary traffic delays for both local traffic and motorists traveling to Lake Mead NRA via Temple Bar Road, but US 93 has been widened from Kingman to the Arizona/Nevada state line to two lanes of traffic in each direction so that faster moving vehicles could go around the transport vehicles.

The entire Project Area is accessible for OHV use on existing roads, trails and washes. Throughout the construction phase of the proposed Project, access to the Project Area for OHV use would be limited due to construction activity, and the associated temporary warning fences or barricades that would be in place to protect public safety. It is not known if there would be an increase in private vehicle traffic from members of the public interested in viewing wind farms construction, but any vehicle traffic on the Project Area would be limited in the same manner as OHV use.

4.9.2.2 Operations and Maintenance

The operations and maintenance phase would not require the wide access roads necessary for construction; consequently, road widths would be reduced to a long-term disturbance width of 20 feet. The amount of total permanent disturbance from post-construction access roads would decrease from 767 acres to 266 acres for Alternative A. The number of Project personnel working on site year-round to perform operations and maintenance activities is estimated at 20 people (Section 4.10.2.1) and, due to the low amount of resulting traffic to the site, Project operations and maintenance activities would have little measurable effect on the current AADT levels along US 93 in the Project vicinity.

Operations and maintenance activities would limit access to some areas on the Project Area because certain areas such as the O&M building, substations, and switchyard, would be fenced and restricted to authorized personnel (refer to Chapter 2, Site Security). This should not affect OHV use, as fenced areas with restricted access could be located outside of existing travel route locations. Additional areas also may be closed temporarily to public access, as necessary, for maintenance activities. About 105 miles of new access road would be added with Alternative A, although most of this roadway would be access along turbine corridors and not through roads. If a crane is needed for repair, the crane would be brought in on trucks and assembled at the turbine site such that the permanent 16-foot wide road (20-foot wide with shoulders/ditches) would be sufficient for site access, and the 10-foot wide shoulders would not need to be reinstalled. The day-to-day operation of Alternative A would not be expected to adversely impact the use of OHVs on and around the Project Area due to the abundance of open accessible land adjacent to the Project Area available for OHV use. Additionally, operations and maintenance of the proposed Project would not impact residential traffic or access in the surrounding areas because there would be no discernable increase in AADT in the surrounding areas. Since access to the Project Area would be via US 93, no residential areas would be impacted.

4.9.2.3 Decommissioning

The transportation impacts to the Project Area and its surrounding areas during the decommissioning phase would be similar to those identified during Project construction since it is assumed that personnel and equipment requirements would be similar. While aggregate and water trucks for mixing concrete would not be necessary, trucks to haul out the portions of foundations that would be removed, and some water trucks would be needed for dust control.

Project access roads would be decommissioned and restored to pre-construction conditions where appropriate. The impact on US 93 traffic would be similar to those impacts identified in the construction phase and increased traffic volumes are anticipated to be sustained for the entire duration of decommissioning. During decommissioning, the existing equipment would be removed, and a Decommissioning Plan would be developed to address the procedures (see Section 2.5.5). During the decommissioning phase, there would be coordination with ADOT regarding treatment of the improvements made within the US 93 ROW to accommodate truck movements to the access road leading to the Wind Farm Site to determine if the improvement would be retained or reclaimed.

4.9.3 Alternative B

4.9.3.1 Construction

Construction impacts to the transportation network for Alternative B would be similar to those identified for Alternative A. While road widths would remain consistent between alternatives, the amount of total on-site disturbance from road construction varies. It is expected that Alternative B would include about 99 miles of new access road within the Wind Farm Site and improvements to about 8 miles of existing road, resulting in about 615 acres of temporary roadway construction disturbance compared to 767 acres for Alternative A.

The amount of construction traffic would be similar to that of Alternative A, but could require fewer construction vehicle trips if there were a decrease in the number of turbine component transports and an associated decrease in the amount of construction traffic internal to the Wind Farm Site. Other construction traffic involving worker and on-site transport would be consistent among all alternatives.

4.9.3.2 Operations and Maintenance

Transportation and access impacts during the operations and maintenance phase for Alternative B would be the similar those identified in Alternative A. However, the total permanent on-site disturbance for roadway development would be 211 acres for Alternative B compared to 266 acres in Alternative A.

The amount of on-site traffic due to operations and maintenance would be consistent among all alternatives because the number of operations personnel for the three action alternatives would be the same.

4.9.3.3 Decommissioning

The decommissioning of Alternative B would be similar to that of Alternative A, but would require fewer vehicle trips than Alternative A because there would be fewer turbines to decommission and thus fewer turbine component and turbine foundations to remove and haul from the site.

4.9.4 Alternative C

4.9.4.1 Construction

Construction impacts to the transportation network for Alternative C would be similar to those identified for Alternatives A and B. While road widths remain consistent among all of the action alternatives, the amount of total on-site disturbance from road construction varies. It is expected that Alternative C would include approximately the same miles of new and existing access roads as Alternative B with 607 acres of temporary roadway construction disturbance compared to 767 acres in Alternative A, and 615 acres in Alternative B.

The amount of construction traffic would be similar to that of Alternative A, but could require fewer construction vehicle trips if there were a decrease in the number of turbine component transports and an associated decrease in the amount of construction traffic internal to the Wind Farm Site. Other construction traffic involving worker and on-site transport would be consistent among all alternatives.

4.9.4.2 Operations and Maintenance

Transportation and access impacts during the operations and maintenance phase for Alternative C would be the similar those identified for Alternatives A and B. However, the total long-term on-site disturbance for roadway development would be 207 acres for Alternative C compared to 266 and 211 acres, respectively, for Alternatives A and B.

The amount of on-site traffic due to operations and maintenance activities would be consistent among all alternatives.

4.9.4.3 Decommissioning

The decommissioning of Alternative C would be similar to that of Alternatives A and B, but would require fewer vehicle trips than Alternative A because there would be fewer turbines to decommission and thus fewer turbine component and turbine foundations to remove and haul from the site.

Table 4-14 compares the construction and post-construction access road disturbance areas across each action alternative.

Table 4-14 Access Roads Area of Disturbance

	Temporary Roadway Disturbance	Permanent Roadway Disturbance
Alternative A	767 acres	266 acres
Alternative B	615 acres	211 acres
Alternative C	607 acres	207 acres

4.9.5 Alternative D – No Action

Existing transportation and access to the Project Area and in its surrounding vicinity would not change with Alternative D, the No Action Alternative. Under this alternative the Project would not be constructed and recreational and residential access would not be expected to change, with OHV access continuing to be managed in accordance with the BLM Kingman Resource Management Plans and as regulated by Mohave County Ordinance 87-02, which is the Ordinance for Off Road Motor Vehicles (Mohave County 1987). The traffic projections developed by ADOT along US 93 in the vicinity of the Project Area would not be influenced by the proposed Project; however, ADOT projections for US 93 between the Nevada State Line and Pierce Ferry Road project daily traffic to rise to 12,000 vehicles per day by 2029 (ADOT no date). ADOT forecast information acknowledges that the projection rates do not represent refined estimates of anticipated traffic volumes.

4.9.6 Mitigation Measures

It is not expected that construction traffic or on-site Project-related traffic would negatively impact residential traffic in the surrounding areas. However, based on regulations deemed appropriate by ADOT, it may be necessary to add turning lanes to US 93 that would provide access to the Project Area in an effort to accommodate the anticipated volume of slow-moving, oversized loads and mitigate the potential for traffic back-ups on a Federal highway. Additionally, the Transportation and Traffic Management Plan, Blasting Plan, and Dust and Emissions Control Plan would be implemented, sensitive areas where disturbance needs to be avoided would be surveyed and flagged. The applicable permits needed to transport equipment and materials would be obtained and there would be close coordination with ADOT and other state transportation departments, as appropriate.

4.9.7 Unavoidable Adverse Impacts

The proposed Project could have some unavoidable adverse impacts on traffic during construction along US 93, depending on the physical upgrades necessary to provide adequate space for construction trucks entering and leaving the highway; however these impacts would be temporary and limited to a very localized area. The proposed Project would not have any unavoidable long-term adverse impacts on transportation and access because existing highway corridors can sufficiently handle the increased traffic anticipated during construction, and new roads within the Project Area would be upgraded or developed to meet Project requirements.

4.10 SOCIAL AND ECONOMIC CONDITIONS

Potential socioeconomic effects with the area of analysis, defined as Mohave County, are presented in this section. The key socioeconomic resources addressed are employment, income, tax revenues, population, housing, and property values. Also addressed in this section are other potential effects on quality of life based on changes in environmental quality (such as air and water quality) and wildlife habitat and species abundance, as analyzed in other resource sections.

4.10.1 Analysis Methods

Data for social and economic analysis was obtained from various sources, as described in the sections that follow.

4.10.1.1 Levels of Analysis

The primary level of analysis for socioeconomic effects is Mohave County, Arizona. However, for fiscal (tax) impacts, the analysis is conducted for three levels: state, county, and municipal.

4.10.1.2 Methodology for Employment and Income Effects

Employment and labor income are common economic indicators used to measure the value of economic activity in an economy. Labor income is the sum of employee compensation (including all wages and employee benefits) and proprietor income (profits). Employment is the average number of employees, whether full or part-time, required to produce a given level of economic output. Income and employment represent the net economic benefits that accrue to a region as a result of increased economic activity. Income and employment effects of the Project construction and operations phases are analyzed in this section, but due to little available data, no effects are quantified for the decommissioning phase.

The effect of the Project on Mohave County employment and labor income are analyzed using an Impact Analysis for Planning (IMPLAN) model with data specific to Mohave County. IMPLAN models include data on the linkages between different industries and facilitate the estimation of total economic effects. Total economic effects include direct effects attributable to the activity being analyzed, as well as the additional indirect and induced effects resulting from money circulating throughout the economy. Because the businesses within a local economy are linked together through the purchase and sales patterns of goods and services produced in the local area, an action that has a direct effect on one or more local industries is likely to have an indirect effect on many other businesses in the region. For example, an increase in construction would lead to increased spending in the adjacent area. Firms providing production inputs and support services to the construction industry would see a rise in their industry outputs as the demand for their products increases. These additional effects are known as the indirect economic effects. As household income is affected by the changes in regional economic activity, additional effects occur. The additional effects generated by changes in household spending are known as induced economic effects. The indirect and induced effects are larger for areas that produce the inputs and support services demanded (otherwise, inputs are imported to the region and the economic activity "leaks" from the region). Thus, the total economic impact of an activity is typically larger for areas with larger populations and larger economies.

IMPLAN is used to estimate the total economic effects in Mohave County of Project alternatives based on the direct expenditures in the local economy during construction and operations on Project-related materials and labor. As described in the sections below, Project-related expenditures would be the primary source of effects on jobs and income, though potential effects from changes in the recreation industry and change in land use are analyzed.

The Project proponent provided an overall Project construction cost estimate of $2.0 million per MW (Runyan 2010). This total cost estimate was separated into constituent elements of labor and materials using data from the Job and Economic Development Impact (JEDI) model for wind energy developed by the U.S. Department of Energy (U.S. Department of Energy 2010). The JEDI model uses industry average data on the costs of construction and operation of wind power development. As alluded to above, only the component of Project expenditures expected to be spent within Mohave County are accounted for in the analysis as only these expenditures would affect the Mohave County economy. The JEDI model provides estimates of the proportion of total costs that may be expected to be expended in the local area based on the population of the area of analysis, with areas of larger population estimated to provide a higher proportion of project inputs than areas with a smaller population.

The Mohave County population is estimated at more than 200,000 people. The JEDI model provides estimates of the proportion of local expenditure for wind farm inputs from counties with 100,000 people and 300,000 people; therefore, an average of these two values was used to estimate the proportion of inputs sourced locally from Mohave County. Using this approach, it is anticipated that approximately 7 percent of total Project expenditures would be spent in Mohave County. The vast majority of total Project expenditures, approximately 76 percent, would be spent on turbine equipment such as blades, towers and the transportation that would be produced elsewhere and transported to the Project site. Aside from these specialized turbine components, it is expected that Mohave County residents and businesses would supply much of the non-skilled labor, goods and services required by the Project. The largest component of Project construction costs spent within the county (78 percent) would be for materials and services such as concrete, rebar, road construction, and site preparation. The second highest component of local construction Project expenditures would be for worker allowances for items such as housing, food, and other living expenses. It is anticipated that much of the labor to construct the Project is specialized, and would be sourced from outside the county, including from the Las Vegas metropolitan area and from other areas around the country.

To the extent that the Project-related expenditure pattern in the county varies from that used in the analysis, the results presented in this section may underestimate or overestimate effects. Table 4-15 summarizes the estimated total and local proportion of construction expenditures by sector for every 100 MW of wind power developed in Mohave County.

Table 4-15 Mohave County Wind Farm Estimated Construction Expenditures per 100 MW

Expenditure Type	Total Expenditure (Millions $)	Estimated Expenditure in Mohave County (Millions $)	Sector
Construction materials (concrete, rebar, roads and site prep)	$21.86	$11.16	Industry spending pattern for construction of new non-residential buildings
Worker allowances for living expenses	$7.60	$1.90	Spending pattern for $50-$75K households
Site certification and permitting	$0.52	$0.52	Management, scientific and technical services
Foundation construction labor	$0.82	$0.41	Worker compensation
High voltage substation construction material	$1.50	$0.18	Construction of new non-residential buildings
Electrical labor	$1.35	$0.12	Worker compensation
Tower erection construction labor	$0.92	$0.04	Worker compensation
Turbines (including blades, towers and transportation)	$151.25		Wind turbine manufacturing
Transformers	$2.47		Communication and energy wire and cable manufacturing
High voltage substation labor	$0.46		Worker compensation
Electrical components (drop cable, wire and high voltage cable)	$7.37		Communication and energy wire and cable manufacturing
Construction management/supervision labor	$0.70		Worker compensation
Attorneys	$1.11		Legal services
Engineering	$2.04		Management, scientific and technical services
Total Construction Costs	$199.97	$14.34	

SOURCE: Cardno ENTRIX derivation using data from National Renewable Energy Laboratory, Jobs and Economic Development (JEDI)

Similarly, Table 4-16 summarizes estimated total and local proportion of operations expenditures by sector for every 100 MW of wind power developed in Mohave County. More than 70 percent of operations expenditures are for replacement parts or insurance, which are not expected to be sourced locally (due to the specialized equipment on wind turbines, none of these parts are to be manufactured or sourced from Mohave County). However, nearly all other Project expenditures are expected to be sourced locally, so a total of 20 percent of annual operation expenditures are expected to be spent within the local economy. The major component of operations and maintenance costs that are retained within Mohave County are for operations labor, which accounts for 72 percent of the total annual local expenditures.

Table 4-16 Mohave County Wind Farm Operations and Maintenance Expenditures per 100 MW

Expenditure Type	Total Cost (Millions $)	Estimated Proportion in Mohave County (Millions $)	Sector
Operations labor	$0.29	$0.29	Employee compensation
Vehicles	$0.05	$0.02	Automotive repair and maintenance
Tools and other consumables	$0.12	$0.02	Building materials and garden supplies
Utilities	$0.02	$0.02	Electric power generation
Utilities	$0.02	$0.02	Water, sewer and other delivery systems
Fuel	$0.02	$0.02	Gas Stations
Fees, permits and licenses	$0.01	$0.01	Management, scientific and technical services
Site maintenance	$0.02	$0.00	Maintenance & repair of non-residential structures
Insurance	$0.37		Insurance Agencies
Replacement parts	$1.08		Wind turbine manufacturing
Total Operations and Maintenance Costs	$2.00	$0.41	

SOURCE: Cardno ENTRIX derivation using data from National Renewable Energy Laboratory, Jobs and Economic Development (JEDI)

4.10.1.3 Fiscal Effect Methodology

The fiscal effects of the Project are analyzed for four types of taxes: personal income tax, transaction privilege tax (TPT), use tax, and property tax. While other business taxes may also increase tax revenues, it is expected that these would be the primary sources of increased taxes from the Project. Regarding income tax, workers residing outside of Arizona, or who were previously unemployed before being hired onto the Project, would provide new personal income tax funds to the State of Arizona. Further, local purchases of many goods and services from within the county and State would be subject to taxation under the TPT. Expenditures on Project materials and labor not purchased within Arizona are not subject to the TPT, but would be subject to the provisions of the Arizona use tax. TPT and use taxes would accrue to the state, the county, and municipalities in the county. Property taxes would be assessed based on the value of the Project and would be collected by the State of Arizona and then distributed to Mohave County.

Income Tax

Arizona levies a personal income tax on both residents and nonresidents earning income in Arizona. Increases in personal income tax would be a result of an increased workforce with increased income. All income earned in Arizona is subject to the state income tax, with income tax rate ranging from 2.5 to 4.5 percent of taxable income (State of Arizona 2010a). The average income tax receipt of total income is roughly 1.1 percent. This rate was calculated using the ratio of total income tax receipts of $1.8 billion (State of Arizona June 2010b) to total estimated income of $159.4 billion (Census 2010a)[1].

Transaction Privilege Tax

The Transaction Privilege Tax (TPT) is a tax on the privilege of doing business in Arizona and applies to all sales, both labor and materials, and to all transactions including wholesale, retail, and business-to-business made in Arizona (State of Arizona 2010c). The Arizona TPT is a flat tax of 6.6 percent, and Mohave County has an additional TPT rate of 0.25 percent. The largest cities in Mohave County, including Colorado City, Bullhead City, Kingman, and Lake Havasu City, have a TPT rate of 2 percent. It

[1] Total income for Arizona was estimated from Census data by multiplying the per capita income of $25,203 by the population of 6,324,865 (Census 2010a).

is assumed that materials purchased within Mohave County are purchased within cities, resulting in a total TPT tax rate of 8.85 percent.

Use Tax

The Use Tax is imposed upon the purchaser of tangible personal property that is used, stored, or consumed in Arizona when the sale was not subject to the TPT. The use tax in Mohave County applies to the purchase of tangible goods from outside of Arizona and is taxed at the same rates as identified in the TPT. Purchases subject to a use tax are exempt from the TPT (State of Arizona 2009a). Materials purchased for the Project subject to the use tax would be taxed by the State of Arizona and Mohave County, at a total rate of 6.85 percent. Materials are only subject to the use tax if the sales tax rate of the state where these materials were purchased is less than the project area use tax rate of 6.85 percent (State of Arizona 2009a). As it is not known what sales tax would be levied on materials purchased outside of Arizona, this analysis assumes that all materials purchased elsewhere would be subject to the use tax, and may therefore overestimate use tax income.

Property Tax

The Project assets would be subject to property tax according to the rates determined for renewable energy generating and transmission facilities. Property taxes are based on full cash value, which is equal to 20 percent of the value of the asset (improvement cost less accumulated depreciation). The full cash value is in turn multiplied by the assessment ratio of 20 percent to derive the net assessed value. The net assessed value is subject to the average Mohave County mill rate of $8.57 per $1,000 of net assessed value (Guin 2011). So for every $1 million of Project asset value, the total property tax is estimated at approximately $343 annually.

Exemptions and Limitations

The TPT and Use Rate is levied on all construction projects; however, contractors receive a deduction that allows only 65 percent of the total costs of construction projects to be taxed (State of Arizona 2009b; Arizona Department of Revenue 2011). Other non-taxable construction expenditures include expenditures on professional services. The State of Arizona does not typically tax professional services; however, care must be taken in the how the prime contractor structures their professional service contracts in order to avoid TPT and use taxes on these services (Heugly 2011).

Under Arizona Revised Statute (A.R.S.) Title 42-5061, Arizona tax law stipulates that sales of solar energy devices shall be excluded from TPT and use tax. Solar energy devices are defined under A.R.S. Title 42-5001 as a system or series of mechanisms to produce electric power including wind generating systems (Comanita 2011). For the purposes of this analysis, use taxes associated the wind turbines and towers and labor for their erection have been excluded from the taxable value.

4.10.1.4 Other Effects: Property Value and Quality of Life

Other effects on socioeconomic resources, specifically, property value and environmental and natural resources with socioeconomic value, are evaluated based on the conclusions from other resource sections. These sections include: climate and air quality, water resources, cultural resources, wildlife, special status species, land use, transportation and access, recreation, and visual resources.

4.10.2 Alternative A – Proposed Action

This section describes the expected effect on socioeconomic resources of the construction, operations and maintenance, and decommissioning phases of Alternative A. Three primary types of effects are evaluated: employment and income, population and housing, property value, and other quality of life effects.

4.10.2.1 Employment and Income

The primary socioeconomic effect of Project construction would be to increase income and employment in Mohave County. As described in the Land Use Section 4.8, economic activities in the Project Area are limited to some recreational use and the short-term livestock grazing that may be displaced due to Project construction. Construction of the Project would result in potential temporary reduction of forage availability in Big Ranch Units A and B (including 747 acres for new access roads), while operation of the Project would result in potential long-term reduction of 339 acres of forage production through the life of the Project. Data from the BLM indicate that there is an average of 0.057 animal unit month (AUM) per acre of Arizona BLM grazing lands, with a rental value of $1.35 per AUM (BLM 2010)[2]. Using these averages, the average value per 1,000 acres of grazing land is estimated at approximately $75 per month. If the total grazing area is reduced by 339 acres, the rancher would potentially lose the income from the value of approximately 20 AUMs (339 x .057 AUM) every year for the life of the Project if other grazing lands cannot be secured. Therefore, the social and economic effects on livestock grazing during all Project phases are anticipated to be negligible.

Likewise, little to no adverse effect on recreation visitor spending (hotels, restaurants, etc.) in the Mohave County economy is anticipated as most of the recreation in affected areas (southern portion of the Lake Mead NRA and the Project Area) is expected to be by local residents rather than non-resident visitors. Furthermore, the total number of affected recreationists in this area is expected to be limited in number to hundreds of users annually (rather than thousands), so the potential effects are also limited (Holland 2010, Marceau 2010). It is also feasible that the Project facilities may attract additional recreational visitors to the area, which would result in a positive effect on visitor spending in the area.

Therefore, this section focuses on the employment and income impacts that would stem from the increased economic activity associated with Project construction and operation (little to no information is available regarding Project decommissioning). This section analyzes the expected employment and income effects of the development of the wind farm itself, but due to a lack of information, does not analyze the effects of transmission line interconnection, collector lines, or substation construction or operation. Additional employment and income would be generated from these Project components, but would likely be very small compared to the costs of the wind farm construction and operation.

Project Total

As described in more detail below, Project-related expenditures for Project construction and operations are anticipated to support additional jobs and income in Mohave County. Project-related economic activity during the 12- to 18-month construction phase (assuming a 500 MW Project) is estimated to support 720 jobs and $38.5 million in Mohave County, of which 440 jobs and $17.3 million are estimated to accrue to local residents. During the 30-year operations phase, approximately 40 jobs would support an additional $2.0 million in household income. This compares to the nearly 76,000 existing jobs in the county and total annual income of $4.85 billion. The present value of total local income effects due to operations over the 30-year life of the Project is anticipated to be approximately $57.3 million, using a 3 percent discount rate. Present value represents the value of a one-time payment today that is equivalent to the 30-year stream of annual income benefits from the Project.

Employment and income impacts presented in Table 4-17 represent estimated impacts derived from a 500 MW Project. If the Project is 425 MW, a 15 percent reduction in Project size, then the employment and income impacts would similarly decrease by approximately 15 percent.

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[2] In Arizona, there are 11.5 million acres of BLM public lands open to grazing with 659,990 active AUMs or 0.057 AUM per grazing acre.

Table 4-17 Alternative A Estimated Employment and Income Impacts in Mohave County (500 MW Project)

Effect	Local Employment (Full and Part-Time Jobs)		Local Income[1] (Millions $)		
	Construction (One Year)	Operations (Annual for 30 Years)	Construction (One Year)	Operations (Annual for 30 Years)	Construction and Operation Present Value
Direct	60	20	$2.9	$1.5	$31.4
Indirect	290	5	$11.1	$0.2	$15.1
Induced	90	10	$3.3	$0.4	$10.8
Total Effects	440	40	$17.3	$2.1	$57.3

[1] Labor income reported includes the value of employee benefits

Construction

Construction of Alternative A would result in hiring of local and non-local construction workers, as well as expenditures for other local goods and services for the Project. The construction phase of the Project is projected to occur over a 12- to 18-month period and directly employ 90 to 275 workers at any given time. Of these workers, approximately 55 employees are expected to be current county residents. As noted above, it is anticipated that much of the labor to construct the Project is specialized, and would be sourced from outside the county, including from the Las Vegas metropolitan area and from other areas around the country. The remaining construction workers are anticipated to be temporary residents that would only reside in the county during the construction phase of the Project. Total income for all construction workers is estimated at $21.2 million, of which an estimated $2.9 million is for local workers (those currently residing in Mohave County rather than Nevada residents or temporary workers relocating to the county only for the duration of the Project).

Additional local jobs would be supported by Project-related expenditures on goods and materials such as construction materials and supplies (known as indirect effects). As previously described, data from the JEDI model was used to estimate expenditures on local goods and services used as inputs to the construction process. It is estimated that this spending in the Mohave County economy for Project inputs would support 290 jobs and $11.1 million in income, primarily in the construction and services sectors.

Employment would be generated in other sectors of the Mohave County economy through spending by employees supported directly or indirectly by Project construction (known as induced effects). Non-local construction workers would spend money in the county on such goods and services as lodging, food, and gas, which results in increased employment and income in these sectors. Increased spending by local construction worker households is also expected to generate additional employment in the county. This increased spending by workers directly and indirectly supporting Project construction is anticipated to generate an additional 90 jobs (Table 4-18) and $3.3 million in income. The majority of this employment and income is anticipated to be in service sectors.

Table 4-18 Alternative A Construction Employment and Income (500 MW Project)

Economic Impact	Local Employment	Local Income[1] (Annual)
Direct Effects	60	$2,860,000
Indirect Effects	290	$11,120,000
Induced Effects	90	$3,280,000
Total Effects	440	$17,260,000

[1] Labor income reported includes the value of employee benefits

In summary, Project-related economic activity during the construction phase is estimated to support 720 jobs and $35.6 million in Mohave County, of which 440 jobs and $17.3 million are estimated to accrue to local residents.

Operations

It is anticipated that the Project would have an operations and maintenance phase that begins immediately following construction and would continue over a 30-year period. Employment figures represent both full- and part-time jobs. The operations and maintenance process for the Project primarily includes turbine maintenance and ROW maintenance and the associated labor, materials and utilities necessary to fulfill these functions. It is assumed that operations and maintenance would be conducted by employees hired locally, or employees that would re-locate and settle locally in the county.

During the operations phase of the Project, an estimated 20 workers would be employed to maintain and operate the wind turbines, with total income to these employees of $1.5 million. In addition to jobs being directly generated by Project operations, the purchase of Project-related materials and services would also indirectly generate local employment. The JEDI model provided that expected expenditures for local goods and services totaled $0.6 million. These expenditures are anticipated to support approximately five jobs in the county, with associated income of $0.2 million.

Finally, expenditures of wages by Project employees and supporting industry employees in the local economy also support local employment. By retaining the laborers in the local area, and providing these individuals with jobs, it is expected that the additional expenditures would support an additional 10 jobs and income of $0.4 million. Thus, total employment and income supported by Project operations, including direct, indirect and induced effects, is estimated to be 40 jobs and $2.1 million in income annually (see Table 4-19).

Table 4-19 Alternative A Operations and Maintenance Employment and Income Impacts, 500 MW Project

Economic Impact	Operations Employment (Full and Part-Time Jobs)	Operations Income[1] (Annual) (Millions $)
Direct Effects	20	$1.5
Indirect Effects	5	$0.2
Induced Effects	10	$0.4
Total Effects	40	$2.1

[1] Labor income reported includes the value of employee benefits.

Decommissioning

The Project is anticipated to have a life of 30 years, at which point decommissioning would commence. Decommissioning would require labor to remove the wind turbines, electrical system, structural foundations, and roads. In addition, labor would be required to re-grade, recontour, and revegetate areas to be restored. Very little data are available regarding the employment and income effects of the decommissioning process. However, it is anticipated that the local labor and income effects would be relatively minor as the decommissioning period is temporary, and it is expected that either the operations team would provide the majority of the labor or that the process would require specialized labor from outside of Mohave County.

4.10.2.2 Fiscal Effects

This section presents the anticipated fiscal impacts from Alternative A for construction and operations phases (little data are available for the decommissioning phase). The present value of property, TPT, use, and income taxes from Alternative A are estimated at $22.5 million, using a 3 percent discount rate over the 30-year life of the Project. The State of Arizona is estimated to receive the majority of these tax receipts ($13.6 million), with the county estimated to receive $7.2 million (primarily from property tax revenue), and city governments within the county are estimated to receive $1.7 million during this 30-year timeframe.

Construction

Total tax revenue in Arizona from Project construction is estimated at approximately $11.1 million, primarily in TPT and use tax accruing to the State. Mohave County is anticipated to receive approximately $366,000 over the construction phase of the Project, while local purchases of goods and labor is anticipated to generate nearly $900,000 in tax revenue for cities within the county (Table 4-20).

Table 4-20 Alternative A, Fiscal Impacts from Construction, 500 MW Project

Tax Type	Expenditures Subject to Taxes	Proportion Taxable[1]	Taxable Value	Tax Rate	Tax Revenue
Arizona					
Personal Income Tax	$21,240,000	80%	$16,893,000	1.1%	$186,000
Transaction Privilege Tax (TPT)	$69,070,000	65%	$44,895,500	6.6%	$2,963,000
Use Tax	$156,150,000	65%	$101,497,500	6.6%t	$6,699,000
Subtotal					$9,853,000
Mohave County					
TPT	$69,070,000	65%	$44,895,500	0.25%	$112,000
Use Tax	$156,150,000	65%	$101,497,500	0.25%	$254,000
Subtotal					$366,000
Cities within Mohave County					
TPT	$69,070,000	65%	$44,895,500	2%	$898,000
Subtotal					$898,000
Total Tax Revenue					$11,112,000

[1] Approximately 80 percent of employee compensation is subject to personal income tax, as approximately 20 percent is estimated to be employee benefits that are not subject to this tax. Also, per Arizona law, only 65 percent of contractor construction costs are subject to TPT and use tax.

Operations

In all, total tax revenue resulting from Project operations is estimated at approximately $585,000 annually, with the majority accruing to jurisdictions in Mohave County as property tax. The anticipated annual tax revenue for the State as a result of operations is approximately $190,000. At current tax rates, tax revenues to Mohave County and its municipalities are estimated at $350,000, nearly all of which is in property taxes (Table 4-21).

Table 4-21 Fiscal Impacts from Operation of Alternative A, 500 MW Project

Tax Type	Expenditures Subject to Taxes	Proportion Taxable	Taxable Value	Tax Rate	Tax Revenue
Arizona					
Income Tax	$1,460,000	80%	$1,161,000	1.1%	$13,000
Transaction Privilege Tax (TPT)	$2,000,000	100%	$2,000,000	6.6%	$132,000
Use Tax	$720,000	100%	$720,000	6.6%	$48,000
Subtotal					$193,000
Mohave County					
TPT	$2,000,000	100%	$2,000,000	0.25%	$5,000
Use Tax	$720,000	10.%	$720,000	0.25%	$2,000
Property Tax (mill rate)	$999,850,000	4%	$39,994,000	.00857%	$343,000
Subtotal					$350,000
Cities within Mohave County					
TPT	$2,000,000	100%	$2,000,000	2%	$40,000
Subtotal					$40,000
Total Tax Revenue					$583,000

Decommissioning

Little data are available on the decommissioning phase, though there would be some income tax generated by decommissioning labor. It is also likely that some transaction privilege tax or use tax would be levied on construction services or materials purchased for decommissioning.

4.10.2.3 Population and Housing Effects

This section provides analysis on the impacts of the Project on the Mohave County population and housing market expected to result from the additional temporary and permanent workforce population needed for construction, operation, and decommissioning of the Project. No other population or housing effects are expected from the Project. For all phases of the Project, the projected workforce needed for Project construction and operations would be a small percentage of the total county population (over 200,000 people) and available vacant housing.

In terms of housing, Mohave County has approximately 28,000 vacant units county-wide, of which approximately 9,000 units are located in the cities and communities closest to the Project site for which data are available: White Hills Census Designated Place (CDP), Dolan Springs CDP, Meadview CDP, Bullhead City, and Kingman. Roughly one-third of these units, or approximately 3,160 units, are available for rent. White Hills is the nearest community to the Project Area, but has only 7 units available for rent. Similarly Meadview CDP has few vacant units available for rent. However, Dolan Springs CDP has a vacancy rate of approximately 30 percent, or 400 units, of which approximately 50 are vacant rental units. There are an additional 2,700 vacant units available for rent and 4,100 housing units for sale in Bullhead City. Kingman, another city proximate to the construction site, has a total vacancy rate of 8.1 percent, with approximately 400 rental units available and 600 housing units for sale. An additional 7,000 housing units are located nearby in Boulder City in Clark County, Nevada, of which approximately 660 are vacant rental units and 150 are vacant units for sale.

Table 4-22 Vacancy Rates and Units Available for Sale and Rent in the Area of Analysis[1]

Geographic Area	Total Housing Units[1]	Vacancy Rate (percent)		Units Available	
		Rental	Homeowner	For Rent	For Sale
Bullhead City, AZ	23,254	11.6	17.4	2,710	4,065
White Hills CDP, AZ	290	14.3	15.1	7	22
Dolan Springs CDP, AZ	1,311	3.6	26.7	48	351
Meadview CDP, AZ	1,373	6.1	11.2	4	75
Kingman, AZ	12,235	3.2	4.9	386	604
Boulder City, NV	6,979	9.5	2.1	663	146
Project Region Subtotal	*45,442*	*9%*	*12%*	*3,818*	*5,263*
State of Arizona	13,530,719	6.5	8.8	173,168	236,212

SOURCE: U.S. Census Bureau 2010 (Census 2010a)

[1] Vacancy rates and units available represent reporting by the U.S. Census Bureau for 2010. Actual rates and units will vary over time and season.

