8.3 GILLESPIE

8.3.1 Background and Summary of Impacts

8.3.1.1 General Information

The proposed Gillespie SEZ is located in Maricopa County in west–central Arizona (Figure 8.31.1-1). The SEZ has a total area of 2,618 acres (11 km^2). In 2008, the county population was 3,958,263. The nearest town is Arlington, about 7 mi (11 km) northeast of the SEZ, with a population of less than 500, while the larger town of Buckeye is located about 17 mi (27 km) northeast and has a population of more than 50,000. Phoenix, Arizona, is approximately 50 mi (48 km) northeast of the SEZ.

The nearest major road access to the SEZ is via Old U.S. 80, which runs north–south 3 mi (5 km) from the eastern tip of the Gillespie SEZ. The nearest railroad is a branch of the UP Railroad that passes within 0.5 mi (0.8 km) of the northwestern edge of the SEZ, and the nearest stop is in Buckeye, 20 mi (30 km) northeast of the SEZ. The nearest airport is the Buckeye Municipal Airport, 20 mi (32 km) from the SEZ, which does not have scheduled commercial passenger service. Phoenix Sky Harbor International Airport is located 59 mi (95 km) away in Phoenix, Arizona.

A 500-kV transmission line runs within 0.5 mi (0.8 km) of the proposed SEZ. It is assumed that this existing transmission line would provide access from the SEZ to the transmission grid (See Section 8.3.1.1.2).

As of February 2010, there were no ROW applications for solar projects within the SEZ; however, there were four ROW applications for solar projects that would be located within 50 mi (80 km) of the SEZ. These applications are discussed in Section 8.3.22.2.1.

The proposed Gillespie SEZ is undeveloped and rural, with few permanent residents in the immediate area. The SEZ is located to the southeast of the Harquahala Basin, in a valley between the Gila Bend Mountains to the southwest and Centennial Wash to the northeast. Land within the SEZ is undeveloped scrubland characteristic of a semiarid desert valley.

The proposed Gillespie SEZ and other relevant information are shown in Figure 8.3.1.1-1. The criteria used to identify the proposed Gillespie SEZ as an appropriate location for solar energy development included proximity to existing transmission or designated corridors, proximity to existing roads, a slope of generally less than 2%, and an area of more than 2,500 acres (10 km^2). In addition, the area was identified as being relatively free of other types of conflicts, such as USFWS-designated critical habitat for threatened and endangered species, ACECs, SRMAs, and NLCS lands (see Section 2.2.2.2 for the complete list of exclusions). Although these classes of restricted lands were excluded from the proposed Gillespie SEZ, other restrictions might be appropriate. The analyses in the following sections evaluate the affected

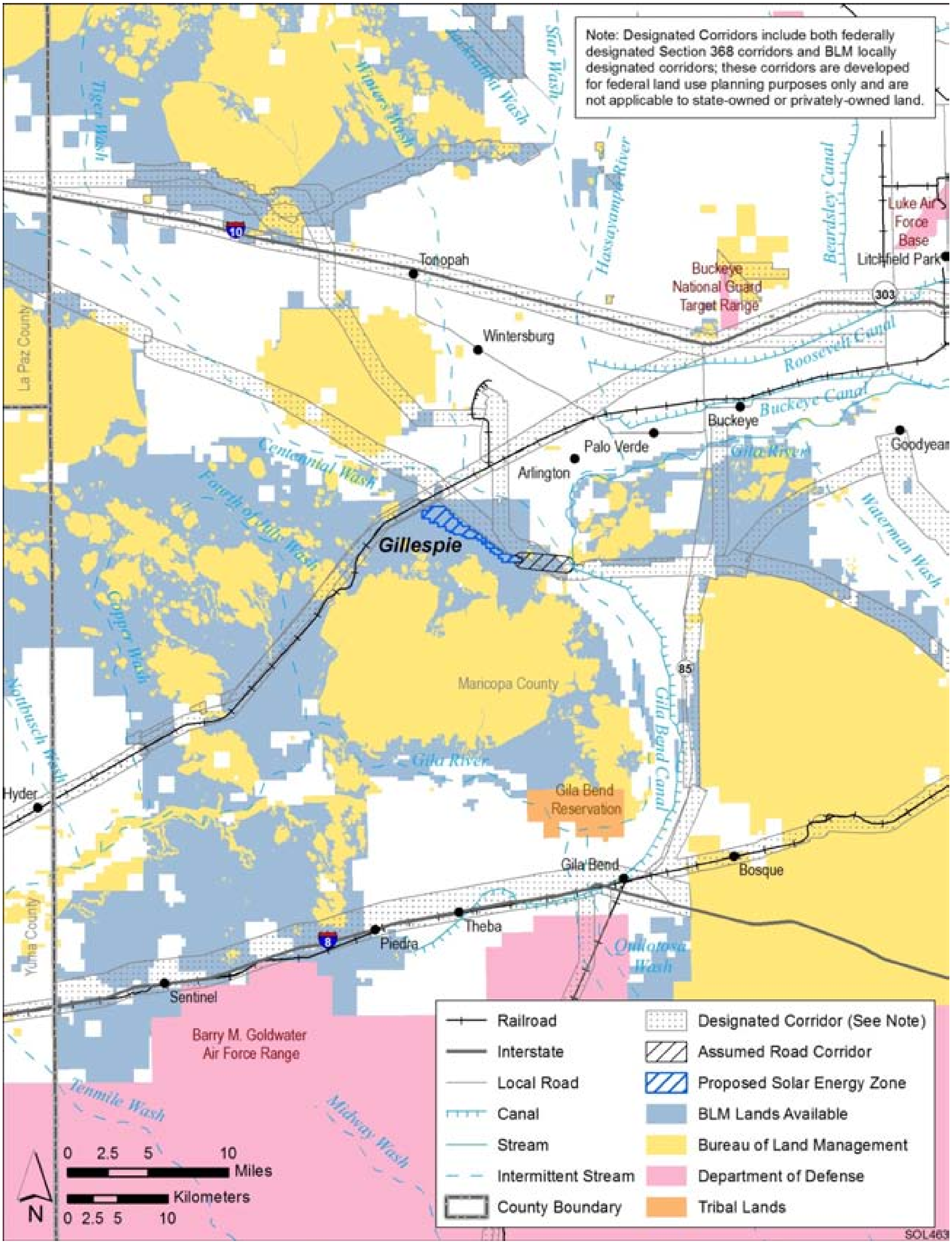

FIGURE 8.3.1.1-1 Proposed Gillespie SEZ

environment and potential impacts associated with utility-scale solar energy development in the proposed SEZ for important environmental, cultural, and socioeconomic resources.

As initially announced in the *Federal Register* on June 30, 2009, the proposed Gillespie SEZ encompassed 3,970 acres (16 km^2). Subsequent to the study area scoping period, the boundaries of the proposed Gillespie SEZ were altered somewhat to facilitate BLM administration of the SEZ area. The revised SEZ is approximately 1,352 acres (5.5 km^2) smaller than the original SEZ as published in June 2009.

8.3.1.2 Development Assumptions for the Impact Analysis

Maximum solar development of the Gillespie SEZ is assumed to be 80% of the SEZ area over a period of 20 years, a maximum of 2,094 acres (8.5 km^2). These values are shown in Table 8.3.1.2-1, along with other development assumptions. Full development of the Gillespie SEZ would allow development of facilities with an estimated total of 233 MW of electrical power capacity if power tower, dish engine, or PV technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 419 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

Availability of transmission from SEZs to load centers will be an important consideration for future development in SEZs. The nearest existing transmission line is a 500-kV line that runs less than 1 mi (1.6 km) west of the SEZ. At full build-out capacity, it is possible that new

TABLE 8.3.1.2-1 Proposed Gillespie SEZ—Assumed Development Acreages, Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S. or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line ROW and Road ROW	Distance to Nearest Designated Corridor[e]
2,618 acres and 2,094 acres[a]	233 MW[b] and 419 MW[c]	Old U.S. 80 3 mi[d]	<1 mi and 500 kV	0 acres and 22 acres	Adjacent

[a] To convert acres to km^2, multiply by 0.004047.

[b] Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km^2/MW) of land required.

[c] Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km^2/MW) of land required.

[d] To convert mi to km, multiply by 1.609.

[e] BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

transmission and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Gillespie SEZ to load centers; however, at this time the location and size of such new transmission facilities are unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5. Project-specific analyses would need to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

For purposes of analysis in the PEIS, it was assumed that the existing 500-kV transmission line, which runs very close to the proposed SEZ (within 0.5 mi [0.8 km]), could provide access to the transmission grid, and thus no additional acreage disturbance for transmission line access was assessed. Access to the existing transmission line was assumed, without additional information on whether this line would be available for connection of future solar facilities. If a connecting transmission line were constructed in the future to connect facilities within the SEZ to a different off-site grid location from the one assumed here, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades if they are needed.

An additional 22 acres (0.9 km^2) would be needed for new road access to support solar energy development in the Gillespie SEZ, as summarized in Table 8.3.1.2-1. This estimate was based on the assumption that a new 3-mi (5-km) access road to the nearest major road, Old U.S. 80, would support construction and operation of solar facilities.

8.3.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 8.3.2 through 8.3.21 for the proposed Gillespie SEZ are summarized in tabular form. Table 8.3.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment. Section 8.3.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Gillespie SEZ are included in Sections 8.3.2 through 8.3.21 and in the summary table. The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would also be required for development in this and other SEZs.

TABLE 8.3.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Gillespie SEZ and SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 2,618 acres (11 km^2). Development of the SEZ for utility-scale solar energy production would establish a large, isolated industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area.	None.
	Construction of a new 3-mi (5-km) road to connect the south end of the SEZ to Old U.S. 80 would result in new surface disturbance of about 20 acres (0.1 km^2) of public land.	Priority consideration should be given to utilizing Agua Caliente Road to provide construction and operational access to the SEZ.
Specially Designated Areas and Lands with Wilderness Characteristics	Wilderness values in the Woolsey Peak and Signal Mountain WAs between 2 and 7 mi (3 and 11 km) and 3.5 to 7 mi (6 to 11 km) respectively, of the border of the SEZ and within the viewshed of the SEZ would be adversely affected. Solar development in the SEZ would contribute to a further reduction in the scenic viewshed of the Saddle Mountain SRMA. The new access road would contribute additional adverse impacts on wilderness values in the Woolsey Peak WA.	Requiring that the solar technologies with lower profiles be used within the SEZ would substantially reduce visual impacts on wilderness and scenic resources.
Rangeland Resources: Livestock Grazing	There would be a 14.6% reduction in future ephemeral grazing authorizations in the Layton allotment.	Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the grazing allotment.
Rangeland Resources: Wild Horses and Burros	None.	None.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Recreation	Areas developed for solar energy production would be closed to recreational use. Inventoried OHV routes in the SEZ also would be closed. There could be some undetermined loss of recreational use in the Woolsey Peak and Signal Mountain WAs because of adverse effects on wilderness values. Potential impacts on recreational use in the Saddle Mountain SRMA are unknown.	None.
Military and Civilian Aviation	The military has expressed concern that any development in the SEZ that exceeds 250 ft (76 m) in height would interfere with military operations in the MTR that is above the SEZ.	None.
	There would be no effect on civilian aviation facilities.	None.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbance activities (affecting 80% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 1,287 ac-ft (1.6 million m^3) of water during the peak construction year.	Wet-cooling options would not be feasible if groundwater were the chosen water source for a solar project; other technologies should incorporate water conservation measures.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	Construction activities would generate as high as 74 ac-ft (91,000 m^3) of sanitary wastewater.	During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain. Before drilling a new well, permits must be obtained from the ADWR, and all groundwater rights policies of the ADWR must be followed. Groundwater monitoring and production wells should be constructed in accordance with state standards. Stormwater management plans and BMPs should comply with standards developed by the ADEQ.
	Assuming full development of the SEZ, operations would use the following amounts of water: • For parabolic trough facilities (419-MW capacity), 299 to 634 ac-ft/yr (369,000 to 782,000 million m^3/yr) for dry-cooled systems; 2,101 to 6,289 ac-ft/yr (2.6 million to 7.8 million m^3/yr) for wet-cooled systems. • For power tower facilities (233-MW capacity), 166 to 352 ac-ft/yr (205,000 to 434,000 m^3/yr) for dry-cooled systems; 1,166 to 3,493 ac-ft/yr (1.4 million to 4.3 million m^3/yr) for wet-cooled systems. • For dish engine facilities (233-MW capacity), 116 ac-ft/yr (143,000 m^3/yr).	Water for potable uses would have to meet or be treated to meet drinking water quality standards. Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site and downstream in Centennial Wash.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	• For PV facilities (233-MW capacity), 12 ac-ft/yr (14,800 m^3/yr). • Assuming full development of the SEZ, operations would generate up to 6 ac-ft/yr (7,400 m^3/yr) of sanitary wastewater.	
Vegetation[b]	Up to 80% (2,094 acres [8.5 km^2]) of the SEZ would be cleared of vegetation; re-establishment of shrub communities in disturbed areas would likely be very difficult because of the arid conditions. Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation. The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition. Grading could affect wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and saguaro cactus communities within the SEZ, access road, and transmission line corridors. Alteration of surface drainage patterns or hydrology could adversely affect downstream communities.	An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub communities, as well as other affected habitats, and minimize the potential for the spread of invasive species or noxious weeds, such as those occurring in Maricopa County, that could be introduced as a result of solar energy project activities (see Section 8.3.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides. All wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and saguaro cactus communities within the SEZ or access road corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. Any cacti that cannot be avoided should be salvaged. A buffer area should be maintained around dry washes, dry wash woodland, mesquite bosque, wetland, and riparian habitats to reduce the potential for impacts.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, dry wash woodland, mesquite bosque, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation. Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities or riparian habitats along the Gila or Hassayampa Rivers.
Wildlife: Amphibians and Reptiles[b]	Direct impacts on amphibians and reptiles from development on the SEZ would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). With implementation of proposed design features, indirect impacts would be expected to be negligible.	None.
Wildlife: Birds[b]	Direct impacts on bird species would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). Other impacts on birds could result from collision with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment.. These indirect impacts are expected to be negligible with the implementation of design features.	The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed. Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Wildlife: Mammals[b]	Direct impacts on big game, small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/ fragmentation would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.	The fencing around solar energy projects should not block the free movement of mammals, particularly big game species.
Aquatic Biota[b]	There are no permanent water bodies, streams, or wetlands present within the area of direct effects of either the proposed Gillespie SEZ or the presumed new access road corridor. There are also no high quality perennial surface water features in the area of indirect effects. Intermittent and ephemeral streams are present in the area of indirect effects and ground disturbance within the SEZ or new access road could increase the transport of soil into aquatic habitat within the Gila River via water- and airborne pathways. The Gila River and the Centennial Wash may contain aquatic habitat and biota and the Gila River flows into perennial surface waters (Colorado River). There is the potential that groundwater withdrawals could reduce surface water levels in the Gila River. Water quality in aquatic habitats in the Gila River and Centennial Wash could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during ground construction activities associated with the presumed new access road.	None.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Special Status Species	Potentially suitable habitat for 29 special status species occurs in the affected area of the Gillespie SEZ. For all of these special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects. There are nine groundwater dependent species that occur outside of the areas of direct and indirect effects. Potential impacts on these species could range from small to large depending on the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals.	Pre-disturbance surveys should be conducted within the area of direct effects to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible for some species, translocation of individuals from areas of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies. Consultation with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Sonoran bald eagle, southwestern willow flycatcher, and Yuma clapper rail. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary).

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Special Status Species *(Cont.)*		Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species that are candidates or under review for listing under the ESA: Sonoran desert tortoise, Tucson shovel-nosed snake, and western yellow-billed cuckoo. Coordination would identify an appropriate survey protocol, and mitigation, which may include avoidance, minimization, translocation, or compensation. Avoiding or minimizing disturbance to desert riparian habitat within the assumed access road corridor could reduce or eliminate impacts on the 17 special status species. Avoidance or minimization of groundwater withdrawals to serve solar energy development on the SEZ could reduce or eliminate impacts to nine special status species. Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based on consultation with the USFWS and AZGFD.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Air Quality and Climate	*Construction*: Temporary exceedances of AAQS for 24-hour and annual PM_{10} and $PM_{2.5}$ concentration levels at the SEZ boundaries and in the immediate surrounding area. Higher concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM_{10} increments at the nearest federal Class I area (Superstition WA). In addition, construction emissions (primarily NO_x emissions) from the engine exhaust from heavy equipment and vehicles have some potential to affect AQRVs (e.g., visibility and acid deposition) at the nearest federal Class I area. *Operations*: Positive impact due to avoided emission of air pollutants from combustion-related power generation: 0.59 to 1.1% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Arizona avoided (up to 565 tons/yr SO_2, 870 tons/yr NO_x, 0.008 ton/yr Hg, and 624,000 tons/yr CO_2).	None.
Visual Resources	The SEZ is in an area of low scenic quality, with cultural disturbances already present. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads. Solar development could produce large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape. The SEZ is located 3.5 mi (5.6 km) from the Signal Peak WA. Because of the open views of the SEZ and elevated viewpoints, strong visual contrasts could be observed by WA visitors.	The development of power tower facilities should be prohibited within the SEZ.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	The SEZ is located 2.1 mi (3.4 km) from the Woolsey Peak WA. Because of the open views of the SEZ and elevated viewpoints, strong visual contrasts could be observed by WA visitors. The SEZ is located 4.3 mi (6.9 km) from the Saddle Mountain SRMA. Because of the open views of the SEZ and elevated viewpoints, moderate to strong visual contrasts could be observed by SRMA visitors. Approximately 18 mi (29 km) of Agua Caliente Road (Agua Caliente Scenic Drive) is within the SEZ viewshed. Approximately 2.2 mi (3.5 km) of the road is within the SEZ. Weak to strong visual contrasts could be observed within and near the SEZ by travelers on the Agua Caliente Road. Approximately 10.8 mi (17.4 km) of the Salome Highway is within the SEZ viewshed. Moderate visual contrast would be expected for most viewpoints on the Salome Highway. Approximately 29 mi (47 km) of Old U.S. 80 is within the SEZ viewshed. Strong visual contrasts could be observed within and near the SEZ by travelers on Old U.S. 80. The communities of Arlington, Palo Verde, Buckeye, and Wintersburg are located within the viewshed of the SEZ, although slight variations in topography and vegetation provide some screening. Strong visual contrasts could be observed within Arlington. Weak visual contrasts could be observed within the other communities.	

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Acoustic Environment	*Construction*. Estimated noise levels at the nearest residences (1.8 mi [2.9 km] from the southeastern SEZ boundary) would be about 35 dBA, which is below the typical daytime mean rural background level of 40 dBA. In addition, an estimated 41-dBA L_{dn} at these residences is well below the EPA guidance of 55 dBA L_{dn} for residential areas. *Operations*. For operation of a parabolic trough or power tower facility located near the southeastern SEZ boundary, the predicted noise level would be about 39 dBA at the nearest residences, which is below the typical daytime mean rural background level of 40 dBA. If the operation were limited to daytime, 12 hours only, a noise level of about 41 dBA L_{dn} would be estimated for the nearest residences, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residences would be 49 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. However, the day-night average noise level is estimated to be about 51 dBA L_{dn}, which is below the EPA guideline of 55 dBA L_{dn} for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residences would be about 38 dBA, which is below the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 41 dBA L_{dn} at these residences would be well below the EPA guideline of 55 dBA L_{dn} for residential areas.	Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residences to the east of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers. Dish engine facilities within the Gillespie SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be located in the central or northwestern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at the nearest residences.
Paleontological Resources	The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed	The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Cultural Resources	Direct impacts on significant cultural resources could occur in the proposed Gillespie SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effects of any project proposed would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP. Impacts on cultural resources also are possible in areas related to the access road, as areas of potential cultural significance could be directly affected by construction or opened to increased access from use.	SEZ-specific design features would be determined during consultations with the Arizona SHPO and affected Tribes and would depend on the findings of cultural surveys.
Native American Concerns	The proposed SEZ is adjacent to the Gila River corridor and lies along the traditional route linking the Colorado River and the Gila River. It is adjacent to the Gila Bend Mountains, which have been identified as culturally important. Development within the SEZ may result in visual or audible disturbance to sacred areas in the mountains. The SEZ itself does contain plant and traditionally important animal species. Development in the proposed SEZ would eliminate some traditionally important plants and some habitat of traditionally important animals. The importance of these resources relative to the plants and animal habitat that will remain undisturbed outside the SEZ must be determined in consultation with the affected Native American Tribe(s). Only 16 mi (26 km) north and upstream of the San Lucy District of the Tohono O’odham Reservation; extreme water drawdown in the SEZ could affect water supplies on the reservation.	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.

TABLE 8.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Gillespie SEZ	SEZ-Specific Design Features
Socioeconomics	*Livestock grazing:* Construction and operation of solar facilities could decrease the amount of land available for livestock grazing in the SEZ, resulting in the loss of less than 1 job (total) and less than $0.1 million (total) in income in the ROI. *Construction:* 288 to 3,813 total jobs; $17.8 million to $236 million income in ROI for construction of solar facilities in the SEZ. *Operations:* 6 to 150 annual total jobs; $0.2 million to $5.9 million annual income in the ROI. Construction of new access road: 244 jobs; $9.4 million in income.	None.
Environmental Justice	Although impacts are likely to be small, minority populations, as defined by CEQ guidelines, occur within 50 mi (80 km) of the boundary of the SEZ; this means that any adverse impacts of solar projects could disproportionately affect minority populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This additional volume of traffic on Old U.S. 80 would represent an increase in traffic of about 200% in the area of the Gillespie SEZ for a single project.	None.

Footnotes on next page.

TABLE 8.3.1.3-1 (Cont.)

Abbreviations: AAQS = ambient air quality standards; ADEQ = Arizona Department of Environmental Quality; ANHP = Arizona Natural Heritage Program; AQRV = air quality-related value; AZGFD = Arizona Game and Fish Department; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO_2 = carbon dioxide; dBA = A-weighted decibel; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; KOP = key observation point; L_{dn} = day-night average sound level; MTR = military training route; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; OHV = off-highway vehicle; PEIS = programmatic environmental impact statement; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 μm or less; PM_{10} = particulate matter with an aerodynamic diameter of 10 μm or less; PSD = prevention of significant deterioration; PV= photovoltaic; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO_2 = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service; VRM = Visual Resource Management; WA = Wilderness Area.

[a] The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Gillespie SEZ.

[b] The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 8.3.10 through 8.3.12.

8.3.2 Lands and Realty

8.3.2.1 Affected Environment

The proposed Gillespie SEZ, a relatively small and isolated SEZ, is about 17 mi (27 km) southwest of Buckeye, Arizona. It is in the northeastern corner of a large block of undeveloped BLM-administered land; it is bordered to the north and east by state and private lands. The Palo Verde Nuclear Generating Station is located about 6 mi (10 km) north of the SEZ, and two large-capacity transmission lines pass within 0.5 mi (0.8 km) of the SEZ near both the northern and southern ends of the area. These transmission lines are located within designated local ROW corridors, and portions of these local corridors also have been identified as 368(b) corridors. A branch of the UP Railroad passes along the northwestern edge of the SEZ, also at a distance of about 0.5 mi (0.8 km), and a small portion of the railroad ROW is within the boundaries of the SEZ. Agua Caliente Road, a Maricopa County road, passes through the SEZ for about 4 mi (6 km) and provides access to the SEZ and to public lands south and west of the SEZ. The overall character of the land in the SEZ area is rural and undeveloped; it is used primarily for grazing and some recreational activities. Portions of the SEZ, especially the southeastern third of the area, are heavily dissected by small drainages.

As of February 2010, there was one ROW application for solar energy facility development that overlaps a small portion of the SEZ, but the bulk of this application is for public lands east of the SEZ. Several additional pending solar energy applications are for areas within 20 mi (32 km) of the SEZ.

8.3.2.2 Impacts

8.3.2.2.1 Construction and Operations

Full development of the proposed Gillespie SEZ could disturb up to 2,618 acres (11 km^2) (Table 8.3.1.2-1). Development of the southeastern portion of the SEZ would require extensive grading and development of drainage controls to make use of a relatively small area. The ROW for the existing county road would be protected as a requirement of any solar development proposal, but the road may prove to be an impediment to solar development since it meanders throughout the larger northwestern portion of the SEZ. The ROW for the road occupies an estimated 29 acres (0.1 km^2) of the site. The road also cuts the SEZ area into smaller portions and provides public access through the site. To avoid these issues, relocation of the road might be considered as part of a site development plan.

The existing railroad ROW that is slightly overlapped by the SEZ appears to have been granted by aliquot parts rather than on a survey that recorded the location of actual facilities, and it likely does not contain any railroad-related facilities. It may be possible with the agreement of the railroad to modify the ROW to allow for development of solar energy facilities in the overlap area. It may also be easier to modify the boundary of the SEZ to conform to the existing railroad ROW.