Construction

Project construction is estimated to span over a 12- to 18-month period, with approximately 90 to 275 construction workers employed at any one time. As up to 55 of these workers are expected to be local residents, the maximum population increase at any one time in Mohave County directly due to Project construction is estimated at approximately 220 people. This is approximately 0.1 percent of the Mohave County population. As noted above, in addition to the directly employed labor force, Project construction is anticipated to support an additional 380 jobs (indirect and induced effects). There may be additional people relocating to the county during Project construction to fill these jobs, but as this employment is generally not specialized and as there is relatively high existing unemployment in the local area, it is expected that most of these jobs supported by the Project would be filled by local residents.

Given the available, vacant housing supply of 3,800 housing units for rent in the county, there is a sufficient supply of housing in existence in the area to accommodate any temporary construction workers. While housing choice by construction worker depends on the type and quality as well as the quantity of available housing, it is expected that with the diversity of choice available in the larger communities proximate to the Project Area that Project-related housing demand would be met by the existing housing supply. Therefore, no new housing is expected to be constructed as a result of the Project. The increased demand for short-term housing from Project construction workers may exert very localized (such as in Dolan Springs CDP) upward pressure on rental market pricing; however, given the high supply of vacant rental units in the county compared to the potential housing demand from Project construction workers, little effect on housing market prices is expected.

Operations

During the operations phase, the Project would employ an estimated 20 workers and support an additional 15 jobs. Long-term population impacts on the county would be less than 35 people, for which there are adequate available, vacant housing units. Therefore, no new housing is expected to be constructed as a result of the Project and little to no effect on housing prices is expected.

Decommissioning

During the decommissioning phase, it is not known how many employees the Project would directly or indirectly support. However, it is expected that the effects would be less than in the Project construction phase in which the population increase is estimated to be less than 0.1 percent of the population. No new housing is expected to be constructed as a result of Project decommissioning, and little to no effect on housing prices is expected.

Visual Impacts and Property Value Effects

Private property values can vary based on the scenic quality of the surrounding landscape. As wind farm developments affect the visual resources in an area, it is possible that such developments could affect property values. However, as described in the visual resources section, there is limited visibility of Project turbines from residential areas in the White Hills Community, Dolan Springs, and Meadview areas. From a few homes located on Indian Peak Road (directly south of the Wind Farm Site), some turbines may be visible (see Visual Resources Section 4.12). Noise can also affect property values, but as discussed in the Noise section (4.15), known residential uses in proximity to wind turbines are not expected to experience construction or operation noise impacts on the basis of Project noise levels complying with Mohave County Zoning Ordinance limits. However, if a threshold of 45 dBA Ldn outdoors is applied as an impact indicator at residential receivers, a portion of the nearby potential residential land use may, under specific wind conditions, experience a noise impact from the operation of wind turbines.

For the homes that have views of the Project Area or may experience noise impacts, property value impacts may occur, but are not expected. Numerous economic studies have analyzed the effect of wind farm development on private property values, and most have found that there is no statistical relationship between property values and proximity to wind farms. For example, a 2009 review of data on 7,500 sales of single-family homes located within 10 miles of 24 existing wind facilities in 9 US states found that there is no consistent, statistically significant effect on home sale prices of a view of wind facilities or proximity to wind facilities (Lawrence Berkeley National Laboratory 2009). While there may temporarily be added traffic, dust, and water use, and sediment in washes in the Project Area, particularly during construction (see below), these effects are not expected to affect property values due to their temporary (during construction) or minor nature.

Construction

Although the Project construction may temporarily adversely affect residents through noise, dust, and increased traffic, Alternative A is not expected to affect private property values in the study area.

Operations

Alternative A is not expected to affect private property values in the study area.

Decommissioning

Alternative A is not expected to affect private property values in the study area.

Other Quality of Life Effects

Quality of life of residents in the area may be affected by changes in traffic density and changes in natural resources or environmental quality, including air quality, water quality/quantity, wildlife habitat, and prevalence of invasive species. In general, these types of impacts would be concentrated during the temporary construction and decommissioning phases, but are expected to be of small magnitude throughout all phases of the Project (as described elsewhere in this chapter).

Construction and Decommissioning

During the construction and decommissioning phases of the Project, some temporary adverse effects on quality of life for local residents may result due to increased Project-related traffic, and potential effects on air quality, water quality, habitat, and potential increased prevalence of invasive species. Increased traffic on existing roads may result, including US 93 and possibly the White Hills Access Road (if construction crews use it to access the site), potentially increasing travel time and travel hazards for local residents. Construction and decommissioning-related emissions and dust may also reduce air quality in the Project Area by emissions of PM_{10} (particulate matter that is 10 micrometers or less in size). PM_{10} can reduce visibility and negatively affect health. The potential adverse consequences of these effects vary significantly by location based on the existing air quality conditions, the local population, and other factors. It is expected that these impacts may be relatively low in the area due to the existing good air quality and low population density.

As discussed in the Water Resources Section 4.4, total pumping withdrawals for dust control and concrete production represent approximately 0.03 percent of recoverable groundwater. This small percentage of depletion is unlikely to affect the overall groundwater supply, especially given the low groundwater use in Detrital Valley. Furthermore, construction and decommissioning activity may also cause a temporary adverse effect on water quality in downstream drainages. If this affects water clarity in areas with high visibility (such as recreation areas, or areas adjacent to residential areas) or affects the quality of aquatic habitat, then adverse temporary, and likely minor, economic effects may result. Similarly, as discussed in the Biological Resources section, habitat areas disturbed by Project construction may be more susceptible to invasive species that may have potential costs to landowners or public agencies.

Local residents and visitors that recreate in the Project Area may be affected by Project construction. The Project may potentially affect the value of the recreation experience for visitors and residents due to: (1) potentially reduced hunting opportunities from fewer deer occurring in the area during construction and decommissioning phases, (2) visibility of wind turbines to recreationists in the backcountry, southern portion of the Lake Mead NRA and to recreationists in and near the Project area such as OHV users, and hunters (potential positive or adverse effects), and (3) potential change in size/quality of OHV-designated roads and trails in project area. The effect on recreationists is expected to be limited as recreation use in the southern portion of the Lake Mead NRA and the Project Area is estimated to be relatively low (in the hundreds of visitors annually (Marceau 2010; Holland 2010)).

Finally, as indicated in the Cultural Resources Section 4.6, little to no adverse impacts are expected to cultural resources from Project activities, resulting in no expected, related socioeconomic effects.

Operations

The type of expected effects on quality of life of local residents would be similar to effects in the construction and decommissioning phases, but would be smaller in magnitude due to reduced activity on the Project site (and associated lower emissions and traffic). Effects on habitat and recreation would likewise be smaller as less area would be disturbed by Project-related operations activity compared to construction activity.

4.10.3 Alternative B

The types of socioeconomic effects from Alternative B are similar to Alternative A. As employment and income from a wind power project typically vary based on the MW of capacity rather than the number of turbines or turbine size, Alternative B is anticipated to support the same number of jobs and income as Alternative A. Similarly, effects on population and housing would be expected to be the same as in Alternative A. Similar to Alternative A, some minor adverse impacts to quality of life, particularly during the temporary construction and decommissioning phases, may occur due to effects of Alternative B on air quality, water quality and quantity, recreation, and wildlife and habitat. These impacts are expected to be smaller than in Alternative A due to the reduction in the number of wind turbines and overall size of the Project footprint. Property value impacts are not anticipated under Alternative A, but are even less likely under Alternative B due to increased distance to turbines from the Indian Peak Drive residential areas and private lands to the east of the Wind Farm Site.

4.10.4 Alternative C

The socioeconomic effects from Alternative C are similar to Alternative B, with the same number of turbines potentially developed in both Alternatives (i.e., the same number of jobs and income as Alternative A, with reduced potential impacts other socioeconomic and quality of life measures). The primary difference between Alternative B and C is that Alternative C provides even greater separation between private lands and turbines. Although little to no impacts are expected on property values and small to negligible impacts are expected on quality of life under Alternative A or Alternative B, this increased separation would reduce further any quality of life or potential private property value impacts of Project development.

4.10.5 Alternative D – No Action

It is anticipated that under the No Action Alternative, socioeconomic resources in Mohave County would continue along current trend lines. These include population, and employment growth rates higher than the Arizona and the U.S. average rates; but relatively high housing vacancy rates and unemployment rates. Other quality of life factors, such as air quality, water quality, scenic vistas, recreation opportunities, and local traffic are also expected to continue similar to current conditions.

4.10.6 Mitigation Measures

Compared to the No Action Alternative, the primary socioeconomic effects of the action alternatives would be to increase income, employment, and tax revenue in Mohave County. The expected increase in income, employment, and tax revenue is the same under all action alternatives. Current economic activities in the Project Area are limited to some recreational use and short-term livestock grazing that may be displaced due to Project construction, with negligible adverse effects on local employment and income. Project-related employment and income is largest under the one-year construction phase, with smaller income and employment effects during the operations phase. Employment and income effects from decommissioning are expected to be smaller than under the construction phase but potentially larger than under the operations phase. Minor to no effects are expected on property values, population, water quantity, or housing due to the action alternatives. Small adverse effects to quality of life, particularly during the temporary construction and decommissioning phases, may result from effects on traffic, air quality, water quality, and recreation. Such adverse effects would be approximately 26 percent smaller in Alternative B and Alternative C than under Alternative A due to the smaller Project size and modified configuration to increase the distance to private property.

No mitigation measures are needed for social and economic conditions because income employment and tax revenue impacts are expected to be positive. The impacts to in connection to activities such as grazing, and effects on property values, population, water quantity or housing would be minimal and no mitigation measures are expected.

4.11 ENVIRONMENTAL JUSTICE

This section presents the potential environmental justice effects of the proposed action alternatives and the No Action Alternative. The key socioeconomic parameters considered in the analysis are race/ethnicity and measures of social and economic well-being, including health, quality of life, per capita income, median household income, and poverty rates. The analysis area considered for environmental justice are presented in detail in Section 3.11.1.1. The data used for this analysis of environmental justice effects, as presented in detail in Section 3.11, are from the most recent available or published data from reliable sources.

4.11.1 Analysis Methods

4.11.1.1 Levels of Analysis

The geographic scope of the analysis focuses on the Census Block Group and County in which the Project Area is located, in comparison to Mohave County and the State of Arizona. The locations of these geographic units are presented in Figures 3-7(a) and 3-7(b) in Section 3.11. As discussed in more detail in Section 3.11.1, the geographic boundaries and divisions of Census Tracts and Block Groups are modified in Census 2010 (see Figure 3-7(b)) compared to Census 2000 (see Figure 3-7(a)). Also, economic data, such as poverty status, per capita income, and median household income, are now only collected through the American Community Survey and are no longer collected in the census. The latest available American Community Survey data are 2005-2009 5-Year Estimates, which are provided for the Census 2000 geographic unit boundaries (the Project would be located in Census Tract 9504, Block Group 2). Therefore, analysis of lower income populations is carried out using slightly different geographic boundaries and data source (see Table 3-21 with data for Census Tract 9504, Block Group 2), while data for identifying populations of minorities is analyzed based on 2010 Census boundaries and data (see Table 3-22 with Census Tract 9504, Block Group 3). More details on the variation in these levels of analysis for minority populations and lower-income populations are provided in the relevant portions of the discussion that follows.

4.11.1.2 Environmental Justice Effects Methodology

As required by Executive Order 12898, environmental justice effects are identified and characterized based on whether low-income and/or minority populations reside within the area of analysis and, if present, whether disproportionately high and adverse human health, environmental, and/or social and economic effects of the proposed action alternatives are anticipated for these populations (relative to total population effects). Following the discussion of existing conditions in Section 3.11, this analysis assesses the magnitude of changes that may occur as a result of the Project in relevant socioeconomic variables and whether these may particularly affect a minority or low-income population. In addition, as per the analysis and conclusion in Section 4.10, this section also considers any other effects on the human environment that could potentially adversely and disproportionately affect the quality of life or health of these groups.

Based on the Federal guidance and professional judgment, the following criteria are used to evaluate potential effects to low income and minority populations:

- Are there any potential adverse socioeconomic, environmental, and human health effects associated with the alternatives?
- Are minorities or low-income communities disproportionately subject to these adverse effects?

Three categories of economic effects are analyzed following the implementation of these actions: employment and income; population and housing; and fiscal. Categories of effects considered that could affect the quality of life or human health include: climate and air quality; transportation and access; recreation; and visual resources. The quality of life effects on minorities or low-income communities are analyzed at the local level given that climate and air quality-, visual-, traffic-, and recreation-related effects of the Project are anticipated to primarily affect communities located in the vicinity of the Project in Census Tract 9504.

4.11.2 Alternative A– Proposed Action

This section analyzes the potential effects of the construction, operation, and decommissioning of these facilities on minorities and low-income communities.

4.11.2.1 Construction

The following discussion analyzes the potential environmental justice effects of the construction phase of the Project on minority and low-income groups.

Effects on Minority Groups

As per the Census 2010 geographic unit boundaries, the Project is located in Census Tract 9504.02, Block Group 3, which is the largest Block Group (in terms of acreage) in Mohave County. Mohave County is almost 87 percent White, with lower proportions of Black, Asian, Hispanic and Latino populations than the State or the Nation, and an equivalent proportion of Native Hawaiian or Other Pacific Islander (NHOPI) (0.2 percent). The proportion of American Indian-Alaskan Native (AIAN) population in the County is lower than that in the State, but higher than the Nation. Compared to the County, Census Tract 9504.02, Block Group 3 has lower proportions of all racial and ethnic groups. Analyzing at the Census Tract-level, Census Tract 9504.02 has a larger proportion of AIAN (3.5 percent) relative to Mohave County, but still lower than the State. At the smaller geographic level of Block Group, the smaller proportions of minorities in Census Tract 9504.02, Block Group 3 do not constitute a concentration of these groups adjacent to the Project Area. Therefore, the analysis does not identify minority populations on which Alternative A may potentially have disproportionately high and adverse effects during the construction phase.

Effects on Low-Income Communities

The economic effects on low-income communities are analyzed at both the County and local levels. As stated earlier, the latest available American Community Survey data are 2005-2009 5-Year Estimates, which are provided for the Census 2000 geographic unit boundaries (in which the Project is located in Census Tract 9504, Block Group 2) (Census 2010b). Based on these estimates, Mohave County has lower per capita and median household incomes compared to Arizona and the United States, and a higher poverty rate compared to the State and the Nation. Analyzing at the smaller geographic levels, the smallest geographic unit for which 2005-2009 American Community Survey data are available is Census Tract. As shown in Table 3-21, the poverty rate in Census Tract 9504, where the Project would be located, is 18.2 percent higher than that in Mohave County, while the per capita income and median household income estimates in the Census Tract are slightly lower than those for the County.

While more recent economic data are not available at the Block Group-level yet, based on older Census 2000 data, in Census Tract 9504, Block Group 2, where the proposed Project would be physically located, both the per capita and median household incomes are lower than the County, while the poverty rate is 70.4 percent higher than the County.

As stated earlier and illustrated in Figures 3-7(a) and 3-7(b) in Section 3.11, both the Census Tract and Block Group in which the Project would be physically located are large in terms of area relative to the Project footprint. While not enough information is available to identify if low-income populations are located directly adjacent to the Project, the data shows that Census Tract 9504, Block Group 2 has a disproportionately high low-income population relative to the County.

As presented in Section 4.10.2, the socioeconomics analysis of potential impacts from the Project has identified increases in jobs, income, and tax revenues in Mohave County, which would have a positive effect on all populations, including low-income and minority populations, and, therefore, positive environmental justice effects. Furthermore, no new housing is expected to be constructed as a result of Alternative A, and no more than a minor effect on housing market prices is anticipated; consequently, no environmental justice effects are expected related to housing.

The quality of life impacts related to air and water quality, visual resources, traffic, and recreation are expected to be concentrated on the population residing in areas immediately adjacent to the Project Area within Census Tract 9504, Block Group 3. As presented in Section 4.10.2, there may be adverse impacts on the quality of life (from potential impacts to water quality, recreation, traffic, and visual resources) and human health (from potential impacts to air quality), particularly during the temporary construction phase of Alternative A. As stated in the preceding discussion, not enough information is available to identify if low-income populations are located directly adjacent to the Project. However, as the Block Group has a disproportionately high low-income population, it is expected that there may be minor adverse impacts that disproportionately affect low-income populations in the project area, resulting in a potential minor environmental justice effect.

4.11.2.2 Operations and Maintenance

Similar to the construction phase, since the smaller proportions of minority populations in the area do not constitute a disproportionate concentration of these groups, the analysis does not identify minority populations on which the operations and maintenance of the facilities under Alternative A may potentially have disproportionately high and adverse effects.

The environmental justice effects on low-income communities related to the operations and maintenance of facilities under Alternative A are similar to those identified under the construction phase, with positive employment and income effects and potentially adverse quality of life impacts related to environmental quality and some recreation uses. However, the job creation- and income-related effects would be of a long-term due to the 30-year life of the Project. Further, potential adverse quality of life effects would be smaller in magnitude compared to the construction phase given the reduced activity around the Project Area (and the associated lower air emissions and traffic).

4.11.2.3 Decommissioning

Similar to the construction phase, since the smaller proportions of minority populations currently in the Project area do not constitute a disproportionate concentration of these groups, the analysis does not identify minority populations on which the operations and maintenance of the facilities under Alternative A may potentially have disproportionately high and adverse effects. The population statistics may differ in approximately 30 years when decommissioning is projected to occur, but the nature of the potential changes in the population cannot be anticipated.

The environmental justice effects on low-income communities during the decommissioning of the Project under Alternative A are similar to those identified under the construction phase above. However, the job creation- and income-related effects would be relatively minor given that the decommissioning period is temporary, and it is anticipated that either the operations team would provide the majority of the labor or that the process would require specialized labor outside of Mohave County.

4.11.3 Alternative B

This section analyzes the potential effects of the construction, operations and maintenance, and decommissioning of these facilities under Alternative B on minorities and low-income communities.

4.11.3.1 Construction

It is anticipated that the environmental justice effects stemming from the construction of facilities under Alternative B would be similar to those for Alternative A as described in Section 4.11.2. However, the potential environmental justice effects related to environmental quality would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported and reduced road mileage constructed, although the positive effects on jobs and income are anticipated to be the same as under Alternative A.

4.11.3.2 Operations and Maintenance

It is anticipated that the environmental justice effects stemming from the operations and maintenance of the Project under Alternative B would be similar to those for Alternative A as described in Section 4.11.2, with positive employment and income effects and potentially adverse quality of life impacts related to environmental quality and recreation. However, the potential adverse environmental justice effects related to environmental quality would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported, although the positive effects on jobs and income is anticipated to be the same as under Alternative A.

4.11.3.3 Decommissioning

It is anticipated that the environmental justice effects stemming from the decommissioning of facilities under Alternative B would be similar to those for Alternative A as described in Section 4.11.2. However, the potential environmental justice effects related to environmental quality would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported, although the positive effects on jobs and income is anticipated to be the same as under Alternative A.

4.11.4 <u>Alternative C</u>

This section analyzes the potential effects of the construction, operations and maintenance, and decommissioning of these facilities under Alternative C on minorities and low-income communities.

4.11.4.1 Construction

It is anticipated that the environmental justice effects stemming from the construction of facilities under Alternative C would be similar to those for Alternative A as described in Section 4.11.2, with positive employment and income effects and potentially adverse quality of life impacts related to environmental quality and recreation. However, the potential adverse environmental justice effects related to environmental quality would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported, although the effects on jobs and income is anticipated to be the same as under Alternative A. Further, given the greater distance of the Project from private property under this Alternative, potentially fewer quality of life and potential property value impacts are anticipated relative to Alternative B.

4.11.4.2 Operations and Maintenance

It is anticipated that the environmental justice effects stemming from the operations and maintenance of the Project under Alternative C would be similar to those for Alternative A as described in Section 4.11.2, with positive employment and income effects and potentially adverse quality of life impacts related to environmental quality and recreation. However, the potential environmental justice effects related to environmental quality would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported, although the effects on jobs and income is anticipated to be the same as under Alternative A. Further, given the greater distance of the Project from private property under this Alternative, potentially fewer quality of life and potential property value impacts are anticipated relative to Alternative B.

4.11.4.3 Decommissioning

It is anticipated that the environmental justice effects stemming from the decommissioning of facilities under Alternative C would be similar to those for Alternative A as described in Section 4.11.2. However, the adverse effects would be slightly reduced given the approximately 25 percent reduction in the maximum number of turbines supported. Further, given the greater distance of the Project from private property under this alternative, potentially fewer quality of life and potential property value impacts are anticipated relative to Alternative B.

4.11.5 Alternative D – No Action

As per the discussion in Section 4.10.5, under the No Action alternative, socioeconomic resources in Mohave County would continue along current trend lines, and other quality of life factors are also anticipated to continue similar to current conditions. Therefore, there are no anticipated effects related to the Project on minority and low-income groups in the Project area; the Block Groups, Census Tracts, and cities/CDPs in the vicinity of the project area; and Mohave County.

4.11.6 Mitigation Measures

The analysis of environmental justice effects of the proposed action alternatives does not identify minority populations on which the Project may potentially have disproportionately high and adverse effects. Also, while not enough information is available to identify low-income communities in the Project area and its direct vicinity, Block Group- and County-level data suggest that Census Tract 9504, Block Group 2 (based on Census 2000 geographic boundaries) and Mohave County in general have larger proportions of low-income populations relative to the County and the State of Arizona, respectively. However, in general, these communities would be positively affected by the Project through the creation of both temporary and permanent jobs, as well as income- and tax-effects. Some adverse quality of life effects would be anticipated on these communities during the construction and decommissioning phases, but those are expected to be minor and primarily of a temporary nature. Overall, the analysis identifies minor to no environmental justice effects of the proposed action alternatives on low-income groups, and no mitigation measures are warranted.

4.12 VISUAL RESOURCES

4.12.1 Analysis Methods

This analysis evaluates potential impacts to visual resources that could result from construction, operation, and decommissioning of the proposed wind farm. The analysis area for the visual resource impact assessment included all lands located within a 20-mile radius of the proposed Project (Map 4-1). According to BLM distance zones, distances greater than approximately 15 miles are considered “seldom seen.” In this distance zone light and dark patterns of vegetation are not visible and only the form or outline of large features are discernible. For this analysis the radius was increased to 20 miles to recognize the potential of greater visibility of a Project this size with nearly 500-foot high turbines with rotating blades.

4.12.1.1 Indicators

Indicators used to measure potential impacts to visual resources that could result from the Project include:

- The level of visual contrast created by the Project
- Changes in VRI class, including component VRI in values (scenic quality, visual sensitivity, and distance zones)
- Conformance with existing VRM objectives

Additional qualitative indicators included the expected level of change to the existing landscape aesthetic, such as lighting, movement, activity (measured in terms of change in vehicular traffic and amount of people), or naturalness.

4.12.1.2 Assumptions

The following assumptions were used when analyzing effects of the Project on visual resources:

- Direct impacts are consequences that occur at the same time and place as the Project. Indirect impacts occur later in time or are farther removed from the Project, but are reasonably foreseeable.
- All potential construction-related impacts to visual resources are considered short term (5 years).
- Change in VRI values was assessed based on the combined contrast of all Project components. Expected change in VRI values was assessed only for long-term operations-related impacts.
- Conformance with VRM objectives was based on expected long-term impacts.

4.12.1.3 Viewshed Analysis

A viewshed analysis using GIS was completed to identify locations where the Project theoretically could be seen, and areas where it was eclipsed by topography (Map 4-1). This analysis determines Project visibility based on the relationship between topography, height of the proposed wind turbines, and average eye height of the viewer. The resulting "seen area," or viewshed, represents the area where one or more turbines could theoretically be seen, and does not represent any measure of detectability of the turbines. The viewshed analysis was used to assess visibility of the Project, and to better understand viewer experience within the landscape. For example, roadway travelers may experience intermittent views of the Project where topography is variable, and more prolonged views where topography is flat. For the purposes of this analysis, input parameters were defined as follows: eye level of 5.5 feet, maximum turbine hub height measuring 264 feet (80 meters), and a maximum blade tip height 492 feet (150 meters). The viewshed was based on the number and configuration of turbines presented in Alternative A.

4.12.1.4 Key Observation Points (KOPs)

The analysis was conducted from ten KOPs representing common and/or sensitive views from five general areas, including: (1) Temple Bar Road; (2) the Lake Mead NRA, (3) Traditional Cultural Areas of members of the Hualapai Tribe; (4) US 93; and, (5) the residential area of White Hills and Indian Peak Road (see Map 4-1). The observation points were selected with the intention of collecting a representative sample of various viewers in the area surrounding the project site including recreational viewers (visitors to Lake Mead NRA), residential viewers (within White Hills), travelers (along US 93 or other key routes), and sensitive viewers (persons visiting wilderness). No KOPs were established in the BLM-administered

Mount Wilson Wilderness Area. For the purpose of this analysis, it was assumed that views from Mount Wilson and Wilson Ridge would focus on the dominant landscape features of Lake Mead and Lake Mohave to north and west, respectively. Consequently, potential impacts to views of the Detrital Valley and Project to the east and south from this area were not analyzed. Consideration was given to establishing a KOP within the proposed wilderness northeast of the Project Area that is administered by NPS; however, in coordination with NPS staff, it was decided that because the number of viewers would be few, the KOPs from Lake Mead NRA would focus on the more frequently visited areas for recreational visitors.

The viewer areas differ by landscape analysis factors, such as their distance from the Project, predominant angle of observation, dominant use (i.e., recreation or travel), and duration of views (including the average travel speed at which the Project could be viewed for KOPs along roads and highways). Photos were obtained at all KOPs, and are presented in Appendix D. All KOPs were chosen from within the viewshed of the Project based on input from BLM staff, NPS staff at Lake Mead NRA, the Hualapai Tribe, and input received at Project scoping meetings. Landscape character and analysis factors for each of the five areas are summarized below. A more complete description of each KOP is provided in Appendix D.

- ***Temple Bar Road*** – The administrative boundary of the Lake Mead NRA is located on the northern boundary of the Project Area. Visitors may enter the NRA via Temple Bar Road, located approximately 5 miles west of Project. Views of the Project Area include the broad, sweeping valley formed by the Detrital Wash, and the mountain peaks of Senator Mountain, Squaw Peak, and residential areas. The landscape is described as open, panoramic and focal, with varied form, line, color, and texture. Manmade features present within the view include Temple Bar Road, a small utility line that crosses the roadway, the entrance station to the Lake Mead NRA, and transmission lines. Views from Temple Bar Road are transient, as motorists are traveling at an average speed of 50 mph to a recreation destination. Views of the Project Area would be at an oblique angle. Visual sensitivity is assumed to be moderate (Section 3.12.4.2).
- ***Lake Mead NRA*** – For the purpose of this analysis, the Lake Mead viewer area is restricted to the portion of the lake and adjacent upland areas extending to a distance of approximately 1.5 miles from the shoreline. This area extends from “The Narrows” to Temple Basin, and includes Temple Bar, a recreation destination outfitted with parking, airstrip, marina and boat launch, lodging, campground, picnic area, and ranger station. Views to the south toward the Project Area are from an inferior (lower elevation) position, and at a distance of greater than approximately 6.5 miles. Golden Rule Peak and Senator Mountain provide some enclosure; however the landscape is large in scale, and appears open and panoramic. The landscape exhibits moderate levels of variation in form, line, color, and texture in landform. The mottled vegetation creates a uniformity of color in foliage. A communications tower located on Senator Mountain and utility line paralleling Temple Bar Road are characterized by weak contrast to the surrounding landscape, and are not easily detected from this view. To characterize views experienced by recreators in the NRA, a KOP (KOP 7) was established at the NPS interpretive kiosk located on Temple Bar Road. The kiosk is located approximately 1.5 miles upland from the south shore of Lake Mead and approximately 0.5 mile west of campgrounds at Temple Bar on Lake Mead. The KOP is approximately 8 miles from the Project boundary for all action alternatives. Viewers in this portion of the NRA include recreators engaged in motorized and non-motorized land- and aquatic-based recreation. For the purpose of this analysis, all viewers situated within the NRA are assumed to have high visual sensitivity (Section 3.12.4.2).
- ***Traditional Cultural Locations of the Hualapai Tribe*** – The Project Area is within territory historically occupied by the Red Rock Band of the Hualapai Tribe. Members of the Mohave Tribe also have identified this area as part of their traditional territory. Traditional cultural resources

have been identified at Senator Mountain, Squaw Peak, and Mata Thija. All locations contain views of the diverse landforms present in the Project area, including Mount Wilson, Squaw Peak, Pilot Knob, and the Black Mountains, and the panoramic views of the Detrital Valley. The landforms exhibit high levels of variation in form, line, color, and texture. Senator Mountain (KOP 169) is located 1.4 miles east of the Project Area, and is characterized as a high elevation viewpoint. From this viewpoint, discernible man-made features include communities, Squaw Peak Road, a single lane dirt road running north-south along the eastern portion of the Project Area, other dirt roads, the Mead-Phoenix and Liberty-Mead high voltage transmission lines, and associated service roads and tower pads. Squaw Peak (KOP 173) is located inside the Project boundary for all action alternatives, on the east side of Squaw Peak and Young Mountain. Man-made features apparent in the view are limited to the met tower in the foreground of the view and a dirt road. Mata Thija is a small cave where the Hualapai Red Rock Band gathered salty earth. Its exact location is unknown; however and the area is represented by KOP 171. The KOP is situated inside the Project boundary defined by Alternative A, and at the Project boundary defined by Alternatives B and C. The Liberty-Mead 345 kV and Mead-Phoenix 500 kV high-voltage transmission lines cross the foreground of the view. Views from each location are considered stationary, as these are destinations. Viewer sensitivity is assumed to be high (Section 3.12.4.2). However, the number of visitors and frequency of visits to these locations are unknown.

- ***US 93*** – US 93 is a paved highway connecting Wickenburg, Arizona to areas located north of Las Vegas, Nevada. The divided highway passes approximately 3-5 miles southwest of the Project Area, in a section identified as a scenic route in the Mohave County General Plan (Mohave County 2010b). Average daily traffic in the section of US 93 located southwest of the Project Area measured approximately 10,300 vehicles per day (ADOT 2009).

  The US 93 viewer area was analyzed using KOP 1 (Householder Pass) and KOP 13 (Rosie's Den). Views from US 93 include portions of the Project Area sited on both BLM- and Reclamation-administered lands. The landscape is described as a broad, sweeping valley formed by Detrital Wash with rolling hills and Senator Mountain in the background. Numerous manmade features can be seen, including the highway, two parallel high-voltage transmission lines, and a fence in the immediate foreground of the view. Although the transmission lines and towers are incongruent with the surrounding landscape elements they do not compete with more natural-appearing landscape features due to the large scale of the landscape relative to these structures. Views from US 93 are considered transient, as motorists are assumed to be traveling at the posted speed limit of 65 mph and visual sensitivity of motorists is assumed to be moderate (Section 3.12.4.2). Motorists would view the Project from varying angles of observation; however views would be predominantly accessed at an oblique angle.

- ***Residential Areas*** – The Residential Area includes the unincorporated residential community of White Hills, and residences on Indian Peak Road. The residences on Indian Peak Road are located approximately 1.0 miles at its closest point from the southern boundary of the Project Area, and are composed of development on private parcels, interspersed within BLM-administered land in a checkerboard pattern. Fewer than 100 homes are located in a square mile development south of Indian Peak Road. Views toward the Project Area to the north are described as open and panoramic. Views include Senator Peak, Squaw Peak, and Mount Wilson characterized by moderate to high levels of variation in form, line, color, and texture. The Mead-Phoenix and Liberty-Mead high voltage transmission lines are within view; however they are indistinct to the casual viewer. Views from residential areas are considered prolonged, and the Project would be seen from varying angles of observation. Viewer sensitivity is assumed to be high (Section 3.12.4.2).

4.12.1.5 BLM Contrast Rating Procedure

The BLM Contrast Rating procedure was used to determine visual contrast that may result from the construction and operation of the Project and was based on photo simulations depicting Project features. Visual contrast between the Project and the existing landscape character is used to determine the adverse effects to visual resources. Impact determinations are based on the identified level of contrast, and are not a measure of the overall attractiveness of the Project (BLM 1986).

At each KOP, existing landforms, vegetation, and structures were described using the basic components of form, line, color, and texture. Project features were then evaluated using simulations, and described using the same basic elements of form, line, color, and texture. The level of perceived contrast between the proposed Project and the existing landscape was then classified using the following definitions:

None: The element contrast is not visible or perceived.

Weak: The element contrast can be seen but does not attract attention.

Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.

Strong: The element contrast demands attention, would not be overlooked, and is dominant in the landscape.

The level of contrast was assessed for all Project components used during construction, operations and maintenance, and decommissioning of the proposed Project. The level of visual contrast expected to result from construction or decommissioning related activities was estimated based on knowledge of anticipated activities and equipment that would be present. No photo simulations of construction or decommissioning were developed. Contrast Rating Forms are provided in Appendix D.

4.12.1.6 Visual Resource Inventory Analysis

The visual resource inventory analysis was used to identify expected change to VRI Classes (Section 3.12.4.2) based on changes to the visual resource values of scenic quality, visual sensitivity, and/or distance zones that may result from operation of the proposed Project. This analysis was completed within the framework of the existing VRI, and at the scale of designated SQRUs, with the goal of understanding how visual resource values and resulting VRI Class may shift at the planning level based on operation of the proposed Project. The analysis was restricted to SQRUs 41 and 14 / SLRU 13 and 65 that overlapped the Project Area. No VRI analysis was completed for adjacent units. Because the proposed Project is located on lands inventoried as VRI Class IV; no reduction in VRI Class is possible. Likewise, the scenic quality score for the Project Area was ranked as Class C, and therefore could not be reduced any further. The VRI analysis thus focused solely on identifying impacts to scenic quality, visual sensitivity, and/or distance zones that may result from the proposed Project. Typically impacts to these VRI components would be evaluated by ranking each key factor used to classify scenic quality or visual sensitivity under operational conditions, and comparing those values to that determined through the established (pre-Project) VRI. Because data was lacking from the scenic quality and sensitivity level analysis completed for the VRI of the Kingman FO, no comparison was made to these data. A discussion of impacts to scenic quality and visual sensitivity is presented below.