Full development of the SEZ for utility-scale solar energy production would establish an isolated industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Although a railroad, county road, and transmission lines are present near the SEZ, the overall appearance of the SEZ is rural and undeveloped, and utility-scale solar energy development would be a new and discordant land use in the area. An area 2 to 3 mi (3 to 5 km) south of the SEZ is designated wilderness.

Should the proposed SEZ be identified as an SEZ in the ROD for this PEIS, the BLM would still have discretion to authorize ROWs in the area until solar energy development was authorized, and then future ROWs would be subject to the rights granted for solar energy development. It is not anticipated that approval of solar energy development within the SEZ would have a significant impact on the amount of public lands available for future ROWs near the area.

8.3.2.2.2 Transmission Facilities and Other Off-Site Infrastructure Impacts

Large transmission lines are located near the SEZ, and a minimal amount of land disturbance would be required to construct a connection to one of these lines to allow for the transmission of solar energy produced within the SEZ to the regional grid.

Old Highway 80 is the closest highway to the SEZ, and for analysis purposes it is assumed that a new 3-mi (5-km) access road would be constructed to connect the southern end of the SEZ to that highway. Creation of this access road would require surface disturbance of about 22 acres (0.1 km^2) of public land. Alternative or additional access to the SEZ could be provided via Agua Caliente Road, which passes through the SEZ. In such a case, improvement of the existing road could be undertaken. Roads and transmission lines also would be constructed within the SEZ as part of the development of the area.

8.3.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

Proposed design features specific to the proposed SEZ include the following:

- Priority consideration should be given to utilizing Agua Caliente Road to provide construction and operational access to the SEZ.

8.3.3 Specially Designated Areas and Lands with Wilderness Characteristics

8.3.3.1 Affected Environment

Ten specially designated areas are located within 25 mi (40 km) of the proposed Gillespie SEZ that potentially could be affected by solar energy development within the SEZ (Figure 8.3.3.1-1). Portions of three of these areas are within 5 mi (8 km) of the SEZ. The areas include the following:

- National Monument
  - Sonoran Desert

- Wilderness Areas
  - Big Horn Mountains
  - Eagletail Mountains
  - Hummingbird Springs
  - North Maricopa Mountains
  - Signal Mountain
  - South Maricopa Mountains
  - Woolsey Peak

- National Historic Trail
  - Juan Bautista de Anza Trail

- Special Recreation Management Area
  - Saddle Mountain

Viewshed analysis indicates that visitors traveling the route of the Juan Bautista de Anza Trail might have limited visibility of development within the SEZ along about 5 mi (8 km) of the trail route from a distance of about 20 mi (32 km). Because of topographic features between the trail route and the SEZ, the only facilities that might be visible would be the tops of solar power towers should that technology be employed. The South Maricopa Mountains WA has only a miniscule percentage of its area within 25 mi (40 km) of the SEZ. Because of these factors, these two specially designated areas are not considered further. There are no lands near the SEZ outside of the 10 specially designated areas that have been identified as needing to be managed to protect wilderness characteristics.

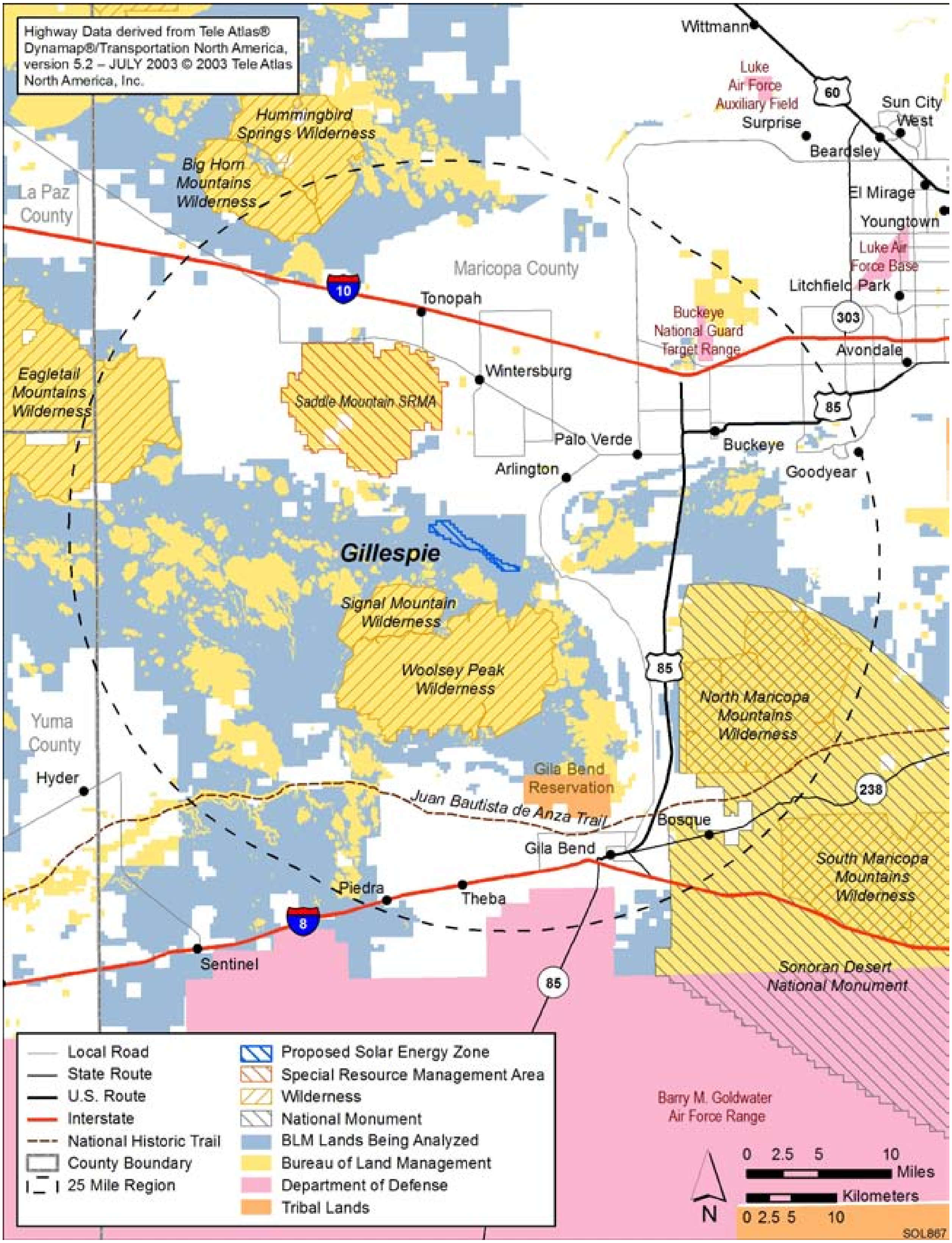

FIGURE 8.3.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Gillespie SEZ

8.3.3.2 Impacts

8.3.3.2.1 Construction and Operations

The primary potential impact on the eight remaining specially designated areas near the SEZ would be from visual impacts of solar energy development that could affect scenic, recreational, or wilderness characteristics of the areas. The visual impact on specially designated areas is difficult to determine and would vary by solar technology employed, the specific area being affected, and the perception of individuals viewing the development. Development of the SEZ, especially full development, would be an important visual component in the viewshed from limited portions of some of these specially designated areas, as summarized in Table 8.3.3.2-1. The data provided in the table, which show the potential area of impact, assumes the use of power tower solar energy technology. Because of the potential height of some components, these facilities, or portions of them, could be visible from the largest amount of land of any of the technologies being considered in the PEIS. Viewshed analysis for this SEZ has shown that the visual impacts of shorter solar energy facilities would be considerably less in some areas than power tower technology (See Section 8.3.14 for more detail on all viewshed analyses discussed in this section). Assessment of the visual impact of solar energy projects must be conducted on a site-specific and technology-specific basis to accurately identify impacts.

In general, the closer a viewer is to solar development, the larger they perceive the facility to be, and the greater the potential for adverse visual impacts. From a visual analysis perspective, the most sensitive viewing distances generally are from 0 to 5 mi (0 to 8 km).

The viewing height above or below a solar energy development area, the size of the solar development area, and the purpose for which a person is visiting an area are also important factors in assessing potential impacts. Individuals seeking a wilderness or scenic experience in areas within sight of solar energy facilities could be expected to be more adversely affected than someone passing a solar facility while traveling along a highway with a destination in mind. Because of the dramatically diminished visibility of solar energy structures at more than 25 mi (40 km), the visual analysis is not extended beyond that point even though there are a few areas where visibility of solar facilities still would be possible. In the case of the Gillespie SEZ, the low-lying location of the SEZ in relation to portions of the Woolsey Peak and Signal Mountain WAs and the Saddle Butte SRMA would tend to highlight the industrial-like development in the SEZ.

National Monument[1]

The northwestern portion of Sonoran Desert National Monument is about 11 mi (18 km) from the SEZ and is at a slightly higher elevation. Solar development within the SEZ would be visible from this portion of the National Monument between about 11 and 17 mi (18 and 27 km),

[1] This description applies only to the areas of the monument outside of the WAs. The WAs are discussed as separate units below.

TABLE 8.3.3.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Gillespie SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[a]		
Feature Type	Feature Name (Total Acreage/Linear Distance)[b]	Visible within 5 mi	Visible within 5 and 15 mi	Visible within 15 and 25 mi
National Monument	Sonoran Desert (496,513 acres)	0 acres	8,356 acres (1.7%)[c]	27, 287 acres (5.5%)
National Historic Trail	Juan Bautista de Anza (1,210 mi)	0 mi	0 mi	22 mi (0.36%)
Wilderness Areas	Big Horn Mountains (20,954 acres)	0 acres	0 acres	2,303 acres (11%)
	Eagletail Mountains (98,544 acres)	0 acres	0 acres	11,918 acres (12%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	4,501 acres (14%)
	North Maricopa Mountains (64,247 acres)	0 acres	1,331 acres (2%)	9,871 acres (15%)
	Signal Mountain (13,467 acres)	1,920 acres (14%)	2,514 acres (19%)	0 acres
	South Maricopa Mountains (60,466 acres)	0 acres	0 acres	3 acres (0.01%)
Special Recreation Management Area	Saddle Mountain (47,696 acres)	661 acres (1%)	27,223 acres (57%)	0 acres

[a] To convert acres to km^2, multiply by 0.004047. To convert mi to km, multiply by 1.609.

[b] Acres listed here are exclusive of the acreage included in the North and South Maricopa Mountains WAs.

[c] Values in parentheses are percentage of feature acreage or road length viewable.

but the viewing angle would be low, the view would be along the narrow axis of the SEZ, and the view would also include both highway and agricultural development between the Monument and the SEZ, leading to a conclusion that there would be minimal visual impact to this portion of the Monument. This northwestern portion of the Monument would have visibility of any type of solar development within the SEZ, not just power tower technology.

Traveling south along the western boundary of the Monument, the distance from the SEZ steadily increases and the views of solar development gradually become less distinct. In the area of the Monument northeast of Gila Bend, the distances from the SEZ are between 15 and 25 mi (24 and 40 km), and because of the distance and the low viewing angle, the visual impacts would be expected to be minimal.

In summary, assuming the use of power tower solar technology, within 11 to 25 mi (17 to 40 km) of the SEZ, about 35,643 acres (144 km^2), or 7.2%, of the Monument would have potential views of solar development in the SEZ. These views would generally be low angle and at relatively long distance, and are not expected to have a significant impact. If any of the lower-height solar technologies are employed within the SEZ, views of the facilities from the Monument would be restricted to only the northwestern corner of the area.

Wilderness Areas

Woolsey Peak and Signal Mountain. At their closest locations, these WAs are within 2 mi (3 km) and 3.5 mi (6 km), respectively, of the boundary of the proposed SEZ. At these close distances and because of the elevated view of development in the SEZ from portions of these WAs, it is anticipated that the wilderness characteristics on 5,552 acres (22 km^2) of Woolsey Peak and 1,920 acres (8 km^2) of Signal Mountain would be adversely affected. An additional 5,837 acres (24 km^2) of the Woolsey Peak WA with visibility of the SEZ is located at between 5 and 7 mi (8 and 11 km). Wilderness characteristics are also likely to be adversely affected in these areas. Impacts within the Woolsey Peak unit would be restricted primarily to the northeastern and west-central portions of the area. Within Signal Mountain WA, an additional 600 acres (2 km^2) are located between 5 and 7 mi (8-11 km) of the SEZ, where wilderness characteristics are also likely to be adversely affected. Most of the impact in the Signal Mountain WA would occur on the northeastern portion of the area. The viewshed around these WAs is not pristine, with the Agua Caliente Road, a railroad, transmission lines, and agricultural development as close as 0.5 mi (0.8 km) from the border of the WAs. Based on additional viewshed analysis, if any of the lower-height solar technologies were employed within the SEZ, impacts on wilderness characteristics would be substantially reduced.

North Maricopa Mountains. This WA is located in the northern end of the Sonoran Desert National Monument and at the closest is 13 mi (21 km) from the SEZ. Within 15 mi (24 km) of the SEZ 1,331 acres (5.4 km^2) of the wilderness is within the viewshed of the SEZ. Much of the view of the SEZ is along its narrow axis, and the development would not take up much of the field of view from the WA. It is not anticipated that wilderness characteristics within this area would be adversely affected. Another 8,500 acres (34.4 km^2) of area in the WA with visibility of the SEZ is within the 15 to 25 mi (24 to 40 km) zone. Development in the SEZ would be distantly visible, but at this distance, impact on wilderness characteristics would be unlikely. Based on additional viewshed analysis, if any of the lower-height solar technologies were employed, there would be substantially reduced visibility of solar facilities in the SEZ from this WA.

Eagletail Mountains, Bighorn Mountains, and Hummingbird Springs. The nearest of these WAs, the Eagletail Mountains WA, is 18 mi (29 km) from the northern boundary of the SEZ. The other two WAs are about 21 mi (34 km) distant from the SEZ. The terrain between these areas and the SEZ is relatively flat, and portions of each of these areas are in the viewshed of the SEZ. However, because of the long distance from the SEZ, the low level of contrast that would be associated with solar facilities, and the small portion of the field of view the SEZ would occupy when viewed from these areas, it is not anticipated there would be any adverse impact on wilderness characteristics in these WAs. Additionally, I-10, the Central Arizona Project Canal, and a large amount of irrigated agricultural development are located in the near foreground of all these areas, which would further reduce the visual effects of facilities in the SEZ.

Special Recreation Management Area

The Saddle Mountain SRMA was established to emphasize provision of geologic, cultural, and wildlife interpretive sites; protection of the area's scenic landscapes and vistas; and promotion of recreation opportunities (BLM 2005). Portions of the SRMA within the viewshed of the SEZ range from 4 to 13 mi (6 to 21 km) from the northern boundary of the SEZ and about 57% of the area would have clear views into the SEZ. The SRMA is currently surrounded by numerous types of human development including I-10, a railroad, the Palo Verde Nuclear Generating Station, agricultural development, and residential development. Solar development in the SEZ would contribute to a further reduction in the scenic viewshed of the SRMA. Because the SEZ is so close to the SRMA and there is no topographic screening between the SEZ and the SRMA, any of the technologies solar considered in this PEIS would be readily visible to visitors within the SRMA.

8.3.3.2.2 Transmission Facilities and Other Off-Site Infrastructure Impacts

Large transmission lines are located near the SEZ, and only a minimal amount of land disturbance would be required to connect to one of these lines and thus link the SEZ to the regional grid. It is not anticipated that this connection would cause any additional impact to specially designated areas.

Construction of a new 3-mi (5-km) long access road to Old Highway 80 would result in the surface disturbance of about 22 acres (0.1 km^2) of public land. Road construction would be within the viewshed of the Woolsey Peak WA, and the road would come within 1.5 mi (2 km) of the WA. The road would contribute additional adverse impacts on wilderness characteristics in the area.

Roads and transmission lines also would be constructed within the SEZ as part of the development of the area.

8.3.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

The following is a proposed design feature specific to the proposed SEZ:

- Requiring that the solar technologies with lower profiles be used within the SEZ would substantially reduce visual impacts on wilderness and scenic resources.

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8.3.4 Rangeland Resources

Rangeland resources include livestock grazing and wild horses and burros, both of which are managed by the BLM. These resources and possible impacts on them from solar development within the proposed Gillespie SEZ are discussed in Sections 8.3.4.1 and 8.3.4.2.

8.3.4.1 Livestock Grazing

8.3.4.1.1 Affected Environment

The proposed Gillespie SEZ includes small portions of three ephemeral grazing allotments (the A Lazy T, Jagow-Kreager, and Layton allotments) and one perennial allotment (Gable-Ming). In the ephemeral allotments, grazing is authorized only in years with good winter-spring rainfall when above-average amounts of annual forage are available. On the perennial allotment, cattle are allowed to graze year-long. Table 8.3.4.1-1 summarizes key information regarding these allotments.

8.3.4.1.2 Impacts

Should utility-scale solar development occur in the SEZ, grazing would be excluded from the areas developed as provided for in the BLM grazing regulations (43 CFR Part 4100).

TABLE 8.3.4.1-1 Grazing Allotments within the Proposed Gillespie SEZ

Allotment	Total Acres[a]	% of Acres in SEZ[b]	Active BLM AUMs	No. of Permittees
A Lazy T	4,827	<1	NA[c]	1
Gable-Ming	121,421	1.3	4,200	1
Jagow-Kreager	13,175	<1	NA[c]	1
Layton	5,781	14.6	NA[c]	1

[a] Includes only public land in the allotment based on the Allotment Master Reports included in the BLM's Rangeland Administration System (RAS) (BLM 2008c).

[b] This is the percentage of the total acreage of public lands in the allotment located in the SEZ.

[c] NA = Not applicable. Since these are ephemeral allotments, no active AUMs are recorded in the BLM RAS system.

This would include reimbursement of the permittees for their portion of the value for any range improvements in the area removed from the grazing allotment. The impact of this change in the grazing permits would depend on several factors, including (1) how much of an allotment the permittee might lose to development, (2) how important the specific land lost is to the permittee's overall operation, and (3) the amount of actual forage production that would be lost by the permittee.

With the exception of the Layton allotment, the percentage of public land in the allotments is so small that if it would be removed from the grazing there would be no significant impact on livestock grazing. Since the Layton allotment is an ephemeral allotment, it is difficult to estimate the potential loss of grazing use because ephemeral grazing operations are erratic. They are dependent on yearly rainfall and the growth of annual forage. For this reason, no estimate of potential loss is offered other than to make the assumption that future grazing authorizations for the Layton allotment would be reduced by the same percentage as the percentage reduction in public lands in the allotment, which would equate to a 14.6% reduction.

8.3.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

The following is a proposed design feature specific to the proposed SEZ:

- Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the grazing allotment.

8.3.4.2 Wild Horses and Burros

8.3.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Seven wild horse and burro herd management areas (HMAs) occur within Arizona (BLM 2010d); a portion of only the Lake Pleasant HMA occurs within 50 mi (80 km) of the proposed Gillespie SEZ (Figure 8.3.4.2-1).

In addition to the HMAs managed by the BLM, the USFS has wild horse and burro territories in Arizona, California, Nevada, New Mexico, and Utah, and is the lead management agency that administers 37 of the territories (Giffen 2009; USFS 2007). None of the territories occur within the SEZ region.

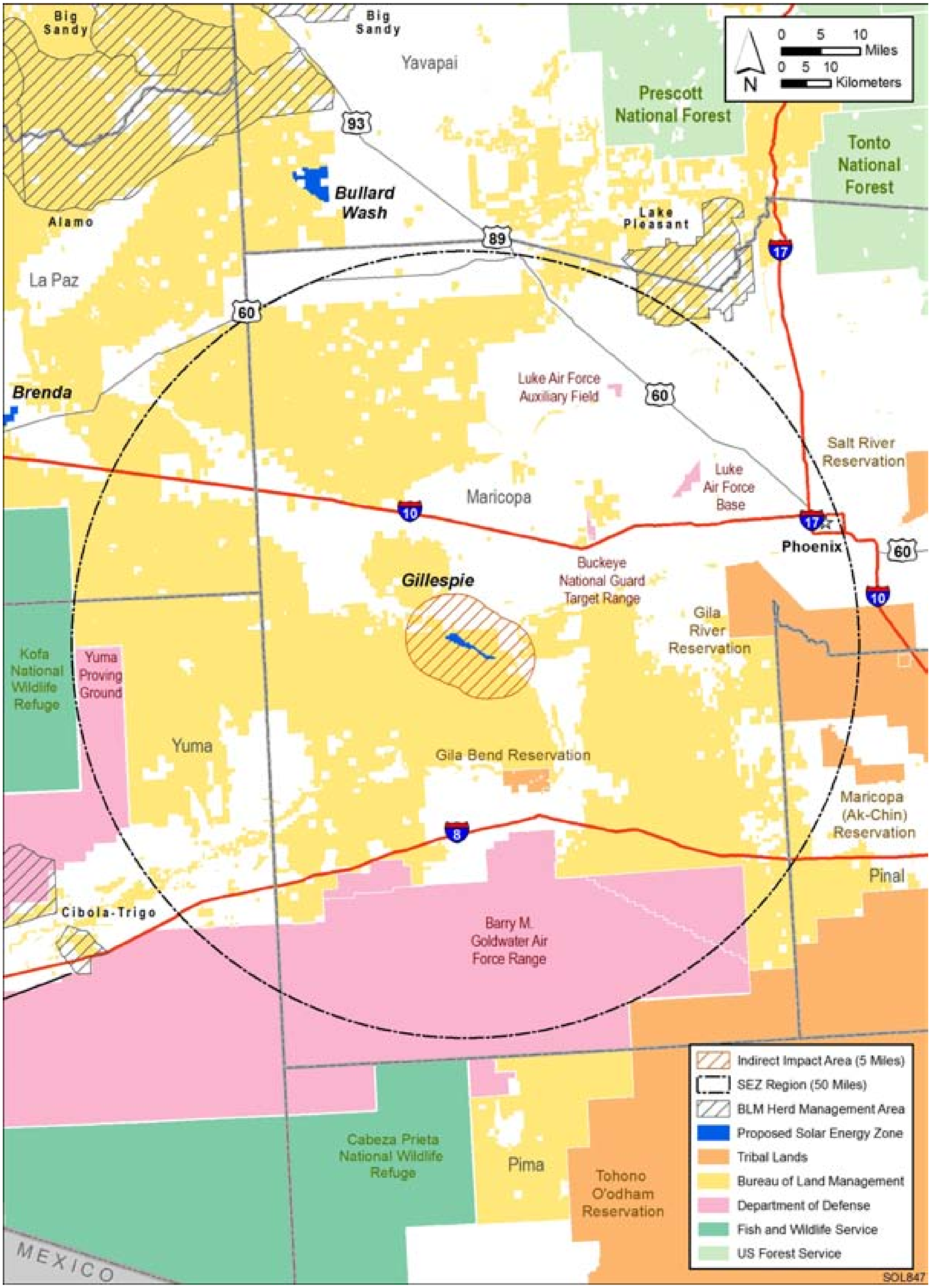

FIGURE 8.3.4.2-1 Wild Horse and Burro Herd Management Areas within the Analysis Area for the Proposed Gillespie SEZ (Source: BLM 2010d)

8.3.4.2.2 Impacts

Because the proposed Gillespie SEZ is about 47 mi (76 km) or more from any wild horse and burro HMAs managed by BLM and more than 50 mi (80 km) from any wild horse and burro territories administered by the USFS, solar energy development within the SEZ would not directly or indirectly affect wild horses and burros that are managed by these agencies.

8.3.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features for solar development within the proposed Gillespie SEZ would be necessary to protect or minimize impacts on wild horses and burros.

8.3.5 Recreation

8.3.5.1 Affected Environment

The proposed Gillespie SEZ is about 7 mi (11 km) long and 1.4 mi (2 km) wide at its widest point. Most of the area is less than 1 mi (2 km) wide. The axis of the area runs in a northwest-southeast direction. The area is so narrow that little recreation use can take place other than for passing through it on existing roads and trails to access other areas. The general area around the SEZ and to the west is lightly used for recreation activities (Ragsdale 2010).

The Agua Caliente Road is a good-quality county road that provides access to old mines, livestock facilities, and to the Signal Mountain and Woolsey Peak WAs, and BLM-administered lands west and south of the SEZ (BLM undated). This road may be considered for designation as a scenic road as part of the Sonoran Desert National Monument Management Plan and Phoenix South RMP Amendment (BLM undated). The area within the SEZ is included within the boundaries of the Lower Gila South RMP (BLM undated), and the area is designated as "limited" to off highway and special recreation vehicle use. Travel is restricted to existing or designated roads and vehicle routes. In addition to Agua Caliente Road, several inventoried routes that cross the SEZ provide access to public lands, old mines, livestock facilities, and to the Signal Mountain and Woolsey Peak WAs south of the SEZ (BLM undated).