- ***Scenic Quality*** – Scenic quality is defined as the visual appeal of a tract of land (BLM 1986). Impacts to scenic quality was determined by evaluating the intensity and extent of potential direct impacts of the proposed Project on the seven key factors used to classify scenic quality (landform, vegetation, water, color, scarcity, adjacent scenery and cultural modification).

No change was expected to result in scenic quality scores for water, color, or adjacent scenery. Although changes to landform and vegetation would occur under all action alternatives, changes are not expected to affect scores for these key factors. Based on this assumption, the analysis focused on the intensity and extent of change to scenic quality that may result from the introduction of cultural modification to the analysis area. The intensity (magnitude) of the action is defined as follows:

> **Low Intensity:** A change in a resource condition is perceptible, but it does not noticeably alter the resource function in the ecosystem or cultural context.
>
> Components used to determine low intensity include weak visual contrast, high visual absorption, short viewer duration, and small spatial scale.
>
> **Medium Intensity:** A change in a resource condition is measurable or observable, and an alteration to the resource function in the ecosystem or cultural context is detectable.
>
> The component used to determine medium intensity is a moderate visual contrast.
>
> **High Intensity:** A change in a resource condition is measurable or observable, and an alteration to the resource function in the ecosystem or cultural context is clearly and consistently observable.
>
> Components used to determine high intensity include strong visual contrast, prolonged viewer duration, and large spatial scale or special dominance.

The geographic extent of the action was defined by the percentage of the SQRU affected by high and moderate contrast of the Project during day and/or night conditions. For the purpose of this analysis, it was assumed that moderate visual contrast could result from the proposed Project during night conditions for the geographic extent of the viewshed, and therefore geographic extent was defined by that area.

- ***Visual Sensitivity*** – Visual sensitivity is defined as a measure of public concern for scenic quality (BLM 1986). For the purpose of this analysis, visual sensitivity was ranked as high, medium, or low based on criteria described in Section 3.12.4.2. Change in visual sensitivity was determined by evaluating the potential for direct and indirect impacts of the proposed Project to alter existing assumptions of visual sensitivity within SLRU 65 or SLRU 13.
- ***Distance Zones*** – Distance zones represent the distance from which the landscape is most commonly viewed, and are established by buffering common travel routes and viewer locations at distances of 3 miles, 5 miles, and 15 miles. To identify potential change in the classification of distance zones, all new and improved roads that would result from operation of the Project were evaluated to determine the expected level of use. Change in distance zones is expected where new or improved roads would be used as common access routes.

4.12.1.7 Conformance with VRM Objectives

The proposed Project is located, in part, on BLM-administered lands managed by VRM Class IV objectives. The VRM Class IV objective is to provide for management activities that require major modification of the landscape. To determine conformance of the proposed Project with this management objective, the level of contrast identified through the contrast rating procedure was compared to acceptable levels of contrast for VRM Class IV. For VRM Class IV areas, "contrast may dominate the view and be the major focus of viewer attention" (BLM 1986).

4.12.1.8 Photographic Simulations

To support the visual resource impact analysis, and to disclose expected visibility of Project components from various vantage points, photographic simulations were prepared for each KOP (Appendix D). Simulations were produced by rendering of Project components (turbines, substations, access roads, etc.) using 3D computer models, and super-imposing these images onto photographs taken from KOPs. Model parameters account for environmental factors, such as viewing angle and light conditions, thereby resulting in an accurate virtual representation of the appearance of the proposed Project. Simulations modeled a Vestas brand turbine, as this model is being considered by BP Wind Energy for this Project. This turbine type is characterized by a hub height of 294 feet (90 meters), and a maximum blade height of approximately 483 feet (146.5 meters). All turbine hubs were oriented facing south based on the prevailing southerly wind at the Project site. The location of ancillary facilities was based on the layout described in Alternative A, Option 1 for the collector lines (all below ground) and transmission line interconnection (345 kV Liberty-Mead line). Ancillary features were included in the simulation if they were located within the portion of the Project captured within the view of the photograph. One exception to this pertains to the substation, in which only the substation pad was modeled. Atmospheric haze was not added in simulations; however, lighting conditions present when the photograph was taken may reduce the perceived clarity of the atmosphere. Views of the Project from all KOPs were simulated under daylight conditions. Simulations of the appearance of night conditions were created for three KOPs using photographs obtained during a three-quarter moon. Night condition simulations depicted appearance of existing lighting and the obstruction lighting on turbines.

A total of 30 static simulations and two animated simulations of the proposed Project were completed. These simulations illustrated the appearance of white turbines, new and improved roads, turbine pads, and substations pads; however they did not include Project features such as transmission interconnect lines, operations and maintenance buildings, or substations. Simulations of Project features and layout specified by Alternative B and/or C were produced for selected KOPs where changes in turbine number and configuration were expected to alter the appearance of the proposed Project as defined by Alternative A. Where the proposed layout of Alternatives B and C were expected to result in nearly identical appearance, one of the alternatives was selected for simulation. Collectively, the simulations demonstrated a range of conditions under which Alternatives A, B, and C of proposed Project would be viewed (time of day, atmospheric conditions, distance, and cardinal direction. One simulation was developed to analyze potential reduction in visual contrast that may result from operation of the Project using turbines painted BLM Standard Environmental Color "Shadow Gray" (Figures D-5(g) and D-5(h) in Appendix D). Two animations were produced to simulate the motion of the turning blades and the flashing of synchronized lighting: One depicts the nighttime lighting of white turbines, and the second depicts daytime lighting required on non-white turbines. These animations are located on the BLM Project website at www.blm.gov/az/st/en/prog/energy/wind/mohave.html.

The static simulations are presented as a set of two photographs: One photograph demonstrating existing conditions, and the second photograph of the same view includes the simulation of the Project facilities. On each photograph sheet the following information is recorded: date and time, latitude and longitude, weather, camera and lens type, viewing direction of the photograph, and distance to the nearest turbine based on a preliminary engineering plan of the turbine layout.

Simulation Validation

To validate the accuracy of the simulations, five existing turbines located southwest of Kingman, Arizona were photographed. Efforts were made to document similar viewing conditions (lighting and viewing distance) as those experienced from the KOPs used in the proposed Project. One photograph was taken to represent a nighttime view of a turbine, complete with hazard lighting, at a distance of 0.9 miles. Photographs used in the validation of simulations are presented in Figures D-11 through D-23 of

Appendix D. The photographic simulations and representative photographs were designed to be viewed 18 inches from the viewer's eye when printed on an 11x17-inch page. This distance portrays the most realistic life-sized images as seen from KOPs.

4.12.2 Alternative A – Proposed Action

Impacts to visual resources are expected to be similar across all action alternatives when viewed from US 93, the residential area, and locations representing Traditional Cultural Resources of the Hualapai Tribal Members. Impacts observed from Temple Bar Road and the Lake Mead NRA are expected to differ across action alternatives. The variation in impacts to visual resources resulting from Alternatives A, B, and C in terms of the level of perceived visual contrast experienced from these viewer positions follows.

This section describes anticipated direct and indirect effects that may occur as a result of construction, operations and maintenance, and decommissioning of Alternative A of the proposed Project. Alternative A would occur on approximately 38,099 acres of BLM-administered lands managed by VRM Class IV objectives.

4.12.2.1 Construction

Visual Contrast

Potential temporary and short-term localized direct impacts to visual resources are expected to result from the numerous workers, construction vehicles, turbine delivery trucks, worker vehicles, dust, and other the construction-related activities. It is expected that, collectively, construction-related actions would create a mosaic of color, glare, angular lines, and smooth texture to the landscape, that could introduce strong contrast in form, line, color, and texture against the existing landscape of the Project Area. Existing landscape character would also be temporarily altered by exposed soil from cut/fill, and scarring of the ground plane for construction staging, laydown areas, turbine clear-zones, installation of underground collection systems, and development of new and improved roadways. The recovery time for disturbed areas may vary based on season and weather within the region. It is expected that visual contrast in form, line, color and texture would increase incrementally as Project features, such as turbines, roads, and transmission poles, come into view. These features may draw attention to the Project Area and the construction activities underway. The level of contrast expected to result from construction-related impacts is summarized in Table 4-23.

The level of contrast would vary depending on analysis factors, such as the location of the viewer in relation to the Project (i.e., distance), visibility, and duration of view. Construction of Alternative A would result in strong visual contrast when viewed from Temple Bar Road. From Temple Bar Road, contrast would be visible during the construction of turbines and roads in the northwest portion of the Project Area (west of Squaw Peak). Construction-related impacts to views experienced by recreators accessing the NRA via Temple Bar Road would be of short duration. When viewed from the lake and adjacent uplands in the Lake Mead NRA, construction-related actions would result in weak visual contrast. The majority of activity would occur on and near the ground, and consequently would be shielded by topography. These impacts constructed within the ground plane would be most visible from higher elevation (superior) positions, such as KOP 169 at Senator Mountain. Roadway travelers on US 93 would have the greatest exposure to the staging and laydown area located in the southwest border of the Project Area; however views would be transient and typically experienced at speeds of approximately 65 mph.

Construction of the Project would be subject to BLM's best management practices (Appendix B). During final design, detailed plans would be developed and reviewed with BLM and other appropriate agencies with jurisdictional or technical expertise or regulatory responsibilities.

Table 4-23 Level of Visual Contrast Expected to Result from Construction of the Project

Project Feature	Expected Contrast	Assumptions
Laydown Areas and Batch Plant	• Strong short-term contrast in form (shape), line, color, and texture due to removal of vegetation and resurfacing with gravel. • Consolidation of construction materials could mimic appearance of structures, and could create strong short-term contrast in form, line, color, and texture. • Laydown yards would be most visible from US 93, residential areas, and locations representing traditional cultural places of the Hualapai Tribe.	• No major alteration to landforms would be required. • The temporary facilities would be removed as soon as practical. • The sites would be reclaimed and revegetated within one year of completing construction. Restoration would follow the plan proposed by BP Wind Energy and approved by BLM and Reclamation.
Turbine Structures	• Alteration of landforms where leveling is required for turbine pads would create incremental moderate contrast in form and line due to contrast between flat, horizontal lines, and the gently rolling appearance of the existing landscape. • Clear Zone required for hub/blade assembly would result in strong short-term contrast in form (shape), line, color, and texture against the surrounding area. • Installation of these structures would result in an immediate contrast in form, line, color, and texture	• Dust suppression design features for fugitive dust control would minimize impacts to visual resources that could result from reduced visibility. • All vegetation would be cleared in the Clear Zone. • Turbine hubs would be from 264 feet to 295 feet above the ground. The rotating blade tips could be up to 492 feet above the ground. There could be a mix of turbine types but the corridors would remain the same. • Turbines would be painted bright white or light off-white. They may be color treated to blend more effectively with the environmental setting, but would need daytime white lights. • Approximately half of the turbines would be lighted at night by red simultaneously flashing strobe lights. The beam would be concentrated in the horizontal plane, minimizing light to the ground.
New / Improved Project Roads and Underground Collection System	• Incremental increase in bold curvilinear lines across the Project Area during construction would create strong contrast in line, color, and texture as vegetation is removed and roads are resurfaced. • If blasting is required, strong contrast in form, line, color, and texture is expected to result from alteration of the landform. • Where construction of a road prism is required, strong contrast in form, line, color, and texture is expected to result from alteration of the landform.	• Dust suppression design features for fugitive dust control would minimize impacts to visual resources that could result from reduced visibility. • Construction of underground collection cables would occur concurrently with road construction and would be within the temporary road area. • The primary access road surface would be 30 to 40 feet wide. Interior roads would have a construction-phase width of generally 36 feet but could be up to 56 feet. Post-construction width including shoulders would be narrowed to 20 feet and the former width would be reclaimed and revegetated. Restoration would follow the plan proposed by BP Wind Energy and approved by BLM and Reclamation.

Project Feature	Expected Contrast	Assumptions
Overhead Transmission Line	• Installation of the conductors and support structures would cause an incremental change in line and texture that would result in weak to moderate contrast.	• No alteration to landform would be required beyond clearing or grading. • Structures for the majority of the line would be steel or concrete monopoles that are nonspecular or a color suitable for the environment. • The conductors would be nonspecular. • A 20-foot-wide construction road would be restored to a 10-foot maintenance road.
Inter-connection Switchyard	• Installation of the switchyard is expected to result in strong contrast of color and texture where vegetation is cleared for construction (up to 12 acres for Liberty-Mead Option; up to 37 acres for Mead-Phoenix Option). • Installation of support structures would cause an incremental change in line and texture that would result in weak to moderate contrast.	• No alteration to landform would be required beyond clearing or grading. • Dust suppression design features for fugitive dust control would minimize impacts to visual resources that could result from reduced visibility. • Structures for the majority of the interconnection would be steel or concrete monopoles that are nonspecular or a color suitable for the environment. • The conductors would be nonspecular.
Project Substations	• Installation of these structures would cause an incremental change in line, color and texture that would result in strong contrast.	• No alteration to landform would be required beyond clearing or grading. • The small control buildings would be painted a neutral color with muted tones to blend with the environment. • Components would typically have a maximum height of 35 feet (lightning masts would have heights closer to 75 feet) and the conductive components would have nonspecular metal surfaces.
O&M Facilities	• Installation of these structures would result in an incremental change in line, color and texture where clearing, grading, and resurfacing is required. • Installation of the building would result in an immediate contrast in line, color, and texture.	• No alteration to landform would be required beyond clearing or grading. • The building would be approximately 60 feet by 100 feet and 16 feet high, with the roof and side panels painted a color to blend with the environment. • Fences would be treated to minimize metal reflections.
Aggregate Pit	• Weak contrast in form, line, color, and texture against the surrounding landscape result from obtaining source materials from the Detrital Wash Materials Pit	• Side slopes would be contoured. • The existing quarry and processing area would not be decommissioned.
General Construction Activities / Work Force	• Operation of construction vehicles would introduce a mosaic of form, line, color, and texture that would result in strong visual contrast. • Increased activity and movement by people and vehicles would result in a strong contrast to existing static landscape during construction of the Project.	• Dust suppression design features for fugitive dust control would minimize impacts to visual resources that could result from reduced visibility. • Construction-related waste would be removed from the site. • Construction traffic is assumed to be at a level described in Chapter 2, Proposed Action and Alternatives.

Wind Turbines

Direct impacts to visual resources are expected to result from the strong visual contrast of the turbines against the existing landscape. Wind turbines, as proposed, would introduce bold, white, vertical and diagonal lines to the landscape. The structures would appear smooth and uniform. Turbine pads would appear round, flat and tan-colored, and would result in strong contrast against the reddish–green shades of the vegetation. The configuration of turbine strings would create a sequence of vertical lines. This systematic repetition of structures would contrast the landscape to varying degrees depending on the angle of observation. Operation of turbines would introduce motion to an otherwise still environment, and turbine hazard lighting would create strong contrast against the darkness of existing night skies. The movement of turbines blades could cause shadow flicker under certain seasonal and atmospheric conditions.

The required megawatts of the proposed Project could be achieved using several different turbine sizes and configurations. For example, the increased energy output of larger turbines would result in the need for fewer turbines. Larger turbines would be spaced farther apart, and the total area of ground disturbance would be slightly less than that resulting from smaller, more numerous turbines. Corridor locations would remain the same regardless of turbine design. Impacts to visual resources resulting from each turbine size are expected to be similar despite the 100 foot difference in height between the smallest and largest turbine model. However visibility of larger turbines from some areas, such as on Lake Mead, may increase, as a greater portion of the turbine hubs and blades would be visible above the horizon. Likewise, larger turbines would be expected to be visible at a greater distance due to size. Should a combination of turbines be used, it is possible that the lack of symmetry in the structures could appear less visually coherent than a design composed of identical turbines. A taller turbine next to a shorter turbine would attract attention, but not as much as the Project itself.

Perceived visual contrast would be strongest when viewed from within the Project Area (i.e., Squaw Peak, Mata Thija), and from adjacent viewer areas located within the Foreground/Middleground distance zone (3 to 5 miles). Visual contrast would decrease with distance due to atmospheric haze, vegetation screening, and variable topography present in the analysis area.

Project Roads

Project roads would appear as bold, tan to gray curvilinear lines with a smooth texture that would contrast the form, line, color, and texture of the existing landscape. Strongest visual contrast would be observed from superior vantage points, such as Senator Mountain (KOP 169), or where the road would require alteration of the existing landform, such as that required near Squaw Peak (KOP 173). Project roads are expected to result in weak to moderate contrast when viewed from US 93 and the residential areas of Whites Hills and Indian Peak Road. From these locations, it is expected that Project roads would appear as disjunct segments, with the majority of contrast resulting from color differences between of the pale gray roadway and the darker hues of the existing landform and vegetation. This contrast would be reduced to a large extent due to variable topography and diversity of color in existing landform. The contrast of the roads would be subordinate to that expected to result from turbines.

Substations

Two substations would be required for operation of the proposed Project. One substation would be located adjacent to the existing Mead-Phoenix and Liberty-Mead transmission lines. The second substation would be located at the northern terminus of the proposed transmission interconnect line, and would primarily be seen by viewers located within the Project Area, such as those traveling on Squaw Peak Road, or located at areas identified by the Hualapai Tribe as representative of cultural locations. The vertical and angular structure and flat, square substation pad would strongly contrast with the softer lines of the surrounding landform and vegetation when viewed from Senator Mountain or Squaw Peak. Beyond

5 miles, visual contrast of the substation is expected to decline to weak. The structure is expected to be seen, but would not attract attention. Contrast of the substations would be subordinate to that expected to result from turbines.

Overhead Transmission Interconnect Lines and Switchyard

Transmission lines and associated transmission poles would appear as sequentially aligned vertical structures (monopoles) that would result in moderate contrast to the existing undeveloped landscapes. The switchyard structures would consist of circuit breakers and air switches without transformers. Anticipated transmission-line and switchyard related contrasts would be consistent across alternatives. Where the fiber optic communication would be mounted near the top of the transmission line, no additional contrast beyond what results from the transmission lines is expected. The transmission lines and poles would primarily be viewed by motorists on Squaw Peak Road, or locations identified by the Hualapai Tribe as representative of cultural locations. The level of contrast would be considered weak. Contrast of the switchyard would be subordinate to that expected to result from turbines.

Collector Lines

Collector lines could be either underground or overhead. Underground collector lines would be collocated to the extent possible with new and improved Project roads. Lines would be buried in trenches measuring 2 feet wide; however wider trenches may be required where multiple sets of cables would be placed. It is expected that visual contrast of trenches would not be evident during the operational phase, as areas would be reclaimed and reseeded with native vegetation. Overhead collector lines would be supported by poles measuring approximately 35 feet tall, and placed at intervals of approximately 250 feet apart. Poles for the overhead collector lines would introduce vertical and horizontal lines that are expected to result in weak contrast against the surrounding landscape. Contrast from collector lines and poles would be subdominant to surrounding turbines and transmission lines.

Operations and Maintenance Building

One O&M facility would be located at the southwest border of the Project Area, approximately 3 miles from US 93. The structure, as proposed, would measure 60 feet by 100 feet, and extend 16 feet in height. The structure would be painted to blend in with the surrounding landscape and minimize visual contrast. The level of degree of contrast expected to result from the building may be reduced by choosing a paint color that would blend with the surrounding and background landscape. Broad, gravel areas (5 acres) would create flat, geometric shapes that result in strong contrast against existing vegetation and topography. The chain-link fence surrounding the structure would create vertical, horizontal, and angular lines, gray color and smooth texture that would appear unnatural against the largely undeveloped surroundings. The structure would primarily be seen by motorists on US 93. Views would be transient, as experienced at high speeds. Overall contrast of the O&M building is expected to be weak. The structure would be visible but would not attract attention. Contrast of the operations and maintenance area would be subordinate to that expected to result from the turbines.

Meteorological Towers (Temporary and Permanent)

Met towers are described as metal lattice structures with three or four legs and red obstruction lights, and measuring approximately 280 feet tall. The structures would be similar in appearance to radio towers. Operation of met towers would introduce vertical and diagonal lines to the landscape. At the current design stage, the specific location of met towers is not known, however it is assumed that the structures would result in weak to moderate contrast, and would be sub-dominant to the proposed wind turbines. No further discussion of potential visual impacts from met towers is presented in this document.

4.12.2.2 Operations and Maintenance

Visual Contrast

Visibility of Project features and expected level of contrast would vary based on the specific location of the viewer, and the configuration of Project components defined by each alternative. Long-term indirect impacts resulting from operations and maintenance of the proposed Project could include a general change in perception of the visual resources of the area over time. Individuals could be drawn to the Project Area to see turbines in close proximity, or may avoid the area due to perceived negative impacts. Long-term direct impacts are described below in terms of both expected level of visual contrast of each Project component, and the anticipated impacts to VRI Class, including component scores for scenic quality, visual sensitivity, and distance zones.

- ***Temple Bar Road*** – Should Alternative A be selected, the proposed Project would be situated approximately 3.9 from the entrance to the Lake Mead NRA on Temple Bar Road. Viewers would see the Project from varying vantage points as they traveled north- and southbound. During the peak visitor use in the summer, the turbines would be frontlit and sidelit in the morning when most visitors would be traveling northbound (toward Lake Mead NRA), and sidelit and backlit in the afternoon when most visitors would be exiting the NRA ((Figure D-2(b), Figure D-2(d)). Direct impacts to visual resources would result from the introduction of structures that would contrast the existing landscape during the daytime and nighttime. Narrow, white, vertical turbines would result in strong contrast against the rounded, stippled, olive and brown vegetation, the horizontal reddish-tan to light gray rolling hills and exposed bedrock, and the horizontal and diagonal lines and brown to dark gray colored backdrop of Squaw Peak. The lack of vegetation and gravel surfacing of Project roads would appear as disjunct tan to gray curvilinear lines. The appearance of road segments would mimic existing variation in landform to some extent, thereby resulting in moderate contrast (Figure D-2(b), Figure D-2(d)). The Project would appear similar in scale to the existing landscape. The movement of the rotating turbine blades would contrast the otherwise still landscape, and would attract attention of the casual observer. Synchronized flashing of the red aviation obstruction warning lights at night would result in strong contrast to the landforms in the background, and night sky where turbines rise above the horizon (Figure D-2(h)).

  Impacts to visual resources from views of the Project from Temple Bar Road would be temporary. Motorists accessing the park on Temple Bar Road would view the Project Area for approximately 9 miles between US 93 to the Lake Mead NRA boundary. This view would include the portion of the Project proposed on Reclamation-administered lands. Driving at the speed limit of 50 mph, the viewers would see the Project for approximately 11 minutes from varying vantage points. Visitors exiting the park would have continuous views of proposed Project from approximately 5 miles north of the boundary of the NRA. At the speed limit of 50 mph, and slowing down for the entrance station, views of the proposed Project from within the park would last approximately 7 minutes, and would include views of vehicle traffic on US 93. Indirect effects, such as recreators choosing other access routes to the Park in order to avoid views of the Project are considered improbable.

  In summary, when viewed from Temple Bar Road, overall visual contrast of form, line, color, and texture of the Project under day and night conditions would be strong. The Project would demand attention, would not be overlooked, and would dominate in the landscape. Views of the Project would be of short duration, and would affect viewers characterized by moderate visual sensitivity.

- ***Lake Mead NRA*** **–** Should Alternative A be developed, wind turbines located in the northeast corner of the Project Area would be visible from the lake and adjacent upland areas in the Lake Mead NRA. The turbines, located approximately 7 miles from KOP #7, would result in weak contrast in texture, and moderate contrast in form, line, and color against the existing landscape during the daytime. The nacelle and blades of two turbines located in lower elevation areas of the northeast corner of the Project Area would be visible. When viewed from inferior (lower elevation areas) such as the lake or shoreline, these structures are expected to be screened to a greater extent by topography and vegetation. Turbines located at higher elevations in this area would be more visible; however their bases would be largely shielded by existing topography, thereby obstructing views of turbine pads and reducing contrast of visible sections of access roads. All other Project components, such as switchyards, transmission interconnect lines and, O & M buildings would be shielded by Squaw Peak and surrounding foothills. The Project viewshed indicates that turbines situated in the west side of the Project Area have the possibility of being seen from Bonelli Landing, and portions of the lake located to the north of this campground. However, these turbines would be located approximately 15 miles or more from Bonelli Landing. Views of turbines are expected to be partially screened by topography and vegetation; thereby resulting in weak visual contrast in form, line, color, and texture during the daytime. Daytime views of proposed Project from Lake Mead NRA are assumed to be intermittent, as most land-based viewers would be focused on views across the water to the north, or would be engaged in aquatic recreation. More sustained views of the Project Area may be experienced by recreators located on anchored houseboats or at campgrounds, or non-motorized recreators located in the Pinto Valley or Jimbilnan Wilderness Areas. Overall contrast of the proposed Project when viewed from the lake and adjacent uplands would be weak during daylight hours. The contrast of the Project would be seen but would not attract attention.

The synchronized flashing of the red aviation obstruction warning lights on turbines located in the northeast corner of the Project Area would be visible from the lake and adjacent uplands during night time conditions. Although the scale of the night sky would be large relative to the size of the lighted area, obstruction lighting would be distinct, and result in moderate contrast against the night sky. Turbine hazard lighting would begin to attract attention and begin to dominate the landscape. Long-term, indirect effects that may result from turbine lighting may include selection against portions of the NRA with views of this feature by recreators seeking less-impacted views of the night sky.

- ***Traditional Cultural Locations of the Hualapai Tribe*** – Viewers situated at Senator Mountain, Mata Thija, and Squaw Peak would view turbines at close proximity (0.9 mile to 1.7 miles), and from varying angles of observation. From Senator Mountain, turbines could be seen within an approximately 180º arc extending from the southwest to the northwest. Views would be experienced from a superior (higher elevation) position, creating a wide view with no screening of Project turbines and turbine pads. All turbines would be viewed below the skyline. From Mata Thija, turbines would be seen at a broad northwest-facing 180º arc, and at similar elevation. Slight variation in topography would shield views of turbine pads; however the majority of tower, hub, and blades would be visible. Turbine strings would parallel the Mead-Phoenix 500 kV and Liberty-Mead 345 kV transmission lines. The strong visual contrast in form, line, color, and texture of the turbines would dominate the more transparent vertical and angular lines of the transmission towers, resulting in an overall industrial appearance to this portion of the Project Area. From Squaw Peak, turbines could be viewed from all directions. Turbines and turbine pads would be evident when viewed at close proximity, and from higher elevation vantage points. Because of the more curvilinear array of turbine strings in the northeast portion of the Project Area, turbines would appear less ordered and linear. Overall, the close proximity of turbines, and the motion associated with the blades would substantially change the character of the landscape when viewed from traditional locations identified by the Hualapai Tribe. Turbines would introduce strong contrast in form, line, color and texture with the existing landscape. The motion and glint of the rotating blades during the day would add strong contrast to the static landscape.

The synchronized flashing of the red aviation obstruction lights at night would introduce strong contrast in color and illumination to the night sky. The contrast of the proposed Project during both day and night conditions would demand attention, would not be overlooked, and would be dominant in the landscape during both day and night conditions. The BLM is continuing to consult with the Hualapai Tribe to determine whether the traditional cultural values of the location would be affected by the alteration of the landscape.

- ***US 93*** – Views of the Project from US 93 would vary based on travel direction. For example, southbound views from Householder Pass would be from a superior position, with little topographic screening of all turbines except those located in the northeast corner of the Project Area. Views from Rosie's Den, more centrally located within the valley, would be from a slightly inferior (lower elevation) position; consequently, a greater likelihood for turbine base and turbines shielded by topography. When traveling northbound, motorists would see the Project for the first time approximately 17 miles south of Rosie's Den. Visual contrast in form, line, color, and texture would increase upon approach. Views would be at an oblique angle to the north/northeast. Motorists traveling southeast would see the Project as they descended from the pass. Views would also be at an oblique angle. Motorists heading in both directions are assumed to be traveling at the posted speed limit of 65 mph, and would view the Project within the larger landscape context of the Detrital Valley, Black Mountains, and Cerbat Mountains. Turbines would be frontlit, sidelit, and backlit during the summer, and frontlit and sidelit in the winter. Daytime views of the turbines would be co-dominant with the existing highway and surrounding mountain features that characterize the landscape. Consequently, overall visual contrast observed during the day from US 93 is expected to be moderate. Contrast would begin to attract attention and begin to dominate the characteristic landscape. Blinking red hazard lights against the night sky is expected to result in strong visual contrast against the night sky. Co-dominant landscape features would not be evident. Lighting would demand attention, would not be overlooked, and would be dominant in the landscape.
- ***Residential Areas*** – Residential viewers would be situated between 1.2 and 4.6 miles from the southern border of the Project Area. Wind turbines would result in strong visual contrast in form, line, color, and texture against the surrounding landscape when viewed from certain areas. Views of the Project Area from many portions of the residential areas of White Hills community are shielded by topography and vegetation. It is expected that viewers situated along Indian Peak Drive, or those located in higher elevation areas in these areas would observe the highest visual contrast. From Indian Peak Drive, wide views of the turbines would be experienced at close proximity. From this vantage point, turbines would extend above the skyline of existing landforms. Turbines would be frontlit, sidelit, and backlit during the summer, and frontlit and sidelit in the winter. The flashing and the extent of hazard lighting viewed from these proximate locations would result in strong contrast to the night sky. Consequently, visual contrast observed during both day and night from residential areas of Indian Peak Drive and White Hills is expected to be strong. Due to the proximity of the proposed Project, and the prolonged and sustained views of residents, visual contrast would demand attention, would not be overlooked, and would be dominant in the landscape.

Visual Resource Inventory Values

The Project Area occupies approximately 26,766 acres of SQRU 41 (20 percent), and 20,299 acres of SQRU 14 (1.5 percent). Based on the Project footprint of Alternative A, the viewshed of the proposed Project occupies approximately 75,743 acres of SQRU 41 (57 percent), and 128,599 acres of SQRU 14 (10 percent). Collectively, Project components described for all action alternatives could impact the VRI components of scenic quality and visual sensitivity in both SQRUs; however, due to the reduced footprint, the extent of impacts would be reduced under Alternatives B and C. Visual distance zones are not expected to change as a result of operation of the proposed Project. The analysis of scenic quality, visual sensitivity, and distance zones is presented in the following sections. No change in VRI Class would result as units cannot be reduced below the current designation of Class IV.

Scenic Quality – The proposed Project is expected to result in localized, high intensity impacts to scenic quality. Based on the viewshed model, these impacts would be evident to some extent in over half of SQRU 41. Because the majority of the affected portion of the SQRU is located within 5 miles of the Project, the intensity of impacts would be high. Modifications would be discordant and promote strong disharmony, consistent with a ranking of -4. Scenic quality would be affected in 10 percent of SQRU 14. Because the intensity and extent of cultural modification across the entire unit is unknown, no cultural modification score was established.

Visual Sensitivity – Although the low visual sensitivity of viewers situated within SLRU 13 established during the pre-1990 VRI cannot be reduced, localized changes in visual sensitivity may nonetheless result from the proposed action. Members of the Hualapai Tribe with cultural ties to traditional locations within the Project Area may become more sensitive as they notice the change to the landscape. Over time they may become less sensitive as the members become accustomed to the perceived disharmony of views, or lack of spiritual connection to identified areas. Likewise, residential viewers may become more sensitive to the changes but would eventually become less sensitive based on an acceptance of the perceived loss of the natural setting of the Project Area. Local visitors to Lake Mead who access the Park via Squaw Peak Road could eventually become accustomed to the turbines and ancillary facilities through repeated use of these roadways, resulting in being less sensitive to change in the landscape character. As a result of the proposed Project, localized viewers within SLRU 65 could become less sensitive.

Residents in White Hills and the Indian Peak Road area may eventually become less sensitive based on perceived loss of the natural setting of the Project Area. Motorists traveling through the unit are not expected to become less sensitive, as this viewer group would experience a large portion of the SLRU that was not affected by the Project. Operation of the proposed Project could indirectly affect visual sensitivity of adjacent areas characterized by little to no cultural modification. Viewers in these more pristine areas could become more sensitive.

Distance Zones – Construction and maintenance of new and improved roads may result in increased use by recreationists accessing the Lake Mead NRA via Squaw Peak Road, or other recreation or cultural destinations within the area. However, it is assumed that the majority of visitors to the Temple Bar area of Lake Mead would still select the paved access provided by Temple Bar Road. Common travel routes and viewpoints assumed to have been used in the pre-1990 VRI would, therefore, not change as a result of the proposed Project. Consequently no change in distance zones is expected.

4.12.2.3 Decommissioning

Decommissioning activities would have a similar effect to visual resources as the construction activities. As Project features are removed during decommissioning, an incremental reduction to visual contrast would be expected. Viewers situated adjacent to the Project Area may see localized decommissioning of turbines; however views would be temporary and include an incremental reduction in visual contrast from Project components. The degree to which decommissioning of the Project would restore scenic quality of affected SQRUs would depend on the extent of other development in the area.

4.12.2.4 Project Options

Project feature options as described in Chapter 2 include:

- Turbine color – either white or Shadow Gray
- Transmission line interconnection – either at the Liberty-Mead 345-kV line with 8 acres of long-term ground disturbance (12 acres temporary) or at the Mead-Phoenix 500-kV line with 31 acres of long-term disturbance (37 acres temporary)
- Collector lines – either all below ground or partially below and partially above ground

Alternative A includes the white turbine option. The contrast rating analysis indicated that a strong contrast in form, line, color, and texture would result from the wind turbines as proposed. At distances of greater than 5 miles, contrast with the smooth texture of the turbines against the coarse texture of the surrounding environment would be reduced to moderate and weak levels; however the bold white color of the turbines would contribute substantially to the persistence of strong contrast in form, line, and color across greater distances.

Alternative A could include either option for the transmission line interconnection and collector lines. If the Mead-Phoenix 500-kV connection would be chosen, then the long-term ground disturbance would be approximately four times as large as that required for the 345-kV connection. The closest KOP to both switchyard locations is KOP 171, Mata Thija. The 500-kV location would be approximately 2 miles away and the 345-kV connection would be 2.8 miles away. Despite the closer location and larger disturbance required for the 500-kV switchyard, the difference in impacts would be minor because of the viewing angle and other existing and proposed ground disturbances and facilities.