8.3.5.2 Impacts

8.3.5.2.1 Construction and Operations

No significant loss of recreational use would be anticipated from development of the proposed SEZ, although any current recreational users would lose the use of any portions of the SEZ developed for solar energy production. Inventoried vehicle routes that pass through areas developed for solar power production could be closed or rerouted, although the county-maintained Agua Caliente Road would continue to provide general access through the area.

Woolsey Peak and Signal Mountain WAs are within 2 to 3.5 mi (3 to 6 km) of the SEZ, and solar development within the SEZ would be very visible from areas within these WAs. Saddle Mountain SRMA is within 4 mi (6 km), and most of the area would have clear views of the SEZ. Whether the presence of solar development in the SEZ would affect recreational use of these areas is unknown, but portions of these areas are located within the most sensitive visual zone surrounding the proposed SEZ. It is anticipated that some users of portions of the WAs may choose to move their activities farther away from solar energy facilities. Potential impacts on visitor use in the SRMA are unknown.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. Data identifying open OHV routes within the proposed SEZ were not available. If such routes were identified during project-specific analyses, they would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

8.3.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

No additional impacts on recreation use are anticipated from construction of transmission facilities to provide a connection between the SEZ and the regional grid.

The new 3-mi (5-km) long road connecting the SEZ to Old Highway 80 would be visible from Woolsey Peak and Signal Mountain WAs. Since the new road would come within 2 mi (3 km) of the Woolsey Peak WA, the potential would exist for the road to contribute additional adverse impact on wilderness characteristics and to cause a potential reduction in recreation use within the WA. However, it is not anticipated that any additional impact caused by construction of the road would be significant in either WA when compared to the adverse impact on the wilderness characteristics already included in Section 8.3.3.2.1, above.

8.3.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide mitigation for some impacts on recreation. No SEZ-specific design features for solar development within the proposed Gillespie SEZ are recommended. However, adoption of the SEZ-specific design features suggested in Section 8.3.3.3 to reduce impacts on wilderness characteristics may also reduce potential adverse impacts on recreation use of the WAs.

8.3.6 Military and Civilian Aviation

8.3.6.1 Affected Environment

The sky above the entire SEZ is encompassed by one MTR with a 300-ft (91-m) above-ground-level operating floor that operates under visual flight rules. The SEZ is located 33 mi (92 km) southwest of Luke Air Force Base and is located within an extensive web of MTRs and SUAs.

The closest public airports to the SEZ are the Buckeye and Gila Bend Municipal Airports, located 15 mi (42 km) northeast and 20 mi (32 km) south-southeast, respectively. Neither of these airports has regularly scheduled passenger or freight service.

8.3.6.2 Impacts

The military has indicated that construction of solar or transmission facilities in excess of 250 ft (76 m) tall would adversely affect the use of the MTR.

Both of the civilian airports are far enough away from the SEZ to not be affected by development on the site.

8.3.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features for solar development within the proposed Gillespie SEZ would be necessary to protect impacts on military and civilian aviation. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would provide adequate mitigation for military and civilian aviation.

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8.3.7 Geologic Setting and Soil Resources

8.3.7.1 Affected Environment

8.3.7.1.1 Geologic Setting

Regional Setting

The proposed Gillespie SEZ is located within the Basin and Range physiographic province in west-central Arizona. It lies to the southeast of the Harquahala Basin (Plain) and sits on a dissected piedmont slope, between the Gila Bend Mountains to the southwest and Centennial Wash, a dry ephemeral stream, to the northeast (Figure 8.3.7.1-1). Centennial Wash flows to the southeast, joining the Gila River just north of the Gillespie Dam southeast of the site (Figure 8.3.7.1-1).

Exposed sediments in the vicinity of the SEZ are predominantly older Quaternary (10,000 to 750,000 yr) alluvial deposits (Qm) and sedimentary rocks of conglomerate and sandstone of Tertiary age (Tsy). Younger alluvial deposits (<10,000 yr) are associated with Centennial Wash. In the Gila Bend Mountains, exposures are predominantly composed of Tertiary volcanics (andesite and basalts) and intrusives. The oldest rocks in the region are the Early Proterozoic metamorphic and granitic rocks that occur in the Gila Bend Mountains to the southwest of the SEZ and the Maricopa and Buckeye Mountains to the east.

Topography

The proposed Gillespie SEZ is situated about 150 ft (45 m) above the Centennial Wash to the northeast (Figure 8.3.7.1-1). The site terrain is fairly flat because the SEZ is narrow and generally follows the slope contour. There is a slight slope to the northeast, with elevations in the northwestern half of the SEZ ranging from about 950 ft (290 m) along the southwestern border to 920 ft (280 m) along the northeast-facing border, and elevations in the southeastern half ranging from about 920 ft (280 m) to 880 ft (270 m). Several unnamed drainages enter the SEZ from the southwest and drain to the northeast toward Centennial Wash (Figure 8.3.7.1-3).

Geologic Hazards

The types of geologic hazards that could potentially affect solar project sites and their mitigation are discussed in Sections 5.7.3 and 5.7.4. The following sections provide a preliminary assessment of these hazards at the proposed Gillespie SEZ. Solar project developers may need to conduct a geotechnical investigation to assess geologic hazards locally to better identify facility design criteria and site-specific design features to minimize their risk.

FIGURE 8.3.7.1-1 Physiographic Features of the Centennial Wash Valley near the Gila Bend Mountains

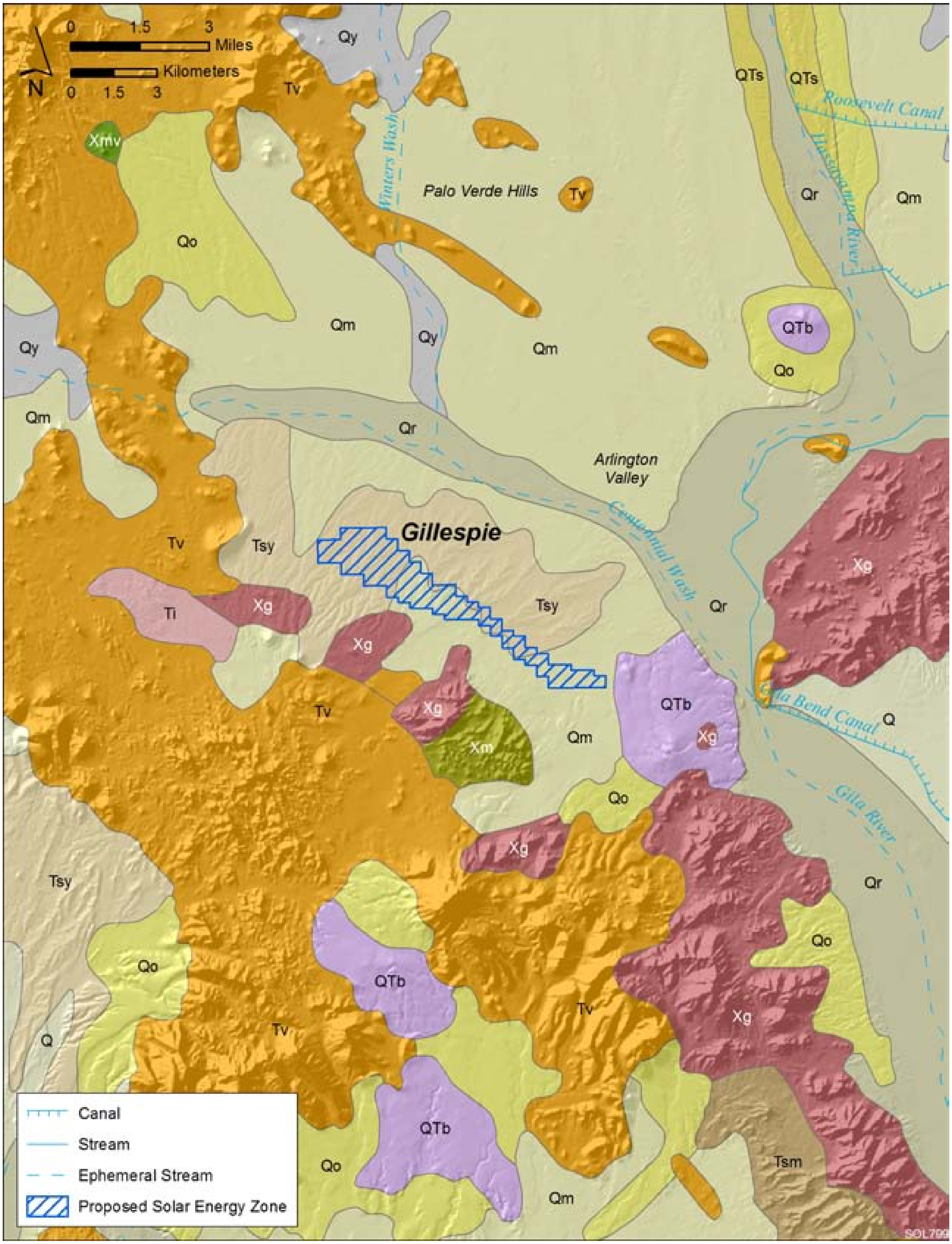

FIGURE 8.3.7.1-2 Geologic Map of the Centennial Wash Valley near the Gila Bend Mountains (adapted from Ludington et al. 2007 and Richard et al. 2000)

Cenozoic (Quaternary, Tertiary)

- Qy — Young alluvium in stream channels and on flood plains and playas (0 to 10,000 yr)
- Qr — River deposits (alluvium)
- Q — Surficial deposits, including wind-blown sand (0 to 2 m.y.)
- Qm — Surficial deposits (10,000 to 750,000 yr)
- Qo — Older surficial deposits (750,000 to 3 m.y.)
- QTb — Basaltic rocks
- QTs — Basin-fill deposits (Miocene to Pleistocene)
- Tsy — Consolidated conglomerate and sandstone
- Tsm — Sedimentary rocks
- Tv — Volcanic rocks
- Ti — Shallow intrusives

Precambrian

- Xg — Granitic rocks (1,600 to 1,800 m.y.)
- Xmv — Metavolcanic rocks
- Xm — Metamorphic rocks (Yavapai Supergroup and Pinal Schist)

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FIGURE 8.3.7.1-2 (Cont.)

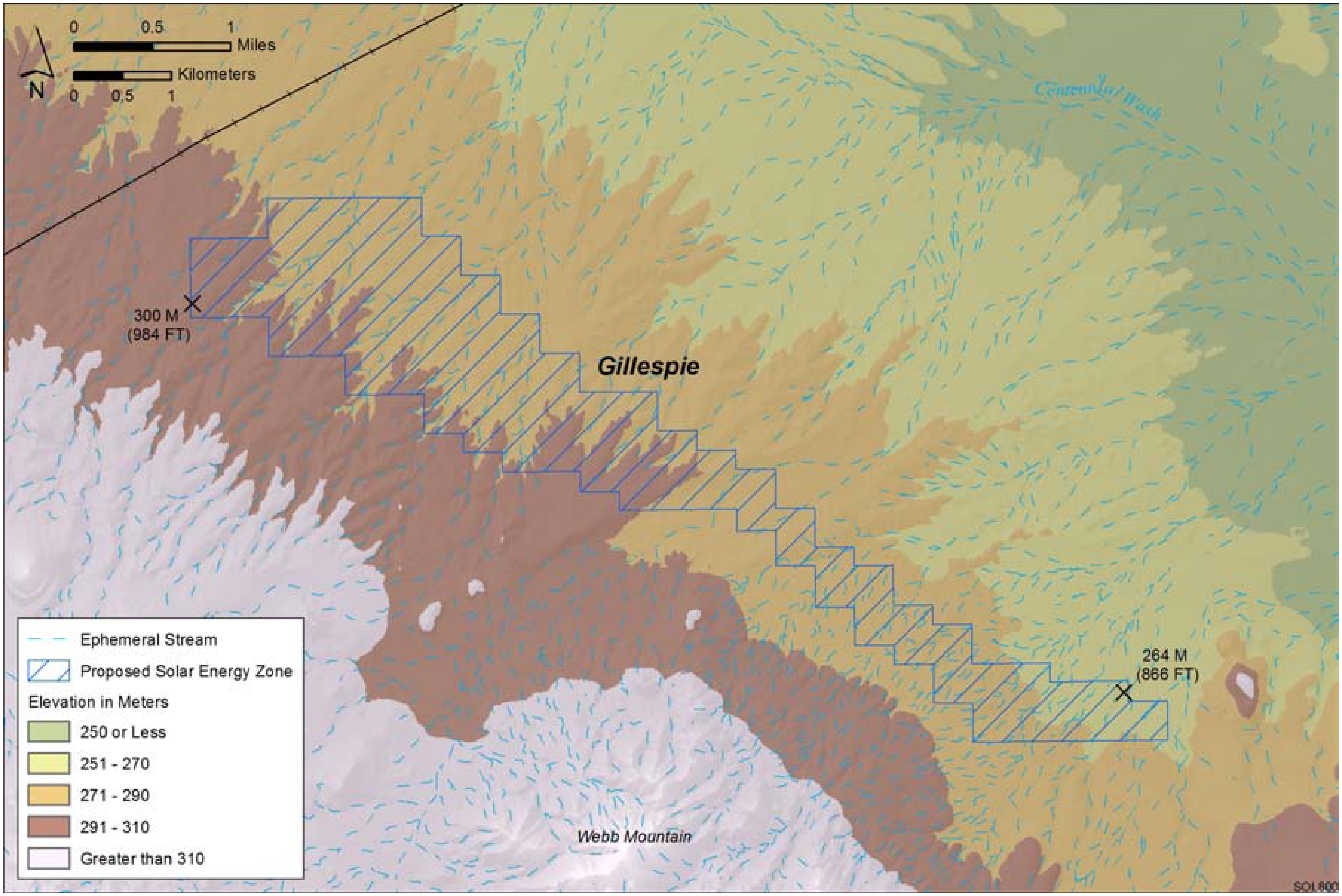

FIGURE 8.3.7.1-3 General Terrain of the Proposed Gillespie SEZ

Seismicity. Most of the seismic activity in Arizona occurs along the northwest-trending boundary (transition zone) between the Basin and Range and Colorado Plateau physiographic provinces north of the three proposed Arizona SEZs (Figure 8.3.7.1-4). No Quaternary faults have been identified in the vicinity of the proposed Gillespie SEZ (USGS and AZGS 2010).

From June 1, 2000 to May 31, 2010, no earthquakes were recorded within a 61-mi (100-km) radius of the proposed Gillespie SEZ (USGS 2010a). The most recent earthquakes have occurred in northern Arizona (north of Flagstaff) and in southeastern California (DuBois and Smith 1980). The largest earthquake in the region occurred on February 4, 1976, near Prescott, Arizona, about 95 mi (155 km) north-northeast of the Gillespie SEZ (Figure 8.3.7.1-4). The earthquake registered a magnitude[2] (ML) of 5.2 (USGS 2010a).

Liquefaction. The proposed Gillespie SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.03 and 0.04 g. Shaking associated with this level of acceleration is generally perceived as light to moderate; the potential damage to structures is very light (USGS 2008). Given the low incidence of earthquakes within a 61-mi (100-km) radius of the Gillespie SEZ and the very low intensity of ground shaking estimated for the area, the potential for liquefaction in valley sediments is also likely to be very low.

Volcanic Hazards. Extensive volcanic activity occurred in Arizona throughout the Tertiary period; the most recent activity occurred less than 4 million years ago, mainly along the edge of the Colorado Plateau in northeastern Arizona (Figure 8.3.7.1-4). Over the past 15 million years, eruptions were predominantly composed of basalt. The nearest volcanic center is the Sentinel volcanic field, about 45 mi (70 km) due south of the proposed Gillespie SEZ; basaltic lava flows erupted from volcanic vents in this area from about 3.3 to 1.3 million years ago (Wood and Kienle 1992). Currently, there is no evidence of volcanic activity in Arizona (Fellows 2000). Lynch (1982) suggests that the next eruption in Arizona would most likely occur in the San Francisco Mountain, Uinkaret, or Pinacate volcanic fields and, because it likely would be of the strombolian type (basaltic lava from a single vent with intermittent explosions), would cause little damage or disruption.

Slope Stability and Land Subsidence. The incidence of rock falls and slope failures can be moderate to high along mountain fronts and can present a hazard to facilities on the relatively flat terrain of valley floors, if they are located at the base of steep slopes. The risk of rock falls and slope failures decreases toward the flat valley center.

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2 Richter scale magnitude (ML) was the original magnitude defined by Richter and Gutenberg for local earthquakes in 1935. It was based on the maximum amplitude recorded on a Wood-Anderson torsion seismograph but is currently calculated for earthquakes with magnitudes ranging from 2 to 6, using modern instruments with adjustments (USGS 2010b).

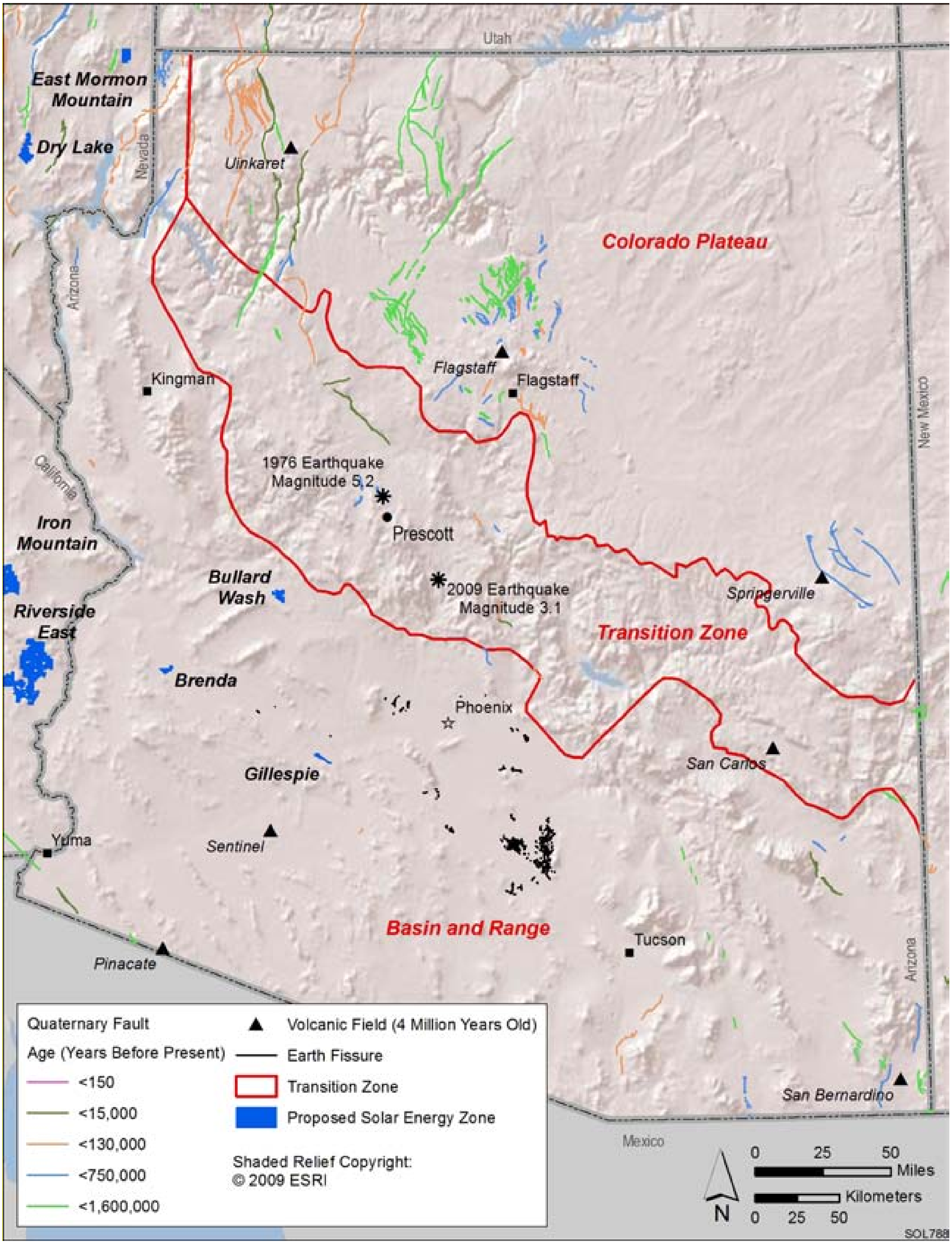

FIGURE 8.3.7.1-4 Quaternary Faults, Volcanic Fields, and Earth Fissures in Arizona (USGS and AZGS 2010; USGS 2010a)

The AZGS has reviewed aerial and satellite imagery and conducted on-the-ground investigations at 23 study areas to identify and map earth fissures with surface expression. The study areas are within four Arizona counties (Pinal, Maricopa, Cochise, and Pima) that are prone to fissuring (Shipman and Diaz 2008). To date, earth fissures and subsidence of about 0.6 ft (0.2 m) have been identified within the Harquahala Plain (Maricopa County), about 20 mi (30 km) northwest of the proposed Gillespie SEZ (AZGS 2010; Galloway et al. 1999) (Figure 8.3.7.1-4). The fissures are the result of ground subsidence due to groundwater overdrafts in the basin that have caused differential compaction in the underlying aquifer. Land failure caused by subsidence and fissures in parts of Arizona has been significant enough to damage buildings, roads, railroads, and sewer lines and necessitate changes in the planned route of the Central Arizona Project aqueduct (Galloway et al. 1999). Subsidence is also thought to be occurring in McMullen Valley near Wendon, Arizona, and may account for frequent flooding events on the Centennial Wash at that location (two 100-year floods in the last 10 years). Wendon is located on the Centennial Wash, upstream of the Gillespie SEZ, about 50 mi (85 km) to the northwest (Allison 2010).

Other Hazards. Other potential hazards at the proposed Gillespie SEZ include those associated with soil compaction (restricted infiltration and increased runoff), expanding clay soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement). Disturbance of soil crusts and desert pavement on soil surfaces may increase the likelihood of soil erosion by wind.

Alluvial fan surfaces, such as those underlying the proposed SEZ, can be the sites of damaging high-velocity "flash" floods and debris flows during periods of intense and prolonged rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris flow fans) depends on the specific morphology of the fan (National Research Council 1996). Section 8.3.9.1.1 provides further discussion of flood risks within the Gillespie SEZ.

8.3.7.1.2 Soil Resources

Soils within the proposed Gillespie SEZ are extremely gravelly sandy loams and very gravelly sandy loams typical of alluvial fan (and fan terrace) settings (Figure 8.3.7.1-5). Parent material consists of fan alluvium from mixed sources. Most soils are characterized as very deep and somewhat excessively to excessively drained with moderate surface runoff potential and moderate to very rapid permeability. The natural soil surface is moderately suited for roads, with a slight to moderate water erosion hazard when used as roads or trails. The susceptibility to wind erosion is low, although all soils have features favorable for dust formation if disturbed (NRCS 2010).

None of the soils within the SEZ is rated as hydric.[3] Occasional flooding of the Carrizo-Momoli complex (flood plain) soils occurs along the major washes that cross the SEZ from the southwest with a 5 to 50% chance of flooding in any given year. The flooding probability

[3] A hydric soil is a soil formed under conditions of saturation, flooding, or ponding (NRCS 2010).

TABLE 8.3.7.1-1 Summary of Soil Map Units within the Proposed Gillespie SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area, in Acres[b] (% of SEZ)
37	Gunsight-Rillito-Carrizo complex (1 to 15% slopes)	Slight	Low (WEG 8)[c]	Consists of 45% Gunsight extremely gravelly sandy loam, 35% Rilliot very gravelly sandy loam, and 15% Carrizo extremely gravelly sandy loam. Nearly level to sloping soils on alluvial fan terraces and flood plains. Parent material is alluvium from mixed sources. Soils are very deep and somewhat excessively drained, with moderate surface runoff potential and moderate to very rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	2,370 (91)
34	Gunsight-Chuckawalla complex (1 to 15% slopes)	Slight	Low (WEG 8)	Consists of 40% Gunsight extremely gravelly sandy loam and 35% Chuckawalla extremely gravelly loam. Nearly level to sloping soils on alluvial fan terraces. Parent material is alluvium derived from mixed sources. Soils are very deep and somewhat excessively drained, with moderate surface runoff potential and moderate to moderately rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	131 (5)
6	Carrizo-Momoli complex (0 to 3% slopes)	Slight	Low (WEG 8)	Consists of 65% Carrizo extremely gravelly sandy loam and 25% of Momoli very gravelly sandy loam. Level to gently sloping soils on alluvial fans, fan terraces, and flood plains. Parent material is alluvium from mixed sources. Soils are very deep and excessively drained, with low surface runoff potential (high infiltration rate) and moderately rapid to very rapid permeability. Available water capacity is very low to low. Slight rutting hazard. Used for rangeland and wildlife habitat; not suitable for cultivation.	117 (4)

Footnotes on next page.

TABLE 8.3.7.1-1 (Cont.)

[a] Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (whole soil; doesn't account for the presence of rock fragments) and represent soil loss caused by sheet or rill erosion where 50 to 75% of the surface has been exposed by ground disturbance. A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions. A rating of "severe" indicates that erosion is expected; loss of soil productivity and damage are likely and erosion control measures may be costly or impractical.

[b] To convert acres to km^2, multiply by 0.004047.

[c] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEGs 8,0 tons per acre per year.

Source: NRCS (2010).

decreases away from the washes where the frequency of flooding is less than once in 500 years. Most of the soils are not suitable for cultivation unless irrigated; none are classified as prime farmland. The major crops in the region are alfalfa (forage), cotton, and small grains with some citrus (NRCS 2010; USDA 2010a).

8.3.7.2 Impacts

Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase of a solar project. These include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such impacts are common to all utility-scale solar energy developments in varying degrees and are described in more detail for the four phases of development in Section 5.7.1.

Because impacts on soil resources result from ground-disturbing activities in the project area, soil impacts would be roughly proportional to the size of a given solar facility, with larger areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2). The magnitude of impacts would also depend on the types of components built for a given facility since some components would involve greater disturbance and would take place over a longer timeframe.

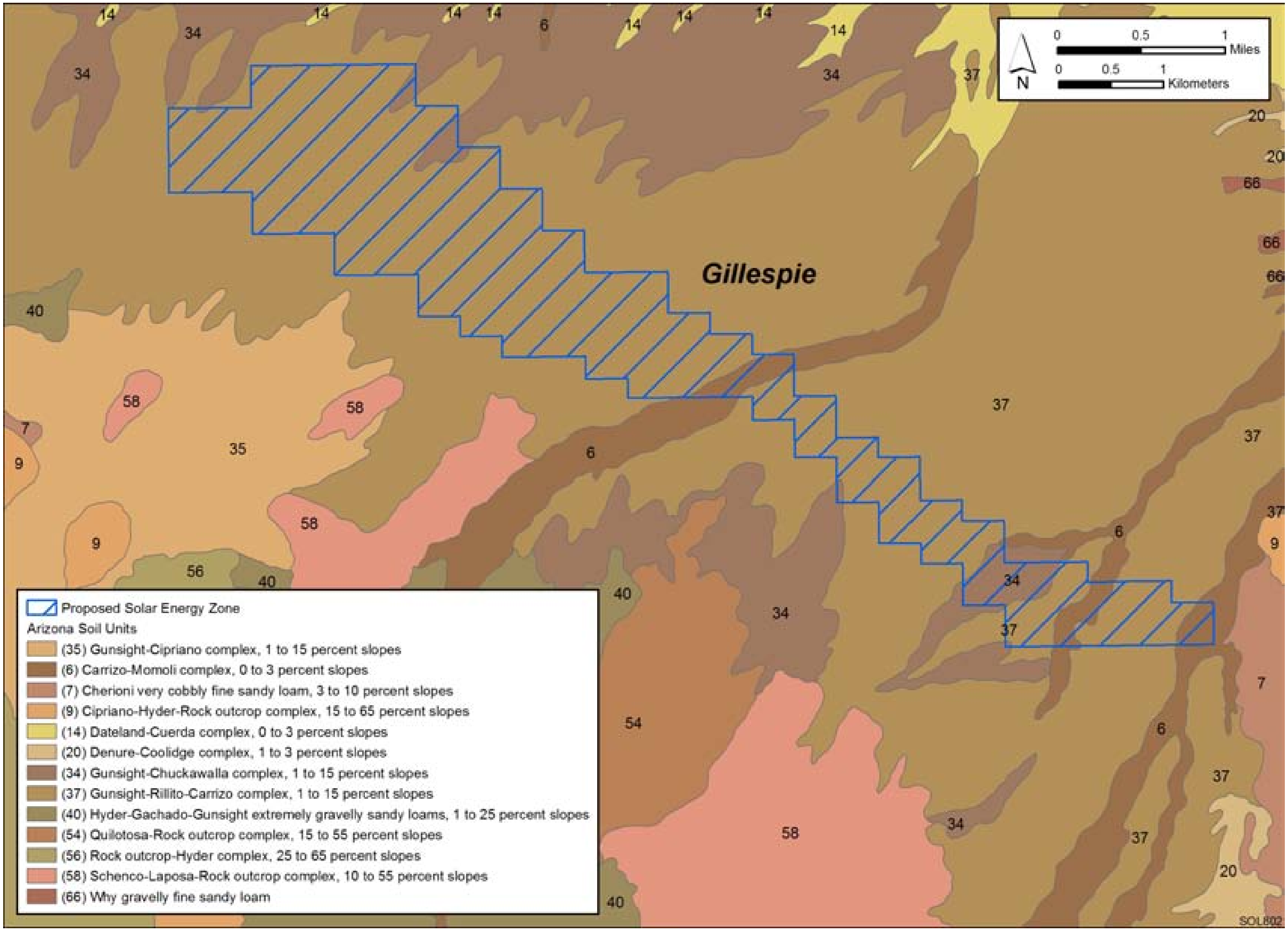

FIGURE 8.3.7.1-5 Soil Map for the Proposed Gillespie SEZ (NRCS 2008)

8.3.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed Gillespie SEZ. Implementing the programmatic design features described under both Soils and Air Quality in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for soil impacts during all project phases.

8.3.8 Minerals (Fluids, Solids, and Geothermal Resources)

8.3.8.1 Affected Environment

The public lands within the proposed Gillespie SEZ have been closed to locatable mineral entry since June 2009 pending the outcome of this solar energy PEIS; however, as of August 2, 2010, there are six placer mining claims that predate the mineral segregation and that are located in the very northern portion of the SEZ (BLM and USFS 2010a). These claims represent prior existing rights and they encumber all or portions of about 210 acres (0.8 km^2) within the SEZ.

No active oil and gas leases are within the SEZ. A portion of the northwestern corner of the SEZ was leased in the past, but that lease has expired. Other scattered expired oil and gas leases also are located in the area around the SEZ (BLM and USFS 2010b). The area remains open for discretionary mineral leasing for oil and gas and other leasable minerals, and for disposal of salable minerals.

No active geothermal leasing or development is occurring in or near the SEZ, nor has the area been leased previously (BLM and USFS 2010b).

8.3.8.2 Impacts

The existing mining claims represent prior existing rights to a small portion of the SEZ, and no solar development would be possible within this area without the claimant's agreement or unless the claims are ruled to be invalid. The mining claimants are free to develop their claims subject to existing regulations, so there would be no loss of locatable mineral resources in this area. Since the rest of the SEZ does not contain existing mining claims, it is assumed that there would be no future loss of locatable mineral production from within the area.

For the purpose of this analysis, it is assumed that future development of oil and gas resources within the SEZ, should any be found, would continue to be possible, since such development could occur with directional drilling from outside the SEZ. The production of common minerals, such as sand and gravel and mineral materials used for road construction or other purposes, might take place in areas not directly developed for solar energy production.

The SEZ has had no history of development of geothermal resources, and for that reason it is not anticipated that solar development would adversely affect development of geothermal resources.

8.3.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required to protect mineral resources. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for impacts on mineral resources.

8.3.9 Water Resources

8.3.9.1 Affected Environment

The proposed Gillespie SEZ is located within the Agua Fria River–Lower Gila River subbasin of the Lower Colorado hydrologic region (USGS 2010c) and the Basin and Range physiographic province characterized by intermittent mountain ranges and desert valleys (Robson and Banta 1995). The proposed SEZ has surface elevations ranging between 880 and 1,040 ft (270 and 320 m). The proposed Gillespie SEZ is located in a valley northeast of the Gila Bend Mountains that is separated from the Tonopah Desert to the north by the Palo Verde Hills and other small mountain ranges (Figure 8.3.9.1-1). Average annual precipitation is estimated to be less than 8 in./yr (20 cm/yr) (ADWR 2010a). Evaporation is estimated to be 105 in./yr (267 cm/yr) (Cowherd et al. 1988).

8.3.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)

There are no perennial surface water features on the proposed Gillespie SEZ. The Gila River is located 3 mi (5 km) east of the eastern edge of the SEZ and is perennial in this area due to waste water treatment effluent released upstream of the area (ADWR 2010a). Centennial Wash flows northwest to southeast to the Gila River approximately 2 to 3 mi (3 to 5 km) northeast of the SEZ (Figure 8.3.9.1-1). Several ephemeral wash tributaries to Centennial Wash flow through the proposed Gillespie SEZ from the mountains to the southwest. Runoff has been measured at two locations in the Centennial Wash near the SEZ (gauges 9517490 and 9517500). Mean annual flow was measured to be 1,486 ac-ft/yr (1.8 million m^3/yr) and 3,065 ac-ft/yr (3.8 million m^3/yr), and maximum annual flow, 5,652 ac-ft/yr (7.0 million m^3/yr) and 9,192 ac-ft/yr (11 million m^3/yr) at gauges 9517490 and 9517500, respectively (ADWR 2010a). Peak streamflow in Centennial Wash has been measured at up to 9,200 ft^3/s (260 m^3/s) in gauge 9517490 in 1993 (USGS 2010d).

Flood hazards within the SEZ are estimated to be between the 100-yr and 500-yr floodplains (Zone X500) (FEMA 2009). Flood warning stations (5075 and 5095) are located at the base of Webb Mountain to the southwest (ADWR 2010a). These stations provide alerts of potential flooding from the unnamed washes that flow out the mountains and through the proposed Gillespie SEZ (ADWR 2010a). A riverine wetland is mapped by the NWI just inside the southeast corner of the SEZ (USFWS 2009a). For further details on wetlands near the SEZ, see Section 8.3.10.

8.3.9.1.2 Groundwater

The proposed Gillespie SEZ is located within the Lower Hassayampa groundwater basin. Recharge in the basin occurs primarily along the Gila River, Hassayampa River, and Centennial Wash, where the basin deposits consist of recently deposited alluvium (Anderson 1995). The three basin fill deposits within the Lower Hassayampa Basin are the upper alluvium, which

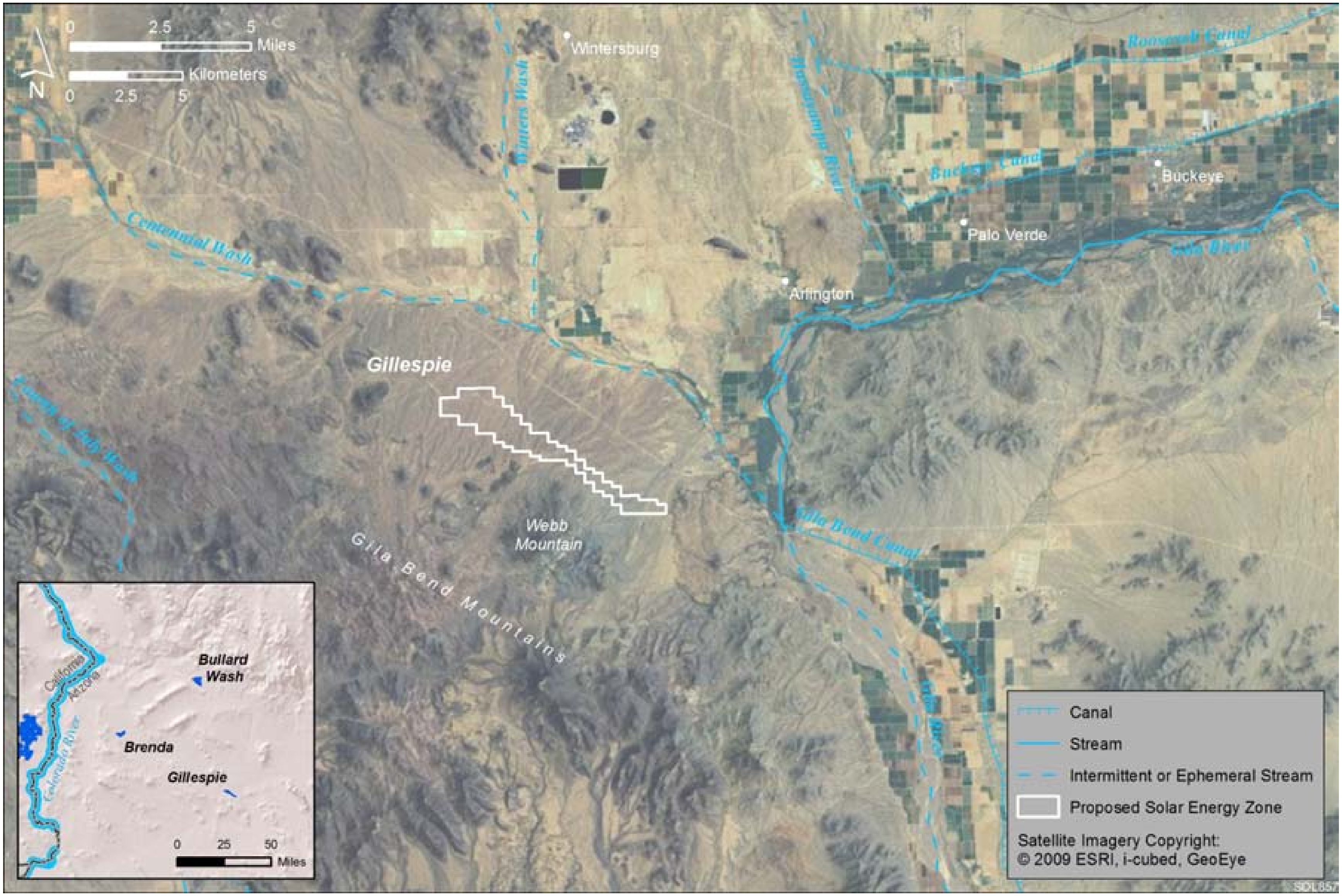

FIGURE 8.3.9.1-1 Surface Water Features near the Proposed Gillespie SEZ

consists of coarse-grained recent alluvial deposits approximately 30 to 60 ft (9 to 18 m) thick; the middle alluvium, which consists of fine grained materials approximately 230 to 300 ft (70 to 91 m) thick; and the lower alluvium, which consists of coarse-grained materials and some consolidated alluvial fan deposits approximately 100 to more than 1,000 ft (30 to 300 m) thick (ADWR 1999). Depth to groundwater near the SEZ ranged from 34 to 227 ft (10 to 69 m) below ground surface in 1981, when the most recent measurements were obtained (USGS 2010d; wells 31438112535301, 331456112460101, 33180112541601).

Pre-disturbance groundwater inflow was estimated to be 32,000 ac-ft/yr (39 million m^3/yr) within the Lower Hassayampa Basin (Freethy and Anderson 1986). Inflows were estimated to originate mainly from underflow from adjacent basins, with a small percentage of inflows as recharge, derived both from loss from streams and from infiltration of precipitation and runoff (Freethy and Anderson 1986). Inflows from the adjacent West Salt River Valley basin were estimated to be between 15,000 and 30,000 ac-ft/yr (18 million and 37 million m^3/yr); inflows from the adjacent Hassayampa Plain basin to the north, 1,000 and 5,000 ac-ft/yr (1.2 million and 6.2 million m^3/yr); and inflows from the Harquahala Basin to west, less than 1,000 ac-ft/yr (1.2 million m^3/yr) (Freethy and Anderson 1986). Outflows to the Gila Bend Basin to the south were estimated to be between 1,000 and 5,000 ac-ft/yr (1.2 million and 6.2 million m^3/yr), primarily as surface water discharge in the Gila River (Anderson 1995; Freethy and Anderson 1986).

Pumping groundwater for agricultural purposes in the Lower Hassayampa Basin reportedly began in the early 1950s (ADWR 1999). Between the 1950s and 1998, water levels declined by up to 90 ft (27.4 m) in the Lower Hassayampa Basin (ADWR 1999). In 1998, a large cone of depression was present in the Lower Hassayampa Basin because of continued agricultural pumping (ADWR 1999).

Groundwater withdrawals in the Lower Hassayampa Basin have led to land subsidence within the basin and an earth fissure approximately 1,200 ft (366 m) long southeast of the town of Wintersburg (ADWR 2010b; AZGS 2009). Land subsidence was measured to be occurring at a rate of up to 0.8 in./yr (2 cm/yr) between 2006 and 2008, primarily in the agricultural areas along the Gila River and near the town of Buckeye (ADWR 2010b).

TDS concentrations sampled from within the Lower Hassayampa Basin range from 1,200 mg/L to more than 3,000 mg/L, and thus the water within the basin exceeds the EPA secondary MCL for TDS (ADWR 2010a; EPA 2009a; USGS 2010d). Drinking water standard exceedances of fluoride, arsenic, nitrate, and volatile or semivolatile organic compounds have also been found in the basin (ADWR 2010a; USGS 2010d, wells: 331519112484901, 331801112541601, 331829112495701, and 331845112522301).

8.3.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals from surface waters and groundwater in Maricopa County were 1.58 million ac-ft/yr (1.95 billion m^3/yr), of which 16% came from surface waters and 84% from groundwater. The largest water use category was agriculture, at 1.27 million ac-ft/yr

(1.57 billion m^3/yr). Thermoelectric water uses accounted for 26,400 ac-ft/yr (32.6 million m^3/yr), with public supply, municipal, and industrial water uses on the order of 25,800 ac-ft/yr (31.8 million m^3/yr), 7,800 ac-ft/yr (9.6 million m^3/yr), and 6,200 ac-ft/yr (7.6 million m^3/yr), respectively (Kenny et al. 2009).

Arizona water law is based on the doctrine of prior appropriation. However, water laws in Arizona are based on a bifurcated system in which surface water and groundwater rights are administered and assessed separately. The state of Arizona has four main sources of water: Colorado River water, surface water separate from the Colorado River, groundwater, and treated effluent. Rights for these four sources are assessed and administered separately; Colorado River water is regulated under the Law of the River, surface water is based on prior appropriation, and groundwater rights are handled on a region by region basis (BLM 2001). Effluent is not available for use until it takes on the characteristics of surface water through treatment (ADWR 2010d). The ADWR is the agency responsible for the conservation and distribution of water in the state. It is also responsible for the administering and assessment of novel and transfer of existing water rights and applications. The agency's broad goal is the security of long-term dependable water supplies for the state, which is the main factor in the assessment of water right applications (ADWR 2010f).

Upon completion of an application for water rights, the ADWR assesses it with three main criteria: whether the proposed water right will conflict with more senior water rights, whether the proposed right is a threat to public safety, and whether the proposed right will be detrimental to the interests and welfare of the general public (BLM 2001). Generally, surface water rights are assessed solely upon the criteria above but they may also be subject to certain management plans in specific areas put into effect by the ADWR. Unlike the majority of groundwater rights that are bound to the land they occupy, users of surface water rights have the option to change location of the water right but not the beneficial use (a change of beneficial use application would need to be submitted). In order to change a surface water right's location, a "sever and transfer" permit needs to be approved by the ADWR and the governing body of the irrigation district or water users council of the proposed new location of the surface water right. Evaluations of "sever and transfer" permits follow the same general evaluation guidelines as new surface water rights, and the proposed new location of the right after the transfer is treated as a new surface water right. The new surface water right must not exceed the old one in annual water use (ADWR 2010d).

Arizona has rights to 2.8 million ac-ft (3.4 billion m^3/yr) of Colorado River water annually, which is further subdivided into allocations for both general Colorado River water users and Central Arizona Project (CAP) users (ADWR 2010j). CAP is a system of water delivery canals, aqueducts, and pumping stations that deliver 1.5 million ac-ft/yr (1.9 billion m^3/yr) of Colorado River water from Lake Havasu to Pima, Pinal, and Maricopa Counties annually (CAP 2010). The flows of the Colorado River are variable and thus the water resource availability is variable from year to year.

Due to historic groundwater overdraft, where groundwater recharge is exceeded by discharge (in some places groundwater overdraft is in excess of 700,000 ac-ft/yr [863 million m^3/yr]), the Ground Water Management Code (The Code) was put into effect in

1980 (ADWR 2010j; ADWR 1999). The Code describes three main goals for the state regarding the management of groundwater: controlling severe overdraft, the allocation of the limited water resources of the state, and the enhancement of the state's groundwater resources using water supply development (BLM 2001). Arizona's groundwater management laws are separated using a three-tier system based on the Code, in which proposed applications are evaluated with an increasing level of scrutiny. The lowest level of management includes provisions that apply statewide, Irrigation Non-Expansion Areas (INAs) have an intermediate level of management, and Active Management Areas (AMAs) have the highest level of management with the most restrictions and provisions. Within an AMA or INA, a groundwater permit is required (BLM 2001). There are currently five AMAs and three INAs in the state, which each have their own specific rules and regulations regarding the appropriation of groundwater (ADWR 2010i). In locations outside of designated AMAs and INAs, a permit is not necessary to withdraw groundwater (BLM 2001). Use of this groundwater, however, requires the filing of a notice of intent to drill with the ADWR.

Recently, the ADWR (2010d) has created guidelines regarding the appropriation of water for solar generating facilities, specifically detailing what information needs to be submitted for permit evaluation. Required information includes the proposed method of power generation, the proposed amount of water to be consumed, the point of diversion, and to what or whom the power is to be distributed. To secure water rights for a solar facility to be located within an AMA, the applicant must demonstrate that there is an "assured water supply" for the life of the project. The ADWR then makes a decision based on whether the proposed water right will be detrimental to public welfare and general conservation of water (ADWR 2010d).

The Arizona State Legislature created the Underground Water Storage and Recovery Program in 1986 and enacted the Underground Water Storage, Savings, and Replenishment Act in 1994 to make use of excess water that may be lost in times of surplus water supply (AWBA 2010). The Underground Water Storage, Savings, and Replenishment Act created the Arizona Water Banking Authority, which has two programs: (1) Underground Storage Facilities, which use excess CAP water, other surface water, or effluent to artificially recharge a groundwater aquifer, and (2) Groundwater Savings Facilities, which provide water supplies (CAP water, other surface water or effluent) in lieu of using groundwater, allowing the groundwater to stay in storage and become "savings" (ADWR 2010e; AWBA 2010). The ADWR is in charge of the distribution of the program's waters as well as the evaluations of permits to store and recover their waters (ADWR 2010e). In order to put this water to use, the ADWR must first award a recovery well permit (ADWR 2010e). If a recovery well permit is submitted for use inside an AMA, a "hydrologic impact analysis" report may also need to be submitted (ADWR 2010d).

From a groundwater management perspective, the proposed Gillespie SEZ is located within the Hassayampa subbasin of the Phoenix AMA basin (ADWR 1999). The Phoenix AMA is subdivided into five groundwater subbasins. The Hassayampa is further divided into the Northern Hassayampa Plain and the Lower Hassayampa Basin (ADWR 1999), the latter of which has boundaries very similar to those of the Lower Hassayampa Basin, as described in USGS reports (e.g., Anderson 1995; Freethy and Anderson 1986). The Phoenix AMA is the largest AMA with an area of 3.6 million acres (14,600 km^2) and an estimated annual natural recharge of 24,200 ac-ft (29.8 million m^3) (ADWR 2010a). Between 2001 and 2005 there was an annual groundwater use of 814,300 ac-ft (1.0 billion m^3) and an annual surface water use of 1.44 million ac-ft (1.8 billion m^3) within the Phoenix AMA (ADWR 2010a).

Groundwater management and assessment of groundwater applications for rights inside AMAs are coordinated by a Ground Water Users Advisory Council (GUAC), a governor-appointed council responsible for managing groundwater within each AMA (BLM 2001). The goal of each GUAC is to achieve "safe yield" in the basin, a scenario in which total inflow of water into the basin is equal to outflow (BLM 2001). In order to achieve these goals, updated groundwater basin management plans are drafted every 10 yr, with conservation plans and requirements becoming more stringent with time. Management plans have been and will be drafted from 1980 to 2025, with the last period being only 5 yr, for a total of five management plans. Each AMA is currently in the third period of the plan management cycle, from 2000 to 2010 (ADWR 2010c).

Groundwater banking provides water within the Phoenix AMA. Within the Phoenix AMA the total permitted storage capacity for underground storage facilities is 962,000 ac-ft/yr (1.19 billion m^3/yr) and the total permitted storage capacity for groundwater storage facilities is 517,520 ac-ft/yr (638 million m^3/yr) (ADWR 2010a). Total deliveries of water to the Phoenix AMA through the AWBA were 79,800 ac-ft (98.5 million m^3) in 2008, 150,200 ac-ft (185 million m^3) in 2007, 124,600 ac-ft (154 million m^3) in 2006, and 33,100 ac-ft (40.8 million m^3) in 2005 (ABWA 2010).

Because the proposed Gillespie SEZ is within an AMA, more restrictions on water use will apply. Water conservation requirements are also more stringent with AMAs.