If the collector line option of being partially below and partially above ground would be chosen, then the visual impact would be greater than if the lines were all below ground and the temporary ground disturbance was successfully reclaimed. However, considering that the poles are about 35 feet in height, the impact of the poles would be minor compared to the size of the turbines.

4.12.2.5 Summary of Impacts

In summary, should Alternative A be implemented, direct impacts to visual resources would result from the introduction of structures characterized by strong visual contrast against the existing landscape during both day and night from at the majority of viewer areas analyzed. Strong visual contrast would be observed from traditional locations identified by the both the Hualapai Tribe, residential areas, and Temple Bar Road. Views from US 93 and Temple Bar Road are expected to be of short duration, and experienced at varying angles of observation. Impacts to views from the lake and adjacent uplands in the Lake Mead NRA would be greatest during nighttime conditions. Prolonged and/or stationary views of Project components from Hualapai Tribe cultural locations, residential areas, and campers situated on or adjacent to Lake Mead would be most affected. Cultural, residential, and recreational viewer groups in these areas are assumed to have high visual sensitivity. Indirect effects may cause viewers to become less sensitive over time due to reduction in scenic quality.

Although operations and maintenance of the proposed Project would be expected to result in a reduction of scenic quality SQRU 41and visual sensitivity of SLRU 13, the VRI class assigned to both SQRUs 14 and 41 and SLRU 65 and 13 would remain a Class C. Operation of the proposed Project under Alternative A would be consistent with VRM Class IV objectives.

4.12.3 Alternative B

Alternative B would occur on approximately 30,872 acres of BLM-administered lands managed by VRM Class IV objectives. This alternative would include the elimination of approximately 10 to 30 turbines from the northwest portion of the Project Area, approximately 5 to 15 turbines from the northeast portion of the Project Area, approximately 10 to 15 turbines from the southern border of the Project Area, and approximately 5 to 10 turbines from the eastern border of the Project Area (Map 2-3).

4.12.3.1 Construction

Construction of Alternative B would create similar short-term, localized, deviations in landscape character as those described for Alternative A. Construction-related impacts would be reduced in the northwest, northeast, and southern portions of the Project Area where turbines and turbine strings are not proposed. Reduced impacts would primarily result from the decrease in viewer duration and increase in viewer distance to construction-related actions.

4.12.3.2 Operations and Maintenance

Visual Contrast

- ***Temple Bar Road*** – Operations and maintenance of Alternative B would result in similar direct impacts to visual resources as those described under Alternative A when viewed from Temple Bar Road; however the duration of time that motorists would observe the Project would be reduced (Figure D-2(e)). The number of turbines in the northwest corner of the Project (west of Squaw Peak) would be reduced by approximately 10 to 30 turbines, thereby increasing the distance to the closest turbine from the entrance to the Lake Mead NRA on Temple Bar Road from 3.9 miles (middleground view) to approximately 7.0 miles (background view). When traveling northbound toward the NRA, travelers would pass the last row of turbines approximately 4.3 miles south of the park boundary (located south of the entrance station), as opposed to 0.4 mile under Alternative A, resulting in a reduction of viewing time from approximately 11 minutes to 6 minutes. The elimination of these turbines would reduce the number of turbines viewed by motorists exiting the NRA, thereby causing the majority of views from Temple Bar Road to be experienced at an oblique angle (toward the southeast).
- ***Lake Mead NRA*** – Operations and maintenance of Alternative B would result in a reduction of direct and indirect impacts to visual resources viewed from the lake and adjacent uplands of the Lake Mead NRA. The reduction in impacts would be primarily due to the removal of 5 to 15 turbines from the northeast portion of the Project Area. The removal of turbines from the northeast portion of the Project Area would be expected to reduce visibility of the proposed Project from the lake and adjacent areas. The nacelle and rotor blades of the remaining turbines situated at lower elevations would still be visible; however, when viewed from inferior (lower elevation areas) such as the lake or shoreline, these structures could be screened by topography and vegetation. Consequently, the portion of the turbines that would be visible would appear small in scale relative to that of the surrounding landscape. Likewise, exposure to synchronized blinking hazard lights would be reduced. Visual contrast in form, line, color, and texture during daylight conditions would be weak (see Figure D-4(c) for simulation of identical view rendered for Alternative C). Although turbines could be seen, they would not attract attention of the casual observer. Visual contrast is not expected to increase to a moderate level during daylight conditions until motorists exiting the NRA pass the entrance to the Park (Figure D-2(e)). Under night conditions, visual contrast from hazard lighting would be expected to vary based on viewer position relative to the turbines in view; however, when viewed from the lake or shoreline, visual contrast would also be expected to be weak, as lighting would not be expected to attract attention

of the casual observer from these locations. Perceived visual contrast of hazard lighting against the night sky would increase incrementally for motorists exiting the park via Temple Bar Road.

- ***Traditional Cultural Locations of the Hualapai Tribe*** – Alternative B would include the elimination of approximately 5 to 10 turbines located west of Senator Mountain. Due to the superior viewer position of Senator Mountain, and the broad views of all Project components, visual contrast would not be expected to change under this turbine configuration.
- ***US 93*** – Alternative B would include the elimination of the southern-most turbine string (approximately 10 to 15 turbines) from the proposed Project. Removal of these turbines would increase the distance between US 93 and the closest turbines by 0.4 mile. The level of visual contrast from US 93 is expected to remain strong.
- ***Residential Areas*** – Alternative B would include the elimination of the southern-most turbine string (approximately 10 to 15 turbines) from the proposed Project. Removal of these turbines would increase the distance between the residential areas on Indian Peak Drive by 0.5 mile; however level of visual contrast is expected to remain strong.

Visual Resource Inventory Values

As potential changes to VRI values are not expected to differ across action alternatives, the changes are the same as for Alternative A.

4.12.3.3 Decommissioning

Decommissioning activities would have a similar effect to visual resources as the construction and decommissioning activities of Alternative A. Decommissioning-related impacts would be reduced in the northwest, northeast, and southern portions of the Project Area where turbines and turbine strings are not proposed. The degree to which decommissioning of the Project would restore scenic quality of affected SQRUs would depend on the extent of other development in the area.

4.12.3.4 Project Options

The Project feature options for Alternative B are similar to those of Alternative A, except that the turbine color could be Shadow Gray. This specific color is a BLM Standard Environmental Color (BLM 2008) and was requested by BLM to be used to analyze the potential to reduce the visual contrast of white structures. Two simulations of the Shadow Gray turbines were completed for views from US 93 at Rosie’s Den under backlit conditions (Figures D-5(g) and D-5(h) in Appendix D). Based on these simulations, the Shadow Gray turbines appear to have a stronger contrast for color than white turbines with the surrounding landscape, and under backlit conditions. It is expected that colored turbines would result in less contrast in color to white turbines during frontlit conditions. There may also be less contrast compared to the landscape in different locations. Contrast in form, line, color, and texture of Shadow Gray turbines would be expected to decrease with distance from the viewer.

It is assumed that a small variation in color choice may prove more successful for this and other turbine locations, and that Shadow Gray may be more successful against different landscapes. Details for this option would be developed during final design and reviewed by BLM.

Due to FAA regulations, turbines painted a non-white color would require daytime lighting (Section 2.5.2.3); consequently, the addition of this lighting scenario is analyzed as part of the turbine color option. The interpretation of impacts resulting from day-lighting of non-white turbines is challenging using static simulations. However, considering day-lighting on structures such as communication towers, it is assumed that such lighting would be obvious on the turbines and would attract the attention of the casual observer.

4.12.3.5 Summary of Impacts

In summary, should Alternative B be implemented, direct impacts to visual resources would result from the introduction of structures characterized by strong visual contrast against the existing landscape both day and night from the majority of viewer areas analyzed. Visual contrast and affected views would be similar to that described under Alternative A; however direct and indirect effects to views from Temple Bar Road, and the lake and adjacent uplands of the Lake Mead NRA would be reduced. The reduction in impacts would be primarily due to the removal of turbines from high elevation areas in the northeast portion of the Project Area. Impacts to views from the lake and adjacent uplands in the Lake Mead NRA would be greatest during nighttime conditions. The reduction of impacts to residential areas would be extremely localized and limited to the residence in the northern portion of the viewer area (Indian Peak Road). Prolonged and/or stationary views of Project components from residential areas, traditional locations identified by the Hualapai Tribe, and camping locations on or adjacent to Lake Mead would be most affected. Residential, cultural, and recreational viewer groups in these areas are assumed to have high visual sensitivity. Indirect effects may cause viewers to become less sensitive over time due to reduction in scenic quality. This reduction in scenic quality may also indirectly cause viewers to become more sensitive in other areas within the resource planning unit where the visual integrity of the landscape remains intact.

Although operations and maintenance of the proposed Project is expected to result in a reduction of scenic quality and visual sensitivity of SQRU 41 and SLRU 13, the VRI class assigned to both SQRUs 14 and 41, and SLRUs 65 and 13 would remain a Class C. Operation of the proposed Project under Alternative B would be consistent with VRM Class IV objectives.

4.12.4 <u>Alternative C</u>

4.12.4.1 Construction

Construction of Alternative C would create similar short-term, localized, deviations in landscape character as those described for Alternatives A and B.

4.12.4.2 Operations and Maintenance

Alternative C would have a reduced footprint due to fewer proposed turbines compared to Alternative A, and would occur on approximately 30,178 acres of BLM-administered lands managed by VRM Class IV objectives (Maps 2-2 through 2-10). This alternative would include the elimination of approximately 15 to 30 turbines from the northwest portion of the Project Area, 5 to 10 turbines from the northeast portion of the Project Area, 10-20 turbines from the southern border of the Project Area, and 5 to 15 turbines from the eastern border of the Project Area. The configuration of turbines would be expected to decrease both the visibility of the Project and duration of view to varying degrees when seen from Temple Bar Road and Lake Mead.

Compared to Alternative B, Alternative C would include the addition of approximately 1-5 turbines in the northwest portion of the Project Area, the addition of 1 to 10 turbines in the northeast, the elimination of 1 to 5 turbines in the south, and the elimination of 5 to 10 turbines from the eastern border of the Project Area. The possible variation in the addition of turbines in the northwest and northeast portions of the Project Area compared to Alternative B would not be expected to result in measureable change in impacts when viewed from US 93, Temple Bar Road, and the Lake Mead NRA. Likewise, despite additional reductions in turbines on the southern and eastern borders of the Project Area, visual contrast would not be expected to result in a detectable reduction in impacts when viewed from adjacent residential areas and the traditional locations identified by the Hualapai Tribe.

Visual Contrast

- ***Temple Bar Road*** – Operations and maintenance of Alternative C would result in similar direct impacts to visual resources as those described under Alternative B. When one turbine string is added under Alternative C, the duration of view of motorists heading towards the park would increase from approximately 6 minutes to 7.5 minutes. This additional turbine string would not be expected to substantially change the duration of time that motorists would see the Project when exiting or entering the Lake Mead NRA (Figure D-2(e)). Compared to Alternative A, the duration of time that motorists would see the Project would decrease from 11 minutes to 7.5 minutes.
- ***Lake Mead NRA*** – Operations and maintenance of Alternative C would result in identical direct impacts to visual resources when viewed from the lake or adjacent areas as those described under Alternative B. Compared to Alternative A, there would be a reduction of direct and indirect impacts to visual resources viewed from the lake and adjacent uplands of the NRA.
- ***Traditional Cultural Locations of the Hualapai Tribe*** – Operations and maintenance of Alternative C would result in similar direct impacts to visual resources as those described under Alternative B. There would be a few less turbines near Senator Mountain and Mata Thija, and one string of turbines would be added south and west of Squaw Peak. Compared to Alternative A, there would be similar direct impacts to the three sites.
- ***US 93*** **–** Operations and maintenance of Alternative C would result in similar direct impacts to visual resources as those described under Alternative B. Compared to Alternative A, there would be the elimination of the northwestern and southern-most turbine strings; however, the level of visual contrast is expected to remain strong.
- ***Residential Areas*** **–** Operations and maintenance of Alternative C would result in similar direct impacts to visual resources as those described under Alternative B. Compared to Alternative A, the southern-most turbine string would be eliminated; however, the level of visual contrast is expected to remain strong.

Visual Resource Inventory Values

As potential changes to VRI values are not expected to differ across action alternatives, the changes are the same as those associated with Alternatives A and B.

4.12.4.3 Decommissioning

Decommissioning of Alternative C would create similar short-term and localized deviations in landscape character as those described for Alternatives A and B.

4.12.4.4 Project Options

The Project feature options for Alternative C are the same as those for Alternative B.

4.12.4.5 Summary of Impacts

In summary, should Alternative C be implemented, direct impacts to visual resources would result from the introduction of structures characterized by strong visual contrast against the existing landscape both day and night from the majority of viewer areas analyzed. Visual contrast and affected views would be similar to those described under Alternative B; however the addition of one turbine string would slightly increase the duration of time that motorists on Temple Bar Road would see the Project when existing or entering Lake Mead NRA. Although operations and maintenance of the proposed Project is expected to result in a reduction of scenic quality and visual sensitivity of SQRU 41 and SLRU 13, the VRI class assigned to SQRUs 14 and 41 and SLRUs 65 and 13 would remain a Class C. Operation of the proposed Project under Alternative C would be consistent with VRM Class IV objectives.

4.12.5 Alternative D – No Action

Under Alternative D, impacts to visual resources resulting from dispersed recreation (i.e., OHV use), livestock grazing, and commercial utility lines would continue. The visual contrast of such activities against the surrounding landscape would be expected to remain weak.

4.12.6 Project Options

Turbine Color Option – Shadow Gray

The contrast rating analysis indicated that a strong contrast in form, line color, and texture would result from wind turbines as proposed. At distances of greater than 5 miles, contrast with the smooth texture of the turbines against the coarse texture of the surrounding environment would be reduced to moderate and weak levels; however, the bold white color of the turbines would contribute substantially to the persistence of strong contrast in form, line, and color across greater distances. A design option to consider painting the wind turbines the BLM Standard Environmental Color of Shadow Gray (BLM 2008) was requested by BLM, and this color was used to analyze the potential to reduce the visual contrast of white structures. Due to FAA regulations, turbines painted a non-white color would require daytime lighting (Section 2.5.2.3); consequently, the addition of this lighting scenario was analyzed as part of this design option.

Two simulations of the Shadow Gray turbines were completed for views from US 93 at Rosie's Den under backlit conditions (Figures D-5(g) and D-5(h) in Appendix D). Based on these simulations, the Shadow Gray turbines appear to have a stronger contrast for color than white turbines with the surrounding landscape, and under backlit conditions. It is expected that colored turbines would result in less contrast in color to white turbines during frontlit conditions. There may also be less contrast compared to the landscape in different locations. Contrast in form, line, color, and texture of Shadow Gray turbines would be expected to decrease with distance from the viewer.

Although the interpretation of impacts resulting from day-lighting of non-white turbines is challenging using static simulations, it is assumed that such lighting would be obvious and would attract the attention of the casual observer. It is assumed that a small variation in color choice may prove more successful for this and other turbine locations, and that Shadow Gray may be more successful against different landscapes. Details for this option would be developed during final design and reviewed by BLM.

Obstruction Lighting

Obstruction lighting results in strong contrast against the night sky. Mitigation to reduce visual contrast resulting from lighting could include an Audio Visual Warning System; however, its use has not been approved by the Federal Aviation Administration (FAA). Such a system would allow night lighting to remain off, unless an aircraft is detected in close proximity, and at an unsafe heading. This technology is not being considered by the FAA for day lighting on non-white turbines, so the turbines would still require the standard flashing white strobes during the day.

4.12.7 Mitigation Measures

The proposed Project would implement BMPs as discussed in Chapter 2. These include BMPs from the R*ecord of Decision for the Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments* (BLM 2005b) and are included as Appendix B of this EIS. The BMPs pertaining to visual resources are listed in Table 4-23 in the Assumptions column.

Obstruction lighting is a visual concern because it would cause strong contrast against the night sky. Mitigation to reduce visual contrast resulting from lighting could include an Audio Visual Warning System. Such a system would allow night lighting to remain off, unless an aircraft is detected in close proximity. However, its use has not been approved by the Federal Aviation Administration (FAA), and is not being considered by the FAA for day lighting on non-white turbines, so the turbines would still require the standard flashing white strobes during the day.

4.12.8 Unavoidable Adverse Impacts

Temporary unavoidable adverse impacts to visual resources would result from ground disturbance and the motions of workers, machinery, and Project components related to construction and decommissioning activities. The ground disturbance would be more extensive during the construction and decommissioning phases than during the operations phase. Long-term unavoidable adverse impacts would occur over the duration of the Project to viewers seeking natural landscapes with minimal manmade facilities and disturbances, both during the day and at night. The impacts could be less over time for viewers who become accustomed to seeing the Project and accept it as part of the landscape. The visual impacts would be unavoidable due to the size and number of turbines; however they would be minimized to the extent possible as final designs are prepared with the approval of BLM and Reclamation.

The long-term visual impacts would be reversible and nearly imperceptible when the Project is decommissioned and the land is restored, based on the removal of Project components, restoration of original contours, and the success of revegetation.

4.13 PUBLIC SAFETY, HAZARDOUS MATERIALS, AND SOLID WASTE

This section discusses the potential effects on occupational and public safety, use and disposal of hazardous materials, and the presence and disposition of solid waste in the Project Area. Information presented in Section 3.13 of this EIS forms the basis on which potential impacts are assessed. In addition, potential issues associated with public safety, hazardous materials, and solid waste that occurred during the agency and public scoping process are identified and discussed.

4.13.1 Analysis Methods

4.13.1.1 Occupational and Public Safety

The method for analysis of occupational and public safety with regard to the proposed alternatives is to conduct a comparison between the safety conditions that would exist with the adoption of any of the proposed alternatives with the conditions as they currently exist as summarized in the Existing Conditions Section 3.13 of this EIS. Current risks are limited to those naturally occurring situations occurring on native desert land that are encountered during recreational activities, including travel on unpaved roads and desert conditions. Some occupational hazards also currently exist to those individuals who maintain existing transmission lines in the area. With the exception of the No Action alternative, safety hazards under any of the other alternatives would be more likely to exist during the construction, operations and maintenance, and decommissioning phases of the Project and less hazardous situations would be encountered during the site monitoring and testing phases. Risks would also vary when considering occupational safety in terms of workers at and on their way to and from the Project site and public safety related to the general public accessing the area.

Typical activities for workers during the construction phase at the Project site would include establishing site access; excavating and installing the tower foundations; erecting the towers; and constructing the O&M buildings, met towers, electrical substations, and switchyard access roads. Routine maintenance of the turbines and ancillary facilities would occur during the operations phase. In addition to typical risks found at any construction site, some of the typical hazards particularly related to wind farm sites would include working at or around extremely heavy weights of Project components, heights, high winds, energized systems, rotating/spinning equipment, and very high crane lifts of large heavy components. In the presence of any of these hazards, there is a risk of injuries or fatalities. To minimize the risks, workers would be required to adhere to safety standards and use appropriate protective equipment.

As discussed in Chapter 3, a number of mining claims are filed within the study area, but no active mining operations are known to exist in the area. One abandoned mine site, known as the Muscovite Mica mine, exists in the northeast portion of the Project Area. No impacts are expected from mines or hazardous materials sites, including abandoned mines, under any of the alternatives. Appendix B outlines BMPs to be followed should hazardous materials be discovered during construction.

4.13.1.2 Hazardous Materials and Solid Waste

Potential impacts are assessed in comparison with information gathered during limited site reconnaissance visits on BLM-administered public lands in October 2009 and on Reclamation-administered lands in July 2010. Based on these visits and a regulatory records search, a Preliminary Initial Site Assessment (PISA) was completed. The impacts associated with the Project alternatives have been weighed against the results found in the PISA (URS 2010b). Adherence to Federal, state, and local requirements for handling and disposing of hazardous materials and wastes would apply under all alternatives.

4.13.2 Alternative A – Proposed Action

4.13.2.1 Occupational Safety Impacts

Health and safety issues that would occur under Alternative A would have a direct impact on workers at the site. The greatest impacts would be experienced during the construction and decommissioning phases, but there is also the potential for accidental spills of hazardous materials and worker accidents to occur during the operations and maintenance phase.

Construction Phase

Prior to the construction phase of the Project, a Project Health, Safety, Security, and Environment (HSSE) Plan would be developed to address health and safety risks and requirements. Some of the topics that would be addressed in the HSSE Plan would include risk management analysis; emergency response; HSSE planning and procedures; implementation; monitoring and reporting results; setting performance targets; and incident classification, investigation and reporting. The HSSE Plan would also outline minimum health and safety requirements, including the use of personal protective equipment, housekeeping (including adequate sanitation facilities for work crews), maintaining a safe workplace, fire prevention, and safe work practices. The HSSE Plan would also include a risk register, which is a document that is used to identify and mitigate risks as they surface. Continued modification and updating of the risk register is a useful tool to incorporate site specific risks and solutions into the plan (BP Wind Energy 2010).

Before work commences at the construction site, all work crews would be oriented and trained in various health and safety policies and procedures that are based upon BP Wind Energy policies (BP Wind Energy 2010), as well as requirements of the Federal Occupational Safety and Health Act (29 USC 651 et seq.) (U.S. Department of Labor [USDL] 2004), and the Arizona Division of Occupational Safety and Health administered by the Industrial Commission of Arizona (USDL 2011).

During the construction phase, blasting may be necessary in order to reach the necessary slope and gradient for Project access roads. This could create a direct, short-term impact on individuals and objects near to the blasting area. Any blasting would be conducted in accordance with a Blasting Plan, minimizing the risks associated with worker safety. All blasting would be designed and carried out by a specialist contractor who has significant experience and expertise in this field and is licensed in the State of Arizona to carry out such work. Every Blasting Plan is unique to its setting, but generally, provisions of the Blasting Plan would include methods to mitigate fly rock, including use of blasting blankets as required. Also, the blast pattern and shot design would be procured from the contractor prior to each blast being made for review and approval of BP Wind Energy. Information on blasting activities would be provided to the owners of any structures within 200 feet of the blast area (BP Wind Energy 2010).

Trenching or plowing for placement of underground electrical and communication lines would occur as part of the Project installation. These activities could cause a direct, short-term impact during the construction phase. Trenching and installation of underground utilities would be conducted in sections so that the amount of open trenches at a given time is minimized. When trenches are not backfilled immediately, escape ramps for wildlife would be constructed at least every 0.25 mile (BP Wind Energy 2010).

Operations and Maintenance Phase

As the operational phase evolves, the HSSE Plan would be adapted to address operational and maintenance activities. Hazards during operations and maintenance activities would be risks associated with working at heights, high winds, and rotating/spinning systems, creating direct, short-term impacts on those individuals exposed to the risks. The International Electrotechnical Commission (IEC) has published minimum safety requirements for wind turbine generator systems (IEC 1999). The IEC requires that the wind turbine generator systems manufacturer provide an operator instruction manual with supplemental information on special local conditions (BLM 2005). The manual would include system safe operating limits and descriptions, start-up and shutdown procedures, and alarm response actions. It would also include an emergency procedures plan identifying probable emergency situations and the actions necessary for operating personnel, including overspeeding, icing conditions, lightning storms, earthquakes, broken or loose guy wires, brake failure, rotor imbalance, loose fasteners, lubrication defects, sandstorms, fires, floods, and other component failure (BLM 2005).

Decommissioning Phase

Impacts under Alternative A on occupational safety during the decommissioning phase would be very similar to those that could potentially occur during the construction phase. Large equipment would be employed to dismantle the turbines (very heavy component parts) along with the ancillary equipment and buildings. No blasting is planned for the decommissioning phase of the Project. However, should this change, any blasting would be conducted in accordance with the Blasting Plan, and as described in the Construction discussion in this section.

4.13.2.2 Public Safety Impacts

Construction Phase

During the construction phase of the Project under Alternative A, public safety would be monitored and enforced through installation of signs and fences at and near the Project site. BP Wind Energy would post safety and warning signs to inform the public of construction activities where the access road enters the Project Area from a public road. Public access to the site would be monitored and a security guard would patrol the site area during non-working hours. During construction, temporary fences would be erected in those locations where public safety risks exist due to disturbed area conditions or the presence of heavy equipment and where site personnel are not currently working. Fences may also be installed in laydown areas to protect the public from risks associated with the presence of heavy machinery and Project materials. Once the operational phase of the Project commences, the Project substation and the Project switchyard would be permanently fenced due to safety risks associated with electrical components and to secure equipment. In addition, the entire completed 5-acre O&M facility would be enclosed by an 8-foot-high chain link fence with barbed wire at the top.

During the construction process, an increased number of slow-moving, oversized heavy vehicles hauling large parts and materials would be traveling on public roads to the Project site. This could cause temporary delays and potentially cause traffic accidents involving the public, creating a direct, short-term impact. A Transportation and Traffic Plan would be developed to mitigate potential incidents (BP Wind Energy 2010). See Section 4.9 for details concerning information gathered regarding potential transportation impacts. A Transportation and Traffic Plan (BP Wind Energy 2011a) developed for the Project used the resulting trip count data to assess the projected impacts against the projected volume of traffic (see Appendix C).

Additional potential public health and safety impacts could be associated with activities required for construction activities which could have direct, short-term adverse impacts from increased traffic and associated reduced visibility caused by fugitive dust. However, dust palliatives would be used on unpaved road surfaces. This may include using water on the road surfaces or treating road surfaces with a chloride application (calcium chloride or magnesium chloride) to control dust. These products are hygroscopic, meaning they draw moisture from the air and keep the road surface damp (BP Wind Energy 2010). The construction of new and reconstructed roads could result in direct, short-term adverse impacts during construction but would later become indirect long-term beneficial impacts on public health and safety by providing improved road conditions and quicker emergency response time to the Project Area.

Operations and Maintenance Phase

Safety systems have been included in the plans for operation of all of the components of the Project. Each wind turbine would contain a safety system that ensures automatic shutdown of the turbine in the event of any mechanical disorders, excessive vibration, grid electrical faults, or loss of grid power. If grid electrical faults or loss of grid power occurs, the turbines would automatically return to service when the disorder is remedied. In the event of a mechanical disorder, the turbines would remain shut down until the disorder is identified and remedied by the Project operations and maintenance team.

In the past, a rare but possible risk was the occurrence of a rotor blade breaking and parts being thrown off the turbine. This typically occurred as a result of rotor overspeed or material fatigue (Hau 2000). Modern turbines generally have lower rotor speeds (18 to 20 revolutions per minute) and better braking systems than the turbines previously produced. Blade design and manufacture has also improved tremendously. Consequently, the risk of rotor breakage is considered negligible due to design and manufacture improvements. Under the BP Wind Energy plan, no turbine on public land would be positioned closer than 1.5 times the total height of the wind turbine (from 585 to 740 feet) to the ROW boundary (BP Wind Energy 2010), further reducing the risk to nearby residents.

The physical obstruction of a wind turbine itself and the effects on communications, navigation, and surveillance systems, such as radar are two primary aviation safety considerations in the development of a wind project (Department of Trade and Industry ([DTI]) 2002). BP Wind Energy would work with the FAA to determine lighting requirements for the wind turbines. A preliminary analysis has been completed and the FAA has determined that if the turbines are a white or light off-white color, a portion of them would be required to be lit at night with red synchronized lights. The Kingman Airport and Industrial Park is located approximately 50 miles from the Project site, a distance at which the potential for accidental impacts between small aircraft and the wind turbines is considered slight. Night lighting of the turbines would not present an impact to aviators flying to and from Triangle Airpark, located approximately 0.5 mile northeast of White Hills Road and US 93, because the airpark is limited through FAA visual flight rule to day-use only. However there would be an increased risk for accidental impacts due to the proximity of the airpark to the Wind Farm Site. Risks could be mitigated through standard airfield operating procedures to direct aircraft away from the turbines until an adequate flight altitude is obtained to safely clear the Wind Farm Site, but an increased risk of mishaps would remain for aircraft experiencing a flight emergency in close proximity to the turbines.

The presence of dry vegetation combined with high winds could produce a potential fire hazard around the Project site during the O&M phase. Electrical shorts, insufficient equipment maintenance, contact with power lines, wildlife interference, or lightning also could potentially be the cause of a fire. At the Project site, the wind turbines would be equipped with built-in fire prevention measures that allow the turbines to shut down automatically before mechanical problems could create excess heat or sparks. Also, the use of underground power collector cables would reduce the risk of fire from short circuits caused by wildlife or lightning. Water carrying trailers (water buffaloes) with a capacity to carry 500 gallons of water would be positioned around the site at appropriate locations for response in the event of a fire. Training for employees and local fire personnel would be conducted to alert all to the safety risk and the appropriate responses (BP Wind Energy 2010).

Decommissioning Phase

Under Alternative A, the risks to public health and safety during decommissioning would be similar to those encountered during the construction phase. Public safety would be monitored and enforced through use of signs and fences at and near the Project site. Safety and warning signs would be posted by BP Wind Energy to inform the public of ongoing decommissioning activities. During the decommissioning process, a number of slow-moving, oversized heavy vehicles hauling large parts and materials away from the Project site would be traveling on public roads. This could cause temporary delays and potentially cause traffic accidents involving the public, creating a direct, short-term adverse impact. The Transportation and Traffic Plan would be modified to mitigate potential incidents that could occur during the decommissioning phase (BP Wind Energy 2010).

Public access to the site would be monitored and a security guard would patrol the site area during the decommissioning phase. Temporary fences would be erected in those locations where public safety risks exist due to disturbed area conditions or the presence of heavy equipment and where site personnel are not currently working. Fences may also be installed in other areas to protect the public from risks associated with the presence of heavy machinery and discarded equipment. Temporary fencing would likely consist of chain link fences, with the height and design varying according to the location and level of risk.

4.13.2.3 Hazardous Materials and Solid Waste

Construction Phase

The use of hazardous materials during the construction phase of the Project could create a direct, short-term risk to those individuals handling and using the materials. Hazardous materials are those chemicals listed in the U.S. Environmental Protection Agency (USEPA) Consolidated List of Chemicals Subject to Reporting under Title III of the Superfund Amendments and Re-authorization Act of 1986 (SARA 1986). Hazardous materials as well as non-hazardous solid wastes such as oils and lubricants are managed under the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. §6901 et seq. [1976]). RCRA gives the USEPA the authority to control hazardous waste from its generation through its transportation, treatment, storage, and finally its disposal.

Hazardous materials anticipated being used or produced for this Project would include:

- Lubricants: grease (potentially containing complex hydrocarbons and lithium compounds, and motor oil
- Fuels: gasoline (potentially containing benzenes, toluene, xylenes, methyl-tert-butyl ether, and tetraethyl lead), and diesel fuel
- Combustion emissions: nitrogen oxide, carbon monoxide, and methane hydrocarbons
- Transmission line emissions: ozone and nitrogen oxide
- explosives

All production, use, storage, transport and disposal of hazardous materials related to this Project during the construction phase would comply with all applicable Federal, state and local laws and regulations. All regulations regarding any toxic substances that are used, generated by, or stored at the Project site would be followed in accordance with the Toxic Substances Control Act of 1976, as amended (15 U.S.C.2601, et seq.; TSCA 1986). Additionally, any release of toxic substances in excess of the reportable quantity established by 40 CFR, Part 117 would be reported as required by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA 1980). The SPCC rule, which includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines, would be followed. The rule requires specific facilities to prepare, amend, and implement SPCC Plans. The SPCC rule is part of the Oil Pollution Prevention regulation, which also includes the Facility Response Plan (FRP) rule.

The use of explosives could occur during the construction phase to establish roads and other construction requirements. Use of explosives would be performed in compliance with the HSSE Plan.

Two batch plants would be constructed to supply high strength concrete for the wind turbine foundations and ancillary facility footings and slabs. Power at these plants, if not through a new distribution line, would most likely be provided by temporary generators. The generators at these plants would be equipped with secondary containment to reduce the risk of accidental spills reaching the ground. If oil or grease is spilled or leaked from equipment, the contaminated sand would be removed and hauled to Silver State Disposal in Clark County, Nevada, which is an approved hazardous material dump. Used oil would be pumped into a truck and hauled to a recycling facility in Las Vegas, Nevada on an as needed basis.

Cement and a mixture of products would be stored in silos located adjacent to the mixing plant. Concrete transit-mix trucks would be cleaned at a location specifically identified in the SWPPP that would be prepared prior to Project commencement, reducing the risk of potential groundwater contamination (BP Wind Energy 2010).

Operations and Maintenance Phase

Operation of the turbines would require the use of lubricants and oils. Turbines typically use four types of lubricating oils and greases, none of which are listed as hazardous by the USEPA. The nacelle of the wind turbines would house a generator and gearbox. Each wind turbine generator would contain approximately 50 gallons of a glycol-water mixture, 85 gallons of hydraulic oil, and 105 gallons of lubricating oil. The lubricating oil would be checked quarterly and filled as needed. Waste oil would be removed from the site by a certified waste contractor (BP Wind Energy 2010). Because of the leak detection and containment systems designed into the turbine generators, there would be little risk of accidental spills of these materials. As with activities occurring during the Construction phase, all SPCC rules would be incorporated into the FRP during the O&M phase.

Limited quantities of lubricants, cleaners, and detergents would be stored at the O&M Building. In addition, a minimum of two 55-gallon drums of virgin oil used for continuing maintenance of the wind turbines would be stored on a secondary containment pallet inside the building, minimizing the potential for accidental spills. Waste fluids would also be stored at the O&M building, but only for a short time during Project operations.

No fuel for construction vehicle refueling would be stored on site during the O&M phase. However, as construction and other vehicles access the site, there would be a slight risk of drips or leaks occurring from routine use of these vehicles. Combustion emissions from construction vehicles would occur, but the construction equipment and vehicles and the O&M trucks would be maintained at all times to minimize leaks of motor oils, hydraulic fluids, and fuels. Vehicle maintenance would be performed off-site. Any chemicals, fuel, and oil located in the Lay-down/Staging Area or the O&M facility would be located in areas that provide for containment of spilled fluids (BP Wind Energy 2010).