Effluent may also be available for use by proposed solar facilities. The Palo Verde Nuclear Plant, which is also within the Lower Hassayampa Basin, has secured effluent of up to 80,000 ac-ft/yr (98.7 million m^3/yr) through 2050 from Phoenix (Bui 2010). More than 324,000 ac-ft/yr (400 million m^3/yr) of effluent is produced within the Phoenix AMA (ADWR 2010a).

8.3.9.2 Impacts

Potential impacts on water resources related to utility-scale solar energy development include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at the place of origin and at the time of the proposed activity, while indirect impacts occur away from the place of origin or later in time. Impacts on water resources considered in this analysis are the result of land disturbance activities (construction, final developed site plan, as well as off-site activities such as road and transmission line construction) and water use requirements for solar energy technologies that take place during the four project phases: site characterization, construction, operations, and decommissioning/reclamation. Both land disturbance and consumptive water use activities can affect groundwater and surface water flows, cause drawdown of groundwater surface elevations, modify natural drainage pathways, obstruct natural recharge zones, and alter surface water-wetland-groundwater connectivity. Water quality also can be degraded through the generation of wastewater, chemical spills, increased erosion and sedimentation, and increased salinity (e.g., by excessive withdrawal from aquifers).

8.3.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy facilities, which are described in more detail for the four phases of development in Section 5.9.1; these impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2. Land disturbance impacts in the vicinity of the Gillespie SEZ could potentially enhance erosion processes, disrupt groundwater recharge, and negatively affect plant and animal habitats associated with the ephemeral channels. Tributaries to Centennial Wash convey flows during storm events, as evident from channel incision and sedimentation patterns within, upstream, and downstream of the Gillespie SEZ. Land disturbance within the SEZ could potentially cause channel incision and sedimentation problems for the Centennial Wash system.

8.3.9.2.2 Water Use Requirements for Solar Energy Technologies

Analysis Assumptions

A detailed description of the water use assumptions for the four utility-scale solar energy technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in Appendix M. Assumptions regarding water use calculations specific to the proposed Gillespie SEZ include the following:

- On the basis of a total area of 2,618 acres (10.6 km^2), it is assumed that one solar project would be constructed during the peak construction year;

- Water needed for making concrete would come from an off-site source;

- The maximum land disturbance for an individual solar facility during the peak construction year would be 2,094 acres (12 km^2);

- Assumptions on individual facility size and land requirements (Appendix M), along with the assumed number of projects and maximum allowable land disturbance, result in the potential to disturb up to 80% of the SEZ total area during the peak construction year; and

- Water use requirements for hybrid-cooling systems are assumed to be on the same order of magnitude as those using dry-cooling system (see Section 5.9.2.1).

Site Characterization

During site characterization, water would be used mainly for fugitive dust control and the workforce potable water supply. Impacts on water resources during this phase of development are expected to be negligible, since activities would be limited in area, extent, and duration; water needs could be met by trucking in water from an off-site source.

Construction

During construction, water would be used mainly for controlling fugitive dust and for providing the workforce potable water supply. Because there are no significant surface water bodies on or adjacent to the Gillespie SEZ, the water requirements for construction activities could be met either by trucking water to the sites, using on-site groundwater resources, or piping in surface water or effluent. Water requirements for dust suppression and potable water supply during the peak construction year are shown in Table 8.3.9.2-1 and could be as high as 1,287 ac-ft (1.6 million m^3/yr). The assumptions underlying these estimates for each solar energy technology are described in Appendix M. Groundwater wells would have to yield up to an estimated 800 gpm (3,000 L/min) to meet the estimated construction water requirements. This yield is within the range of producing wells within the Lower Hassayampa Basin and is typical of well yields of small to medium-sized farms in Arizona (ADWR 2010a; USDA 2009a). Withdrawal of the construction water would require a permit from the ADWR. In addition to groundwater withdrawal, up to 74 ac-ft (91,000 m^3/yr) of sanitary wastewater would be generated annually and need to be either treated on-site or sent to an off-site facility. Groundwater quality in the vicinity of the SEZ has concentrations of TDS, arsenic, fluoride, and

TABLE 8.3.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Gillespie SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	1,199	1,255	1,255	1,255
Potable supply for workforce (ac-ft)	74	31	13	7
Total water use requirements (ac-ft)	1,273	1,287	1,268	1,262
Wastewater generated				
Sanitary wastewater (ac-ft)	74	31	13	7

[a] Assumptions of water use for fugitive dust control, workforce potable supply, and wastewater generation are presented in Table M.9-1 (Appendix M).

[b] Fugitive dust control estimation assumes a local pan evaporation rate of 105 in./yr (267 cm/yr) (Cowherd et al. 1988; WRCC 2010b).

[c] To convert ac-ft to m^3, multiply by 1,234.

other constituents that exceed drinking quality standards (ADWR 2010a). Water would need to be treated or imported to meet drinking water quality standards for potable water.

Operations

Water would be required for mirror/panel washing, the workforce potable water supply, and cooling during operations. Cooling water is required only for the parabolic trough and power tower technologies. Water needs for cooling are a function of the type of cooling used (dry, wet, hybrid). Further refinements to water requirements for cooling would result from the percentage of time that the option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 8.3.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per megawatt. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

The water use requirements of the solar energy technologies are a factor of the full build-out capacity, as well as assumptions on water use and technology operations discussed in Appendix M. Table 8.3.9.2-2 lists the amounts of water needed for mirror/panel washing, potable water supply, and cooling activities for each solar energy technology. At full build-out capacity, the estimated total water use requirements for non-cooling technologies (i.e., technologies that do not use water for cooling) during operations are 12 and 118 ac-ft/yr (14,800 to 146,000 m^3/yr) for the PV and dish engine technologies, respectively. For technologies that use water for cooling (i.e., power tower and parabolic trough), total water needs range from 166 ac-ft/yr (0.2 million m^3) (power tower for an operating time of 30% using dry cooling) to 6,289 ac-ft/yr (7.8 million m^3/yr) (parabolic trough for an operating time of 60% using wet cooling). Operations would generate up to 6 ac-ft/yr (7,400 m^3/yr) of sanitary wastewater; in addition, for wet-cooling technologies, 66 to 119 ac-ft/yr (81,400 to 147,000 m^3/yr) of cooling system blowdown water would need to be either treated on-site or sent to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are effectively lined in order to prevent any groundwater contamination.

Water demands during operations would most likely be met by withdrawing groundwater from wells constructed on-site. The non-cooled technologies—PV system and dish engine—would require well yields of 7 to 72 gpm (28 to 272 L/min), respectively. Cooled technologies (parabolic trough and power tower) would require well yields from 102 to 393 gpm (389 to 1,490 L/min) for dry cooling and 723 to 3,900 gpm (2,740 to 14,800 L/min) for wet cooling. The required well yields for non-cooled technologies are within the range of well yields within the Lower Hassayampa Basin and are much less than the water demands for cooled technologies. Cooled technology water demands (particularly wet cooling) could exceed the average annual yield for a single well within the basin.

The water demands for technologies that require wet cooling are significant. For the Phoenix AMA, groundwater use between 2001 and 2005 exceeded natural recharge by an average of 790,000 ac-ft/yr (974 million m^3/yr); however, artificial groundwater recharge credits within the basin totaled approximately 1.46 million ac-ft (1.8 billion m^3) as of the end of 2008

TABLE 8.3.9.2-2 Estimated Water Requirements during Operations at the Proposed Gillespie SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	419	233	233	233
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	209	116	116	12
Potable supply for workforce (ac-ft/yr)	6	3	3	0.3
Dry cooling (ac-ft/yr)[e]	84–419	47–233	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	1,885–6,074	1,047–3,374	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	118	12
Dry-cooled technologies (ac-ft/yr)	299–634	166–352	NA	NA
Wet-cooled technologies (ac-ft/yr)	2,101–6,289	1,166–3,493	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	119	66	NA	NA
Sanitary wastewater (ac-ft/yr)	6	3	3	0.3

a Land area for parabolic trough was estimated at 5 acres/MW (0.02 km^2/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km^2/MW).

b Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).

c Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.

d To convert ac-ft to m^3, multiply by 1,234.

e Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr per MW and wet-cooling value assumes 4.5 to 14.5 ac-ft/yr per MW (range in these values represents 30 and 60% operating times) (DOE 2009a).

f NA = not applicable.

g Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

(ADWR 2010a; ADWR 2010h). Based on the information presented here, using groundwater for wet cooling for the full build-out scenario is not deemed feasible for the Gillespie SEZ. To the extent possible, facilities using groundwater for dry cooling should implement water conservation practices to limit water needs. Access to surface water supplies or treated effluent for use by a solar project would depend on the availability of those resources and also on the construction of a pipeline to convey water to the SEZ.

The availability of water rights and the impacts associated with groundwater withdrawals or surface water use would need to be assessed during the site characterization phase of a proposed solar project. Less water would be needed for any of the four solar technologies if the full build-out capacity was reduced. The analysis of water use for the various solar technologies assumed a single technology for full build-out. Water use requirements for development scenarios that assume a mixture of solar technologies can be estimated using water use factors described in Appendix M, Section M.9.

The effects of groundwater withdrawal rates on potential drawdown of groundwater elevations and flow directions would need to be assessed during the site characterization phase of a solar project and during the development of water supply wells. In the vicinity of the proposed Gillespie SEZ, groundwater elevations declined by up to 90 ft (27.4 m) between the 1950s and 1998 (ADWR 1999). In portions of the Lower Hassayampa Basin, the land surface is subsiding at a rate of about 0.8 in./yr (2 cm/yr) because of the declining groundwater levels (ADWR 2010b). With these existing conditions, further groundwater withdrawals for solar energy development could produce further drawdown of groundwater elevations and land subsidence in the vicinity of the SEZ. These indirect impacts could disturb regional groundwater flow patterns and recharge patterns, potentially affecting ecological habitats (see discussion in Section 8.3.10).

Groundwater quality in the vicinity of the SEZ has concentrations of TDS, arsenic, fluoride, and other constituents that exceed drinking quality standards (ADWR 2010a). Water would need to be treated or imported to meet drinking water quality standards for potable water.

Decommissioning/Reclamation

During decommissioning/reclamation, all surface structures associated with the solar project would be dismantled, and the site reclaimed to its preconstruction state. Activities and water needs during this phase would be similar to those during the construction phase (dust suppression and workforce potable supply) and may also include water to establish vegetation in some areas. However, the total volume of water needed is expected to be less. Because quantities of water needed during the decommissioning/reclamation phase would be less than those for construction, impacts on surface and groundwater resources also would be less.

8.3.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Gillespie SEZ is nearly adjacent to existing transmission lines, as described in Section 8.3.1.2, but the SEZ is located approximately 3 mi (5 km) from the nearest state or U.S. route (Old 80). Impacts associated with the construction of roads and transmission lines deal primarily with water use demands for construction, water quality concerns relating to potential chemical spills, and land disturbance effects on the natural hydrology. Water needed for road construction (e.g., for soil compaction, dust suppression, and workforce potable supply) could be trucked to the construction area from an off-site source. As a result, water use impacts would be negligible. Impacts on surface water and groundwater quality resulting from spills would be minimized by implementing the mitigation measures described in Section 5.9.3 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the potential to increase sediment and dissolved solid loads in downstream waters would be conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts associated with alterations to natural drainage pathways and hydrologic processes.

8.3.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources from solar energy development at the proposed Gillespie SEZ are associated with land disturbance effects on the natural hydrology, water quality concerns, and water use requirements for the various solar energy technologies. Impacts relating to water use requirements vary depending on the type of solar technology built and, for technologies using cooling systems, the type of cooling (wet, dry, hybrid) employed. Water requirements would be greatest for wet-cooled parabolic trough and power tower facilities. Dry cooling reduces water use requirements by approximately a factor of 10 compared with wet cooling. PV requires the least amount of water among the solar energy technologies. The estimates of groundwater recharge, discharge, underflow from adjacent basins, and historical data on groundwater extractions and groundwater surface elevations suggest that there is not enough water available to support the water-intensive technologies, such as those using wet cooling for the full build-out scenario.

Because the Gillespie SEZ is located within the Phoenix AMA, a permit would be required for any groundwater supply wells dedicated to a solar facility. A permit would also be required for use of surface water or effluent by a solar facility. Either way, a solar facility would be required to demonstrate that there is an assured water supply for the life of the project. To use any surface water or effluent, pipelines would need to be constructed and fees paid. Using groundwater for the solar project in the basin (particularly for projects that use wet cooling) would worsen overdraft conditions and could increase land subsidence in the vicinity of the solar project. Calculations could be performed to determine the impact of the land subsidence on the storage capacity of the underlying aquifer and the direction of groundwater flow. Use of groundwater from a new well or an increased capacity on an existing well would also require a hydrologic impact analysis report, as described above.

In addition, the water quality in many parts of the basin does not comply with drinking water quality standards, so groundwater would need to be treated or potable water would need to be imported into the area to support potable needs at solar energy facilities.

Land disturbance activities can cause localized erosion and sedimentation issues, as well as alter groundwater recharge and discharge processes. Centennial Wash and its tributaries provide significant recharge to the Lower Hassayampa Basin, and land disturbance activities in the vicinity of the SEZ could significantly affect groundwater recharge to the basin. In addition, land disturbance within the SEZ could affect channel erosion and sedimentation patterns in Centennial Wash and its tributaries.

8.3.9.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, will mitigate some impacts on water resources. Programmatic design features would focus on coordinating with federal, state, and local agencies that regulate the use of water resources to meet the requirements of permits and approvals needed to obtain water for development, and conducting hydrological studies to characterize the aquifer from which groundwater would be obtained (including drawdown effects, if a new point of diversion is created). The greatest consideration for mitigating water impacts would be in the selection of solar technologies. The mitigation of impacts would be best achieved by selecting technologies with low water demands.

Proposed design features specific to the proposed Gillespie SEZ include the following:

- Wet-cooling options would not be feasible if groundwater was the chosen water source for a solar project, and other technologies should incorporate water conservation measures;

- During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain;

- Before drilling a new well, permits must be obtained from the ADWR, and all groundwater rights policies of the ADWR must be followed (ADWR 2010c);

- Groundwater monitoring and production wells should be constructed in accordance with state standards (ADWR 2010g);

- Stormwater management plans and BMPs should comply with standards developed by the Arizona Department of Environmental Quality (ADEQ 2010b);

- Water for potable uses would have to meet or be treated to meet drinking water quality standards; and

- Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site and downstream in Centennial Wash.

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8.3.10 Vegetation

This section describes and discusses potential impacts on vegetation that could occur or is known to occur within the potentially affected area of the proposed Gillespie SEZ. The affected area considered in this assessment includes the areas of direct and indirect effects. The area of direct effects is defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and includes the SEZ and a 60-ft (18-m) wide portion of an assumed access road corridor. The area of indirect effects is defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed access road corridor, where ground-disturbing activities would not occur but that could be indirectly affected by activities in the areas of direct effect.

Indirect effects considered in the assessment include effects from surface runoff, dust, and accidental spills from the SEZ and the road corridor, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ or road corridor. This area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

8.3.10.1 Affected Environment

The proposed Gillespie SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata)* white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Parkinsonia microphyla*) - cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas. Such species include western honey mesquite, ironwood (*Olneya tesota*), and blue paloverde (*Parkinsonia florida*), as well as species such as smoketree (*Psorothamnus spinosus*), which are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). The proposed Gillespie SEZ is located in an area transitional to the Arizona Upland subdivision, which includes paloverde-cacti-mixed scrub communities. Annual precipitation in the Sonoran Desert occurs primarily in winter and summer (Turner and Brown 1994), and is low in the area of the SEZ, averaging about 7.6 in. (193 mm) at Tonopah, Arizona (see Section 8.3.13).

Land cover types, as described and mapped under SWReGAP (USGS 2005), were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed Gillespie SEZ are shown in Figure 8.3.10.1-1. Table 8.3.10.1-1 provides the surface area of each cover type within the potentially affected area.

Lands within the proposed Gillespie SEZ are classified primarily as Sonora–Mojave Creosotebush–White Bursage Desert Scrub. Additional cover types within the SEZ are given in Table 8.3.10.1-1. During a September 2009 visit to the site, the dominant species observed in the sparse desertscrub communities present within the SEZ was creosotebush. Saguaro cactus, paloverde, and ironwood, characteristic Sonoran Desert species, are present but infrequent. Cacti species observed within the SEZ were saguaro cactus, pencil cholla (*Opuntia*), and barrel cactus (*Ferocactus* sp.). Sensitive habitats on the SEZ include desert dry washes and dry wash woodlands. The area has a history of livestock grazing, which likely has affected the plant communities on the SEZ.

The area of indirect effects, including the area within 5 mi (8 km) around the SEZ and the access road corridor, contains 13 cover types (listed in Table 8.3.10.1-1). The predominant cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub.

The eastern half of the Gillespie SEZ is included in the NWI; the western half is not (USFWS 2009a). A riverine wetland is located just inside the southeast corner of the SEZ. No other wetlands are mapped in the eastern half of the SEZ. NWI maps are produced from high-altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009a). This intermittently flooded wetland occurs along an unnamed wash that extends from south of the SEZ to Centennial Wash northeast of the SEZ. The access road corridor also crosses this riverine wetland near the SEZ. Large areas of wetland occur near the eastern end of the access road corridor, associated with the Gila River and Arlington Canal, east of Old Highway 80. These wetland areas primarily support scrub-shrub plant communities near the Gila River and are part of an extensive area of riparian habitat mapped as North American Warm Desert Riparian Woodland and Shrubland, North American Warm Desert Riparian Mesquite Bosque, and Invasive Southwest Riparian Woodland and Shrubland. These riparian habitats are dependent on groundwater discharge. Smaller areas of riparian habitat occur along the Hassayampa River, northeast of the SEZ, and may also receive groundwater discharge. Riverine wetlands occur along the Gila River and Arlington Canal. Wetlands with emergent plant communities, including intermittently, temporarily, and seasonally flooded wetlands, also occur in this area. Wetlands that are semipermanently flooded occur along the Gillespie Dam. Within the 5-mile (8-km) area of indirect effects, an unnamed tributary of the Gila River south of the SEZ is mapped as an intermittently flooded riverine wetland, and much of the Centennial Wash north of the SEZ is mapped as a temporarily flooded riverine wetland, with scrub-shrub, emergent, and sparsely vegetated (less than 30% vegetation cover) wetlands located near Centennial Wash. The scrub-shrub wetlands are primarily mapped as North American Warm Desert Riparian Mesquite Bosque. Two intermittently flooded palustrine wetlands with sparse plant communities, about 1 acre (0.004 km^2) in size, are located north of the SEZ, near the northeastern boundary. These wetlands are formed by dikes across ephemeral washes. One of these is mapped as North American Warm Desert Riparian Mesquite Bosque. A number of small wetlands east of the SEZ were formed by excavation.

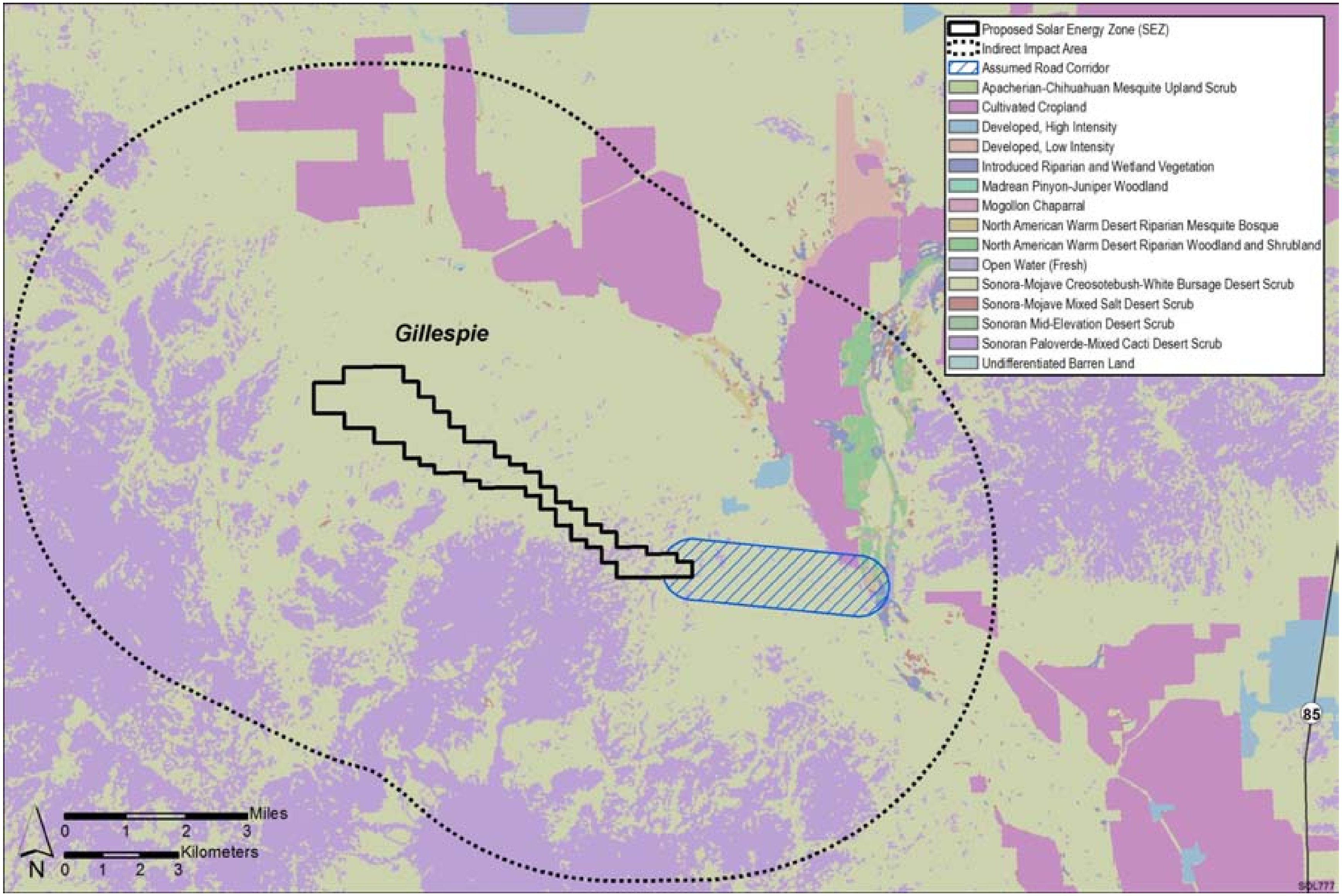

FIGURE 8.3.10.1-1 Land Cover Types within the Proposed Gillespie SEZ (Source: USGS 2004)

TABLE 8.3.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Gillespie SEZ and Potential Impacts

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Corridor and Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f]
Sonora–Mojave Creosotebush–White Bursage Desert Scrub: Occurs in broad valleys, lower bajadas, plains, and low hills in the Mojave and Sonoran deserts. Shrubs form a sparse to moderately dense cover (2%-50%), although the ground surface may be mostly barren. The dominant species are typically creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Other shrubs, dwarf-shrubs, and cacti may also be dominant or form sparse understories. Herbaceous species are typically sparse, but may be seasonally abundant.	2,482 acres[g] (0.1%, 0.2%)	19 acres (<0.1%)	57,863 acres (2.1%)	Small
Sonoran Paloverde-Mixed Cacti Desert Scrub: Occurs on hillsides, mesas, and upper bajadas. The tall shrubs yellow paloverde (*Parkinsonia microphylla*) and creosotebush (*Larrea tridentata*), which are sparse to moderately dense, and/or sparse saguaro cactus (*Carnegia gigantea*) characterize the vegetation. Other shrubs and cacti are typically present. Perennial grasses and forbs are sparse. Annual species are seasonally present and may be abundant.	131 acres (<0.1%, <0.1%)	1 acre (<0.1%)	28154 acres (1.8%)	Small
North American Warm Desert Riparian Mesquite Bosque: Occurs along perennial and intermittent streams as relatively dense riparian corridors composed of trees and shrubs. Honey mesquite (*Prosopis glandulosa*) and velvet mesquite (*P. velutina*) are the dominant trees. Vegetation is supported by groundwater when surface water is absent.	0 acres	1 acre (<0.1%)	529 acres (3.2%)	Small
North American Warm Desert Riparian Woodland and Shrubland: Occurs along medium to large perennial streams in canyons and desert valleys. Consists of a mix of riparian woodlands and shrublands. Vegetation is dependent upon annual or periodic flooding, along with substrate scouring, and/or a seasonally shallow water table.	0 acres	1 acre (<0.1%)	1,027 acres (8.5%)	Small

1

TABLE 8.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Corridor and Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f]
Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	0 acres	<1 acre (<0.1%)	10,335 acres (2.6%)	Small
Invasive Southwest Riparian Woodland and Shrubland: Dominated by non-native riparian trees and shrubs.	0 acres	<1 acre (<0.1%)	446 acres (2.0%)	Small
Apacherian-Chihuahuan Mesquite Upland Scrub: Occurs on foothills where deeper soil layers store winter precipitation. Dominant species are western honey mesquite (*Prosopis glandulosa*) or velvet mesquite (*P. velutina*) along with other deep-rooted shrubs and succulents. Cover of grasses is low.	0 acres	<1 acre (<0.1%)	15 acres (0.3%)	Small
Sonora-Mojave Mixed Salt Desert Scrub: Extensive open-canopied shrublands in the Mojave and Sonoran deserts, usually occurring around playas and in valley bottoms or basins with saline soils. Vegetation is typically composed of one or more *Atriplex* species; other salt-tolerant plants are often present or even codominant. Grasses occur at varying densities.	0 acres	<1 acre (<0.1%)	312 acres (0.8%)	Small
Open Water: Plant or soil cover is generally less than 25%.	0 acres	<1 acre (<0.1%)	96 acres (3.9%)	Small
Developed, Medium-High Density: Includes housing and commercial/industrial development. Impervious surfaces compose 50%-100% of the total land cover.	0 acres	0 acres	209 acres (0.1%)	Small

TABLE 8.3.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Corridor and Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f]
Developed, Open Space – Low Intensity: Includes housing, parks, golf courses, and other areas planted in developed settings. Impervious surfaces constitute up to 49% of the total land cover.	0 acres	0 acres	27 acres (0.1%)	Small
Barren lands non-specific: Includes a variety of barren areas, generally with less than 15% cover of vegetation.	0 acres	0 acres	26 acres (0.6%)	Small
Sonoran Mid-Elevation Desert Scrub: Occurs on lower slopes along the northern edge of the Sonoran Desert. Generally consists of an open shrub layer and a generally sparse herbaceous layer.	0 acres	0 acres	1 acre (<0.1 %)	Small

[a] Land cover descriptions are from USGS (2005). Full descriptions of land cover types, including plant species, can be found in Appendix I.

[b] Area in acres, determined from USGS (2004).

[c] Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region.

[d] For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide road ROW from the SEZ to the nearest highway. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide road corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[e] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the 1-mi (1.6-km) wide access road corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and were (1) *small*: a relatively small proportion (≤1%) of the cover type within the SEZ region would be lost; (2) *moderate*: an intermediate proportion (>1 but ≤10%) of a cover type would be lost; and (3) *large*: >10% of a cover type would be lost.

[g] To convert acres to km^2, multiply by 0.004047.

Numerous ephemeral dry washes occur within the SEZ, generally flowing northeast to Centennial Wash. These dry washes typically contain water for short periods during or following precipitation events and likely include temporarily flooded areas. Although these washes generally do not support wetland or riparian habitats, woodlands occur along the margins of a number of the larger washes.

The State of Arizona maintains an official list of weed species that are designated noxious species (AZDA 2010). Table 8.3.10.1-2 summarizes the noxious weed species regulated in Arizona that are known to occur in Maricopa County (USDA 2010b), which includes the proposed Gillespie SEZ.

The Arizona Department of Agriculture classifies noxious weeds into one of three categories (AZDA 2010):

- "Prohibited: Noxious weeds (includes plants, stolons, rhizomes, cuttings, and seed) that are prohibited from entry into the state."
- "Regulated: Noxious weeds that are regulated (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state may be controlled or quarantined to prevent further infestation or contamination."
- "Restricted: Noxious weeds that are restricted (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state shall be quarantined to prevent further infestation or contamination."

TABLE 8.3.10.1-2 Designated Noxious Weeds of Arizona Occurring in Maricopa County

Common Name	Scientific Name	Category
African rue	*Peganum harmala*	Prohibited
Buffelgrass	*Pennisetum ciliare*	Regulated, Prohibited
Burclover	*Medicago polymorpha*	Regulated, Prohibited
Camelthorn	*Alhagi pseudalhagi*	Restricted, Prohibited
Common purslane	*Portulaca oleracea*	Regulated, Prohibited
Floating water hyacinth	*Eichhornia crassipes*	Regulated, Restricted, Prohibited
Dodder	*Cuscuta* spp.	Restricted, Prohibited
Field bindweed	*Convolvulus arvensis*	Regulated, Prohibited
Field sandbur	*Cenchrus incertus*	Regulated, Prohibited
Hydrilla	*Hydrill verticillata*	Prohibited
Morning glory	*Ipomoea* spp.	Prohibited
Puncture vine	*Tribulus terrestris*	Regulated, Prohibited
Russian knapweed	*Acroptilon repens*	Restricted, Prohibited
Southern sandbur	*Cenchrus echinatus*	Regulated, Prohibited

Sources: AZDA (2010); USDA (2010b).

Many invasive plant species that are not designated as noxious weeds also occur in Maricopa County, and include cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), Arabian schismus (*Schismus arabicus*), Mediterranean grass (*Schismus barbatus*), fountaingrass (*Pennisetum setaceum*), Sahara mustard (*Brassica tournefortii*), and saltcedar (*Tamarix* spp.) (USDA 2010b). No noxious weed or invasive plant species was observed on the SEZ in August 2009.

8.3.10.2 Impacts

The construction of solar energy facilities within the proposed Gillespie SEZ would result in direct impacts on plant communities due to the removal of vegetation within the facility footprint during land-clearing and land-grading operations. About 80% of the SEZ (2,094 acres [8.5 km^2]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations, and could include any of the communities occurring on the SEZ. Therefore, for the purposes of this analysis, all of the area of each cover type within the SEZ is considered to be directly affected by removal with full development of the SEZ.

Indirect effects (caused, for example, by surface runoff or dust from the SEZ) have the potential to degrade affected plant communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance. Indirect effects can also cause an increase in disturbance-tolerant species or invasive species. High impact levels could result in the elimination of a community or the replacement of one community type by another. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor or small level of impact.

Possible impacts from solar energy facilities on vegetation that are encountered within the SEZ, as well as general mitigation measures, are described in more detail in Section 5.10.4. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 (selected from the general mitigation measures) and from any additional mitigation applied.

8.3.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact would affect a relatively small proportion (≤1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); a moderate impact could affect an intermediate proportion (>1 but ≤10%) of cover type; a large impact could affect greater than 10% of a cover type.

Solar facility construction and operation in the proposed Gillespie SEZ would primarily affect communities of the Sonora–Mojave Creosotebush–White Bursage Desert Scrub cover type. One additional cover type that would be affected within the SEZ is Sonoran Paloverde-Mixed Cacti Desert Scrub. Table 8.3.10.1-1 summarizes the potential impacts on land cover types resulting from development of solar energy facilities in the proposed Gillespie SEZ. These cover types are relatively common in the SEZ region. Desert dry washes and dry wash woodlands are important sensitive habitats in the region.

Several cover types that would potentially be affected by the access road ROW are relatively uncommon, representing 1% or less of the land area within the SEZ region: Sonora-Mojave Mixed Salt Desert Scrub (0.8%), Open Water (0.05%), and Invasive Southwest RiparianWoodland and Shrubland (0.4%), North American Warm Desert Riparian Mesquite Bosque (0.3%), North American Warm Desert Riparian Woodland and Shrubland (0.2%), Apacherian-Chihuahuan Mesquite Upland Scrub (0.1%). The Invasive Southwest Riparian Woodland and Shrubland cover type likely includes few native species.

The construction, operation, and decommissioning of solar projects within the proposed Gillespie SEZ would result in small impacts on all cover types in the affected area.

Because of the arid conditions, re-establishment of desert scrub communities in temporarily disturbed areas would likely be very difficult and might require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation. Cryptogamic soil crusts occur in many of the shrubland communities in the region and likely occur on the SEZ. Damage to these crusts, such as by the operation of heavy equipment or other vehicles, can alter important soil characteristics, such as nutrient cycling and availability, and affect plant community characteristics (Lovich and Bainbridge 1999).

The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition. Fugitive dust deposition could affect plant communities of each of the cover types occurring within the area of indirect effects identified in Table 8.3.10.1-1.

The riverine wetland in the southeast corner of the SEZ could be directly impacted during site grading if fill material is placed within the channel of the unnamed stream. Grading near the wetland could disrupt surface water or groundwater flow characteristics, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation, and could potentially alter wetland plant communities and affect wetland function. Increases in surface runoff from a solar energy project site could also affect the hydrologic characteristics of the riverine wetland. The introduction of contaminants into wetlands in or near the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation effects or hydrologic changes could also extend to wetlands outside of the SEZ, such as the palustrine wetlands near the northern boundary of the SEZ. Wetlands along or near Centennial Wash, north of the SEZ, could be affected by sedimentation, erosion, or hydrologic changes as a result of solar project activities in the SEZ.

Grading could also affect desert dry washes within the SEZ and access road corridor. Several desert washes in the SEZ and corridor support woodland communities of paloverde, ironwood, and mesquite. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities. Vegetation within these communities could be lost by erosion or desiccation. Communities associated with intermittently flooded areas downgradient from solar projects in the SEZ could be affected by ground-disturbing activities. Site clearing and grading could result in hydrologic changes and could potentially alter plant communities and affect community function. Increases in surface runoff from a solar energy project site could also affect hydrologic characteristics of these communities. The introduction of contaminants into these habitats could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in these areas, which could degrade or eliminate sensitive plant communities. Section 8.3.9 contains further discussion of impacts on washes. Direct impacts on desert washes that are waters of the United States would require permitting from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

The construction of an access road to Old U.S. 80 potentially could result in impacts on wetlands and riparian habitat that occur within the assumed access road corridor. Areas of palustrine and riverine wetlands, mapped as open water, North American Warm Desert Riparian Mesquite Bosque, North American Warm Desert Riparian Woodland and Shrubland, and Invasive Southwest Riparian Woodland and Shrubland occur within the presumed access road corridor. These wetland and riparian habitats are associated with the Gila River and, although they could be indirectly impacted by access roads, would be unlikely to be directly impacted.

Although the use of groundwater within the Gillespie SEZ for technologies with high water requirements, such as wet-cooling systems, may be unlikely, groundwater withdrawals for such systems could reduce groundwater elevations (see Section 8.3.9). In addition, impacts from land disturbance to drainages on the SEZ that are tributaries of Centennial Wash could adversely affect groundwater recharge processes. Plant communities in the vicinity of the SEZ that depend on accessible groundwater, such as riparian woodland and shrubland or mesquite bosque communities, could become degraded or lost as a result of lowered groundwater levels. Because the Gila River receives groundwater discharge, scrub-shrub, emergent, and other wetland and riparian habitats along the river could be affected by lower groundwater levels. Riparian habitats along the Hassayampa River may be dependent on groundwater discharges, and could also be affected.

8.3.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

Executive Order 13112, "Invasive Species" (*Federal Register*, Volume 64, page 61836, Feb. 8, 1999) directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts of invasive species. Potential impacts of noxious weeds and invasive plant species resulting from solar energy facilities are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in the affected area of the proposed Gillespie SEZ, such that weeds could be transported into areas that were previously relatively weed-free. This situation could result in reduced restoration success and possible widespread habitat degradation. Areas of invasive species near the SEZ include about 446 acres (1.8 km^2) of

Invasive Southwest Riparian Woodland and Shrubland which occurs within the area of indirect effects. Species designated as noxious weeds in Arizona known to occur in Maricopa County are listed in Table 8.3.10.1-2.

Approximately 209 acres (0.85 km^2) of the Developed, Medium-High Density and 27 acres (0.1 km^2) of Developed, Open Space–Low Intensity cover type occurs within the area of indirect effects. Disturbance associated with solar project development may promote establishment and spread of invasive species that are associated with these cover types. Past or present land uses such as grazing or recreational OHV use within the SEZ area of potential impacts may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Disturbance associated with existing roads and transmission lines within the SEZ area of potential impacts also likely contributes to the susceptibility of plant communities to the establishment and spread of noxious weeds and invasive species.

8.3.10.3 SEZ-Specific Design Features and Design Feature Effectiveness

In addition to programmatic design features, SEZ-specific design features would reduce the potential for impacts on plant communities. While the specifics of some of these practices are best established when considering specific project details, some measures can be identified at this time, as follows.

- An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of Creosotebush-White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub communities, as well as other affected habitats, and minimize the potential for the spread of invasive species or noxious weeds, such as those occurring in Maricopa County, that could be introduced as a result of solar energy project activities (see Section 8.3.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All wetland, dry wash, dry wash woodland, mesquite bosque, riparian, and saguaro cactus communities within the SEZ or access road corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. Any cacti that cannot be avoided should be salvaged. A buffer area should be maintained around dry washes, dry wash woodland, mesquite bosque, wetland, and riparian habitats to reduce the potential for impacts.

- Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, dry wash woodland, mesquite bosque, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities or riparian habitats along the Gila or Hassayampa Rivers.

If these SEZ-specific design features are implemented in addition to other programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on wetland, dry wash, dry wash woodland, riparian, mesquite bosque, and saguaro cactus communities would be reduced to a minimal potential for impacts.

8.3.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Gillespie SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the following references: Arizona Field Ornithologists (2010), Brennan (2008), Hoffmeister (1986), and SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). The amount of aquatic habitat within the SEZ region was determined by using available GIS surface water datasets to estimate the length of linear perennial stream features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 60-ft (18-m) wide portion of an assumed 3-mi (4.8-km) long access road. The maximum developed area within the SEZ would be 2,094 acres (8.5 km^2), and the maximum developed area within the access road corridor would be 22 acres (0.1 km^2).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1.0-mi (1.6-km) wide assumed access road corridor where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effects (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or road construction area). (For the proposed Gillespie SEZ, the indirectly affected area for the access road occurs within the area of indirect effects for the SEZ.) Potentially suitable habitat for a species within the SEZ greater than the maximum of 2,094 acres (8.5 km^2) of direct effects was also included as part of the area of indirect effects. The potential magnitude of indirect effects would decrease with increasing distance from the SEZ. The area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to such effects. These areas of direct and indirect effects are defined and the impact assessment approach is described in Appendix M.

The primary land cover habitat type within the affected area is Sonora-Mojave creosotebush-white bursage desert scrub (see Section 8.3.10). No aquatic or wetland habitats occur on the SEZ. Aquatic habitats that occur within the area of indirect effects include Winters Wash, Centennial Wash, Gila River, and Gila Bend Canal. A number of other washes, creeks, rivers, and canals occur within the SEZ region (Figure 8.3.9.1-1).

8.3.11.1 Amphibians and Reptiles

8.3.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Gillespie SEZ. The list of amphibian and reptile species potentially present in the project area was determined from species lists available from Brennan (2008) and range maps and habitat information available from the SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used.

On the basis of species distributions within the area of the SEZ and habitat preferences of the amphibian species, the Great Basin spadefoot (*Spea intermontana*) and red-spotted toad (*Bufo punctatus*) would be expected to occur within the SEZ (Brennan 2008; USGS 2007; Stebbins 2003). However, breeding habitat for these species is not present within the SEZ. Breeding habitat for these species would be present in Winters Wash, Centennial Wash, and Gila River in the area of indirect effects.

More than 30 reptile species occur within the area that encompasses the proposed Gillespie SEZ (Brennan 2008; USGS 2007; Stebbins 2003). The desert tortoise (*Gopherus agassizii*), a federal and state-listed threatened species, is discussed in Section 11.2.12. Lizard species expected to occur within the SEZ include the desert horned lizard (*Phrynosoma platyrhinos*), Great Basin collared lizard (*Crotaphytus bicinctores*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus draconoides*).

Snake species expected to occur within the SEZ include the coachwhip (*Masticophis flagellum*), common kingsnake (*Lampropeltis gentula*), glossy snake (*Arizona elegans*), gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), and nightsnake (*Hypsiglena torquata*). The Mohave rattlesnake (*Crotalus scutulatus*), sidewinder (*C. cerastes*) and western diamond-backed rattlesnake (*C. atrox*) would be the most common poisonous snake species expected to occur on the SEZ.

Table 8.3.11.1-1 provides habitat information for representative amphibian and reptile species that could occur within the proposed Gillespie SEZ.

8.3.11.1.2 Impacts

The types of impacts that amphibians and reptiles could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.3.11.1.3 identifies SEZ-specific design features of particular relevance to the proposed Gillespie SEZ.

The assessment of impacts on amphibian and reptile species is based on available information on the presence of species in the affected area as presented in Section 8.3.11.1.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific

TABLE 8.3.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Amphibians					
Great Basin spadefoot (*Spea intermontana*)	Sagebrush flats, semidesert shrublands, pinyon-juniper woodlands, and spruce-fir forests. Breeds in temporary and permanent waters including rain pools, pools in intermittent streams, and flooded areas along streams. About 2,760,300 acres[h] of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,188 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-spotted toad (*Bufo punctatus*)	Dry, rocky areas at lower elevations near desert springs and persistent pools along rocky arroyos, desert streams and oases, open grassland, scrubland oaks, and dry woodlands. About 4,325,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,864 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Lizards					
Desert horned lizard (*Phrynosoma platyrhinos*)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edge of dunes. Burrows in soil during periods of inactivity. About 4,347,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,405 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,916 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Great Basin collared lizard (*Crotaphytus bicinctores*)	Usually inhabits alluvia, lava flows, mountain slopes, canyons, buttes, rock outcrops, washes, and rocky plains. Limiting factors are the presence of large boulders and open/sparse vegetation. About 4,318,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,849 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Side-blotched lizard (*Uta stansburiana*)	Low to moderate elevations in washes, arroyos, boulder-strewn ravines, rocky cliff bases, and flat shrubby areas in canyon bottoms. Often along sandy washes. Usually in areas with a lot of bare ground. About 4,264,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western whiptail (*Cnemidophorus tigris*)	Arid and semiarid habitats with sparse plant cover. About 4,318,800 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,108 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Lizards (Cont.)					
Zebra-tailed lizard (*Callisaurus draconoides*)	Open, warm-desert habitats, especially dry washes and canyons with fine gravel and sand. About 4,330,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,419 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Snakes					
Coachwhip (*Masticophis flagellum*)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 4,264,000 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Common kingsnake (*Lampropeltis getula*)	Coniferous forests, woodlands, swampland, coastal marshes, river bottoms, farmlands, prairies, chaparral, and deserts. Uses rock outcrops and rodent burrows for cover. About 4,750,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,755 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Glossy snake (*Arizona elegans*)	Light shrubby to barren deserts, sagebrush flats, grasslands, and chaparral-covered slopes and woodlands. Prefers sandy grasslands, shrublands and woodlands. About 4,279,200 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Gophersnake (*Pituophis catenifer*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,988,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,991 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Groundsnake (*Sonora semiannulata*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,315,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,108 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Mohave rattlesnake (*Crotalus scutulatus*)	Upland desert and lower mountain slopes including barren desert, grassland, open juniper woodland, and scrubland. Especially common in areas of scattered scrubby growth such as creosote and mesquite. About 4,994,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,558 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Nightsnake (*Hypsiglena torquata*)	Arid and semiarid desert flats, plains, and woodlands; areas with rocky and sandy soils are preferred. During cold periods of the year, it seeks refuge underground, in crevices, or under rocks. About 4,267,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Sidewinder (*Crotalus cerastes*)	Windblown sand habitats near rodent burrows. Most common in areas of sand hummocks topped with creosote, mesquite, or other desert plants. About 4,269,000 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,563 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Snakes (Cont.)					
Western diamond-backed rattlesnake (*Crotalus atrox*)	Dry and semidry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,797,200 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,782 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.

c Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.

e For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.1-1 (Cont.)

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: Brennan (2008); CDFG (2008); NatureServe (2010); USGS (2004, 2005, 2007).

impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 8.3.11.1.3).

In general, impacts on amphibians and reptiles would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality to individual amphibians and reptiles. On the basis of the impacts on amphibians and reptiles summarized in Table 8.3.11.1-1, direct impacts on representative amphibian and reptile species would be small, ranging from a high of 0.08% for the Great Basin spadefoot to only 0.04 to 0.05% for all other species (Table 8.3.11.1-1). Larger areas of potentially suitable habitats for the amphibian and reptile species occur within the area of potential indirect effects (i.e., 2.1% to 2.2% for all species). Indirect impacts on amphibians and reptiles could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, collection, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term adverse impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for amphibian and reptile species would be the restoration of original ground surface contours, soils, and native plant communities associated with desert scrub, playa, and wash habitats.

8.3.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for effects on amphibians and reptiles. Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. SEZ-specific design features are best established when considering specific project details. However, because potentially suitable habitats for the representative amphibian and reptile species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

8.3.11.2 Birds

8.3.11.2.1 Affected Environment

> **Desert Focal Bird Species**
>
> Bird species whose requirements define spatial attributes, habitat characteristics, and management regimes representative of a healthy desert system (Chase and Geupel 2005).

This section addresses bird species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Gillespie SEZ. The list of bird species potentially present in the project area was determined from the Arizona Field Ornithologists (2010) and range maps and habitat information available from the SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used.

Twelve of the bird species that could occur in the affected area of the SEZ are considered focal species in the *Desert Bird Conservation Plan* (CalPIF 2009): ash-throated flycatcher (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-throated sparrow (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), common raven (*Corvus corax*), Costa's hummingbird (*Calypte costae*), Gila woodpecker (*Melanerpes uropygialis*), ladder-backed woodpecker (*Picoides scalaris*), Le Conte's thrasher (*Toxostoma lecontei*), Lucy's warbler (*Vermivora luciae*), phainopepla (*Phainopepla nitens*), and verdin (*Auriparus flaviceps*). Habitats for most of these species are described in Table 8.3.11.2-1. Because of its special species status, the burrowing owl is discussed in Section 8.3.12.1.

Waterfowl, Wading Birds, and Shorebirds

As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns) are among the most abundant groups of birds in the six-state solar study area. However, within the proposed Gillespie SEZ, waterfowl, wading birds, and shorebird species would be mostly absent. Centennial Wash, Winters Wash, Gila River, and Gila Bend Canal within the area of indirect effects may attract some species. However, the Arizona Canal, Beardsley Canal, Buckeye Canal, Gila Bend Canal, Gila River, Grand Canal, Hassayampa River, Roosevelt Canal, and Salt River that occur within the 50-mi (80-km) SEZ region would provide more viable habitat for this group of birds.