Power generated from the turbines would be fed through a breaker panel at the turbine base inside the tower that is interconnected to a pad-mounted transformer. The 34.5-kV transformer foundation would be a concrete pad placed over compacted soil or granular material. Each pad-mounted transformer would contain approximately 500 gallons of mineral oil used to aid in cooling the electrical components located within the box. Leak detection and containment systems have been engineered into the design of these transformers. Each transformer undergoes an inspection prior to placement on the pad and is inspected during operations. As a result, potential for accidental spills resulting from malfunction or breach of the transformers is low. No polychlorinated biphenyls (PCBs) would be used in transformers on this Project (BP Wind Energy 2010).

The generated electricity from the turbines would travel via collector lines to the substation where a larger transformer would be housed. Each substation transformer would contain approximately 12,000 gallons of mineral oil for cooling. The substation transformers would have a specifically designed containment system to minimize the risk of accidental fluid leaks (BP Wind Energy 2010). Given this, the potential for discharge to the environment would be considered slight.

Transmission line emissions of ozone and nitrogen oxide could occur, but these emissions would be produced in minute amounts, and would not produce a significant discharge to the environment.

Routine maintenance on the pad-mounted transformers and substation would be conducted every six months, and would consist of oil checks, verification of trip settings, and tightening of connections in accordance with the manufacturer's maintenance recommendations (BP Wind Energy 2010).

Some generation of solid wastes would occur during the construction phase; however, careful estimation of needed materials would minimize the generation of wastes at the site. When feasible, wastes generated during the construction phase would be recycled. Materials that could be recycled include steel, wood, and paper. These materials would be sorted and stored in dumpsters for ultimate transport to a regional landfill that provides recycling services. Non-recyclable materials, such as concrete waste, would be collected and transported to the regional landfill by a contracted waste management company (BP Wind Energy 2010). These measures would reduce the possibility of contamination from waste materials.

Decommissioning Phase

Under Alternative A, the risks of exposure to hazardous materials and wastes by workers and the public during decommissioning would be similar to those encountered during the construction phase. Appropriate handling procedures in compliance with all Federal, state, and local requirements in place at the time would be followed. Removal of maintenance oils and lubricants would occur as the turbines were dismantled and removed, and all other hazardous materials would be removed from the site using standard procedures for removal and disposal.

With the largest footprint and the greatest amount of wind turbines scheduled for construction, Alternative A presents the most risk to public and worker safety, exposure to hazardous materials and wastes, and solid waste. However, based on planned safety measures, worker training requirements, and compliance with Federal, state and local requirements, the impact of the Project on the public and workers would be minimal over the life of the Project.

4.13.3 Alternative B

Under Alternative B, the Project footprint would be reduced to approximately 30,872 acres of BLM-managed land and approximately 3,848 acres of Reclamation-managed land. Because of the reduced acreage, the number of wind turbines constructed under this alternative would be anticipated to be reduced to approximately 166 to 208 turbines, depending on the turbine size chosen. Therefore, the potential for occupational injuries, public safety incidents, accidental spills of hazardous materials and wastes, and solid waste dumping would be reduced proportionally from Alternative A.

4.13.3.1 Occupational Safety Impacts

Construction Phase

With fewer turbines being constructed for this alternative (estimated at up to 75 fewer than Alternative A) and fewer ancillary buildings being built, it is anticipated that the time spent by workers needed on site would be reduced accordingly. This reduction would be greater on the Reclamation-managed land where approximately 60 fewer turbines would be erected. Additionally, based on planned safety measures and worker training requirements, the impact of the Project on the public and workers would be less than Alternative A. Overall, impacts on workers would be minimal over the life of the Project.

Operations and Maintenance Phase

Approximately 75 fewer turbines would be installed under Alternative B as compared with those planned for installation under Alternative A. This would proportionately reduce the need for the amount of maintenance activities required to maintain the fewer number of turbines and supporting equipment. However, the equipment is designed to require little hands-on maintenance, which results in only a slight difference between the maintenance required between Alternatives A and B.

Decommissioning Phase

As with the Construction Phase for Alternative B, fewer turbines would need to be decommissioned, and less equipment would be needed to remove turbine components. This would take workers less time than what would be needed for Alternative A. In any case, precautions would be taken to alert the public regarding the use of heavy, slow-moving equipment emerging from the Project site and traveling along main thoroughfares. A slightly less short-term adverse impact would result in decommissioning under Alternative B, though the differences would be minimal.

4.13.3.2 Public Safety Impacts

Construction Phase

The same preventative measures used for Alternative A would be implemented under Alternative B to ensure the safety of the public during the construction of the Project.

Operations and Maintenance Phase

During the O&M phase, the public would continue to be protected by means of informational signage and fencing. Activity outside of the Project site, particularly along the roadways, would be reduced from that experienced during the construction phase. Based on the smaller footprint of this alternative, the risk of injury to the public would be reduced proportionately from Alternative A.

Decommissioning Phase

As with all alternatives, BP Wind Energy would follow the directives of the Transportation and Traffic Plan to provide appropriate signage and traffic control to remove large equipment along local roadways during the decommissioning process. With fewer turbines to dismantle, there would be fewer trips to remove the equipment, but this volume would not be substantial.

4.13.3.3 Hazardous Materials Impacts

Construction Phase

During the construction phase for Alternative B, fewer turbines would be installed than would occur under Alternative A. A certain amount of hazardous materials and solid wastes would be used during installation of the turbines, but given the strict requirements for handling and maintenance of these materials under RCRA guidelines, and the thorough training provided to the workers, there is no indication that any different risks identified for Alternative A would be encountered.

Operations and Maintenance Phase

As previously mentioned, operation of the turbines requires the use of lubricants and oils. The turbines typically use four types of lubricating oils and greases, none of which are listed as hazardous by the RCRA.

Strict rules listed in RCRA dictate the use and disposal methods of hazardous materials, therefore the difference in impact from Alternative A would only be slight due to the smaller footprint of Alternative B.

Decommissioning Phase

Since fewer turbines would be erected, decommissioning of the turbines at the conclusion of the Project would be slightly smaller for Alternative B than for Alternative A. However, by following the guidance provided in the Transportation and Traffic Plan, no substantial difference in the decommissioning efforts between Alternatives A and B should occur.

4.13.4 Alternative C

4.13.4.1 Occupational Safety Impacts

Construction Phase

As with Alternative B, the Project footprint for Alternative C would be reduced similarly from that proposed for Alternative A. While the acreage and number of turbines would be similar to Alternative B, the planned placement of the turbines would differ and would be shifted to provide a greater separation between the private lands and the nearest turbines. Generally the same number of turbines would be installed as Alternative B, and the location of the installation would have little or no impact on worker safety, so the impact would be about the same for Alternative C as Alternative B.

Operations and Maintenance Phase

Under Alternative C, the risks experienced by workers at the Project site would be the same as Alternative B.

Decommissioning Phase

Alternative C would have little or no difference in risks to workers at the Project site as Alternative B.

4.13.4.2 Public Safety Impacts

Construction Phase

Alternative C would have the same number of turbines constructed as with Alternative B, and the impacts would be the same.

Operations and Maintenance Phase

From a public safety perspective, the greater distance between private lands and turbines would offer a greater separation from the risk of exposure to the hazards associated by turbines. The risk includes a small potential for leaked lubricants and cooling oils, and the rare risk of a broken rotor blade or other component being thrown from the turbine could provide less opportunity for unauthorized entry onto the Project site by the public.

Decommissioning Phase

Impacts from decommissioning under Alternative C would be the same as under Alternative B because precautions would be taken to alert the public regarding the use of heavy, slow-moving equipment emerging from the Project site and traveling along main thoroughfares.

4.13.4.3 Hazardous Materials Impacts

Construction Phase

Based on the similar number of turbines and ancillary equipment that would be constructed, the use of hazardous materials and production of solid waste during the construction phase would be similar for Alternative C as it would be for Alternative B.

Operations and Maintenance Phase

During the operations and maintenance phase for Alternative C, activities involving the use of hazardous materials would be similar to those encountered under Alternative B. Based on the strict requirements for handling and maintenance of these materials as defined by the USEPA under RCRA, and training provided to the workers, no additional risk would be encountered than found under either Alternative B or A.

Decommissioning Phase

As experienced with the previous phases for Alternative C, strict requirements and training for the handling and maintenance of hazardous materials would be observed, making the risk the same as found under Alternative B.

4.13.5 <u>Alternative D – No Action</u>

Under Alternative D, the wind energy Project would not be developed and the public health and safety environment would remain the same as it currently is described in Section 3.13. There would be no adverse impacts on health and safety from Project construction, O&M, and decommissioning activities because the Project would not occur. In addition, no associated new sources of hazardous materials or solid wastes would be introduced to the Project Area. Impacts would continue to be related to current available access to the area and the associated opportunity for illegal dumping or accidental petroleum product releases from vehicles. The continuation of existing impacts and management guidelines would continue as they are directed in the Kingman RMP.

4.13.6 Mitigation Measures

Mitigation measures previously discussed in this section regarding occupational and public safety, and the presence and handling of hazardous materials/waste and hazardous and solid waste would be completed in the event the Project is implemented. All construction, operation, and decommissioning activities would be conducted in compliance with applicable Federal and state occupational safety and health standards. Additional mitigation measures associated with Project implementation are listed below.

- A safety assessment would be conducted to describe potential safety issues and the means that would be taken to mitigate them. This would include preparation of an HSSE Plan that addresses safety issues related to workers and the public.
- Additional plans should be prepared including a SWPPP, Blasting Plan, Transportation and Traffic Management Plan, Waste Management Plan, SPCC, Dust and Emissions Control Plan, and Reclamation Plan. These plans would include elements that contribute to a maintaining a safe environment and/or minimizing the potential for adverse health effects associated with dust or pollutants in water, and other safety and operations plans as needed.
- Local planning authorities would be consulted regarding increased traffic issues during the construction and decommissioning phases.
- The Project would comply with FAA regulations, including use of lighting requirements to warn aviators of obstructions (FAA 2007).
- A fire management and response strategy to minimize the potential for a fire and to promptly extinguish fires would be developed.

4.13.7 Unavoidable Adverse Impacts

Unavoidable adverse impacts affecting health and safety would occur if the safety rules and regulations were not observed, resulting in severe injury or loss of life to a worker or member of the public.

With regard to hazardous materials, hazardous wastes, and solid waste, unavoidable adverse impacts could occur if an accidental spill were not properly addressed according to Federal, state, or local requirements as defined under RCRA and the SPCC rule.

4.14 MICROWAVE, RADAR, AND OTHER COMMUNICATIONS

Wind turbines are known to potentially cause interference with microwave communications and radar systems. This section provides a discussion of the analysis of the extent of this potential interference due to the Project, both specifically and cumulatively, as well as possible mitigation measures. The analysis provided in this section addresses only the operations and maintenance phase of the Project because the blades of a turbine in motion would be the only cause of impacts to microwave, radar, or other communication paths. The blades would not be operating during construction and decommissioning. After a 45-day period of review, no Federal agencies identified any concerns regarding blockage of their radio frequency transmission. An early turbine layout was submitted to the FAA for review, and

Determinations of No Hazard to Air Navigation were issued for all turbine locations in January 2011. The Determinations are due to expire in July 2012. Due to the addition or relocation of turbines since that time, a revised turbine layout has been submitted to the FAA for review, and new Determinations issued for the added or relocated turbines. For those remaining Determinations set to expire in 2012 prior to Project construction, the Project would file an extension request or, if necessary, resubmit the entire Project to the FAA. The analysis area is all known radar and microwave communication facilities within 50 miles of the Project Area.

4.14.1 Analysis Methods

Microwave

A microwave study for the Project was conducted by Comsearch on August 25, 2011 (Comsearch 2011) (see Appendix E) to determine the potential for the Project to interfere with privately operated microwave beams under all of the action alternatives. The study identified 13 microwave beams near the Project site. Additionally, the Project proponent has requested the National Telecommunications and Information Administration (NTIA), which overseas Federal communication resources, to provide a review of the Project. The October 28, 2011 response from the NTIA indicates that after a 45-day period of review, no Federal agencies identified any concerns regarding blockage of their radio frequency transmissions. Any wind turbine that would potentially interfere with these microwave communication resources would require relocation or elimination from the Project.

Microwave beams are used to transmit television, radio or other communication signals. Wind turbines can interfere with microwave paths by physically blocking the line-of-sight between two microwave transmitters. Additionally, wind turbines have the potential to cause blockage and reflections (ghosting) to television reception. Blockage is caused by the physical presence of the turbines between the television station and the reception points. Ghosting is caused by multipath interference that occurs when a broadcast signal reflects off of a large reflective object, in this case a wind turbine, and arrives at a television receiver delayed in time from the signal that arrives via direct path.

Radar/Air Traffic

The Project site has been analyzed using the Department of Defense (DOD) Preliminary Screening Tool (Appendix F) for long-range radar (LRR), weather surveillance radar-1988 Doppler radars (NEXRAD), and military operations (MilOps). The wind turbines proposed for this Project would be a maximum of 499 feet (152.1 meters) total blade height above existing grade and would need to comply with Federal Aviation Regulations (FAR) Part 77 (FAA 2010c).

Radar is used for several important purposes including real-time tracking for air traffic controllers of military and civilian aircraft, supporting homeland security missions, and monitoring of weather systems. Historically, there has been concern about potential interference between wind turbines and radar operations. Wind turbines can create what is known as "turbine clutter," a phenomenon that occurs when radar signals are bounced off of the moving blades and other parts of the turbines and create false signals that appear as a blacked out area on radar. It is difficult to track planes through "turbine clutter." On Doppler (weather) radar the "turbine clutter" is translated as a storm.

4.14.2 Alternative A – Proposed Action

Microwave

The microwave study was intended for preliminary planning purposes only and the actual proposed wind turbine locations were not provided to Comsearch at the time of the study. Study results identified 13 microwave beam paths near the Project site. However, wind turbines under all action alternatives have been sited to avoid the identified microwave beam paths. Because the wind turbines would not be located in areas that would result in microwave interference, there would be no impact to microwave communications.

Radar/Air Traffic

For LRR, NEXRAD, and MilOps, the analysis indicates that the Project site is classified as “green,” meaning that the Project is not likely to cause an impact with National Air Defense and Homeland Security Radars, weather radars, or military operations. Regardless of the results of this preliminary screening, any object that is more than 200 feet in height (such as wind turbines) can create a hazard to navigable airspace. An aeronautical study was prepared in accordance with FAR Part 77 and resulted in a No Hazard Determination for each proposed wind turbine under all action alternatives. Aeronautical studies yielded a Determination of No Hazard for each proposed wind turbine and determined that the wind turbines should be white and have synchronized red lights. Since the FAA is required to coordinate with the military as part of the No Hazard Determination process, and no concerns were raised, there would be no impact expected to radar or military operations.

Any change to the location or height of the determined wind turbines would require the submittal of the change to the FAA, completion of a new aeronautical study, and the issuance of a new Determination of No Hazard for each changed wind turbine site.

4.14.3 Alternative B

Should the turbines be painted gray, additional daytime safety lighting (synchronized white lights) would be required. With these safety measures met, there would be no impact to air traffic safety. The selection of Alternative B would not result in different impacts than those noted above for Alternative A.

4.14.4 Alternative C

Should the turbines be painted gray, additional daytime safety lighting (synchronized white lights) would be required. With these safety measures met, there would be no impact to air traffic safety. The selection of Alternative C would not result in different impacts than those noted above for Alternative A and Alternative B.

4.14.5 Alternative D – No Action

Under the No Action Alternative, the proposed Project would not be built and the proposed Project site would remain undeveloped. There would be no risk of interference with microwave beams or radar (including military, airport and weather radar) since the proposed wind turbines would not be installed. Likewise there would be no impact to navigable airspace.

4.14.6 Mitigation Measures

No adverse impacts have been identified, therefore no mitigation measures are required beyond those commitments incorporated into the Project as described below:

- Wind turbines would be relocated or eliminated from the Project as necessary to avoid the 13 microwave beams that are near the Project site.
- Relocated wind turbines, if any, would be submitted to the FAA for review and require the issuance of new Determinations of No Hazard.
- Wind turbines would be marked with synchronized obstruction warning lights as required by the FAA Determination of No Hazard and FAA Advisory Circular 70/7460-1K (FAA 2007).

4.14.7 Unavoidable Adverse Impacts

No unavoidable adverse impacts to microwave, radar, and air traffic have been identified for the Project.

4.15 NOISE

The following section describes the assessment of temporary predicted noise impacts due to Project construction and decommissioning, and long-term predicted noise impacts due to operations and maintenance. For explanation of acoustical terminology that is used in this analysis, the reader should refer to Section 3.15.1.1. A technical report titled "Noise and Vibration Study, Mohave County Wind Farm Project" (abbreviated in this section as NVS) (URS 2012), which is available upon request at the BLM Kingman Field Office, provides additional detail on the description of analysis methodologies and presentation of predicted results summarized in this section.

4.15.1 Analysis Methods

The noise assessment for the Project was based on indicators for noise impact assessment that are typically absolute or relative threshold criteria, established by applicable laws, ordinances, and regulations. Relevant guidance can also provide the basis for reasonable indicators as described in the following paragraphs.

Noise Levels

Section 3.15.1.1 of this EIS describes the Federal, state and local (i.e., Mohave County, Arizona) guidance and regulations that define thresholds for acceptable Project noise levels. In summary, and according to the Mohave County Zoning Ordinance, Project operation noise up to 70 dBA during the day and 63 dBA at night is legally permitted. Construction noise is excluded from these limitations. However, in remote rural settings such as those that represent the Project Area and its surroundings, a lower guidance threshold based on probability of causing human listener annoyance (or possibly sleep disturbance at night) might be more appropriate when assessing potential noise impact. Hence, and as introduced in Section 3.1.1.1 of the NVS, sound levels of 45 dBA L_{eq} (based on 8-hour period) and 55 dBA L_{dn} are two suggested guidance indicators for private lands (either currently occupied or planned as residential uses) in the Project noise analysis study area, corresponding with World Health Organization (WHO) and USEPA guidelines, respectively. The more stringent of these two, 45 dBA L_{eq} (8-hour), is used in this impact assessment.

For Lake Mead NRA lands in the Project noise analysis study area, such as those that abut the northern boundary of the Project in Alternative A, Section 3.15.1.2 states that a guidance-based nighttime Leq of 35 dBA would apply. This kind of limit is known as a fixed or absolute criterion, and is different from what might be the application of a relative criterion to define noise level thresholds, like those set forth in OAR 340-035-0035, that vary with the background sound level. Table 4-24 below shows this difference in terms of what the anticipated future ambient (i.e., Project noise added to the non-Project background) may become. The presented background sound levels in Table 4-24 are based on an analysis of NPS LAKE018 survey sound data, correlated to concurrent available wind speed data at prospective turbine hub height. The table indicates that when the hub height wind speed increases, the wind speed at ground level (where NPS was measuring sound level) appeared to proportionately increase as well and thus generate higher background noise.

Table 4-24 Comparison of Project Noise Assessment Methods Using Wind Measured at Hub Height and LAKE018 Sound Data

Hub height wind speed (m/s)	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Nighttime background sound at ground level (from analysis, regression of NPS data)	27	29	31	33	35	37	39	41	42
NPS recommended threshold – **absolute 35 dBA nighttime Leq for Project Noise**									
Project noise	35	35	35	35	35	35	35	35	35
Future ambient	36	36	36	37	38	39	40	42	43
Increase over existing non-Project ambient (background)	9	7	5	4	3	2	1	1	1
Hypothetical potential threshold – **allowable increase over ambient = 10 dBA, with 50 dBA future ambient cap**									
Project noise	36	38	40	42	44	46	48	49	49
Future ambient	37	39	41	43	45	47	49	50	50
Increase over existing non-Project ambient (background)	10	10	10	10	10	10	10	9	8

Using the NPS recommended fixed criterion of 35 dBA Leq nighttime for Project noise over Lake Mead NRA lands, the increase over existing ambient sound level diminishes as the non-Project background sound rises. When background sound is relatively low, the future ambient stays close to 35 dBA. When background sound is high, the Project noise has less acoustical contribution to the future ambient. Above 9 mps, Table 4-24 suggests that, with a difference of only 1 dBA, it may be difficult to discern the Project noise from the background sound.

On the other hand, Table 4-24 shows that usage of a relative criterion like "ambient + 10 dBA" would allow Project noise to dominate the ambient soundscape across the range of hub-height wind speeds and exceed 45 dBA Leq above 8 mps, where turbines are expected to operate at full power-generating capacity. While 45 dBA Leq might be considered an outdoor sound level compatible with sleep for someone inside a building, overnight campers at Lake Mead NRA are unlikely to have the noise-reduction benefit of a structure and would thus be directly exposed to Project noise.

Thus, and because it also avoids the relative criterion need to define both the background sound level and the time period over which it should be assessed, the absolute guidance-based criterion of 35 dBA nighttime Leq is used in this EIS analysis as an impact indicator with respect to Lake Mead NRA lands in the Project study area.

Noise Levels for Wildlife

There are no Federal guidelines for determining acceptable sound or vibration levels for terrestrial wildlife. While human-caused sound can affect wildlife, such effects vary with several factors that include the species of the fauna under consideration, its sensitivity, habituation to noise disturbance, and the characteristics and duration of the disturbance. Research to identify and support the establishment of applicable and/or acceptable noise thresholds with respect to wildlife is ongoing.

Lacking an established numerical threshold, for purposes of this analysis one might generally and anthropomorphically attribute human noise sensitivity to wildlife in the Project study area. Thus, for fauna on Lake Mead NRA land, a guidance-based impact indicator might be the same 35 dBA L_{eq} (9-hour) nighttime threshold from Project noise as analyzed for human receivers in the park. On private lands in the Project study area that are likely to have some degree of human occupancy or residential usage and thus sources of noise from human activities that present wildlife (i.e., those that inhabit these lands despite—or due to—human presence or proximity) would have developed habituation, a guidance-based indicator might be the same 45 dBA L_{eq} (8-hour) from Project noise as suggested for these lands with respect to human receivers.

4.15.1.1 Methods and Assumptions

The analysis area for noise includes the Project Area and additional area bounded by a perimeter approximately 2 miles from the furthest extent of wind turbine generator (a.k.a., "turbine") layout positions as contemplated in the alternatives under consideration.

Representative Receivers

This analysis considers predicted noise at five representative locations as discussed in the NVS: LT1, LT2, LT3, LMNRA, and LAKE018. The first three are long-term ambient sound measurement locations from the field survey conducted in October 2009 and as described in Section 3.15.1.3 of this EIS. LMNRA is location positioned on the border of Lake Mead NRA that adjoins the northwestern boundary of the Project for Alternative A. LAKE018 is a measurement location selected by NPS as part of its spring 2011 ambient sound level survey on Lake Mead NRA land that is in proximity to, but not co-located with, the previously described Lake Mead NRA representative location (see Map 3-10).

In addition to consideration of these five locations, which are intended to represent different broad geographical areas adjacent to the Project, this assessment also illustrates or describes other locations or areas where Project noise emission may exceed an impact indicator. This description may either be expressed as a generalized distance from one or more Project noise sources to a potential listener location where excess noise is predicted to occur; or, it may be presented graphically as an isopleth associated with an impact indicator value superimposed upon a geographical map of the Project and its surroundings that comprise the analysis study area.

Construction

Noise effects were estimated using Cadna/A®, a Windows® based software program that predicts and assesses noise levels near user-input noise sources based on internationally accepted standards (ISO 1996a, b, c, d) for noise propagation calculations. The Cadna/A-based outdoor sound propagation model was applied to four turbine construction activity center-point locations (roughly collocated with a turbine mast) that are nearest to the five representative noise-sensitive receivers considered in this impact analysis for each of the three action alternatives.

On-road vehicular traffic from construction activity would be considered minimal enough to have little effect on the noise environment. Construction staging areas are far enough from noise receptors that construction-related noise in these areas would be expected to diminish to non-impactful levels at the receptor locations. Therefore, on-road vehicular noise and construction activities in the laydown/staging areas were not included in the Cadna/A models, which instead focus on the activity of heavy construction equipment (e.g., crane and truck) at a turbine location. Although heavy construction equipment activity would generally occur only during daylight hours, some operations such as turbine assembly and concrete pouring could occur at night; hence, estimated nighttime construction noise emission is conservatively assumed to be 4 dBA less than daytime noise emission, as detailed in the NVS.

For all alternatives, it should be noted that construction activities at any given turbine site are expected to be characterized as sporadic, with equipment-intensive events separated by relatively long periods of inactivity. For example, once a foundation is poured, it is likely that a minimum of four weeks will pass while the concrete cures and before anything else can take place. Hence, estimated noise levels are not anticipated to be constant over the construction period.

Noise from blasting operations, if such activity would be required, could be predicted based on an estimated noise level derived from the Federal Highway Administration (FHWA) Roadway Construction Noise Model User's Guide (U.S. Department of Transportation, FHWA 2006). It describes that the maximum noise level (L_{max}) at 50 feet (15 meters) from blasting would be 94 dBA. Depending on the expected frequency of blasting events over an 8-hour time period, which is not known at this time but potentially available as part of a detailed blasting plan to be developed for the Project, the corresponding L_{eq} at some distance could be predicted and compared with either the 45 dBA L_{eq} (8-hour) or 35 dBA L_{eq} (9-hour nighttime) impact indicator as geographically appropriate. Such predictions could assume attenuation from geometric divergence as sound propagates away from a source (i.e., the oft-heard "-6dB per doubling of distance" rule of thumb for a point source) and the additional sound attenuating effect of atmospheric absorption. Until more detailed information on the expected blasting activity is available, for purposes of predictive analysis in this EIS, it is assumed that up to 24 blast events occur over an 8-hour period, and that each blast event is one second in duration. Using these assumed parameters and the FHWA L_{max} data for a single event, an 8-hour L_{eq} for blasting is 45 dBA at a distance of 400 feet, absent the contribution of background sound at this location. At approximately triple this distance (1,150 feet), 35 dBA L_{eq} (8-hour) would be expected.

Using these analysis techniques and their assumptions, a noise impact would be expected to occur when the noise from heavy construction equipment operation or blasting for the Project exceeds the guidance-based thresholds of 45 dBA Leq (8-hour) on private lands in the study area and 35 dBA Leq (9-hour) nighttime level over Lake Mead NRA land.

Operational Noise

The Cadna/A® Noise Prediction Model (Version 4.0.135) was used to estimate the Project-generated operation sound level at noise-sensitive receivers (see Section 3.3.1 of the NVS for the detailed methodology). The Cadna/A outdoor sound propagation model was run for the two most prevalent wind directions (i.e., from the north and from the south) for each of the three action alternatives.

While the quantity of turbines varies slightly among the three action alternatives (i.e., Alternatives B and C represent reductions in turbine quantity from Alternative A), the turbine type used in each analysis was a Siemens SWT-2.3-113 model that can generate 2.3 MW of electrical power under a wind speed at hub height of 12 meters per second (mps). Per IEC 61400-11 (ed. 2, 2002) measurement standards, each turbine operating at this hub height wind speed (or as referenced to a wind speed of about 9 mps at 10m above ground) or greater has a sound power level (PWL) of 105 dBA. For purposes of prediction model conservatism, an uncertainty adjustment of 2 dBA was added to this overall A-weighted PWL.

While a pad-mounted electrical transformer at the base of each turbine would create noise from ground level, its sound power would likely be much less than that of the sum of aerodynamic noise sources associated with the moving wind turbine rotor blades.

Anticipated noise from regular Project maintenance would include infrequent vehicle travel on Project Area roads that interconnect the wind turbine locations. Some human activity also would be expected at the O&M building and other Project structures or equipment areas, such as substations and the switchyard. Compared to the aggregate of Project wind turbines, these are not considered dominant or continuous sources of significant Project noise.

Using this analysis technique and its assumptions, a noise impact would be expected to occur when the Project operation noise exceeds the guidance-based threshold of 45 dBA L_{eq} (8-hour) on private lands in the study area and a 35 dBA L_{eq} (9-hour) nighttime level over Lake Mead NRA land. These thresholds are with respect to only Project operation noise and do not include non-Project sources of noise that also contribute to what would be a future ambient sound environment. When ground-level wind speeds are calm (and thus, generally do not provide a significant source of noise due to turbulence resulting from wind traversing vegetative ground cover, terrain features, or man-made structures) and in the absence of other significant non-Project noise emitters, the background sound environment could be low enough to make the Project operation noise a dominant contributor to the future ambient sound level at a location. However, as indicated in Section 3.15, the existing ambient sound environment has been measured and exhibits ground-level SPL that can rise in magnitude as wind speeds at hub height elevation increase. Under the right conditions, it is possible and probable that non-Project sources of noise (e.g., turbulence resulting from wind traversing vegetative ground cover) may demonstrate overall A-weighted L_{eq} that would exceed Project operation noise at many locations.

Impact Duration

Consistent with what is described in Section 4.1.1, the duration of an impact might be considered temporary, relative to the operational life of the Project, if it is no greater than that of the construction period needed to complete the Project. Hence, construction impacts are generally considered temporary in nature, while impacts associated with operating turbines would tend to be considered long term (i.e., greater than five years after completion of Project construction), lasting for the expected operational life of the Project.

4.15.2 Alternative A – Proposed Action

4.15.2.1 Construction Noise

As shown in Table 4-25, of the five representative noise-sensitive receivers, LT2 would be expected to experience estimated Project construction sound that would exceed 45 dBA L_{eq} by more than 2 dBA during the day, and would thus be expected to experience a temporary noise impact. For receiver locations on other private lands that are similarly as distant from heavy equipment construction activity as position LT2 is (approximately 2,000 feet) from the nearest turbine, similar temporary noise impact would be expected.

Table 4-25 Estimated Heavy Equipment Construction Noise Levels at Representative Noise Sensitive Receivers

Sound Level Assessment Locations	Estimated Heavy Equipment Construction Noise (L_{eq}, dBA)			
	Alternative A		Alternatives B & C	
	Daytime (7 AM-10 PM)	Nighttime (10 PM-7 AM)	Daytime (7 AM-10 PM)	Nighttime (10 PM-7 AM)
LT1	37	33	29	25
	40 dBA L_{dn}		32 dBA L_{dn}	
LT2	47	43	47	43
	51 dBA L_{dn}		51 dBA L_{dn}	
LT3	24	20	18	14
	27 dBA L_{dn}		22 dBA L_{dn}	
LMNRA [1]	43	39	18	14
	46 dBA L_{dn}		22 dBA L_{dn}	
LAKE018 [2]	39	35	18	14
	42 dBA L_{dn}		21 dBA L_{dn}	

NOTES:
[1] Lake Mead NRA boundary location.
[2] An ambient sound survey location (N 35° 56' 30.0" W114° 26' 47.9") chosen and conducted by Lake Mead NRA via Natural Sounds Program staff of the National Park Service.

Aside from LT3, which is expected to experience construction noise ranging from only 20 to 24 dBA L_{eq}, anticipated construction noise at other representative locations would range from 33 to 47 dBA L_{eq}. At both representative Lake Mead NRA locations (LMNRA and LAKE018), and other Lake Mead NRA land that is similarly as distant from heavy equipment construction activity as these two positions are from the nearest turbine, similar temporary noise impact would be expected.

If blasting were required for the turbine foundation nearest to LT2 (a distance of approximately 2,000 feet from the noise monitoring location on the boundaries of planned residential development areas near the Wind Farm Site), the predicted blast noise level—based on the method described in Section 4.15.1.1—would be 30 dBA L_{eq} and thus considerably lower than the guidance level of 45 dBA L_{eq}. Using this prediction technique and set of assumptions, a potential receiver on private lands would have to be closer than 400 feet (122 meters) from the blast location to experience the guidance-based impact indicator of 45 dBA L_{eq} (8-hour). On Lake Mead NRA land within the study area, a potential receiver would need to be less than 1,150 feet (351 meters) distant from the blast noise source to experience the guidance-based indicator of 35 dBA L_{eq} (9-hour).

4.15.2.2 Operational Noise

The estimated operation noise levels for the two wind-direction scenarios are shown in Table 4-26 and are less than 45 dBA L_{eq} at the three representative locations: LT1, LT2, and LT3. With the exception of the Lake Mead NRA location for the south-to-north wind scenario for Alternative A, sound levels for the two representative Lake Mead NRA locations are expected to be less than 35 dBA L_{eq}. Maps 4-2 and 4-3 help illustrate, by way of SPL isopleths, where planned or actual residential-use land might be exposed to Project operational noise levels greater than 45 dBA L_{eq}, and where Lake Mead NRA land might be exposed to Project operational noise levels greater than 35 dBA L_{eq}. In summary, the locations where these excesses occur are as follows:

- On Map 4-2, which depicts predicted turbine operation noise contours for wind headed south at 12 mps, the northwest corner of the privately owned square-mile section in Township 29 North, Range 19 West that is due west of the privately owned square-mile section occupied by LT3 is expected to experience noise levels greater than 45 dBA L_{eq} but less than 50 dBA L_{eq}.
- On Map 4-3, which depicts predicted turbine operation noise contours for wind headed north at 12 mps, the southwest corner of the privately owned square-mile section in Township 29 North, Range 19 West that is due west of the privately owned square-mile section occupied by LT3 is expected to experience noise levels greater than 45 dBA L_{eq} but less than 50 dBA L_{eq}. At two areas along the southern border of Township 30 North, Range 20 West, where Lake Mead NRA land abuts the Project Area, predicted turbine operation noise is expected to range from about 35 to 40 dBA $L_{eq,}$ which is over the 35 dBA Leq guidance-based standard proposed by Lake Mead NRA. This intrusion of Project operation noise having an anticipated SPL greater than 35 dBA L_{eq} extends into Lake Mead NRA no further than a half-mile from the northern Project boundary associated with Alternative A, and the approximate total area exposed to this Project operation noise SPL is less than one square mile.