Neotropical Migrants

As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse category of birds within the six-state solar energy study area. Species expected to occur within

TABLE 8.3.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants					
Ash-throated flycatcher (*Myiarchus cinerascens*)	Common in scrub and woodland habitats including desert riparian and desert washes. Requires hole/cavity for nesting. Uses shrubs or small trees for foraging perches. About 4,357,500 acres[h] of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Black-tailed gnatcatcher (*Polioptila melanura*)	Nests in bushes mainly in wooded desert washes with dense mesquite, paloverde, ironwood, and acacia. Also occurs in desert scrub habitat. About 4,301,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,526 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Neotropical Migrants (Cont.)					
Black-throated sparrow (*Amphispiza bilineata*)	Chaparral and desertscrub habitats with sparse to open stands of shrubs. Often in areas with scattered Joshua trees. Nests in thorny shrubs or cactus. About 4,283,900 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Brewer's sparrow (*Spizella breweri*)	Common in Mojave and Colorado deserts during winter. Occupies open desert scrub and cropland habitats. About 2,720,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,293 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Cactus wren (*Campylorhynchus brunneicapillus*)	Desert (especially areas with cholla cactus or yucca), mesquite, arid scrub, coastal sage scrub, and trees in towns in arid regions. Nests in *Opuntia* spp.; twiggy, thorny trees and shrubs; and sometimes in buildings. Nests may be used as winter roost. About 1,592,600 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) during construction and operations	29,182 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 174 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Common poorwill (*Phalaenoptilus nuttallii*)	Scrubby and brushy areas, prairie, desert, rocky canyons, open woodlands, and broken forests. Mostly in arid and semiarid habitats. Nests in open areas on a bare site. About 4,312,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,875 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common raven (*Corvus corax*)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or man-made structures. Forages in sparse, open terrain. About 4,988,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,991 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Neotropical Migrants (Cont.)					
Costa's hummingbird (*Calypte costae*)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 4,354,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Gila woodpecker (*Melanerpes uropygialis*)	Prefers sparsely covered desert habitats containing large saguaro cacti. About 1,865,200 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) during construction and operations	30,393 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Greater roadrunner (*Geococcyx californianus*)	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. Fairly common in desert habitats. Requires thickets, large bushes, or small trees for shade, refuge, and roosting. Usually nests low in trees, shrubs, or clumps of cactus. Rarely nests on ground. About 4,785,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,755 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Horned lark (*Eremophila alpestris*)	Common to abundant resident in a variety of open habitats. Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 3,139,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	68,924 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	19 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,653 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Neotropical Migrants (Cont.)					
Ladder-backed woodpecker (*Picoides scalaris*)	Fairly common in Mojave and Colorado Deserts. Variety of habitats, including deserts, arid scrub, riparian woodlands, mesquite, scrub oak, pinyon-juniper woodlands. Digs nest hole in rotted stub or dead or dying branches of various trees. Also nests in saguaro, agave, yucca, fence posts, and utility poles. Nests on ledges; branches of trees, shrubs, and cactus; and holes in trees or walls. About 4,357,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Le Conte's thrasher (*Toxostoma lecontei*)	Open desert wash, alkali desert scrub, and desert succulent shrub habitats. Prefers to nest and forage in arroyos and washes lined with dense stands of creosotebush and salt bush. About 4,279,200 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,080 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Lesser nighthawk (*Chordeiles acutipennis*)	Open country, desert regions, scrub, savanna, and cultivated areas. Usually near water, including open marshes, salt ponds, large rivers, rice paddies, and beaches. Roosts on low perches or the ground. Nests in the open on bare sites. About 4,344,100 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,393 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Loggerhead shrike (*Lanius ludovicianus*)	Open country with scattered trees and shrubs, savanna, desert scrub, desert riparian, Joshua tree, and occasionally open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are important aspect of habitat). Nests in shrubs and small trees. About 4,819,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,228 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Lucy's warbler (*Vermivora luciae*)	Breeds most often in dense lowland riparian mesquite woodlands. Inhabits dry washes, riparian forests, and thorn forests during winter and migration. About 1,612,200 acres of potentially suitable habitat occurs within the SEZ region.	131 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) during construction and operations	30,171 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Phainopepla (*Phainopepla nitens*)	Common in Mojave and Colorado deserts. Desert scrub, mesquite, juniper and oak woodlands, tall brush, washes, riparian woodlands, and orchards. Nests in dense foliage of large shrubs or trees, sometimes in a clump of mistletoe. About 2,008,600 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) during construction and operations	40,506 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Say's phoebe (*Sayornis saya*)	Arid open country, deserts, sagebrush plains, dry barren foothills, canyons, cliffs, ranches, and rural homes. Nests in cliff crevices, holes in banks, sheltered ledges, tree cavities, under bridges and roofs, and in mines. About 3,181,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	68,925 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	19 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,653 acres in area of indirect effects	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Neotropical Migrants (Cont.)					
Verdin (*Auriparus flaviceps*)	Desert riparian, desert wash, desert scrub, and alkali desert scrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 4,685,700 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,442 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Birds of Prey					
American kestrel (*Falco sparverius*)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 2,282,000 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	40,609 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Golden eagle (*Aquila chrysaetos*)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 2,044,500 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	40,373 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 261 acres in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.
Prairie falcon (*Falco mexicanus*)	Open habitats adjacent to cliffs or bluffs. Occurs mainly in desert grassland, chaparral, and creosotebush-bursage habitats. About 5,017,600 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,559 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Red-tailed hawk (*Buteo jamaicensis*)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,061,100 acres of potentially suitable habitat occurs in the SEZ region.	131 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) during construction and operations	38,844 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 87 acres in area of indirect effects	Small overall impact.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Turkey vulture (*Cathartes aura*)	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 3,190,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	70,915 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost <0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Upland Game Birds					
Gambel's quail (*Callipepla gambelii*)	Deserts, especially in areas with brushy or thorny growth, and adjacent cultivated areas. Usually occurs near water. Nests on the ground under cover of small trees, shrubs, and grass tufts. About 4,379,700 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,866 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Mourning dove (*Zenaida macroura*)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 5,010,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	87,839 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Upland Game Birds (Cont.)					
White-winged dove (*Zenaida asiatica*)	Nests in low to medium height trees with dense foliage and fairly open ground cover. Feeds on wild seeds, grains, and fruit. About 4,362,900 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,839 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.

[e] For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.2-1 (Cont.)

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: Arizona Field Ornithologists (2010); CDFG (2008); CalPIF (2009); NatureServe (2010); USGS (2004, 2005, 2007).

the proposed Gillespie SEZ include the ash-throated flycatcher, black-tailed gnatcatcher, black-throated sparrow, Brewer's sparrow (*Spizella breweri*), cactus wren (*Campylorhynchus brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven, Costa's hummingbird, Gila woodpecker, greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), ladder-backed woodpecker, Le Conte's thrasher, lesser nighthawk (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy's warbler, phainopepla, Say's phoebe (*Sayornis saya*), and verdin (Arizona Field Ornithologists 2010; CalPIF 2009; USGS 2007).

Birds of Prey

Section 4.10.2.2.4 provides an overview of the birds of prey (raptors, owls, and vultures) within the six-state solar study area. Raptor species that could occur within the proposed Gillespie SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (Arizona Field Ornithologists 2010; USGS 2007). Several other special status birds of prey are discussed in Section 8.3.12.

Upland Game Birds

Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state solar study area. Upland game species that could occur within the proposed Gillespie SEZ include Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), and white-winged dove (*Zenaida asiatica*) (Arizona Field Ornithologists 2010; USGS 2007).

8.3.11.2.2 Impacts

The types of impacts that birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.3.11.2.3 identifies design features of particular relevance to the proposed Gillespie SEZ.

The assessment of impacts on bird species is based on available information on the presence of species in the affected area as presented in Section 8.3.11.2.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with federal or state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on birds (see Section 8.3.11.2.3).

In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), and from disturbance, injury, or mortality to individual birds. Table 8.3.11.2-1 summarizes the potential impacts on representative bird species resulting from solar energy development in the proposed Gillespie SEZ. On the basis of the impacts on birds summarized in Table 8.3.11.2-1, direct impacts on representative bird species would be small for all bird species (ranging from a high of 0.08% for Brewer's sparrow to a low of 0.007% for the Gila woodpecker (Table 8.3.11.2-1). Larger areas of potentially suitable habitats for the bird species occur within the area of potential indirect effects (e.g., up to 3.4% of available habitat for the Brewer's sparrow). Indirect impacts on birds could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with desert scrub, playa, and wash habitats.

8.3.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

The successful implementation of programmatic design features presented in Appendix A, Section A.2.2, would reduce the potential for effects on birds, especially for those species that depend on habitat types that can be avoided (e.g., wash habitats). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While SEZ-specific design features important for reducing impacts on birds are best established when considering specific project details, the following design features can be identified at this time:

- For solar energy projects within the SEZ, the requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.

- Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.

If the SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. However, as potentially suitable habitats for most of the bird species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

8.3.11.3 Mammals

8.3.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which potentially suitable habitat occurs, within the potentially affected area of the proposed Gillespie SEZ. The list of mammal species potentially present in the project area was determined from Hoffmeister (1986) and range maps and habitat information available from the SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used. About 45 species of mammals have ranges that encompass the area of the proposed Gillespie SEZ (Hoffmeister 1986; USGS 2007); however, suitable habitats for a number of these species are limited or nonexistent within the SEZ (USGS 2007). Similar to the overview of mammals provided for the six-state solar energy study area (Section 4.10.2.3), the following discussion for the SEZ emphasizes big game and other mammal species that (1) have key habitats within or near the SEZ, (2) are important to humans (e.g., big game, small game, and furbearer species), and/or (3) are representative of other species that share important habitats.

Big Game

The big game species that could occur within the affected area of the proposed Gillespie SEZ include cougar (*Puma concolor*) and mule deer (*Odocoileus hemionus*) (Hoffmeister 1986; USGS 2007). Because of its special species status, the Nelson's bighorn sheep is addressed in Section 8.3.12.

Other Mammals

A number of small game and furbearer species occur within the area of the proposed Gillespie SEZ. Species that could occur within the area of the proposed Gillespie SEZ include the American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*, common), desert cottontail (*Sylvilagus audubonii*), gray fox (*Urocyon cinereoargenieus*), javelina or spotted peccary (*Pecari tajacu*), kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), and striped skunk (*Mephitis mephitis*) (USGS 2007).

The nongame (small) mammal species generally include smaller mammals such as rodents, bats, and shrews. Species for which potentially suitable habitat occurs within the SEZ include the Arizona pocket mouse (*Perognathus amplus*), Botta's pocket gopher (*Thomomys bottae*), cactus mouse (*Peromyscus eremicus*), canyon mouse (*P. crinitis*), deer mouse (*P. maniculatus*), desert pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex crawfordi*), desert woodrat (*Neotoma lepida*), Merriam's pocket mouse (*Dipodomys merriami*), round-tailed ground squirrel (*Spermophilus tereticaudus*), southern grasshopper mouse (*Onychomys torridus*), and white-tailed antelope squirrel (*Ammospermophilus leucurus*) (Hoffmeister 1986; USGS 2007).

Bat species that may occur within the area of the SEZ include the big brown bat (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), California myotis (*Myotis californicus*), silver-haired bat (*Lasionycteris noctivagans*), spotted bat (*Euderma maculatum*), and western pipistrelle (*Pipistrellus hesperus*) (Hoffmeister 1986; USGS 2007). However, roost sites for the bat species (e.g., caves, hollow trees, rock crevices, or buildings) would be limited to absent within the SEZ. Several other special status bat species that could occur within the SEZ area are addressed in Section 8.3.12.1.

Table 8.3.11.3-1 provides habitat information for representative mammal species that could occur within the proposed Gillespie SEZ.

8.3.11.3.2 Impacts

The types of impacts that mammals could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.3.11.3.3, below, identifies design features of particular relevance to mammals for the proposed Gillespie SEZ.

The assessment of impacts on mammal species is based on available information on the presence of species in the affected area as presented in Section 8.3.11.3.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on mammals (see Section 8.3.11.3.3).

Table 8.3.11.3-1 summarizes the potential impacts on select mammal species resulting from solar energy development (with the inclusion of programmatic design features) in the proposed Gillespie SEZ.

Cougar

Up to 2,094 acres (8.5 km^2) of potentially suitable cougar habitat could be lost through solar energy development within the proposed Gillespie SEZ. An additional 22 acres (0.09 km^2) could be lost by access road development. Together, these potential losses represent about 0.05% of potentially suitable cougar habitat within the SEZ region. Over 88,000 acres (356 km^2) of potentially suitable cougar habitat occurs within the area of indirect effects for the SEZ and access road. This is about 2.0% of potentially suitable cougar habitat within the SEZ region. Overall, impacts on cougar from solar energy development in the SEZ would be small.

TABLE 8.3.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur in the Affected Area of the Proposed Gillespie SEZ

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Big Game					
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,357,400 acres[h] of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,420 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Mule deer (*Odocoileus hemionus*)	Most habitats, including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,780,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,916 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Small Game and Furbearers					
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,292,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,107 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Small Game and Furbearers (Cont.)					
Black-tailed jackrabbit (*Lepus californicus*)	Open plains, fields, and deserts with scattered thickets or patches of shrubs. Also open, early stages of forests and chaparral habitats. Rests during the day in shallow depressions, and uses shrubs for cover. About 3,186,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	70,210 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Bobcat (*Lynx rufus*)	Most habitats except subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,788,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	59,849 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Coyote (*Canis latrans*)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 5,002,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,436 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
Desert cottontail (*Sylvilagus audubonii*)	Abundant to common in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Thickets and patches of shrubs, vines, and brush also used as cover. About 4,728,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,468 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Gray fox (*Urocyon cinereoargenteus*)	Deserts, open forests, and brush. Prefers wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,677,000 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,415 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Javelina (spotted peccary) (*Pecari tajacu*)	Often in thickets along creeks and washes. Beds in caves, mines, boulder fields, and dense stands of brush. May visit a water hole on a daily basis. About 4,448,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	90,289 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
Kit fox (*Vulpes macrotis*)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seeks shelter in underground burrows. About 4,327,700 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,864 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Ringtail (*Bassariscus astutus*)	Usually in rocky areas with cliffs or crevices for daytime shelter, desert scrub, chaparral, pine-oak and conifer woodlands. About 4,926,600 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,678 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Striped skunk (*Mephitis mephitis*)	Prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, log, or building. About 4,689,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,442 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Nongame (small) Mammals					
Arizona pocket mouse (*Perognathus amplus*)	Various desert scrub habitats. Sleeps and rears young in underground burrows. About 4,285,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,552 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Big brown bat (*Eptesicus fuscus*)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 4,900,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	97,218 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Botta's pocket gopher (*Thomomys bottae*)	Variety of habitats, including shortgrass plains, oak savanna, agricultural lands, and deserts. Burrows are more common in disturbed areas such as roadways and stream floodplains. About 4,267,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,551 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals					
Brazilian free-tailed bat (*Tadarida brasiliensis*)	Cliffs, deserts, grasslands, old fields, savannas, shrublands, woodlands, and suburban/urban areas. Roosts in buildings, caves, and hollow trees. May roost in rock crevices, bridges, signs, or cliff swallow nests during migration. Large maternity colonies inhabit caves, buildings, culverts, and bridges. About 4,914,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	98,175 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Cactus mouse (*Peromyscus eremicus*)	Variety of areas, including desert scrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 4,376,300 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,866 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
California myotis (*Myotis californicus*)	Desertscrub, semidesert shrublands, lowland riparian, swamps, riparian suburban areas, plains grasslands, scrub-grasslands, woodlands, and forests. Roosts in caves, mine tunnels, hollow trees, and loose rocks. About 4,296,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,107 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Nongame (small) Mammals					
Canyon mouse (*Peromyscus crinitus*)	Associated with rocky substrates in a variety of habitats, including desert scrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 4,333,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,876 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Deer mouse (*Peromyscus maniculatus*)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,672,900 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	97,913 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert pocket mouse (*Chaetodipus penicillatus*)	Sparsely vegetated sandy deserts. Prefers rock-free bottomland soils along rivers and streams. Sleeps and rears young in underground burrows. About 4,336,200 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,554 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Desert shrew (*Notiosorex crawfordi*)	Usually in arid areas with adequate cover such as semiarid grasslands, shortgrass plains, desert scrub, chaparral slopes, shortgrass plains, oak savannas and woodlands, and alluvial fans. About 4,769,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	99,201 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert woodrat (*Neotoma lepida*)	Sagebrush scrub; chaparral; deserts and rocky slopes with scattered cactus, yucca, pine-juniper, or other low vegetation; creosotebush desert; Joshua tree woodlands; scrub oak woodlands, pinyon-juniper woodlands; and riparian zones. Most abundant in rocky areas with Joshua trees. Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,350,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,405 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Merriam's kangaroo rat (*Dipodomys merriami*)	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 4,344,100 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	87,393 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Round-tailed ground squirrel (*Spermophilus tereticaudus*)	Low flat areas with desert shrubs and usually with sandy soils. Also in areas with coarse hard-packed sand and gravel, alkali sinks, and creosotebush communities. Burrows usually at base of shrubs. Avoids rocky hills. About 4,375,400 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,421 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Silver-haired bat (*Lasionycteris noctivagans*)	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah, and desertscrub habitats. Roosts under bark, and in hollow trees, caves and mines. Forages over clearings and open water. About 2,959,500 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	59,610 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	
Nongame (small) Mammals (Cont.)					
Southern grasshopper mouse (*Onychomys torridus*)	Low, arid, shrub and semiscrub vegetation of deserts. About 4,358,500 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	88,337 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Spotted bat (*Euderma maculatum*)	Various habitats from desert to montane coniferous forests, mostly in open or scrub areas. Roosts in caves and cracks and crevices in cliffs and canyons. About 2,777,500 acres of potentially suitable habitat occurs within the SEZ region	2,094 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat) during construction and operations	60,254 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,827 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Western pipistrelle (*Parastrellus hesperus*)	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons. Roosts mostly in rock crevices, sometimes mines and caves, and rarely in buildings. Suitable roosts occur in rocky canyons and cliffs. Most abundant bat in desert regions. About 4,503,800 acres of potentially suitable habitat occurs in the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,798 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,740 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 8.3.11.3-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Access Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
White-tailed antelope squirrel (*Ammospermophilus leucurus*)	Low deserts, semidesert and montane shrublands, plateaus, and foothills in areas with sparse vegetation and hard gravelly surfaces. Spends its nights and other periods of inactivity in underground burrows. About 4,260,400 acres of potentially suitable habitat occurs within the SEZ region.	2,094 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat) during construction and operations	86,536 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 1,914 acres in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 2,094 acres of direct effects within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 2,094 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For access road development, direct effects were estimated within a 3-mi (4.8-km) long, 60-ft (18-m) wide access road ROW from the SEZ to Old Highway 80. Indirect effects were estimated within a 1-mi (1.6-km) wide access road corridor, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.3.11.3-1 (Cont.)

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq$1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq$10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDFG (2008); Hoffmeister (1986); NatureServe (2010); USGS (2004, 2005, 2007).

Mule Deer

Up to 2,094 acres (8.5 km^2) of potentially suitable mule deer habitat could be lost through solar energy development within the proposed Gillespie SEZ. An additional 22 acres (0.09 km^2) could be lost by access road development. Together, these potential losses represent about 0.04% of potentially suitable mule deer habitat within the SEZ region. About 99,000 acres (400 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects for the SEZ and access road. This is about 2.1% of potentially suitable mule deer habitat within the SEZ region. Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Other Mammals

Direct impacts on all other representative mammal species from solar energy development within the proposed Gillespie SEZ would be small (Table 8.3.11.3-1). For all of these species, up to 2,094 acres (8.5 km^2) (0.04 to 0.08%) of potentially suitable habitat would be lost. Direct impacts on these species from access road development would range from 20 to 22 acres (0.8 to 0.9 km^2) (Table 8.3.11.3-1). Loss of potential habitat to access road development would be <0.001% of potentially suitable habitat within the SEZ region for any of these species. Larger areas of potentially suitable habitats for these mammal species occur within the area of potential indirect effects (i.e., from 1.9 to 2.2% of available habitat) (Table 8.3.11.3-1).

Summary

Overall, impacts on mammal species would be small (Table 8.3.11.3-1). In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term adverse impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for mammal species would be the restoration of original ground surface contours, soils, and native plant communities associated with desert scrub, playa, and wash habitats.

8.3.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for effects on mammals. Specifics of mitigation measures that are particularly important to reduce impacts on mammals are best established when considering project-specific details. However, the following SEZ-specific design feature can be identified at this time:

- The fencing around solar energy projects should not block the free movement of mammals, particularly big game species.

If this SEZ-specific design feature is implemented in addition to programmatic design features, impacts on mammals could be reduced. However, potentially suitable habitats for a number of the mammal species occur throughout much of the SEZ; therefore, species-specific mitigation of direct effects for those species would be difficult or infeasible.

8.3.11.4 Aquatic Biota

8.3.11.4.1 Affected Environment

The proposed Gillespie SEZ is located in a semiarid desert valley where surface waters are typically limited to intermittent washes that only contain water for short periods during or following precipitation. No perennial or intermittent streams or water bodies are present in the proposed Gillespie SEZ or within the area of direct effects associated with the presumed new access road. Ephemeral streams cross the SEZ, but these drainages only contain water following rainfall and typically do not support wetland or riparian habitats. Aquatic habitat and communities are not likely to be present in the ephemeral drainages, although opportunistic crustaceans and aquatic insect larvae adapted to desert conditions may be present even under dry conditions (Levick et al. 2008). However, more detailed site survey data is needed to characterize the aquatic biota, if present, in the proposed Gillespie SEZ. The NWI has only partially mapped the Gillespie SEZ. A riverine wetland is located just inside the southeast corner of the SEZ (USFWS 2009a). Wetlands are described in detail in Section 8.3.10.1.

There are no perennial or intermittent water bodies present within the area of indirect effects associated with the SEZ or the presumed road corridor. Several perennial and intermittent streams are present within the area of indirect effects associated with the proposed Gillespie Wash SEZ, including 5 mi (8 km) of the perennial Gila River, 2 mi (3 km) of Gila Bend Canal, and 21 mi (34 km) of intermittent washes. Within the area of indirect effects associated with the presumed new access road there are 0.31 mi (0.5 km) of the perennial Gila River, 0.73 mi (1 km) of the intermittent Centennial Wash, 0.09 mi (0.1 km) of intermittent portions of the Gila River, and 0.05 mi (0.1 km) of the Gila Bend Canal. The intermittent Centennial Wash carries significant flows to the Gila River (Section 8.3.9.1.1). Although portions of the Gila River near the SEZ are perennial (primarily due to wastewater treatment effluent released upstream of the area), most of the Gila River below Phoenix is intermittent because of water withdrawals for municipal and agricultural uses (Section 8.3.9.1.1). The Gila River becomes perennial again near its confluence with the Colorado River more than 90 mi (145 km) from the SEZ.

The intermittent streams present in the area of indirect effects may contain aquatic habitat and aquatic species when sufficient water is present. For example, one study of intermittent desert streams and washes in the western United States indicated that although communities consisted primarily of terrestrial invertebrates, they also contained aquatic taxa from the Insecta, Hydracarina, Crustacea, Oligochaeta, Hirudinea, and Gastropoda groups, as well as tolerant native and introduced fish species (URS Corporation 2006). Biota in ephemeral or intermittent streams may also contribute to populations in perennial reaches by dispersing downstream during wet periods with increased hydrologic connectivity (Levick et al. 2008). Fish collections in the Salt River near Phoenix indicated Sonora sucker (*Catostomus insignis),* largemouth bass (*Micropterus salmoides*), bluegill sunfish (*Lepomis macrochirus*), and tilapia (family Cichlidae) were consistently abundant species. Other species were of sporadic occurrence and generally were uncommon to rare (Marsh and Kesner 2006).

Outside of the indirect effects area, but within 50 mi (80 km) of the proposed Gillespie SEZ, are approximately 47 mi (76 km) of perennial streams, 745 mi (1,199 km) of intermittent streams, and 153 mi (246 km) of canals. No water bodies are present within 50 mi (80 km) of the proposed Gillespie SEZ. Intermittent streams are the only surface water feature in the area of direct and indirect effects and their area represents approximately 3% of the total amount of intermittent stream present in the 50-mi (80 km) SEZ region.

8.3.11.4.2 Impacts

Because surface water habitats are a unique feature in the arid landscape in the vicinity of the proposed Gillespie SEZ, the maintenance and protection of such habitats may be important to the survival of aquatic and terrestrial organisms. The types of impacts that aquatic habitats and biota could incur from the development of utility-scale solar energy facilities are described in detail in Section 5.10.3. Aquatic habitats present on or near the locations selected for construction of solar energy facilities could be affected in a number of ways, including (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of water quality.

As mentioned above, no permanent water bodies, streams, or wetlands are present within the boundaries of either the proposed Gillespie SEZ or the presumed new access road corridor, and consequently direct impacts on aquatic habitats from solar energy development are unlikely. In addition, no high-quality perennial surface water features are located in the area of indirect effects. Intermittent and ephemeral streams are present in the area of indirect effects associated with the SEZ. The Gila River and the Centennial Wash may contain aquatic habitat and biota and the Gila River flows into perennial surface waters (Colorado River). Disturbance of land areas within the SEZ for solar energy facilities could increase the transport of soil into aquatic habitat within the Gila River via water and airborne pathways, adversely affecting aquatic habitat locally and downstream. However, more detailed site surveys for biota in ephemeral and intermittent surface waters would be necessary to determine whether solar energy development activities would result in direct or indirect impacts on aquatic biota. The introduction of waterborne sediments to Centennial Wash and the Gila River could be minimized by using common mitigation measures, such as settling basins and silt fences, or directing water draining from the developed areas away from streams.

In arid environments, reductions in the quantity of water in aquatic habitats are of particular concern. Water quantity in aquatic habitats could also be affected if significant amounts of surface water or groundwater are utilized for power plant cooling water, for washing mirrors, or for other needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, were developed at the site. The associated impacts would ultimately depend on the water source used (including groundwater from aquifers at various depths). There are no surface water sources on the proposed Gillespie SEZ that could be used to supply water needs. Water demands during normal operations would most likely be met by withdrawing groundwater from wells constructed on-site. Groundwater outflows are primarily as surface water discharge in the Gila River (Section 8.3.9.1.2). Consequently, groundwater withdrawals could reduce water supporting aquatic organisms in the Gila River (Section 8.3.9.2.4) and other surface water features outside of the SEZ and area of indirect effects, and, as a consequence, potentially reduce habitat size and connectivity, and create more adverse environmental conditions for aquatic organisms in those habitats. Additional details regarding the volumes of water required and the types of organisms present in potentially affected water bodies would be required in order to further evaluate the potential for impacts from water withdrawals.

As described in Section 5.10.2.4, water quality in aquatic habitats could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site characterization, construction, operation, or decommissioning/reclamation of a solar energy facility. This is particularly true of ground disturbance activities near the Gila River and Centennial Wash associated with the presumed new access road.

8.3.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified at this time. If programmatic project design features described in Appendix A, Section A.2.2 are implemented and if the utilization of water from groundwater or surface water sources is adequately controlled to maintain sufficient water levels in aquatic habitats, the potential impacts on aquatic biota and habitats from solar energy development at the proposed Gillespie SEZ would be negligible.