Table 4-26 Estimated Operational Noise Levels — Cadna/A Prediction Model Scenarios

Sound Level Assessment Locations	Estimated Aggregate Project Turbine Operation (dBA L_{eq})					
	Alternative A		**Alternative B**		**Alternative C**	
	Scenario 1 (12 mps from North)	**Scenario 2** (12 mps from South)	**Scenario 1** (12 mps from North)	**Scenario 2** (12 mps from South)	**Scenario 1** (12 mps from North)	**Scenario 2** (12 mps from South)
LT1	38	27	33	22	33	22
	44 dBA L_{dn}	33 dBA L_{dn}	39 dBA L_{dn}	28 dBA L_{dn}	39 dBA L_{dn}	28 dBA L_{dn}
LT2	44	35	43	34	43	34
	50 dBA L_{dn}	41 dBA L_{dn}	49 dBA L_{dn}	40 dBA L_{dn}	49 dBA L_{dn}	40 dBA L_{dn}
LT3	26	25	23	23	23	23
	32 dBA L_{dn}	31 dBA L_{dn}	29 dBA L_{dn}	29 dBA L_{dn}	29 dBA L_{dn}	29 dBA L_{dn}
LMNRA [1]	27	38	15	25	16	25
	33 dBA L_{dn}	44 dBA L_{dn}	21 dBA L_{dn}	31 dBA L_{dn}	22 dBA L_{dn}	31 dBA L_{dn}
LAKE018 [2]	22	34	14	24	15	24
	28 dBA L_{dn}	40 dBA L_{dn}	20 dBA L_{dn}	30 dBA L_{dn}	21 dBA L_{dn}	30 dBA L_{dn}

NOTES:
[1] Lake Mead NRA boundary location.
[2] An ambient sound survey location (N 35° 56' 30.0" W114° 26' 47.9") chosen and conducted by Lake Mead NRA via Natural Sounds Program staff of the National Park Service.

4.15.2.3 Decommissioning Noise

The decommissioning process is much like the construction process, but in reverse order. That is, heavy equipment would be used to remove the turbines and other related Project facilities. The noise effects would be temporary, lasting only as long as necessary to remove Project features and to reclaim the site, and would be comparable to those noise levels predicted for the construction phase for all three action alternatives.

4.15.3 Alternative B

4.15.3.1 Construction Noise

Similar to Alternative A, of the five representative noise-sensitive receivers, only LT2 would be expected to experience estimated Project construction sound that would exceed 45 dBA L_{eq} by more than 2 dBA during the day and would thus be expected to experience a temporary noise impact. For receiver locations on other private lands that are similarly as distant from heavy equipment construction activity as position LT2 is (approximately 2,600 feet) from the nearest turbine, similar temporary noise impact would be expected.

While Alternative A construction noise at the two Lake Mead NRA representative locations would be at or above 35 dBA L_{eq}, construction noise at these two locations for Alternative B is expected to be much quieter: less than 20 dBA L_{eq}.

If blasting were required for the turbine foundation nearest to LT2 (a distance of approximately 2,600 feet from the noise monitoring location on the boundaries of planned residential development areas near the Wind Farm Site), the predicted blast noise level—based on the method described in Section 4.15.1.1—would be 27 dBA L_{eq} and thus considerably lower than the guidance level of 45 dBA L_{eq}. Using this prediction technique and set of assumptions, a potential receiver on private lands would have to be closer than 400 feet (122 meters) from the blast location to experience the guidance-based impact indicator of 45 dBA L_{eq} (8-hour). On Lake Mead NRA land within the study area, a potential receiver would need to be less than 1,150 feet (351 meters) distant from the blast noise source to experience the guidance-based indicator of 35 dBA L_{eq} (9-hour).

4.15.3.2 Operational Noise

The estimated operational noise levels for the two wind-direction scenarios shown in Table 4-26 are less than 45 dBA L_{eq} at each of the five representative locations. Furthermore, the sound levels are expected to be less than 35 dBA L_{eq} at the two representative Lake Mead NRA locations. Maps 4-4 and 4-5 help illustrate, by way of noise contours, that no planned or actual residential-use land is expected to be exposed to Project operational noise levels greater than 45 dBA L_{eq}, and no Lake Mead NRA land is expected to be exposed to Project operation noise levels greater than 35 dBA L_{eq}.

4.15.4 Alternative C

4.15.4.1 Construction Noise

Similar to Alternative A, of the five representative noise-sensitive receivers, only LT2 would be expected to experience estimated Project construction sound that would exceed 45 dBA L_{eq} by more than 2 dBA during the day and would thus be expected to experience a temporary noise impact. For receiver locations on other private lands that are similarly as distant from heavy equipment construction activity as position LT2 is from the nearest turbine (approximately 2,600 feet), similar temporary noise impacts would be expected.

While Alternative A construction noise at the two Lake Mead NRA representative locations would be at or above 35 dBA L_{eq}, construction noise at these two locations for Alternative C is expected to be much quieter: less than 20 dBA L_{eq}.

If blasting were required for the turbine foundation nearest to LT2 (a distance of approximately 3,100 feet from the noise monitoring location on the boundaries of planned residential development areas near the Wind Farm Site), the predicted blast noise level—based on the method described in Section 4.15.1.1—would be 25 dBA L_{eq} and thus considerably lower than the guidance level of 45 dBA L_{eq}. Using this prediction technique and set of assumptions, a potential receiver on private lands would have to be closer than 400 feet (122 meters) from the blast location to experience the guidance-based impact indicator of 45 dBA L_{eq} (8-hour). On Lake Mead NRA land within the study area, a potential receiver would need to be less than 1,150 feet (351 meters) distant from the blast noise source to experience the guidance-based indicator of 35 dBA L_{eq} (9-hour).

4.15.4.2 Operational Noise

The estimated operational noise levels for the two wind-direction scenarios shown in Table 4-26 are less than 45 dBA L_{eq} at each of the five representative locations, and less than 35 dBA L_{eq} at the two representative Lake Mead NRA locations. Maps 4-6 and 4-7 help illustrate, by way of noise contours, that no planned or actual residential-use land is expected to be exposed to Project operational noise levels greater than 45 dBA L_{eq}, and no Lake Mead NRA land is expected to be exposed to Project operation noise levels greater than 35 dBA L_{eq}.

4.15.5 Alternative D – No Action

The No Action Alternative involves no construction, operations or maintenance, or decommissioning of the Project; thus, no noise impacts are anticipated. Existing background noise levels in the Project Area and vicinity would pervade and comprise noise from general recreational uses, occasional aircraft (including fixed-wing commercial flights and helicopter tourism), traffic on area roads and highways, and other noise already present in the Project Area. If residential land use construction activity increases, such activity and its resulting development of residences (and their corresponding noise-producing activities) may correspondingly increase the ambient sound environment.

4.15.6 Mitigation Measures

4.15.6.1 Measures Common to All Action Alternatives

The following measures are recommended during construction and decommissioning phases to reduce noise levels:

- All noise-producing equipment and vehicles using internal combustion engines would be equipped with exhaust mufflers, air-inlet silencers where appropriate, and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Mobile or fixed "package" equipment (e.g., arc-welders, air compressors) would be equipped with shrouds and noise control features that are readily available for that type of equipment. The diesel generator, a potential power source for the batch plant described in Chapter 2, would similarly be equipped to keep its resulting sound emission to levels below 81 dBA at a distance of 50 feet.
- All mobile or fixed noise-producing equipment used on the Project, which is regulated for noise output by a local, state, or Federal agency, would comply with such regulation while in the course of Project activity.

- The use of noise-producing signals, including horns, whistles, electronic alarms, sirens, and bells, would be for safety warning purposes only.
- No construction-related public address, loudspeaker, or amplified music system would exhibit sound levels that exceed limits imposed by local regulation at any adjacent noise-sensitive land use, or that exceed noise limits imposed on elements of the wind farm, whichever is the lowest level of acceptable noise.
- The contractors would implement a noise complaint process and hotline number for usage by members of the surrounding community (e.g., White Hills, Arizona). Were such a hotline established, BLM or its compliance inspectors would likely have the responsibility and authority to receive, evaluate, and when appropriate make reasonable efforts to resolve noise complaints.

The following measures would help the Project maintain low noise levels during the operations and maintenance phase:

- The proposed Project design and implementation would include appropriate noise attenuation measures adequate to help ensure that the noise levels from turbine transformers, substations, and other ancillary systems or components would not cause aggregate noise levels produced by operation of the Project to exceed identified thresholds. For instance, HVAC systems on an occupied control or maintenance building might feature, if needed, sound abating cabinet linings or intake/exhaust shrouds that are typically offered by manufacturers as optional equipment upgrades.
- Maintenance and security patrol vehicles, such as pick-up trucks and/or all-terrain vehicles, using internal combustion engines would be equipped with exhaust mufflers, air-inlet silencers where appropriate, and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Operation of these vehicles would typically be expected to occur on access roads that interconnect turbine positions.

In addition to these general measures, the following mitigation measures are suggested as appropriate and with respect to a 45 dBA L_{eq} guidance-based goal for planned or actual residential land, and a quieter 35 dBA L_{eq} guidance-based goal for Lake Mead NRA land.

4.15.6.2 Alternative A

The options for mitigating wind turbine operational noise to meet the 45 dBA Leq guidance-based goal for planned or actual residential land and to meet the quieter 35 dBA Leq guidance-based goal for Lake Mead NRA land tend to be limited. One method would be to increase distance between impacted receiver positions and the nearest wind turbines that are likely to be the most significant contributors to the aggregate wind turbine operation noise level. Action Alternatives B and C effectively provide this form of mitigation by way of their reduced wind turbine quantity and siting layouts being different from that of Alternative A.

4.15.6.3 Alternative B

No operation noise impacts are anticipated, thus no mitigation is foreseen for this action alternative.

4.15.6.4 Alternative C

No operation noise impacts are anticipated, thus no mitigation is foreseen for this action alternative.

4.15.7 <u>Unavoidable Adverse Impacts</u>

The turbine layout associated with Alternative A appears to expose some nearby planned or existing residential land uses to operation noise levels that exceed the guidance criterion of 45 dBA L_{eq}, and expose some Lake Mead NRA land to operation noise levels that exceed the guidance-based criterion of 35 dBA L_{eq}. Since all turbines in the layout for Alternative A are expected to operate at full capacity under the right ambient wind conditions, this potential impact appears unavoidable without intentionally "turning off" a quantity of turbines, which is what Alternatives B and C essentially represent.

4.16 CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations for implementing NEPA requires the consideration of cumulative effects in the decision-making process for federal projects. Cumulative effects are defined as "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).

Cumulative impacts are most likely to occur when a relationship exists between a proposed alternative and other actions that have, or are expected to occur in a similar location, time period, or involve similar actions. A geographic scope for the analysis of each resource has been defined and is presented in Table 4-27, Cumulative Impact Analysis Areas. Geographic scope is usually defined by the natural boundaries of the resources, rather than Project Area administrative boundaries. These areas were defined to be inclusive of all potentially significant effects on the resources of concern and effects from the combined impacts of the Project and other past, present, and reasonably foreseeable future actions. Projects in close proximity to the proposed alternatives would be expected to have more potential for cumulative impacts than those more geographically separated. Similarly, cumulative impacts could occur from individually insignificant actions, but may become significant when combined with other actions taking place over a period of time. As defined previously, temporary impacts are those that would occur primarily during construction, short-term impacts would persist for up to about 5 years, and long-term effects would occur for an extended period, longer than 5 years (Section 4.1.1). The timeframe for the analysis of each resource also has been defined and is presented in Table 4-27.

Table 4-27 Cumulative Impact Analysis Areas

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Climate and Air Quality	Project boundary plus a 10-mile buffer Project boundary for greenhouse gas emissions is undefined	Temporary (Long term for greenhouse gas emissions)	Particulates and fugitive dust are not expected to travel farther than10 miles before settling to the ground. Particulates and fugitive dust would be generated primarily during construction and decommissioning.	• Particulates (PM_{10} and $PM_{2.5}$) • Hazardous Air Pollutants • Fugitive dust
Geology, Soils, and Minerals	Lower and Middle Detrital watershed and the Trail Rapids Wash-Lower Colorado River watershed	Long term to permanent	Erosion from wind and water movement in disturbed areas is expected to be minimal beyond the watersheds. Impacts on soils, geologic resources, and minerals would occur primarily during construction, with potential to extend over the life of the wind farm and beyond.	**Soils:** • Erosion from wind and/or water • Soil productivity • Soil stability **Geology and Minerals:** • Access to mineral resources • Regional or local use of mineral materials
Water Resources	Lower and Middle Detrital watershed and the Trail Rapids Wash-Lower Colorado River watershed	Temporary to short term	Erosion from wind and water movement in disturbed areas is expected to be minimal beyond the watersheds. Impacts on water resources would be generated primarily during construction and decommissioning.	• Sediment erosion into drainages • Hydrological function • Groundwater use

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Biological Resources	**Vegetation:** Project Area plus a 20-mile buffer that is limited by the boundary of the Colorado River on the north and west. **Noxious Weeds:** Project Area plus a 20-mile buffer that is limited by the boundary of the Colorado River on the north and west. **Special Status Plants:** Project Area plus a 20-mile buffer that is limited by the boundary of the Colorado River on the north and west. **Terrestrial Wildlife:** Project Area plus a 20-mile buffer that is limited by the boundary of the Colorado River on the north and west. **Golden Eagle:** Project Area plus a 90-mile buffer **Bats and Other Birds:** Project Area plus a 20-mile buffer that is limited by the boundary of the Colorado River on the north and west.	Short and long term	Provides a naturally divisible analysis to account for regional ecological processes within the area, while disregarding negligible effects beyond the natural boundary of the Colorado River for species other than the golden eagle. The golden eagle analysis accounts for current BLM directive to analyze potential impacts on golden eagles as these relate to the regional breeding population and the usual dispersal distance for golden eagle fledglings. Impacts on biological resources would be generated during construction, operations and maintenance and decommissioning.	**Vegetation:** • Conversion of native landcover • Change in plant composition **Noxious Weeds and Invasive Species:** • Introduction and spread of noxious weeds and invasive species **Wildland Fire:** • Change in fire frequency • Change in fire regime **Special Status Plants:** • Changes in quantity and quality of habitat • Change in population numbers • **Terrestrial Wildlife** Change to quantity and quality of habitat • Change to food resources • Causes of fatality **Raptors:** • Change to quantity and quality of habitat • Change to food resources • Change to regional breeding population **Bats and Other Birds:** • Change to quantity and quality of habitat • Change to food resources • Change to roost site availability • Change to regional population • Causes of fatality

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Wildland Fire	Hualapai and Detrital watersheds	Long term	Provides a naturally divisible analysis to account for regional ecological processes related to dispersal of seeds and non-native propagules and surface disturbances that could affect fire regime and condition class. Impacts on fire regime would be related to changes to vegetation and land uses over the life of the project.	• Fire condition class • Fire regime
Cultural Resources	Project boundary plus a 20-mile buffer	Long term to permanent	Consistent with defined area of potential effects for visual impacts on cultural resources. Impacts on cultural resources could continue over the life of the wind farm.	• Cultural resources disturbed or destroyed by prior, ongoing, and future actions • Cultural resources protected by management objectives within the analysis area. (ACECs, wilderness, LMNRA)
Paleontological Resources	Lower and Middle Detrital Wash, up to 10 miles from the project boundary and Trail Rapids Wash-Lower Colorado River watershed boundaries, up to 10 miles from the project boundary	Permanent	Provides consistency with analysis of soils and water resources and associated areas of erosion from wind and water movement. Disturbed areas are expected to be minimal beyond several miles from the site. Impacts on paleontological resources would occur primarily during construction, with potential to extend over the life of the wind farm and beyond.	• Geologic resources that potentially contain significant fossils

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Land Use	Project boundary plus a 20-mile buffer The area also would include the extent of involved electric transmission systems.	Temporary to long term	Impacts to land use related to residential development, utility corridors, and livestock grazing would be limited to the Project Area and 20-mile buffer. Impacts beyond 20 miles are expected to be minimal. Impacts on land use could include displacement of activities during construction and changes in future use patterns over the life of the wind farm.	• Residential developments • Utility corridors and areas used to support transmission lines • Grazing allotments Big Ranch Units A and B and Gold Basin • National Park Service and State Trust lands • Existing mining claims
Recreation	Project boundary plus a 20-mile buffer	Temporary to long term	Consistency with visual and cultural resources, as most recreational impacts would be associated with past/traditional experience and visual aspects from recreational sites. Impacts on recreation could include displacement of activities during construction and changes in recreational use patterns over the life of the wind farm.	• Changes to the recreation setting and experience including: – Soundscape – Visual resources – Vegetation communities – Developed and primitive camping – Wildlife viewing – OHV routes and use – Horseback riding and hiking – Hunting – Fishing – Wilderness Areas – Mount Wilson and Mount Tipton – NPS-proposed wilderness
Transportation and Access	Project boundary plus a 20-mile buffer	Temporary	Impacts to the transportation network are expected to be minimal in the areas beyond the project site. Impacts on transportation and access would occur primarily during construction and decommissioning.	• Annual Average Daily Traffic (AADT) levels on Federal, State or County roads • Change in access to specific areas • Change in the type of vehicles using the transportation network

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Social and Economic Conditions	Mohave County	Temporary and long term	Impacts to employment and income opportunities are expected to increase through added employment and the associated income. Quality of life factors may be impacted by the Project. Impacts on social and economic conditions could occur from construction (and decommissioning) and operations.	• Employment factors, including job opportunities, commuting distance, and salaries • Housing vacancy • Median income • Tax and other revenues paid to local, State and Federal agencies • Quality of life parameters such as recreation opportunities and environmental quality • Tax base and revenue generated to the Federal government and County/City governments
Environmental Justice	Mohave County	Temporary and long term	While the proposed wind farm may impact populations more locally, projects throughout the County may influence presence of environmental justice populations. Impacts on low-income and minority populations could result from construction (and decommissioning) and operations.	• Disproportionate impact on low income and minority populations
Visual Resources	Project boundary plus a 20-mile buffer	Short and long term	BLM's visual threshold for "Seldom Seen" land is 15 miles; however, the viewshed may extend beyond this distance and certain sensitive locations may view this and other projects simultaneously. Impacts on visual resources could occur during construction (and decommissioning) and operations.	• Viewer sensitivity from residents/communities, recreational users, travelers along Highway 93, Lake Mead National Recreation Area (LMNRA) visitors • Night sky impacts • Landscape characteristics including line, form, color, and texture • Contrasting elements on the landscape from the addition of

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
				structures (turbines, roads, transmission lines, substations/ switchyards) to the visual environment
Public Safety, and Hazardous Materials and Solid Waste	**Public Safety:** • Project boundary • US-93 between Hoover Dam and the intersection of Pierce Ferry Road • White Hills Road • Unpaved/unmarked access roads within 5 miles of the project boundary **Hazardous Materials and Solid Waste:** Project boundary plus 1 mile buffer and projects that use, store, or transport hazardous materials	Temporary and long term	**Public Safety:** Impacts to public safety related to traffic accidents would be expected to occur on roadways located within and nearby the project site, as well as on roadways used to deliver parts and equipment. Occupational accidents would be limited to those incidents occurring at the project site. **Hazardous Materials and Solid Waste:** Due to project activities within the project boundary, it is anticipated that spills of hazardous materials or wastes could occur. The transport, or handling of hazardous materials is regulated, and any off-site spills (from either the Project, or other hazardous waste carriers) would be disposed of as required by handling permits. Any project that uses, stores, or transports hazardous materials could create an impact due to unexpected spills or traffic accidents. Impacts on public safety and from hazardous materials could occur during construction (and decommissioning) and operations.	**Public Safety:** • Potential exposure to hazardous materials and solid waste • Increased traffic • Introducing oversized loads into the traffic flow for the short term • Visibility issues related to fugitive dust • Health issues associated with fugitive dust **Hazardous Materials and Solid Waste:** Areas used for the storage and transport of hazardous material and solid waste

Resource	Cumulative Impact Analysis Area	Cumulative Impact Analysis Timeframe	Rationale for Cumulative Impact Analysis Area and Timeframe	Elements to Consider
Microwave Radar and Other Communications	Because no impact on microwave radar and other communications would occur as a result of the proposed project or alternatives, no cumulative impacts are analyzed.			
Noise	Project boundary plus a 5-mile buffer	Temporary and long term	Noise from a source diminishes with distance. From predictive noise models on the Project, in general, predicted operation or construction noise seems to fall below 35 dBA Leq (i.e., the lower of the two thresholds under Elements to Consider) when the distance between a potential receiver and the noise generator is over 2.5 miles. If another project (i.e., from the cumulative list) was also creating noise of similar magnitude, and was similarly 2.5 miles distant from the same receiver but in the opposite direction (and thus, 5 miles distant from the Project), the combined noise level would also likely be less than 35 dBA. Impacts from noise could occur during construction (and decommissioning) and operations.	• 35 dBA threshold for potential impact over LMNRA land • 45 dBA threshold for residential development • Other renewable projects, existing communities, residences, proposed master planned communities • Commercial over flights, traffic noise from Hwy 93 • Detrital Wash material pit use

In December 2010, a letter and map were sent to numerous agencies to request their input on actions within the defined study region for the Project Area that might contribute to a cumulative effects analysis.[3] Responses were received from the Hualapai Tribe, the Arizona Game and Fish Department and Mohave County. Many of the identified actions had no schedule associated with them, or the project was not implemented as scheduled. Table 4-28 presents a description of the past, present and reasonably foreseeable future actions and projects that were considered in the analysis of the incremental impact of the Project when added to other actions. The past, present, and reasonably foreseeable infrastructure projects that would occur within a 20-mile radius of the Project Area are displayed, to the extent practicable, on Map 4-8. The specific impacts of each action or activity in Table 4-28 are not independently analyzed or presented, but have been considered and included within the analysis of cumulative impacts on each resource.

Past, current, and reasonably foreseeable future management activities occurring in the cumulative impact areas include mining activities, livestock grazing, range improvements, recreation (hunting, OHV use), access routes, other renewable energy projects, temporary met towers, transmission lines, telephone lines, communication towers, and community development. Other disturbances that are ongoing include wildfire and establishment and spread of noxious weeds and invasive plant species. All resource impacts would be added to these actions to present the cumulative picture or incremental contribution this Project would have on the resources. Quantitative information is used when available and as appropriate to portray the magnitude of an impact; however, for most past, present and reasonably foreseeable activities, quantitative information is not available. Consequently, this assessment is primarily qualitative for most resources.

Table 4-28 Past, Present, and Reasonably Foreseeable Future Actions and Projects

Action / Project Name	Description	Location
Past Actions / Projects		
Historical Mining	Prospectors first ventured into Mohave County after the northern California gold placers played out during the 1850s and 1860s. In the early 1860s, an outcropping of lode gold was discovered about 25 miles southwest of Kingman, and the Moss Mine was developed. That mine eventually yielded $250,000 in gold and led to a Mohave County mining rush that lasted into the mid-1860s. Mining activities were briefly curtailed in the county between 1865 and 1868 because of heightened tensions with the Hualapai Tribe, but by 1870 the discovery of rich silver and gold veins in the Hualapai and Cerbat ranges, as well as increased military presence, resulted in a resurgence. Prospectors from Nevada and California flowed into the area, and the population of the mining camps of Cerbat, Todd Basin, Mineral Park, and Stockton Hill grew. By 1880, more than 2,000 mining claims were staked in those areas. Mining became a major source of income in Mohave County after the Atlantic & Pacific Railroad (later known as the Atchison Topeka & Santa Fe Railway) arrived in 1883, which reduced transportation costs and provided a means for obtaining better equipment. By 1909, prospectors had established 11 mining districts in Mohave County, mostly in the	Mohave County, Arizona

[3] BLM requested input from the following agencies/tribe: Western Area Power Administration, National Park Service (Lake Mead National Recreation Area), Natural Resources Conservation Service, U.S. Army Corps of Engineers, U.S. Department of Defense, Arizona Department of Game and Fish, Arizona Department of Environmental Quality, Arizona Department of Transportation, Arizona State Land Department, Mohave County (Development Services), and the Hualapai Tribe.

Action / Project Name	Description	Location
	Black Mountains or the Cerbat range. The Gold Road Mine, Tom Reed Mine, and United Eastern Mine in the Black Mountains are considered the three greatest gold mines in Arizona, having shipped nearly 2 million ounces of gold and more than 1 million ounces of silver between 1870 and 1980. Mining activity in the county decreased in the 1920s, but the Great Depression stimulated renewed mining activity in the 1930s. In 1942, most mines were declared nonessential to the World War II effort and mining activity in Mohave County has been limited ever since.	
Historical Grazing	Free grazing on the public domain brought ranchers west, and the arrival of miners and soldiers in Mohave County in the 1850s and 1860s stimulated the development of farms and ranches to supply their settlements. Most of the ranches in the county were small, family-operated cattle operations along the Colorado River, but some sheep, goats, horses, and pigs also were raised. Ranching expanded into the Big Sandy River Valley in the interior of Mohave County by 1865. Ten years later, ranches were being established in the Sacramento and Hualapai valleys and in the Hackberry and Peach Springs areas. The cattle industry was booming by the late 1880s, and by 1890, it was estimated that 60,000 head of cattle and 500 goats grazed Mohave County ranges. In 1883, the Atlantic & Pacific Railroad was completed, providing easier access to suppliers and markets beyond the region. Prior to 1934, governing regulations were not applied to grazing activities on public land, and much of the land was heavily grazed. Fluctuations in precipitation and temperature affected the growth of natural rangeland vegetation; this combined with heavy grazing caused many areas to become unsuitable for grazing. The Taylor Grazing Act of 1934, designed to limit grazing to more sustainable levels, prevented the livestock industry from restocking the range with the size of herds grazed in earlier times. In the late 1940s, the Bureau of Land Management first issued public land grazing allotments to Mohave County ranchers.	Mohave County, Arizona
Community Settlement	The earliest Euro-American settlement in the area that would become Mohave County was Fort Mojave, which the U.S. Army established in the Bullhead City area in 1859. In the 1860s, Mormons began to operate ferries on the Colorado River to accommodate expansion of settlement south from Utah. Mormon missionary Jacob Hamblin first ferried across the river east of the confluence with Grand Wash in 1863 and Harrison Pierce developed the ferry in 1876. Bonelli's Ferry or Rioville was established in the early 1870s at the confluence of the Virgin River near present-day Temple Bar. Littlefield, a Mormon agricultural community near the Virgin River, was founded in 1865 and is one of the oldest communities still in existence in the county. Other early settlements in the county included Hardyville, which was established along the Colorado River in 1864 as a distribution and shipping point for mines in the Cerbat Mountains, and the mining communities of Cerbat and Mineral Park. All three of these communities served as the county seat at separate times during the 1870s. Mining towns were populated and abandoned following the "boom" and "bust" of area mines, but some of these communities were able to survive after the mines were no longer considered profitable, including the communities of Oatman, Chloride, and Hackberry. Kingman was founded as a railroad siding along the Atlantic & Pacific Railroad	Mohave County, Arizona

Action / Project Name	Description	Location
	(later known as the Atchison Topeka & Santa Fe Railway) in 1883, and the county seat was moved there in 1887. The railroad and the construction of highway routes beginning in the early 1910s and 1920s supported Kingman's early growth and resulted in the establishment of other smaller communities along these routes. Kingman's growth was given a boost in the 1930s with the construction of the Hoover Dam and continued to grow during the World War II era with the establishment of the Kingman Army Airfield in 1942.	
Hoover Dam	The Hoover Dam is a concrete arch-gravity dam that provides hydroelectric power, water, and flood control to parts of Arizona, southern Nevada, and southern California. The dam, which impounds Lake Mead in the Black Canyon of the Colorado River, is located near Boulder City, Nevada, approximately 25 miles southeast of Las Vegas, Nevada. The Bureau of Reclamation constructed Hoover Dam between 1931 and 1936 during the Great Depression. Hoover Dam is a major tourist attraction; nearly a million people tour the dam each year. The Hoover Dam Bypass, a 3.5-mile-long corridor on U.S. Highway 93, was constructed between 2005 and 2010 to reduce traffic congestion and improve safety at the river crossing near Hoover Dam. (The Hoover Dam Bypass also is discussed under present actions for transportation.)	Clark County, Nevada and Mohave County, Arizona
Lake Mead National Recreation Area	The reservoir that was created by building Hoover Dam became Lake Mead, which was declared a national recreation area in 1964 by Public Law 88-639. The Lake Mead NRA includes two lakes and covers approximately 1.5 million acres of land, but does not include the area managed by Reclamation for the operation of Hoover Dam and Davis Dam. It is characterized by a contrast of desert and water, mountains and canyons, and primitive backcountry and public marinas. P.L. 88-639 directs that "Lake Mead National Recreation Area shall be administered… for general purposes of public recreation, benefit, and use, and in a manner that will preserve, develop, and enhance, so far as practicable, the recreation potential, and in a manner that will preserve the scenic, historic, scientific, and other important features of the area, consistently with applicable reservations and limitations relating to such area and with other authorized uses of the lands and properties within such area." (The Lake Mead NRA also is discussed under present actions for recreation management).	Clark County, Nevada and Mohave County, Arizona
Present Actions / Projects		
Lake Mead National Recreation Area General Management Plan	The Lake Mead National Recreation Area General Management Plan, approved on March 12, 2003, provides broad guidance for decisions about natural and cultural resource protection, appropriate types and levels of visitor activities, and facility development (NPS 2003). The plan describes the area's mission, purpose, and significance, and defines the resource conditions and visitor experiences that should be achieved and maintained over time. One of the plan's objectives is to preserve the visual quality of recreational areas, such as park roads, the lake surface, and hiking routes.	Clark County, Nevada and Mohave County, Arizona

Action / Project Name	Description	Location
Mohave County General Plan	The Mohave County General Plan was adopted in 1995 and updated in 2010. The goals of the plan are to provide basic infrastructure, maintain and protect the County's resources, provide community systems or facilities and services, promote economic development and employment opportunities, encourage affordable housing and a variety of housing types, and improve intergovernmental relations.	Mohave County, Arizona
Dolan Springs Area Plan	The Dolan Springs Area Plan was adopted in 2003 with the goals of ensuring a stable economy through planned growth, promoting core development, encouraging development of adequate and affordable housing, protecting the environment and conserving natural resources, and maintaining a high quality of life and community values.	Dolan Springs, Arizona
Renewable Energy Project	Western Wind Energy operates the Kingman Wind Farm, a 10.5 MW fully integrated combined wind and solar energy generation facility, on 1,110 acres of land owned by the company in Kingman, Arizona. The Kingman Wind Farm began commercial operations on September 24, 2011. The project includes five Gamesa turbines, 500 KW of Suntech Crystalline PV solar cells, a collection system, a substation, roads, interconnection facilities, and a maintenance building.	Kingman, Arizona
Mining Activities	There are federal mineral reserves, mineral districts, potential mining claims, and historic mining areas in the project vicinity. The northeast portion of the Project Area includes two inactive mica, feldspar, and quartz mines, and nearby there are several other closed mine sites, prospect sites, and other mineral features. There are four mining districts east and south of the Project Area: the Cyclopic, Gold Hill, Gold Basin, and White Hills districts—these include numerous, though currently closed mines that were mainly mined for gold and silver in the past. One prospect site for uranium, lead, and zinc is located approximately 8 miles south of the Project Area. The western edge of the Project Area also shares a boundary with a sodium potassium deposit. Mining claims are scattered about this part of Mohave County, largely to the south and east of the Project Area near the aforementioned existing mining districts, but overall it is an area of low favorability for mineral mining. Mercator Minerals Mineral Park open pit copper, silver, and molybdenum mine in the Cerbat Mountains is the only active metallic mine near the Project Area. Four sand, gravel, and/or stone quarries are active in the cumulative impact analysis area: Canyon Sand and Gravel northwest of the Project Area near Highway 93, Kalamazoo Materials' White Hills Pit, Red Mountain Mining's Mineral Park near the Cerbat Mountains, and the Detrital Wash Materials Pits near Highway 93 and the proposed access to the Wind Farm Site.	Mohave County, Arizona

Action / Project Name	Description	Location
Grazing Activities	The BLM Kingman Field Office manages approximately 88 livestock grazing allotments in the region. Forage availability in the allotments is both ephemeral and perennial and most ranching operations on public land in the region are yearlong cow-calf enterprises. Many rangeland improvement projects have been occurring throughout the region. Most allotment boundaries are defined by fences except where natural barriers effectively control livestock. Many allotments are further divided by interior fences to form pastures, which control livestock movement. Numerous range features such as springs, wells, storage tanks, and rain catchments have been developed to provide water for livestock and wildlife. Vegetation treatments have been undertaken and have involved herbicides, prescribed burning, roller chopping, and reseeding of native plants.	Mohave County, Arizona
Off-Highway Vehicle Use	Off-Highway Vehicles (OHV) are used for recreation (e.g., motorcycle racing and rockhounding) and for transportation to recreation sites (e.g., to hunting or camping sites). OHV use is most prominent near populated cities such as Kingman. All BLM-managed land in the area is designated as limited to existing roads, navigable washes, and trails. Limited OHV areas are where vehicle use is restricted at certain times, in certain areas, and/or to certain vehicular use in order to meet specific resource management objectives. Although OHV use in the area is limited to existing roads, trails, and navigable washes, increased OHV use has resulted in a growing network of unauthorized trails.	Mohave County, Arizona
Wilderness	Mount Tipton Wilderness Area: The 30,760-acre Mount Tipton Wilderness is located in Mohave County, 25 miles north of Kingman, Arizona. The wilderness area includes the entire northern half of the Cerbat Mountains. The elevation of Mount Tipton Peak is 7,148 feet and dominates the wilderness. Another scenic attraction at Mount Tipton is the Cerbat Pinnacles, located north of and below Mount Tipton. The Wilderness Area provides a wide range of recreation opportunities including hiking, backpacking, photography, and horseback riding. Development activities that diminish wilderness values are prohibited within the boundaries of this area. Mount Wilson Wilderness Area: The Mount Wilson Wilderness Area encompasses 23,900 acres and is located in Mohave County, Arizona, approximately 30 miles southeast of Las Vegas, Nevada and 60 miles northwest of Kingman, Arizona. The wilderness contains 8 miles of Wilson Ridge and Mount Wilson with an elevation of 5,445 feet. Mount Wilson is the most prominent range in the Hoover Dam area. The area contains several springs which support a wide variety of wildlife, including a population of desert bighorn sheep. Development activities that diminish wilderness values are prohibited within the boundaries of this area.	Mohave County, Arizona

Action / Project Name	Description	Location
Areas of Critical Environmental Concern (ACECs)	Black Mountains ACEC: The 114,242-acre Black Mountains ACEC is designated in the 1995 Kingman BLM Resource Management Plan Record of Decision to protect big horn sheep and wild burro habitat; federal candidate plant species habitat; outstanding scenic values; and rare and outstanding cultural resources. The ACEC is characterized by large mesas and ridges, steep cliffs, rocky foothills, and sandy washes. The highest peak in the mountain range is Mount Perkins with an elevation of 5,456 feet. Joshua Tree Forest / Grand Wash Cliffs ACEC: The 39,060-acre Joshua Tree Forest/Grand Wash Cliffs ACEC is designated in the 1993 Kingman BLM Resource Management Plan Record of Decision to protect unique vegetation; outstanding scenic values; rare cultural resources; and peregrine falcon aerie. The ACEC is characterized by large, scenic stands of Joshua trees set against a backdrop provided by the Grand Wash Cliffs. The area provides outstanding opportunities for dispersed recreation.	Mohave County, Arizona
Electric Transmission Lines	Existing transmission infrastructure present includes the Mead-Phoenix 500kV Transmission Line and the Mead-Liberty 345kV Transmission Line (both administered by Western), and the Four Corners-Moenkopi-Eldorado 500kV Transmission Line (owned and operated by Arizona Public Service).	Mohave, Coconino, Yavapai and Maricopa Counties, Arizona
Transportation Facilities/ Highways	The major transportation feature in the project vicinity is US Highway 93, which provide access to the cities of Kingman, Arizona and Las Vegas, Nevada. That highway is supported by a network of local roads to smaller cities, towns, and communities in the area. The Federal Highway Administration, in conjunction with the Arizona Department of Transportation (ADOT) and the Nevada Department of Transportation (NDOT), officially opened a new segment of US 93, formally known as the Hoover Dam Bypass in October 2010. (The Hoover Dam Bypass also is discussed under past actions for Hoover Dam.)	Clark County, Nevada and Mohave County, Arizona
Triangle Airpark Airport	Triangle Airpark Airport is located east of Highway 93 in White Hills, Arizona. The airport encompasses 115 acres and has two runways, one paved and one dirt. The airport is privately owned by Boulder City Aero Club Inc. and is open to the public with prior written permission required.	Mohave County, Arizona
Urban and Rural Development	Urban development in Mohave County is planned for areas that have already experienced or have been planned for intensive development. Development in the cumulative impact analysis area includes residential development along, and in the vicinity of, Pierce Ferry Road near Dolan Springs and the Lake Las Vegas master planned community west of the Lake Mead NRA in Clark County, Nevada. Other areas of urban development, though more distant to the study area, include land adjacent to incorporated cities, land within outlying communities and the more intensely developing areas such as Golden Valley, which is about 40 miles south of the Project Area and about 10 miles west of Kingman (Mohave County 2010b).	Project Area plus 20-mile buffer

Action / Project Name	Description	Location
Reasonably Foreseeable Future Actions		
Renewable Energy Projects	Multiple applications have been submitted to BLM for rights-of-way on public land for renewable energy projects, including solar and wind facilities. In addition, private lands are being considered for these projects, as evidenced by the Hualapai Valley Solar Energy Project and Table Mountain Renewable Energy Project. Potential projects, irrespective of land ownership, include known potential projects of: • Mountain Spring Solar Energy Project – potential for 250 MW, on 6,700 acres • Dolan Springs Wind Energy Project – MW not yet determined • Grand Canyon West Wind Energy Project – potential for 50 MW generation • Clay Springs Wind Energy Resource Area – potential for up to 150 MW generation • Music Mountain Hydroelectric Energy Project – 450 MW pumping capacity • Table Mountain Renewable Energy Project – renewable energy project using Solar, Wind, and Water recharge on approximately 5,500 acres (potential MW unknown) • Searchlight Wind Energy Project – 200 MW on 18,949 acres In addition, applications for rights-of-way have been filed with BLM for other solar energy projects in Nevada. Though all of these projects have been proposed, some may not be developed in the future; however, for the purpose of the cumulative analysis, additional wind and solar electric generating facilities are expected to be constructed and operated in the vicinity of the Project.	Various locations in Mohave County, Arizona and Clark County, Nevada
Mining Activities	The continued rise in the price of gold, or perhaps uranium, may spark renewed interest in the low-grade deposits of the region but there are no current known plans to reopen old mines or develop a new mine.	Mohave County, Arizona
Electric Transmission Lines	Regional transmission line projects and/or upgrades are anticipated in Northwestern Arizona and Southern Nevada, which may connect to the grid through either the Mead or Eldorado substations. The various projects that have been proposed or approved include the following known projects: • Southern Nevada Intertie Project – 500 kV • Navajo Transmission Project – 500 kV • Chinook – 500 kV • Zephyr – 500 kV • Centennial West – 500 kV • Sonoran-Mohave Renewable Transmission Project • One Nevada (ON) Line Project – 500 kV • Anova Project – 500 kV • Las Vegas to Los Angeles Transmission Project – 500 kV • Eldorado to Devers – 500 kV • Transwest Express – 500 kV Some of these transmission projects may not be developed in the future; however, for the purpose of the cumulative analysis,	Various locations in Mohave County, Arizona and Clark County, Nevada

Action / Project Name	Description	Location
	additional transmission facilities are expected to be constructed and operated in the vicinity of the Project.	
Transportation Facilities / Highways	The Arizona Department of Transportation (ADOT) has been and will continue to implement a series of projects to widen and improve US 93 from Wickenburg to Hoover Dam. ADOT's long-term vision is to transform this highly traveled route into a four-lane divided highway through the entire 200-mile stretch. Future projects include Antelope Wash, milepost 101 to 104, and Carrow Stephens, milepost 116 to 119. These projects are scheduled for fiscal years 2015 and 2016. A realignment study for State Route 95 (SR 95) will be completed that would define a new route from Interstate 40 (I-40) to State Route 68 (SR 68), between the Black Mountains to the east and the developed portions of the Colorado River corridor to the west. The project is being studied due to high traffic volumes and long delays on SR 95 between I-40 and Bullhead City.	Clark County, Nevada and Mohave County, Arizona Mohave County, Arizona
Urban and Rural Development	The urban areas in outlying communities will likely continue current patterns of development. The areas appropriate for suburban development primarily are located on the fringes of the urban development areas. The remainder of the unincorporated areas in the County is planned for rural development. Specific future master planned communities have been proposed and approved in the White Hills area, in the vicinity of the Project. Mohave County has included a requirement in the 2005 and 2006 Resolutions to the General Plan to show sufficient development progress on projects before the 2015 General Plan update. It is not known at this time what progress would be made on the proposed and approved developments. The developments identified include: • The Ranch at White Hills and Mardian Ranch • White Hills Central • The Ranch at Red Lake • The Villages at White Hills Over the life of the project, these master planned communities, or other similar communities including residential and commercial uses, are expected to be developed.	White Hills area of Mohave County

Cumulative impacts would be greatest under Alternative A because it represents the largest extent of the proposed Wind Farm Site. Alternatives B and C would produce a similar degree of cumulative impacts since they would have similar disturbance areas. Alternative D, the no action alternative, would not contribute to cumulative impacts. In the sections that follow, the cumulative effects analysis for each affected element of the environment is presented.

4.16.1 <u>Climate and Air Quality</u>

4.16.1.1 Alternatives A, B, and C

The air quality in the area is affected by travel on local highways and roads, OHV use for recreational activities, a limited number of industrial facilities in Mohave County, and naturally occurring wind events and dust storms. These activities do not typically degrade the ambient air quality in the area. Dust storms occurring during the monsoon season in the desert may result in temporary, localized exceedances of the NAAQS for particulate matter.

In the areas surrounding the project boundary, on-road vehicle use is expected to continue at current or increased levels. US 93 has been recently widened from Kingman to the Arizona/Nevada state line to two lanes of traffic in each direction and is a heavily used highway.

There are also residential development plans for master-planned communities in the White Hills area and near Lake Mead NRA that would increase population and therefore likely increase the number of vehicles traveling on local roads and highways, the number of residents participating in OHV-related recreation, and expand commercial development in the area.

Existing industrial facilities that hold Title V (major source) Air Quality Permits include the Mohave Valley Landfill, American Woodmark, Griffith Energy, and the South Point Energy Center. With regard to future industrial development, BLM has received multiple requests for renewable energy projects, including solar, wind, and hydroelectric facilities. As with the proposed wind facility, emissions from these facilities would be greatest during the construction phase, with very low emission levels during the operating phase. Renewable energy projects typically do not require Title V Permits unless they include provisions for backup power generated using combustion equipment requiring fossil fuels.

Since air pollutant emissions occurring during the operational phase of the Project would be relatively miniscule (infrequent vehicle and emergency generator operation), the analysis of cumulative impacts is focused on emissions from other sources occurring during the construction phase, and having impacts within the same area as the proposed Project. Coarse particulate matter typically emitted by earthmoving and material handling operations (such as the grading and excavation activity, and the CSWP and concrete batch plants) is unlikely to be transported more than a few miles, except on unusually windy days, during which project emissions would likely be masked by naturally occurring dust. Particulate matter and gaseous pollutants resulting from combustion of fuels (such as tailpipe emissions from on-site construction vehicles and equipment, and employee commuting vehicles) are also emitted at or near ground-level, and would likely disperse to immeasurable concentrations within 10 miles. Based on the activities and projects contributing to cumulative effects, no other actions would occur within the 10-mile radius for cumulative analysis of air quality impacts and at times that would overlap with construction of the proposed project. However, if construction of the proposed wind farm were to occur simultaneous with other planned or proposed developments (i.e., solar, residential, mineral extraction), some temporary cumulative impacts could occur as a result of the additional particulate matter emissions. The cumulative analysis on air quality assumed that only projects within a 10-mile radius of the proposed action should be considered, since fugitive dust resulting from earthmoving operations tends to fall out well within that distance.

Greenhouse gases would be emitted at increased levels during the maximum18-month construction schedule for the proposed wind farm. The global warming potential associated with total project GHG emissions over the 12- to 18-month construction effort was estimated to be 1,113,880 tons of CO2*e*. The GHG emissions from construction and decommissioning of the Project would have an incremental impact on regional climate change, along with other past, present, and reasonably foreseeable future actions. Although the cumulative effects during construction may have a slight, adverse effect on climate change, the operational wind farm would contribute a beneficial long-term impact, because wind farms produce electricity while emitting relatively low quantities of GHGs when compared to fossil-fuel fired generation facilities.

Although present and reasonably foreseeable future actions in the project vicinity indicate that sources of air pollutants may increase, existing environmental regulations in the State of Arizona are designed to ensure that sources comply with dust control regulations and the NAAQS. Under all action alternatives, impacts from construction and decommissioning would be temporary, and no long-term cumulative impacts are expected.

4.16.1.2 Alternative D – No Action

There are planned residential developments within the 10-mile radius of the Project Area. It is not known when they will be developed, however, if they are developed in the reasonably foreseeable future, some temporary cumulative impacts could occur as a result of the additional particulate matter emissions.

4.16.2 Geology, Soils, and Minerals

4.16.2.1 Alternatives A, B, and C

Cumulative impacts on rock, soil, and minerals can occur over a long period of time, resulting in gradual changes in soil and rock erosion potential, ecological function, and mineral access. The impacts on the site soils and rocks would be greatest from actions that involve ground disturbing activities, such as construction for highway improvements and planned developments as well as industrial activities, such as mining. Construction activities have the potential to permanently alter the geology and bedrock of the area of cumulative effects. The primary areas that would be affected are the Lower and Middle Detrital watershed and the Trail Rapids Wash-Lower Colorado River watershed. The two primary impacts stem from the potential for soil erosion due to wind and water movement and the depletion of the Detrital Wash Materials Pit.

The potential for erosion and blowing dust associated with ground disturbance are the major soils concern, although the potential for erosion would diminish over time for those actions that include a reclamation phase to stabilize soils. Other planned projects or developments in the cumulative impact area also could result in soil loss from ground-disturbing activities, particularly during construction. In combination with the proposed wind farm, the additional projects could result in a long-term loss of soils in the area given the increased disturbance and developed features.

In addition to the proposed wind farm, improvements to US 93 and other past projects have added to the depletion of the resources located in the Detrital Wash Material Pit; consumption of the extracted materials is irreversible, and future projects may be required to seek materials from one of the existing sand and gravel pits in the vicinity or locate a new source. As a result, permanent cumulative impacts from other planned activities in combination with the proposed wind farm could include depletion of mineral materials from the Detrital Wash Area. As a result, greater reliance on or development of other mineral material sources could be necessary within the cumulative impact analysis area, or in areas further away from the Project site. Nearby new sources that may be relied upon could include: Fayro No. 4, Gold Crown, Gravel Pit #4, and Mineral Material Area 1,2,3 (U.S. Geological Survey 2011).

4.16.2.2 Alternative D – No Action

Under the No Action Alternative, cumulative effects on geology, soils, and minerals, would be the same as those described under Alternatives A, B, and C, except the 180,000 cubic yards of raw materials extracted from Detrital Wash Material Pit would be available for other projects. Even if the Project is constructed, it would require only a portion of the raw materials available in the Detrital Wash Material Pit. This is not to say that the mineral material source would not be depleted in the future, as the area has been previously mined, and would remain available for lease from the BLM. Compared to Alternatives A, B and C, the potential for erosion and blowing would be less unless the BLM issues a mining permit for the Detrital Wash Material Pit to another entity for another project requiring road base material.

4.16.3 Water Resources

4.16.3.1 Surface Water Impacts

Alternatives A, B, and C

The types of projects that could contribute to cumulative surface water impacts in the analysis area include solar energy facilities, power/utility line construction and improvements, grazing, mining, and residential developments.

As shown on Map 4-7, Projects Considered for Cumulative Effects Analysis, two solar energy facilities are planned within the cumulative impacts analysis boundary: the Mountain Spring Solar Energy Project and the Table Mountain Renewable Energy Project. Surface disturbance associated with these facilities could have the same types of surface water impacts as the proposed wind farm project, namely stream or drainage modifications, increased runoff, and decreased surface water quality. In combination with the proposed Project, stream sediment loads in Detrital Wash could increase during peak flow events, particularly if the wind farm and solar facilities are constructed at the same time. A number of power line projects have been proposed or approved within the cumulative impacts analysis area (Table 4-27). Construction activities for these projects could create localized surface disturbance that may contribute eroded sediment to nearby ephemeral washes. In combination with the proposed wind farm, this could increase cumulative sediment loads in Detrital Wash and its tributaries, depending on the timing of cumulative activities. That is, potential compounding of temporary to short-term impacts on surface water quality could occur during construction, if multiple projects were under construction simultaneously during a peak flow event. Similar impacts could occur during decommissioning.

Existing grazing allotments on public land within the analysis boundary could also contribute to cumulative surface water impacts from erosion. Livestock grazing removes vegetation that stabilizes soils and causes rutting along livestock movement corridors. The increase in erosion from rangeland could lead to water quality impacts from increased sediment loads in nearby ephemeral washes. These impacts could combine with construction impacts from the proposed wind farm to increase sediment loads in Detrital Wash, Trail Rapids Wash, and other unnamed washes within the cumulative analysis boundary, particularly in the short term (i.e., during construction, or similarly, during decommissioning).

Aside from sand and gravel quarries, there are no active mines within the cumulative analysis boundary, and no plans for future mining projects are known at this time. However, cumulative surface water impacts are still possible from historic mine sites in the White Hills, Gold Basin, and Gold Hill mining districts located south and east of the Project (Map 3-4). The reclamation status of these historic mines is currently unknown. Tailings piles left at the mines could act as a source of sediment, dissolved metals, and acid drainage that could degrade surface water quality. Though limited to peak flow events, these mine-related impacts could contribute to surface water quality degradation in the Detrital and Trail Rapids Wash-Lower Colorado River watersheds, in the short term.

Map 4-7, Projects Considered for Cumulative Effects Analysis, shows four planned developments to the east and south of the Project Area that could contribute to cumulative surface water impacts. Construction of these developments would likely modify existing surface drainage characteristics as lots are graded and storm water is routed to drainage channels and retention basins. These changes could affect the Trail Rapids Wash-Lower Colorado River, Lower Detrital Wash, and Middle Detrital Wash watersheds. New road construction for residential development could increase erosion and transport of dissolved and suspended sediment loads to nearby washes. In combination with the proposed wind farm, this would contribute to cumulative surface quality water impacts, depending on the timing of the activities. Similar to the impacts from renewable energy developments, there could be increased potential for compounding of temporary to short-term impacts on surface water quality during construction or decommissioning, if multiple projects were under construction simultaneously.

Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future actions would have the same cumulative effects on surface water as described under Alternatives A, B, and C. Construction of renewable energy projects, livestock grazing, historic mines and planned development could result in erosion and the transport of sediment resulting in short-term impacts to surface water quality.

4.16.3.2 Groundwater Impacts

Alternatives A, B, and C

The cumulative impact analysis boundary for groundwater resources is the Detrital Valley groundwater basin. The currently low groundwater demands in the basin (<300 acre-feet per year [ADWR 2009]) are likely to increase in future years due to projected residential development, solar energy projects, and a lack of viable surface water sources. The proposed Project would likely use less water than either residential developments or solar energy facilities.

Future water use for the planned development communities in the cumulative analysis area depends on the density of housing (i.e., number of households per acre), number of people per household, and whether the households are occupied year-round or seasonally. The Ranch at White Hills and Mardian Ranch community would be located immediately southeast of the Project site, and would occupy approximately eight 640-acre parcels (5,120 total acres, Map 4-7, Projects Considered for Cumulative Effects Analysis). Waskom and Neibauer (2010) have estimated that the typical household uses up to 0.5 acre-feet of water per year to satisfy the demands of a home and lawn. If it is assumed that single-family homes are constructed on 2-acre lots in the Ranch at White Hills and Mardian Ranch development community, and each household consumes 0.5 acre-feet of water per year, this would equate to an estimated 1,280 acre-feet per year of new consumptive water use. These water demands would presumably be supplied from the Detrital Valley Basin-Fill aquifer. Although approximate, the water use estimate for the Villages at White Hills illustrates how water demands for the proposed wind farm (75.2 acre-feet) would be small compared to the annual requirements of a single development community. The long-term impacts of having four new development communities in close proximity to the Project could include groundwater level declines in the Basin-Fill aquifer and a reduction of groundwater availability in storage. However, the potential for cumulative impacts on groundwater from the proposed Project combined with these developments would be temporary to short-term, as the main groundwater withdrawal for the proposed Project would occur during construction activities. These construction activities likely would be complete before the planned communities would be consuming water.

Use of groundwater during O&M of the Project would be similar to that of a residential well for a single home (approximately 0.1 acre feet per year) and, in combination with the proposed residential development, would not present a quantifiable cumulative impact.

A temporal overlap of groundwater withdrawal would occur during decommissioning, where temporary increases in groundwater withdrawal could incrementally deplete groundwater storage over a temporary to short-term time period.

Proposed solar energy projects in the cumulative analysis area may have similarly high groundwater demands. The Mountain Spring Solar Project south of the proposed Project has been designed as a thermoelectric plant that would use concentrated solar energy to heat water for power production. The Plan of Development for the Mountain Spring Project indicates that if constructed, operation of the plant would require an average of 2,000 acre-feet per year consumptive water use (EPG 2008). This quantity is higher than projected construction water use for the proposed Project (75.2 acre-feet). The Mountain Spring Solar Project would be located in the Detrital Valley groundwater basin and would presumably obtain its water supply from the Basin-Fill aquifer. Another solar energy facility, the Table Mountain

Renewable Energy Project, could also be built in the Detrital Valley groundwater basin, although water use estimates are not available for the Table Mountain project at this time. Long-term impacts of having two new solar plants in close proximity to the proposed wind farm could include groundwater level declines in the Basin-Fill aquifer and a reduction of groundwater availability in storage. However, the potential for cumulative impacts on groundwater from the proposed Project combined with these solar projects would be temporary to short-term, as the main groundwater withdrawal for the proposed Project would occur during construction activities. These construction activities likely would be complete before the solar projects would be consuming water. A temporal overlap of groundwater withdrawal would occur during decommissioning, where temporary increases in groundwater withdrawal could incrementally deplete groundwater storage over a temporary to short-term time period.

Alternative D – No Action

Under the No Action alternative, the past, present and reasonably foreseeable future actions would have the same cumulative effects on groundwater as described under Alternatives A, B and C. Construction of renewable energy projects and planned development could result in water level declines in the Basin-Fill aquifer and reduction of groundwater availability in storage. The cumulative effect on the aquifer and groundwater availability would be long-term due to the on-going groundwater demands that would be created by these projects.

4.16.4 Biological Resources

4.16.4.1 Alternatives A, B, and C

The cumulative effects analysis area for vegetation and wildlife other than golden eagles includes the Project Area alternatives plus a 20-mile buffer to the south and east that is limited by the Colorado River on the north and west. This area contains the major natural dispersal barriers and the connected areas surrounding the Project Area, while also limiting the size of the analysis area to a meaningful acreage (about 991,730 acres) to consider the effects. The analysis area for golden eagles includes Project Area alternatives plus a surrounding 90- mile radius, which was defined by using a typical dispersal distance of juvenile golden eagles. Due to the scale of the cumulative analysis, the additional differences among the Project alternatives would be inconsequential.

Vegetation, Invasive Plants and Noxious Weeds, and Wildland Fire

The types of projects or actions that could contribute to impacts on vegetation include mining, livestock grazing, urban and rural community settlement and development, planning projects, OHV use, special designation areas, transmission line development, roads and highways, and other renewable energy developments. Historic settlement, mining, and livestock grazing would have started some of the first, widespread, modern surface disturbances in the analysis area, beginning in the 1850s through the 1940s. These would have initiated direct local losses of vegetation and could have started the indirect impacts of fragmenting blocks of vegetation, changing the composition of plant communities, and introducing non-native invasive plants. The introduction of introduced plant species would also have initiated the indirect changes in wildland fire that increased the intensity and decreased the interval of wildland fire over time. Establishment of the BLM, the Taylor Grazing Act, and Lake Mead National Recreation Area would have established the initial areas and authorities to start limiting disturbance and maintaining vegetation communities.

Present local and federal planning efforts and federal land designations have further limited disturbances or better defined methods to manage and protect vegetation resources. Present development of transmission lines, transportation routes, and urban and rural development, along with OHV use, has expanded long-term surface disturbance areas that have further led to the direct loss of native vegetation. These also have led to the long-term increase of areas with indirect impacts that fragment larger vegetation blocks into smaller ones and the means and areas in which invasive plants could degrade native vegetation and change the wildland fire regime.

Future solar and wind energy developments, mining, urban and rural development, and infrastructure developments could result in further subdivision or and loss of native vegetation and would add to the disturbed area where invasive plants or noxious weeds can spread in the analysis area. The direct and indirect long-term disturbance acreage in the Project Area, until revegetation using native plants is complete, would affect about 0.14 percent of the analysis area. In combination, the proposed wind farm and other past, present, and planned activities would result in long-term residual disturbances that would continue to fragment and isolate patches of vegetation, change species composition in plant communities, increase the potential for establishment and spread of noxious weeds and invasive plant species, and keep wildland fire regimes away from historic patterns.

Wildlife (Small Mammals, Reptiles, and Amphibians)

The types of projects or actions that could contribute to impacts on wildlife are the same as those that would affect vegetation. Direct loss of habitat and indirect degradation would have begun in the 1850s through the 1940s. Livestock grazing could have spread invasive plants and altered the cover and composition of plant communities used by wildlife. Mining, urban and rural development, roads, and infrastructure development would have consumed useable habitat and fragmented large blocks of habitats into smaller isolated ones. The establishment of the BLM, the Taylor Grazing Act, and Lake Mead National Recreation Area would have helped to limit disturbances on federally administered lands in the analysis area and would have helped in the direct or indirect retention of habitat for wildlife.

Present local and federal planning efforts and federal land designations have further limited disturbances and preserved vulnerable habitats and species. Present development of transmission lines, transportation routes, and urban and rural development, along with OHV use, have expanded direct loss of habitats and indirect degradation through fragmentation and introduced plant species. Also recreational OHV use and transportation along highways also have killed wildlife along roadways.

Future solar and wind energy developments, mining, urban and rural development, and infrastructure developments would result in further subdivision and loss of habitat and direct mortality of some individuals. The direct and indirect long-term disturbance acreage of wildlife habitat in the Project Area, until revegetation is complete, would affect about 0.14 percent of the analysis area. In combination, the proposed wind farm and other past, present, and planned activities would result in long-term impacts that would continue to reduce the size and increase the amount fragmentation and isolation of wildlife habitats in the analysis area. These could exclude some species and reduce the number of species occupying areas affected by disturbance. These also could increase the possibility of reducing the size some populations of species in the analysis area.

Bats

The types of activities and cumulative impacts to bats would be the same as for wildlife, except that past activities would include persecution that could have increased mortality, and proposed future projects that could contribute to increased mortality in the future.

Bats that have chosen temporary night roosts or day roosts at human dwellings likely have been killed in the past. However, current awareness of bats is increasing and is likely improving overall bat conservation in the analysis area. Mining in the past could have disturbed or eliminated roost sites and affected breeding opportunities in mountainous places. Present and future mining could continue to disturb colonies of bats in steep mountainous areas. Historic mines also have increased roosting sites and opportunities for cavernous roosting bats in the analysis area.

Future wind energy developments would kill an undetermined number of bats in the future. If spatial and relative abundance trends of low bat activity observed in the Project Area are consistent in the analysis region, then population-level impacts are unlikely. In combination, the proposed wind farm and other past, present, and planned activities would result in long-term impacts that would continue the possibility of reducing the size some populations of species in the analysis area.

Big Game

The types of projects or actions that could contribute to impacts on big game and the resulting cumulative impacts would be similar to those described for wildlife, but the species could have been impacted by overharvesting in the past and present. Also, habitat fragmentation could be a greater factor for these species due to their need for larger contiguous tracts of land for survival.

Past competitive loss of foraging opportunities between livestock and pronghorn, mule deer, and bighorn sheep and overharvesting of these game species could have led to large population decreases after settlement. Also past and present persecution of mountain lions likely has reduced the population below its natural potential in the analysis area.

Present local and federal planning efforts and federal land designations have further limited disturbances or better defined methods to manage and protect vulnerable habitats for these species. Establishment of the Mount Wilson Wilderness Area and Black Mountains ACEC likely helped to better protect bighorn sheep populations and habitat in those areas.

Present development of transmission lines, transportation routes, and urban and rural development have expanded direct loss of habitats and indirect degradation through fragmentation. High speed vehicle travel along Highway 93 has likely resulted in deaths for all big game species. These present developed uses and disturbances could have lowered the dispersal opportunities.

Future solar and wind energy developments, mining, urban and rural development, and infrastructure developments could result in further subdivision and loss of habitat and direct mortality of some individuals. The direct and indirect long-term disturbance acreage in the Project Area, until revegetation is complete, would affect about 0.14 percent of the analysis area. In combination, the proposed wind farm and other past, present, and planned activities could result in populations being below historical potentials; however, these would likely remain stable into the future, though they may require more intensive management to do so.

Birds

The types of projects or actions that could contribute to impacts on birds include mining, livestock grazing, urban and rural community settlement and development, planning projects, OHV use, special designation areas, transmission line development, roads and highways, and other renewable energy developments. Direct loss of habitat and indirect degradation of habitat from introduced non-native plants and fragmenting of large blocks of contiguous habitat into smaller discontinuous ones would have begun with historic settlement, mining, and livestock grazing in the 1850s through the 1940s. The establishment of the BLM, the Taylor Grazing Act, and Lake Mead National Recreation Area would have provided the initial areas and laws to start limiting disturbance and preserving habitat for birds. Golden eagles and other raptors likely were persecuted and killed to protect livestock in the past.

Present local and federal planning efforts, laws, and federal land designations have further limited disturbances or better defined methods to directly and indirectly protect vulnerable habitats and species. Present development of transmission lines, transportation routes, and urban and rural development, along with use, have expanded direct loss of habitats and indirect degradation through fragmentation and introduced plant species. Buildings, transmission lines, and other built structures likely have led to more fatal bird collisions since initial settlement of the region. Vehicles traveling along highways, particularly Highway 93, would have killed and continue to kill birds that collide with vehicles. Golden eagles and buteos were likely electrocuted as they attempted to perch on old-style transmission lines and transmission poles. Conversely, transmission line towers have increased the availability of nesting platforms for raptors, largely buteos and golden eagles, and perch structures in the analysis region. Consequently, greater foraging opportunities could exist in the region compared to pre-settlement times. Modern design standards to protect raptors from electrocution and to increase visibility of power lines to birds have greatly limited these sources mortality in the present and into the future.

Future solar and wind energy developments, mining, urban and rural development, and infrastructure developments could result in further subdivision and loss of habitat and direct mortality of some individual birds. Wind energy developments in the analysis area would increase mortality of bird species. The observed trends in the area were that there was a low abundance of resident and migratory birds, lack of migratory flyways, and a majority of species that have a low vulnerability to rotor collisions. If these patterns are similar to other wind energy sites in the analysis area, then it would be unlikely that bird species in the region would experience population-level impacts. The direct and indirect long-term disturbance acreage in the Project Area, until revegetation is complete, would affect about 0.14 percent of the analysis area for birds other than golden eagles. In combination, the proposed wind farm and other past, present, and planned activities would not eliminate any species from the analysis area, but could increase the possibility of individual deaths in some species.

The total direct and indirect long-term disturbance acreage in the Project Area would be less than 0.009 percent of the analysis area for golden eagles. Also, a recent study of population trends of golden eagles across the West indicate that the population in the analysis area is likely stable (Nielson et al. 2010), but recruitment of juvenile eagles may have declined over a 5-year period (2006-2010). The authors were hesitant to attribute a cause to trends in the data and also stated that the breeding segment of the population may be stable despite the decrease in the number of juveniles (Nielson et al. 2010). With mitigation measures proposed in the ECP for this Project, any deaths of golden eagles from this wind farm could be offset by reducing deaths from other possible sources in the region. In combination, the proposed wind farm and other past, present, and planned activities would not affect larger regional trends in the golden eagle population.

Special Status Species

BLM Sensitive Plants

The types of projects that could contribute to cumulative impacts on silverleaf sunray habitat and populations in the analysis area include solar energy facilities, transmission line construction and improvements, livestock grazing, and roadway, mineral and residential developments. Under all alternatives the amount of short-term surface disturbance from the Project would be less than 0.1 percent of the analysis area. Surface disturbance from the Project and other solar energy facilities, transmission lines, roadway and mineral developments could disturb potential habitats. Projects requiring federal and/or state permits would be required to conduct preconstruction surveys to identify and avoid silverleaf sunray populations; however, avoidance of all populations and suitable habitat may not be possible. Reclamation would restore these areas, but restored areas may not be able to support the species. Residential development also could result in surface disturbance of habitat and indirectly reduce adjacent suitable habitat, if landscaping introduced new vegetation species to undisturbed areas.

Long-term the surface disturbance from the Project and other surface disturbance could alter suitable habitat if invasive species were introduced or soils were damaged during development activities. In combination, the proposed wind farm and other past, present, and planned activities could reduce the larger regional population. However, these long-term indirect impacts from development could be reduced if BLM or other federal, state, or local agencies require adherence to development guidelines and weed management plans in areas disturbed by the Project and other actions.

Protected Arizona Native Plants

Similar to the cumulative effect described for BLM sensitive plants, surface disturbance to populations and habitats of the Las Vegas bear poppy, cottontop cactus, straw-top cholla, and Navajo Bridge cactus and other salvage restricted species, would be similar to those described in the previous subsection for the silverleaf sunray except there could be the loss of individual cottontop cactus and other salvage restricted plants. This would result in a minor direct impact if it reduced the number of individual plants within the analysis area. Preconstruction surveys to identify populations of these species can identify avoidance areas where practicable; however, in site-specific areas where this is not possible, individual plants can be transplanted to a suitable site within the analysis area. Cumulative impacts would be reduced by following native plant salvage measures developed in a native plant salvage plan (if required) for the Project and other surface disturbing activities on federal and state lands. Reclamation, plant salvage and revegetation would reduce long-term indirect impacts on individual plants and their habitats from the Project in combination with other past, present, and reasonably foreseeable actions. Depending upon the extent of surface disturbance, mineral and residential development on private lands where no federal or state permits are required could reduce the number of salvageable plants in the analysis area.

Federally Listed Wildlife

The Sonoran desert tortoise (or Morafka's desert tortoise) is a federal candidate species that inhabits the analysis area. Surface disturbance from the construction of solar energy facilities, transmission line construction and improvements, and roadway, mineral and residential developments could result in the cumulative loss of individuals and habitat. Under all alternatives the amount of short-term surface disturbance from the Project would be less than 0.1 percent of the analysis area with Alternative A having the greatest extent of surface disturbance. Long-term surface disturbance from the Project and other cumulative actions could reduce or degrade desert tortoise habitat where vegetation would be cleared for construction; however, the Project would result in a small long-term loss as reclamation and revegetation would restore habitats on all but about 339 acres that would be required for the Project. The construction of the Project and other actions also could result in the short-term loss of individuals and burrows; however, preconstruction surveys would reduce the effects on the individuals of the local population.

Transportation improvements, access roads for transportation, transmission lines, mining and residential development in addition to the Project could reduce the integrity of desert tortoise habitat and the loss of dispersal habitats in the analysis area. Long-term, the reduction in habitat integrity could result in indirect impacts to the tortoise population if it reduced habitat quality, limited movement, or altered forage. Vehicle traffic on roads including interior roads for the Project could increase the potential for vehicle mortality and the loss of individual desert tortoises in the analysis area. In combination, the proposed wind farm and other past, present, and planned activities could result in tortoise populations decreasing their natural potential; however, these could remain stable into the future, though they would require more intensive management to do so.

BLM Sensitive Wildlife

Cumulative impacts to BLM sensitive wildlife (5 bat species and 4 bird species) would not substantially differ from those described for bats and birds. The combined cumulative impacts from the Project with past, present, and reasonably foreseeable future actions likely would not result in population level impacts to the species but could increase the possibility of individual deaths near disturbance sites.

Arizona Wildlife of Concern

Cumulative impacts to other Arizona wildlife of concern (the Mexican free-tailed bat, Gila monster, and 20 bird species) would not substantially differ from those described for bats, wildlife, and birds. The combined cumulative impacts from the Project with past, present, and reasonably foreseeable future actions likely would not result in population level impacts to the species but could increase the possibility of individual deaths near disturbance sites.

4.16.4.2 Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future actions would have the same cumulative effects on biological resources as described under Alternatives A, B and C., Cumulative impacts from mining, livestock grazing, urban and rural community settlement and development, planning projects, OHV use, special designation areas, transmission line development, roads and highways, and other renewable energy developments could alter fire regimes, wildlife, and special status species habitat. The effects would be less than under the action alternatives due to the decrease in surface disturbance.

4.16.5 Cultural Resources

4.16.5.1 Alternatives A, B, and C

The analysis area for cumulative impacts was defined as extending 20 miles from the proposed Project Area, which is the extent of consideration of potential visual impacts on cultural resources. The time frame for cumulative direct impacts is generally permanent because disturbed or destroyed cultural resources are nonrenewable.

Only a small fraction of the approximately 2,100 square miles of the cumulative impact area has been surveyed for cultural resources, and information about cultural resources within the analysis area is incomplete. The cultural resource overview and survey plan that was prepared for the Project documented that site densities recorded by documented surveys varied considerably. The highest density was about 26 sites per square mile, but that survey covered only 200 acres and was in an area of intense historic mining activity around the Cyclopic Mine and nearby springs. The five most extensive surveys, which are more representative of the region, averaged about 4 sites per square mile (Rogge 2010). That suggests there could be on the order of 8,000 cultural resources within the analysis area. The results of the survey conducted for the Project indicates that a considerable proportion of the sites reflect historic transportation, grazing, and mining activities, and about half of the sites are likely to be important and retain integrity (Kirvan et al. 2011).

The identified past, present, and reasonably foreseeable residential and solar and wind projects are estimated to involve disturbance of approximately 100 square miles, which could disturb or destroy approximately 400 cultural resource sites or 5 percent of the cultural resources within the analysis area. Other past actions, such as the construction of roads and power lines, mining and ranching activities, and the filling of Lake Mead, disturbed or destroyed other cultural resources. Although the extent of those disturbances is not readily quantifiable, much of the analysis area remains undeveloped, and thousands of cultural resources probably remain intact but have yet to be discovered and recorded. Historical and archival documents, oral histories, and archaeological evidence indicate that the more intensively occupied ancestral Hualapai sites were located in the hills surrounding the immediate Project Area. If sites of that type do exist in the vicinity of the Project, increased human presence also may lead to cumulative impacts to those sites.

Almost half of the analysis area is managed to conserve natural and cultural resources, including the Joshua Tree-Grand Wash Cliffs and the Black Mountains Ecosystem Management ACECs, Mount Wilson and Mount Tipton Wildernesses, and Lake Mead NRA. Potential impacts of uses of public land managed by BLM and State Trust land also would be considered for projects proposed in the future, and measures to avoid or reduce or mitigate impacts on important cultural resources are likely to be implemented. Despite avoidance and mitigation, the proposed wind farm in combination with other planned or proposed activities could have a potentially additive impact on cultural resources over the long-term.

Indirect cumulative impacts resulting from most types of infrastructure development projects are likely to be long-term because those facilities probably would be present for decades. The proposed Project, combined with other reasonably foreseeable projects, including other planned renewable energy and residential development projects, could result in indirect cumulative impacts to traditional cultural resources and other cultural resources sensitive to visual impacts within the cumulative impacts analysis area, especially those resources with views to the south and east of the Project Area, where multiple projects are planned.

The cultural resources that would be affected by the proposed wind farm action alternatives are a small fraction of a percent of the cultural resources within the cumulative impact analysis area, and impacts on those resources would be avoided or mitigated to the maximum extent practicable. If disturbance is unavoidable, recovery and preservation of artifacts and information and other potential mitigation measures would be implemented in accordance with Section 106 consultation. Any residual impacts would not represent a significant cumulative impact to those of other past, present, and reasonably foreseeable future actions.

4.16.5.2 Alternative D – No Action

The No Action alternative would reduce the potential of impacts on cultural resources in addition to those of reasonably foreseeable projects in the cumulative impacts analysis area, which are primarily utility and residential projects south and east of the proposed wind farm. The reduction of direct impacts would be minor because only a few cultural resources would be disturbed by construction and operation of the proposed wind farm and they represent only a fraction of the percent of the cultural resources within the analysis area. The No Action alternative would result in a greater reduction of potential indirect visual impacts on cultural resources within the cumulative impacts analysis area because strings of tall wind turbines would not be constructed over a large area northwest of where other future residential and renewable energy projects are most likely to be built.

4.16.6 Paleontological Resources

4.16.6.1 Alternatives A, B, and C

Projects involving the construction of new facilities within the vicinity of the Project Area include renewable energy projects, mining, electrical transmission lines, transportation facilities/highways, and urban and rural development. Of these, urban and rural development would have the greatest potential impact to paleontological impacts in the White Hills area of Mohave County, because this type of ground disturbance occurs on private land and would not require the evaluation and monitoring activities associated with federal actions. Paleontological resources are affected primarily from subsurface soil disturbances, which include grading, digging for foundations, and trenching for utilities. These activities, from urban and rural development in combination with the proposed Project, could result in a permanent cumulative decrease in the overall amount and density of paleontological resources which are nonrenewable resources.

4.16.6.2 Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable projects and actions would have the same cumulative effect on paleontological resources as described under Alternatives A, B and C. Subsurface soil disturbance within the cumulative impact analysis area could result in a decrease in the amount and density of paleontological resources, but this would be less than those under the action alternatives.

4.16.7 Land Use

4.16.7.1 Alternatives A, B, and C

The cumulative impact analysis boundary is the Project boundary plus a 20-mile buffer including electric transmission systems. The potential for cumulative land use, recreation, and livestock grazing impacts exists where there are multiple planned projects in the same area. Cumulative impacts on land use could result from numerous existing and proposed industrial developments adjacent to the Project Area, including, mining, renewable energy, and transmission lines. Cumulative impacts to mining were discussed in Section 4.16.2, and are not repeated here.

Implementation of the proposed Project and proposed future renewable energy development projects (such as the Dolan Springs wind project and the Table Mountain and Mountain Spring solar energy projects) and future transmission lines would add new industrial facilities to the area. Increased renewable energy development could drive the demand for the use of new and existing right-of-way corridors for transmission lines, pipelines, distribution lines, and roads to support the construction of the planned facilities. As industrial development occurs, the existing rural environment would become increasingly industrial and contribute to changing the historic rural lifestyle on adjacent residential properties and could encourage future collocation of other industrial projects. In combination with the proposed Project, other renewable energy or industrial developments could cumulatively diminish the visual quality of the recreation setting and the recreation experience to users of the area over the long term based on the additive effects of the projects (and additional associated infrastructure).

The Lake Mead NRA General Management Plan describes the area's mission, purpose, and significance, and defines the resource conditions and visitor experiences that should be achieved and maintained over time. Over the long term, the proposed Project combined with future renewable energy development and residential communities could conflict with the plan's objective to preserve the visual quality of recreational areas, such as park roads, the lake surface, and hiking routes.

Implementing the proposed Project and proposed future renewable energy development projects, transmission lines, and residential communities could indirectly result in short-term cumulative impacts on those visiting the proposed wilderness areas in Lake Mead NRA. Construction of associated infrastructure could increase vehicle traffic and cause temporary delays for those visitors trying to access the proposed wilderness areas. Impacts would be indirect, minor, short-term and occur only during construction. If residential communities and additional access roads are constructed near the proposed wilderness areas, this could indirectly increase or improve access for those visiting the proposed wilderness areas. Impacts would be indirect, minor, and long-term.

If construction on several proposed actions in close proximity occurred simultaneously, cumulative short-term impacts on recreation and residential property could occur from noise and increased traffic from industrial construction vehicles. Impacts associated with increased noise and traffic from construction activities would be temporary, but there may be residual traffic and noise following construction from operational use and/or activities associated with the new development.

In combination with the proposed Project, if future master planned communities, including the Ranch at White Hills and Mardian Ranch, are developed, this could contribute to a conversion of land from undeveloped open space lands to residential and/or commercial lands. Similar to the addition of other renewable developments, these projects together could cumulatively diminish the visual quality of the recreation setting and experience to users of the federal and state lands in the area over the long term.

A recent zoning proposal for a helicopter landing site nearby was withdrawn; however, according to Mohave County representatives, it is likely that there will be similar proposals involving helicopter tours. The location of the landing sites may be affected because aircraft would not be able to operate at low levels within the airspace over the Project Area because of the obstructions, which could influence take-off and landing patterns. The turbines would add an obstruction to small aircraft that may fly near or over the Project Area. In addition, the distribution line that may extend along US 93 and along the primary access road to support the O&M building would add a new obstruction and potential flight safety concern. In combination, the proposed Project and a helicopter tour operation, if one were proposed, could not occur in the same location, but the availability of undeveloped land in the region would not preclude helicopter landing sites in the broader area. The opportunities for recreational helicopter touring would not be affected, but the Project components in combination with helicopter tours could contribute to noise and visual intrusions which could influence recreational experiences, particularly for those seeking a natural setting.

4.16.7.2 Alternative D – No Action

Under the No Action alternative, implementation of proposed future renewable energy projects, transmission lines, industrial facilities, and residential communities would contribute to a land use conversion from undeveloped open space lands to residential and/or commercial lands. The associated infrastructure could reduce the visual quality of the recreation setting and experience. If the projects include new access roads, this could indirectly improve access and opportunities for motorized recreation. Loss or damage to vegetation during construction could indirectly impact livestock forage availability in localized areas if projects are constructed within grazing allotments. Construction of proposed projects could increase vehicle traffic and cause temporary delays for those visitors trying to access Mount Wilson Wilderness Area. The associated cumulative impact from these actions would be similar to the cumulative impacts as described under the Action Alternatives, except disturbance at the Wind Farm Site would not contribute to the land use changes, and cumulative impacts would not occur on the private airstrip.
Transportation and Access

4.16.7.3 Alternatives A, B, and C

The proposed Project site, is located in an area with few major regional highways (US 93) combined with a series of local access roads. Planned actions, including the proposed Project, other renewable energy projects, and future master planned communities, would contribute to an expanded network of access routes, but would also add to the amount of traffic on existing routes by bringing more people to the area. Construction of the other renewable energy projects and master planned communities is not expected to overlap with the construction of the proposed Project, which limits the potential for temporary additive effects on transportation and access in the area. In the case of the proposed Project and other energy projects, the increase in traffic would be mostly limited to the construction or decommissioning phases (short-term impacts), whereas residential development would have a long-term effect on traffic volumes. However, in combination with the proposed Project, traffic from the proposed residential development could create temporary cumulative impacts on transportation and access during the decommissioning of the Project.

ADOT is in the process of widening and improving US 93 between Wickenburg and the Hoover Dam, which would better accommodate traffic flow when industrial development projects require the use of US 93 to bring equipment and materials to construction sites. All improvements to US 93 within the identified cumulative impacts area have been completed, and no additional projects are planned at this time. Consequently, during construction of the Project under the action alternatives traffic flow in this area would not be compromised by the combination of slow-moving vehicles and oversized loads being hauled through road construction zones.

The implementation of the roadway improvement project to widen and improve US 93 from Wickenburg to Hoover Dam as well as the recent construction of the Hoover Dam bypass would provide a long-term beneficial effect to the residents and traveling public in the area of influence. Roadway improvements, including the transformation of the existing US 93 into a divided four-lane highway along its entire 200-mile stretch, would provide increased safety when considering the potential increase in planned housing developments and other renewable energy projects in the area of influence.

4.16.7.4 Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable project and actions would have the same cumulative effect on transportation as described under Alternatives A, B and C. However, there would be no impacts related to increased traffic or delays due to the proposed Project since the Project would not be built under Alternative D.

4.16.8 <u>Social and Economic Conditions</u>

4.16.8.1 Alternatives A, B, and C

Cumulative impacts of the Project and other planned projects on socioeconomic conditions, including population, housing, employment, income, and quality of life are described in this section. Projects considered for the cumulative analysis include two proposed solar energy projects: Mountain Spring Solar Energy and Table Mountain Renewable Energy Project, as well as the Dolan Springs Wind Energy Project. There are also four proposed or approved residential development communities considered in the analysis: The Ranch at Red Lake, White Hills Central, the Villages of White Hills, and the Ranch at White Hills and Mardian Ranch. These projects would convert lands in the County from undeveloped open space and increase the industrial, commercial, and residential land uses in the study area, changing the area from predominantly rural conditions and affecting the rural way of life in the area.

Cumulatively, the developments in Mohave County, including the proposed Project, would increase employment and income opportunities as well as increase population and housing in the region over the long term. Associated with increased population, there would be expected increases in traffic and noise. There would also be decreased acreage of open space, with potential reduction in semi-primitive outdoor recreation and wildlife viewing opportunities, as well as potential temporary reduction in air and water quality conditions within and near the Project vicinity, especially during construction periods.

4.16.8.2 Alternative D – No Action

Under the No Action alternative, implementation of proposed future renewable energy projects, transmission lines, industrial facilities, and residential communities would contribute to the employment and income opportunities, and increase in population and housing over the region. The associated cumulative impact from these actions would be similar to the cumulative impacts as described under the Alternatives A, B, and C, except there could be less effect on employment and income opportunities.

4.16.9 Environmental Justice

4.16.9.1 Alternatives A, B, and C

Cumulatively, the environmental justice effects of the proposed renewable energy projects and proposed residential development project in Mohave County would tend to increase employment and income opportunities in the region, which may help to reduce the proportion of low income households in the area and thereby reduce environmental justice effects over the long term. There could also be potential temporary reductions in air and water quality conditions within and near the Project vicinity, especially during construction periods, as well as decreased acreage of open space, with potential reduction in semi-primitive outdoor recreation and wildlife viewing opportunities. There may therefore be environmental justice impacts related to quality of life over the long term. Due to the rural nature of the area as well as the types of foreseeable future developments, it is anticipated that potential environmental quality impacts would result in negligible environmental justice effects related to human health in the long term.

4.16.9.2 Alternative D – No Action

Under the No Action alternative, implementation of proposed future renewable energy projects, transmission lines, industrial facilities, and residential communities would contribute to a land use conversion from undeveloped open space lands to residential and/or commercial lands. The associated cumulative impact from these actions would be similar to the cumulative impacts as described under the Alternatives A, B and C, except disturbance at the Wind Farm Site would not contribute to the possibility of income and employment opportunities, not add to the possibility of long term environmental justice impacts related to quality of life over the long term.

4.16.10 Visual Resources

4.16.10.1 Alternatives A, B, and C

The analysis area for cumulative impacts was defined by a 20-mile radius surrounding the proposed Project. The analysis focused on the viewshed of the proposed Project within the Detrital Valley; however, areas outside the viewshed were considered if a clear nexus with direct or indirect impacts of the proposed Project would exist. The cumulative impacts analysis was based on the extent to which the natural landscape character of the analysis areas would be transformed to a more developed character as a result of past, present, and reasonably foreseeable future actions. The extent of expected change to the existing landscape character was based on assumptions of intensity and geographic extent of past, present, and reasonably foreseeable future actions. The intensity of impacts was defined by the expected level of visual contrast, and geographic extent of perceived contrast.

Past actions in the analysis areas that have influenced visual resources are limited to the Town of White Hills (established in 1890), the US 93 highway corridor, local connector roads, access roads leading to the Lake Mead NRA and Grand Canyon NP, and the high voltage Liberty-Mead and Mead-Phoenix transmission lines. Development outside the Valley includes the Hoover Dam and Lake Mead reservoir, including recreational facilities within the NRA. These actions have generally resulted in low intensity and localized impacts to visual resources; however, the contrast of Lake Mead against the surrounding arid landscape would be considered strong. Several reasonably foreseeable future actions are planned for the analysis area that may affect visual resources, including residential development (Ranch at Red Lake, the Ranch at Temple Bar, the Villages of White Hills, and the Ranch at White Hills and Mardian Ranch) and renewable energy projects (Mountain Spring Solar Energy Project, the Dolan Spring Wind Energy Project, and the Table Mountain Renewable Energy Project).

The proposed Project, combined with other reasonably foreseeable utility-scale energy projects would result in strong visual contrast and a transformation of the area to a more industrial setting when viewed during both day and night conditions over the long term. The expansion of residential areas would expand the footprint of developed areas through the addition of structures, roads and electrical distribution lines and associated visual contrast. The expanded developed area would be particularly evident during night time conditions, when lighting would extend from the Dolan Springs Wind Energy Project southwest to the Mountain Spring Solar Energy Project. Impacts of combined actions would be perceived as strongest where viewed by sensitive viewers in the White Hills residential area, traditional areas identified by the Hualapai Tribe, and the Mount Tipton and Mount Wilson Wilderness Areas. Indirectly, these changes could result in a long-term reduction in visual sensitivity within the affected landscape and could increase visual sensitivity in adjacent areas where development is limited.

4.16.10.2 Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable projects and actions would have the same cumulative effect on visual resources as described under Alternatives A, B and C. Renewable energy projects south and east of the Project area and proposed and community developments could have cumulative effects on sensitive viewers in the White Hills residential area and in the traditional cultural area of Senator Mountain depending on which direction they would be looking. However, compared to Alternatives A, B and C, the cumulative effect would be less for the sensitive viewers in the White Hills residential area and in the traditional cultural area of Senator Mountain.

In the proposed Project area, and the land to the north and west, there are no reasonably foreseeable future land uses except designating portions of Lake Mead NRA as wilderness. Therefore those areas would retain the natural landscape with the associated views. Under the No Action alternative, viewers at the traditional cultural areas of Squaw Peak, and Mata Thija, along Temple Basin Road, and in the Lake Mead NRA would not experience any change from the existing or reasonably foreseeable conditions.

4.16.11 Public Safety, Hazardous Materials, and Solid Waste

4.16.11.1 Alternatives A, B, and C

Elements comprising potential cumulative impacts include occupational and public health and safety, and hazardous materials and solid waste.

Occupational and Public Health and Safety

The area of influence for cumulative impacts with regard to occupational and public health and safety is the Project boundary, along travel routes US 93 between Hoover Dam, the intersection of Pierce Ferry Road and White Hills Road, and unpaved, unmarked access roads within 5 miles of the Project boundary.

Planning and preliminary project activities are underway for the identified renewable energy projects within the area of influence of the study area. Each of these new facilities would likely require the presence of heavy equipment and use of the local roads for transport of construction materials and materials associated with plant operations, creating temporary congestion on the roadways that would increase the probability for accidents during construction. An increase in employees traveling to and from work also would contribute to the risk of increased roadway accidents, particularly if construction of multiple facilities occurred simultaneously, which is not expected at this time. However, should that occur, these additive cumulative impacts could result from those planned projects in conjunction with the proposed Project.

The future master planned communities and residential developments are within close proximity to the Project Area, which would result in the potential for an increase in the number of residents using the local roadways. Combined with the increase in large trucks with oversized loads related to the potential renewable energy projects, a greater risk of traffic accidents would occur. However, the planned communities may not be developed prior to the project construction, but they could be in place at some time during operation or by the time of decommissioning. As a result, the combination of additional vehicles and more roadway users could increase production of dust, resulting in temporarily reduced visibility in the area and the potential for adverse health impacts to occur.

It is likely that most of the proposed renewable energy projects would use and/or dispose of hazardous materials and wastes. While compliance with federal, state, and local requirements for handling and disposal of these materials would be required, it is possible that an accidental spill could occur, resulting in slightly additive impacts in the long term when combined with the proposed Project.

Hazardous Materials and Solid Wastes

The various renewable energy projects planned near the Project site would likely utilize or produce many of the same hazardous materials that were discussed in Section 4.13.2.3 for this Project, such as lubricants, fuels, combustion emissions, and explosives, and would generate some hazardous wastes that would need to be disposed of at a regulated facility. The risk of accidental hazardous materials and waste spills would increase, but with proper training and observation of federal, state, and local requirements, little or no adverse impact to surrounding properties would be anticipated.

The implementation of the roadway improvement project to widen and improve US 93 from Wickenburg to Hoover Dam as well as the recent construction of the Hoover Dam bypass would provide a long-term beneficial effect to the residents and traveling public in the area of influence. Roadway improvements, including the transformation of the existing US 93 into a divided four-lane highway along its entire 200-mile stretch would provide increased safety when considering the potential increase in planned housing developments and other renewable energy projects in the area of influence.

4.16.11.2 Alternative D – No Action

Under the No Action alternative, the past, present, and reasonably foreseeable projects and actions would have the same cumulative effect on occupational and public health and safety as described under Alternatives A, B and C. If the other planned renewable energy projects in the area of influence of the study area are constructed, the increased risk of roadway accidents due to the presence of heavy equipment and large trucks used for construction would be similar to Alternatives A, B and C. However, under the No Action Alternative, the possibility of simultaneous construction activities would be removed, which would lower the risk of roadway accidents. Likewise, if the future master planned communities are developed, there is also potential for increased residential traffic associated with those communities and a greater risk of roadway accidents.

The potential for accidental spills or contamination of hazardous materials is also present from the other renewable energy projects and mining operations, but all projects would be required to use and/or dispose the materials and wastes in accordance with federal, state, and local requirements.

4.16.12 Microwave, Radar, and Other Communications

4.16.12.1 Alternatives, A, B, and C

Because no impact on microwave radar and other communications would occur as a result of the proposed project or alternatives, no cumulative impacts are analyzed.

4.16.12.2 Alternative D – No Action

Because no impact on microwave radar and other communications would occur as a result of the proposed project or alternatives, no cumulative impacts are analyzed.

4.16.13 <u>Noise</u>

4.16.13.1 Alternatives A, B, and C

Known existing and future development in the vicinity of the Project that is more than five miles away from the nearest turbine associated with the Project would be sufficiently distant to support a reasonable expectation of no cumulative noise impact resulting from any project alternative under consideration. This is due to natural sound attenuation primarily from geometrical divergence, ground absorption and air absorption.

Construction of new residences and commercial enterprises occurring on current privately-owned parcels or subdivisions that are within 5 miles distance from the project boundary would create noise that is temporary, resulting in additional noise in the short term during construction, particularly if construction occurs simultaneously. However, this temporary noise is excluded from Mohave County Zoning Ordinance limits. The planned residences and commercial enterprises would introduce potential sources of operation noise such as heating, ventilation, and air conditioning equipment; vehicle operation; generators; pumps; other equipment; and human activities that would be logarithmically additive over the long term, which would help raise ambient outdoor sound above existing levels that currently include contribution from existing land uses and other natural and man-made sources (e.g., road traffic, aircraft overflights, etc.). The actual rise in ambient sound level would depend on proximity of the receptor or measurement location to the new noise source. In addition, in combination, the proposed Project may influence other potential actions in the area that could generate additional noise (i.e., helicopter tours), resulting in an indirect cumulative reduction in potential noise.

The contribution of the Project's turbine operation noise towards a cumulative or future ambient outdoor sound level of 45 dBA L_{eq} (i.e., the suggested guidance threshold considered appropriate for residential areas) that includes noise from these existing proposed and future developments is expected to be negligible beyond the outermost 35 dBA L_{eq} contour displayed in Maps 4-1 through 4-6 from Section 4.15.2. This is because the logarithmic sum of two sound levels that differ by more than 10 dBA is essentially the larger of the two.

The likelihood of the Project making a significant contribution to a cumulative level of 45 dBA L_{eq} depends on the receptor or measurement location proximity to the Project and the magnitude and proximity of other sources. For example, if anticipated noise from the Project was 42 dBA L_{eq} at the boundary of a residential land use, a non-project ambient or background level of 42 dBA L_{eq} would produce a result of 45 dBA L_{eq} (i.e., the logarithmic sum of two equal sound levels is 3 dBA higher than one of the levels).

As the logarithmic addition of two equal levels can never be greater than 3 dBA, the Project's anticipated cumulative effect would never be greater than 3 dBA—a modest gain considered slight but detectable by the average healthy human ear. In other words, as inequity between the Project noise and non-Project background sound grows (which means either the Project noise or the non-Project background sound would be more dominant at a given location), the cumulative effect diminishes towards zero.

4.16.13.2 Alternative D – No Action

Under the No Action alternative, development of new residential and commercial land uses would occur as described under the Action Alternatives. Reasonably foreseeable future projects would contribute to the amount of development in the area, raising the ambient sound level of the Project vicinity. The cumulative rise in ambient sound level depends on receiver location and the types and proximity of noise generating activities. For example, residential and industrial (renewable energy projects, mining, etc.) development could influence the locations of recreational activities (such as driving off-road vehicles) that also create noise. Therefore, the pattern of development would influence the ambient sound level for any given location.

4.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A commitment of resources is irreversible when its primary or secondary impacts limit the future option for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for later use by future generations, and represents a permanent effect.

Implementation of any of the action alternatives involving construction would require a commitment of natural, physical, human, and fiscal resources. Construction and operation of any of the action alternatives would require similar commitment of these resources. This discussion focuses on:

- The Project's use of nonrenewable resources during construction and operation, which includes fossil fuels, electricity, water, mineral materials, cement products, and labor; and
- The changes expected to occur as a result of the proposed Project including the commitment of land for the proposed Project, physical changes in the environment, effects on human populations, and fiscal changes.

For all the action alternatives, Alternative A would represent the greatest impact to irreversible and irretrievable commitments of resources, as well as unavoidable adverse impacts because this alternative would have the largest footprint and number of turbines.

Alternatives B and C would have smaller construction and operation impacts because the footprint of the Project, and the associated resources used to construct the Project would be less. It should be noted however, that the construction of fewer turbines would mean constructing turbines with higher generation capacity to satisfy the interconnection agreements and Western's tariff. The amount of energy used by consumers over the life of the proposed Project has been presumed to remain constant, or rise, which would mean that the energy produced to meet this demand may come from either renewable resources, such as a different wind farm, or non-renewable resources, such as a coal fire plant. In this context, Alternatives B and C would represent an overall larger negative impact, and an irreversible and irretrievable commitment of resources, because although construction impacts would be less, additional alternative sources for energy would be required.

The No Action alternative would represent no irreversible and irretrievable commitment of resources or unavoidable adverse impacts in relation to the proposed Project. However, the No Action alternative may represent possible impacts to resources on a regional basis because the amount of energy required for the demand would need to be produced from other sources. It would be speculation to say that the demand and subsequent supply would be from other renewable energy sources.

Construction of the proposed Project would require the use of fossil fuels for construction vehicles, equipment, and construction-worker vehicles. Electricity would also be used at construction trailers or by portable generators during project construction. Wind is a renewable resource that would not be depleted or altered by the action alternatives and could offset the need to consume fossil fuels.

Construction of the proposed Project would require the use of various types of raw building materials, including cement, aggregate, steel, electrical supplies, piping, and other building materials such as metal, stone, sand, and fill material. Additionally, the fabrication and preparation of these construction materials would require labor and natural resources. Utilization of these resources would be irretrievable. However, these resources are readily available at this time, and adverse effects on their continued availability would not be expected.

Inert underground electrical cables and underground concrete turbine pads may be removed or left in place depending on the requirements in the BLM ROW grants. This would represent an irreversible and irretrievable commitment. Construction and operation of the proposed facilities would require labor, which would be otherwise unavailable for other projects. The commitment of labor is considered irretrievable. Due to the current economic downturn in the area, and country as a whole, this commitment of labor, while irretrievable, would not be considered an adverse effect, because the Project would be supplying much needed employment. Furthermore, fiscal resources would be irretrievably committed to construction and operation of the proposed project. These funds would then not be available for other projects and activities.

In addition to the resources used in construction and operation of the proposed Project, there would be some irreversible and irretrievable loss of existing resources in the impact areas. The loss of productivity (i.e., forage, wildlife habitat) from lands devoted to Project facilities would be an irreversible and irretrievable commitment during the time that those lands are out of production and until they are successfully revegetated. Most of the land would be returned to production after restoration and revegetation; however, the vegetation community may take several growing seasons to fully recover given the arid nature of the landscape. The length of time required for vegetation to recover would vary, depending on the final approved method of reclamation, and any changes that may occur in reclamation processes during the various reclamation phases (post-construction, and decommissioning).

Impacts on geological resources could result from surface and subsurface disturbing activities. Both surface and subsurface geology could be damaged (fractured) or destroyed during project construction activities that disturb bedrock such as coring, trenching, blasting, clearing, and grading. Blasting, coring, and trenching would fracture and permanently alter bedrock resulting in irreversible and irretrievable impacts on geology. The type of and magnitude of bedrock disturbance would be different for each of the Project features, and would be contingent of the location of the individual item.

The Project would use gravel mined from the Detrital Wash, and this use would represent a depletion of the resource, which is irretrievable and irreversible. However, due to the abundance of gravel, and relatively low demand for this resource in the area, this impact would not be considered a substantial loss.

The permanent loss of soil and vegetation within small and highly localized areas that would not be reclaimed would result in irreversible and irretrievable impacts on soils and vegetation.

Surface water, groundwater, and ephemeral washes could be impacted during Project construction activities that disturb soil and bedrock. Blasting, coring, and trenching could increase the potential for sediment erosion and transport by removing stabilizing vegetation and increasing runoff during storm events, and possibly alter the natural flow of water and redirect the flow path of the water resulting in irreversible and irretrievable impacts on hydrology. Each action alternative would have the potential to impact hydrology on all, or portions of areas associated with each project feature.

Groundwater pumping for Project construction activities would remove up to about 75 acre-feet from storage in the Basin-Fill aquifer of the Detrital Valley. These withdrawals would be irretrievable since they would either be used for consumptive purposes, such as mixing cement, or would be applied for dust control and lost to evapotranspiration. Groundwater losses associated with the Project would be replenished very slowly due to limited natural recharge that occurs mainly in mountain-front areas. However, projected withdrawals represent a very small portion (0.03 percent) of potentially recoverable groundwater in the township where the pumping wells are located. As such, the consequences of this impact on the Detrital Valley Basin-Fill aquifer would be nearly imperceptible, and natural recharge would, over time, replenish the aquifer.

Archaeological sites are a finite resource and cannot be replaced once damaged or destroyed. All identified sites have been determined to be moderate to negligible/minor concerning impacts to the resource. However, if new archaeological sites are found during construction, an assessment of impacts would be required. Consequently, while none have been identified at this time, the project would result in irreversible and irretrievable impacts on cultural resources.

Although no paleontological localities are known in the Project Area, the absence of records does not indicate the absence of the possibility of their occurrence. Geologic deposits in the area are of a type that could produce paleontological resources. If any are uncovered during construction a monitoring and mitigation program would be developed, but the movement of the artifacts would represent an irreversible and irretrievable impact.

4.18 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). Effects on resources are often characterized with respect to their being of a long or short duration. The impacts and use of resources associated with the proposed Project are described in earlier sections in this chapter and are not repeated in this section. This section discusses the tradeoffs in the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity of resources, which would not differ appreciably among the action alternatives.

The Project would require commitments of resources as discussed in the previous resource sections, for the life of the Project through the conversion of undeveloped land to a wind energy facility. Impacts during construction would be relatively short term (12 to 18 months) and would be mitigated by BMPs and stipulations, including requirements for habitat restoration, which would help minimize the impacts on long-term productivity.

The impacts during operations would constitute long-term uses of the environment; however, these uses would not conflict with relevant land use plans administered by BLM, Reclamation, and Mohave County. The impacts of short-term use during decommissioning also would be mitigated by required habitat restoration activities, which would result in making the land suitable for other uses.

The short- and long-term use of the environment from the Project can be compared to the long-term maintenance and enhancement associated with the benefits provided by the Project. Wind energy would provide clean, renewable energy consistent with federal and state goals to increase production of renewable energy to help reduce dependence on fossil fuels.

Impacts on transportation and access and economics would occur primarily during construction and decommissioning; although economic benefits, to a lesser extent, could extend throughout operation of the Project. Boosts to the local economy would be realized through labor, purchase of supplies, and through the needs of workers associated with constructing and decommissioning the Project.

Although the Project would not require a large amount of land to be taken out of production, relative to the amount of undeveloped land in the area (See Section 2.2.2), losses of vegetation, displacement of animals and habitats from natural productivity to accommodate Project infrastructure and temporary disturbances during construction would occur. Constructing the Project would result in short-term and long-term disturbances of biological habitats and could cause long-term reductions in the biological productivity in localized areas near facilities. Long-term impacts on wildlife productivity would equate to impacts on populations. The impacts on mature vegetative communities and associated wildlife habitat would last until the vegetation was reestablished to current conditions.

4.19 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

The BLM encourages the development of wind energy within acceptable areas, consistent with the Energy Policy Act of 2005 and the BLM Energy and Mineral Policy (August 26, 2008).

4.19.1 Energy Analysis

Section 4.17 discusses the irretrievable and irreplaceable energy requirements associated with the proposed Project.

Chapter 1 of this EIS discusses the energy requirements under the National Energy Policy Act which establishes a goal for the Secretary of the Interior to approve 10,000 MW of electricity from non-hydropower renewable energy projects located on public land. Chapter 1 also discusses the energy requirements of BLM and Reclamation under various laws, policies and orders. Additionally, Arizona, Nevada and California have all established standards for generation of energy from renewable sources. Based on these requirements, the analysis for energy requirements involves discussing the ability of the Project to contribute to the federal and state goals and standards.

For any wind farm project, conservation potential can be discussed in two separate areas. The first conservation potential involves the ability for conservation of non-renewable resources through the use of renewable resources to provide basic energy needs to people. All energy technologies have some negative impact on the natural environment, and the second conservation potential involves the ability of the Project to promote the conservation of species that may be impacted by the Project.

4.19.2 Conservation Potential

The Project would be considered a contributor toward reaching the federal and state goals and standards for meeting energy requirements. BP Wind Energy has applied to generate at least 425 MW, and up to 500 MW of power at the proposed Mohave County Wind Farm Project and has filed interconnection agreements with Western that commit the firm to this generation capacity if the Project is approved (see Section 2). The substitution of fossil fuels with the increasing use of renewable energy sources is fundamental to reducing emissions of greenhouse gases.

The production of either 425 MW or 500 MW would represent a direct conservation potential because the energy produced would not consume non-renewable resources.