8.3.12 Special Status Species (Threatened, Endangered, Sensitive, and Rare)

This section addresses special status species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Gillespie SEZ. Special status species include the following types of species[4]:

- Species listed as threatened or endangered under the ESA;
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the BLM as sensitive;
- Species that are listed by the State of Arizona[5]; and
- Species that have been ranked by the State of Arizona as S1 or S2, or species of concern by the USFWS; hereafter referred to as "rare" species.

Special status species known to occur within 50-mi (80 km) of the Gillespie SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the ANHP (Schwartz 2009; ANHP 2010), SWReGAP (USGS 2004, 2005, 2007), and the USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from Nature Serve, quad-level occurrences provided by the ANHP, as well as modeled land cover types and predicted suitable habitats for the species within the 50 mi (80 km) region as determined from SWReGAP. The 50-mi (80-km) SEZ region intersects La Paz, Maricopa, Pinal, and Yuma Counties in Arizona. However, the SEZ and affected area occur only in Maricopa County. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

8.3.12.1 Affected Environment

The affected area considered in the assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the Gillespie SEZ, the area of direct effects included the SEZ and the area within the assumed access road corridor where ground disturbing activities are assumed to occur. Due to the proximity of existing infrastructure, the impacts of construction and operation of transmission lines outside of the SEZ are not assessed, assuming that the existing transmission infrastructure might be used to

[4] See Section 4.6.4 for definitions of these species categories. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840 (BLM 2008a). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

[5] State-listed species for the state of Arizona are those plants protected under the Arizona Native Plant Law or wildlife listed by the Arizona Game and Fish Department as Wildlife of Special Concern (WSC).

connect some new solar facilities to load centers, and that additional project-specific analysis would be conducted for new transmission construction or line upgrades (refer to Section 8.3.1.2 for development assumptions). The area of indirect effects was defined as the area within 5 mi [8 km] of the SEZ boundary and within the assumed access road corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. Indirect effects considered in the assessment included effects from groundwater withdrawals, surface runoff, dust, noise, lighting, and accidental spills from the SEZ, but do not include ground disturbing activities. For the most part, the potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary land cover habitat type within the affected area is Sonora-Mojave creosote desert scrub (see Section 8.3.10). Potentially unique habitats in the affected area in which special status species may reside include desert washes and associated riparian habitats. There is also approximately 10,000 acres (40 km^2) of agricultural land cover types in the affected area. There are no aquatic habitats known to occur on the SEZ or anywhere within the area of direct effects. Aquatic habitats known to occur within the area of indirect effects are the Hassayampa River, Gila River, Gila Bend Canal, and Centennial Wash (Figure 8.3.12.1-1).

In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS expressed concern that riparian habitat for the southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma clapper rail along the Gila River may be indirectly affected by project development on the SEZ. The southwestern willow flycatcher and Yuma clapper rail are listed as endangered under the ESA; the western yellow-billed cuckoo is a candidate for listing under the ESA. Riparian habitats for these species along the Gila River may be indirectly affected by groundwater withdrawals from the lower Hassayampa River Groundwater Basin to serve solar energy development on the SEZ. Although a portion of the Gila River flows through the area of indirect effects, some additional areas occur downstream of the SEZ and outside of the area of indirect effects as defined above. These areas are included in our evaluation because of the possible effect of groundwater withdrawals.

All special status species that are known to occur within the Gillespie SEZ region (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest recorded occurrence, and habitats in Appendix J. Of these species, there are 29 that could be affected by solar energy development on the SEZ, based on recorded occurrences or the presence of potentially suitable habitat in the area. These species, their status, and their habitats are presented in Table 8.3.12.1-1. For many of the species listed in the table (especially plants), their predicted potential occurrence in the affected area is based only on a general correspondence between mapped SWReGAP land cover types and descriptions of species habitat preferences. This overall approach to identifying species in the affected area probably overestimates the number of species that actually occur in the affected area. For many of the species identified as having potentially suitable habitat in the affected area, the nearest known occurrence is over 20 mi (32 km) away from the SEZ.

Based on ANHP records, quad-level occurrences for the following 10 special status species intersect the affected area of the Gillespie SEZ: California barrel cactus, straw-top cholla, roundtail chub, lowland leopard frog, Sonoran desert tortoise, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, California leaf-nosed bat, and cave myotis. These species are indicated in bold text in Table 8.3.12.1-1.

8.3.12.1.1 Species Listed under the Endangered Species Act That Could Occur in the Affected Area

In scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS expressed concern for impacts of project development within the SEZ on habitat for the southwestern willow flycatcher and Yuma clapper rail, species listed as endangered under the ESA. In addition to these species, the Sonoran population of the bald eagle—listed as threatened under the ESA—may also occur in the affected area of the Gillespie SEZ. Of these species, the southwestern willow flycatcher and Yuma clapper rail have quad-level occurrences within the affected area in riparian habitats along the Gila River, about 5 mi (8 km) east of the SEZ. These three species are discussed below and information on their habitat is presented in Table 8.3.12.1-1; additional basic information on life history, habitat needs, and threats to populations of these species is provided in Appendix J.

Sonoran Bald Eagle

The Sonoran population of the bald eagle is currently listed as threatened under the ESA, although recent findings by the USFWS have indicated that listing for this species is not warranted (USFWS 2010b). According to ANHP records, the species is known to occur along the Gila River, approximately 15 mi (24 km) south of the SEZ (Figure 8.3.12.1-1). This species is primarily known to occur in riparian habitats associated with larger permanent water bodies such as lakes, rivers, and reservoirs. However, it may occasionally forage in arid shrubland habitats. According to the SWReGAP habitat suitability model, approximately 98,500 acres (399 km^2) of potentially suitable winter foraging habitat for the Sonoran population of the bald eagle may occur in the affected area of the Gillespie SEZ (Table 8.3.12.1-1). Because there is relatively little aquatic and riparian habitat (2,100 acres [8 km^2]) in the affected area, most of this potentially suitable foraging habitat is represented by shrubland. Critical habitat has not been designated for this species.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is a small neotropical migrant bird that inhabits riparian shrublands, woodlands, and thickets in the southwestern United States. Although the SWReGAP habitat suitability model for the southwestern willow flycatcher does not identify any suitable habitat for this species within the affected area, quad-level occurrences for this species intersect the affected area, and these occurrences are presumably from riparian habitats along the Hassayampa and Gila Rivers east of the SEZ within the area of indirect effects and

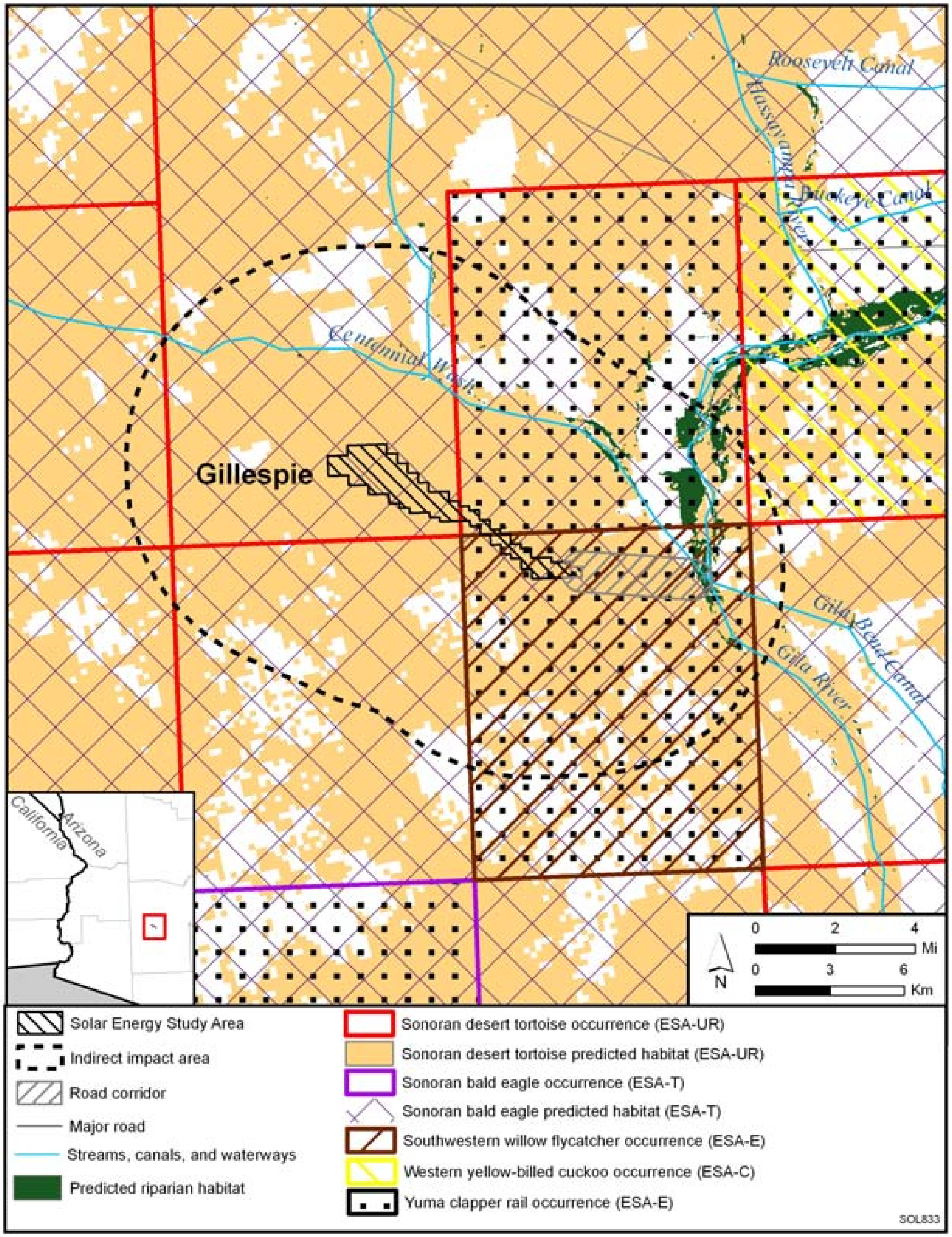

FIGURE 8.3.12.1-1 Known or Potential Occurrences of Species Listed as Endangered or Threatened under the ESA, Candidate for Listing under the ESA, or Species under Review for ESA Listing in the Affected Area of the Proposed Gillespie SEZ (Sources: Schwartz 2009; USFWS 2010b; USGS 2007)

TABLE 8.3.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Gillespie SEZ

				Maximum Area of Potential Habitat Affected[c]			Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	
Plants							
Arid tansy-aster	*Machaeranthera arida*	AZ-S1	Low sand dunes, alkaline flats, riverbanks, and sandy roadsides. Nearest recorded quad-level occurrences are near Phoenix, approximately 30 mi[i] southeast of the SEZ. About 293,000 acres[j] of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,264 acres of potentially suitable riparian habitat (0.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitat in the access road corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plant species that could be found only in desert riparian areas in the area of direct effects.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
California barrel cactus[k]	***Ferocactus cylindraceus* var. *cylindraceus***	AZ-SR	Gravelly or rocky hillsides, canyon walls, alluvial fans, and desert washes at elevations between 200 and 2,900 ft.[l] Quad-level occurrences intersect the affected area. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable mitigations.
California snakewood	*Colubrina californica*	AZ-S2	Sandy desert washes, steep gullies, and rocky or gravelly slopes at elevations below 3,000 ft. Nearest quad-level occurrence is 7 mi south of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable mitigations.
Hohokam agave	*Agave murpheyi*	BLM-S; AZ-HS; FWS-SC; AZ-S2	Endemic to Arizona and Sonora, Mexico on benches or alluvial terraces on gentle bajada slopes above major drainages in desert scrub communities. Elevation ranges between 1,300 and 3,200 ft. Nearest recorded quad-level occurrences are approximately 45 mi north of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c] Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Straw-top cholla	***Opuntia echinocarpa***	AZ-SR	Sandy or gravelly soil of benches, slopes, mesas, flats, and washes at elevations between 1,000 and 6,700 ft. Quad-level occurrences intersect the affected area. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.
Tumamoc globeberry	*Tumamoca macdougalii*	BLM-S; AZ-SR	Endemic to southern Arizona and northern Mexico in xeric situations, in shady areas of nurse plants along gullies and sandy washes at elevations below 3,000 ft. Nearest quad-level occurrence is approximately 35 mi southeast of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. See arid tansy-aster for a list of applicable potential mitigations.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Invertebrates							
Maricopa tiger beetle	*Cicindela oregona maricopa*	FWS-SC	Known primarily from Maricopa County, Arizona in sandy riparian areas such as stream banks and sand bars. Nearest recorded quad-level occurrences are approximately 45 mi north of the SEZ. About 50,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (3.9% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian habitat in the access road corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Fish							
Roundtail chub	***Gila robusta***	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Larger tributaries in the Colorado Basin, from Wyoming south to Arizona and New Mexico; cool to warm water streams and rivers consisting of pools adjacent to riffles and runs and with boulders, tree roots, submerged trees and branches, and undercut cliff walls. Historic quad-level occurrence intersects the affected area from the Gila River, within 5 mi east of the SEZ. The species is currently not known to occur in the affected area. About 300 mi of potentially suitable habitat within the Gila and Hassayampa Rivers occurs within the SEZ region.	0 mi	0 mi	9 mi of potentially suitable aquatic habitat within the Gila River (3.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable historic habitat for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Amphibians							
Arizona toad	*Bufo microscaphus*	FWS-SC	Woodlands and low-elevation riparian habitats in association with permanent or semi-permanent water bodies; in and along streams, ditches, flooded fields, irrigated croplands, and permanent reservoirs. Nearest recorded quad-level occurrence is from the Hassayampa River, approximately 50 mi north of the SEZ. About 3,950 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	655 acres of potentially suitable habitat (16.7% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species to negligible levels.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Amphibians (Cont.)							
Lowland leopard frog	***Lithobates yavapaiensis***	BLM-S; AZ-WSC; FWS-SC	Aquatic systems in desert grasslands, pinyon-juniper woodlands, and agricultural areas, including rivers, streams, beaver ponds, springs, earthen cattle tanks, livestock guzzlers, canals, and irrigation sloughs. Quad-level occurrences intersect the affected area. About 246,500 acres of potentially suitable habitat occurs within the SEZ region.	288 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	0 acres	7,480 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable habitats for this species may be directly affected on the SEZ or indirectly affected from groundwater withdrawals. Avoiding or minimizing disturbance to suitable habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species to negligible levels. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Reptiles							
Desert tortoise (Sonoran population)	***Gopherus agassizii***	ESA-UR; BLM-S; AZ-WSC	Mojave and Sonoran Deserts in desert creosotebush communities on firm soils for digging burrows, along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Quad-level occurrences intersect the affected area. About 3,750,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	76,700 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Reptiles (Cont.)							
Gila monster	*Heloderma suspectum*	FWS-SC	Mojave and Sonoran Deserts in areas of rocky, deeply incised topography and riparian habitat, desert scrub, thorn scrub, desert riparian, oak woodland, and semi-desert grassland. Lower mountain slopes, rocky bajadas, canyon bottoms, and arroyos at elevations below 3,950 ft. Nearest quad-level occurrence is 6 mi north of the SEZ. About 4,322,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	21 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	87,600 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mexican rosy boa	*Charina trivirgata trivirgata*	BLM-S; FWS-SC; AZ-S1	Sonoran Desert near rocky hillsides and rock outcroppings. Nearest quad-level occurrence is approximately 20 mi southeast of the SEZ. About 3,800,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	84,700 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Reptiles (Cont.)							
Tucson shovel-nosed snake	*Chionactis occipitalis klauberi*	ESA-C; BLM-S; AZ-S1	Endemic to Arizona from Pima, Pinal, and Maricopa Counties in creosote-mesquite floodplain habitats with soft sandy loam soils and sparse gravel. Nearest quad-level occurrence is approximately 20 mi southeast of the SEZ. About 1,436,500 acres of potentially suitable habitat occurs within the SEZ region.	384 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	7 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	31,400 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds							
Bald eagle (Sonoran population)	*Haliaeetus leucocephalus*	ESA-T; BLM-S; AZ-WSC; AZ-S2	Winter resident in the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. May occasionally forage in arid shrubland habitats. Nearest quad-level occurrence is from the Gila River, approximately 15 mi south of the SEZ. About 4,775,500 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	22 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	98,500 acres of potentially suitable foraging habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Cattle egret	*Bubulcus ibis*	AZ-S1	Winter resident and migrant in the SEZ region. Herbaceous, scrub-shrub, forested, and riparian wetlands as well as croplands and herbaceous grasslands, wet pastureland, marshes, fresh and brackish situations, dry fields, agricultural areas, and garbage dumps. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 43,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,780 acres of potentially suitable aquatic or riparian habitat (4.1% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable aquatic or riparian habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Ferruginous hawk	*Buteo regalis*	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Winter resident in the SEZ region. Grasslands, sagebrush and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands. Nests in tall trees or on rock outcrops along cliff faces. Known to occur in Maricopa County, Arizona. About 395,000 acres of potentially suitable foraging habitat occurs within the SEZ region.	0 acres	0 acres	10,600 acres of potentially suitable foraging habitat (2.7% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct impact. No species-specific mitigation is warranted.
Great egret	*Ardea alba*	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley in open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 28,750 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,000 acres of potentially suitable aquatic or riparian habitat (3.5% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Potentially suitable aquatic or riparian habitats for this species may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Long-eared owl	*Asio otus*	AZ-S2	Winter resident in the SEZ region. Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, riparian areas, and desert oases. Nests in trees in old nests of other birds or squirrels; sometimes nests in tree cavities. Nearest quad-level occurrence is approximately 30 mi west of the SEZ. About 4,733,750 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	22 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	98,700 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Snowy egret	*Egretta thula*	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley in open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi south of the SEZ. About 675,200 acres of potentially suitable habitat occurs within the SEZ region. The species is expected to occur as a transient only on the SEZ.	425 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	15,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable aquatic or riparian habitats for this species may be directly affected on the SEZ and access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Southwestern willow flycatcher	***Empidonax traillii extimus***	ESA-E; AZ-WSC; AZ-S1	Riparian shrublands and woodlands, thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable riparian habitats and avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in consultation with the USFWS under Section 7 of the ESA.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; FWS-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Nearest quad-level occurrence is approximately 14 mi east of the SEZ. About 4,376,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied burrows in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Western snowy plover	*Charadrius alexandrinus nivosus*	AZ-WSC; AZ-S1	Breeds on alkali flats around reservoirs and sandy shorelines. Nearest quad-level occurrence is 7 mi (11 km) south of the SEZ. About 400,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,100 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western yellow-billed cuckoo	***Coccyzus americanus***	ESA-C; AZ-WSC	Considered to be a riparian obligate, usually found in large tracts of cottonwood/willow habitats with dense sub-canopies. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or minimizing disturbance to suitable riparian habitats and avoiding or limiting groundwater withdrawals for solar energy development on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Yuma clapper rail	***Rallus longirostris yumanensis***	ESA-E; AZ-WSC	Year-round resident in the SEZ region. Freshwater marshes containing dense stands of cattails. Nests on dry hummocks or in small shrubs among dense cattails or bulrushes along the edges of shallow ponds in freshwater marshes with stable water levels. Quad-level occurrences intersect the affected area. About 50,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	2 acres of potentially suitable riparian habitat lost (<0.1% of available potentially suitable habitat)	2,000 acres of potentially suitable riparian habitat (4.0% of available potentially suitable habitat)	Small to large overall impact. Potentially suitable aquatic or riparian habitats for this species may be directly affected in the access road corridor or may be indirectly affected outside the SEZ from groundwater withdrawals. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species. The potential for impact and need for mitigation should be determined in consultation with the USFWS under Section 7 of the ESA.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals							
California leaf-nosed bat	***Macrotus californicus***	BLM-S; AZ-WSC; FWS-SC	Year-round resident in desert riparian, desert wash, desert scrub, and palm oasis habitats at elevations below 2,000 ft. Roosts in mines, caves, and buildings. Quad-level occurrences intersect the affected area. About 3,960,000 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	21 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	85,900 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Cave myotis	***Myotis velifer***	FWS-SC	Lower Colorado River Basin in southeastern California and southwestern Arizona in desert scrub, shrublands, washes, and riparian habitats. Roosts in colonies in caves. Quad-level occurrences intersect the affected area. About 4,265,700 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	86,100 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. No direct impact on roost habitat. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 8.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Access Road (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Western red bat	*Lasiurus blossevillii*	BLM-S; AZ-WSC	Year-round resident in SEZ region. Forages in riparian and other wooded areas. Roosts primarily in cottonwood trees along riparian areas. Nearest recorded quad-level occurrence is from the Hassayampa River, approximately 50 mi north of the SEZ. About 17,400 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	625 acres of potentially suitable foraging or roosting habitat (3.6 % of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Western yellow bat	*Lasiurus xanthinus*	BLM-S; AZ-WSC; AZ-S2	Year-round resident in desert riparian, desert wash, and palm oasis habitats at elevations below 2,000 ft. Roosts in trees. Nearest quad-level occurrence is from the vicinity of Phoenix, approximately 40 mi northeast of the SEZ. About 4,407,500 acres of potentially suitable habitat occurs within the SEZ region.	2,618 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	20 acres of potentially suitable foraging or roosting habitat lost (<0.1% of available potentially suitable habitat)	87,500 acres of potentially suitable foraging or roosting habitat (2.0% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to riparian woodlands in the access road corridor could reduce impacts to foraging or roosting habitat. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied roosting areas in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

Footnotes on next page.

TABLE 8.3.12.1-1 (Cont.)

[a] AZ-S1 = ranked as S1 in the State of Arizona; AZ-S2 = ranked as S2 in the State of Arizona; AZ-SR = salvage restricted plant species under the Arizona Native Plant Law; AZ-WSC = listed as a wildlife species of concern in the State of Arizona; BLM-S = listed as a sensitive species by the BLM; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.

[b] For plant species, potentially suitable habitat was determined by using SWReGAP land cover types. For terrestrial vertebrate species, potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[c] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. Impacts of transmission line construction, upgrade, or operation are not assessed in this evaluation due to the proximity of existing infrastructure to the SEZ.

[d] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[e] For access road development, direct effects were estimated within a 3-mi (5-km), 60-ft (18-m) wide road corridor from the SEZ to the nearest existing state or federal highway. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide access road corridor. No new transmission was assumed to be needed for this SEZ due to the proximity of an existing ROW.

[f] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the access road corridor where ground disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Indirect effects on groundwater-dependent species were considered outside these defined areas.

[g] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq$1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq$10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[h] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[i] To convert mi to km, multiply by 1.609.

[j] To convert acres to km^2, multiply by 0.004047.

[k] Species in bold text have been recorded or have designated critical habitat within 5 mi (8 km) of the SEZ boundary.

[l] To convert ft to m, multiply by 0.3048.

the assumed access road corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover model, approximately 2,000 acres (8 km^2) of riparian habitat occurs within the affected area (Table 8.3.12.1-1). This riparian habitat and other riparian habitat areas further downstream along the Gila River may be dependent on surface discharges from the lower Hassayampa River Groundwater Basin. Designated critical habitat for this species does not occur within the SEZ region.

Yuma Clapper Rail

The Yuma clapper rail occurs in freshwater marsh habitats containing dense vegetation such as cattail (*Typha* sp.), bulrush (*Scirpus* sp), or reeds (*Phragmites* sp.) from Needles, California south and west to the Salton Sea and southeast to Arizona and Mexico. Although the SWReGAP habitat suitability model for the Yuma Clapper rail does not identify any suitable habitat for this species within the affected area, quad-level occurrences for this species intersect the affected area, and these occurrences are presumably from riparian habitats along the Hassayampa and Gila Rivers east of the SEZ within the area of indirect effects and the assumed access road corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover model, approximately 2,000 acres (8 km^2) of riparian habitat occurs within the affected area (Table 8.3.12.1-1). This riparian habitat and other riparian habitat areas farther downstream along the Gila River may be dependent on surface discharges from the lower Hassayampa River Groundwater Basin. Designated critical habitat for this species does not occur within the SEZ region.

8.3.12.1.2 Species That Are Candidates for Listing under the ESA

In its scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS identified 2 species that are candidates for listing under the ESA that may be impacted by solar energy development on the Gillespie SEZ: the Tucson shovel-nosed snake and the western yellow-billed cuckoo. These 2 species are discussed below and information on their habitat is presented in Table 8.3.12.1-1; additional basic information on life history, habitat needs, and threats to populations of these species is provided in Appendix J.

Tucson Shovel-Nosed Snake

The Tucson shovel-nosed snake is a fairly small snake that is one of three subspecies of the western shovel-nosed snake known to occur in Arizona. The other two subspecies of the western shovel-nosed snakes – the Colorado Desert shovel-nosed snake (*Chionactis occipitalis annulata*) and Mojave shovel-nosed snake (*C. o. occipitalis*) may also occur in the affected area of the SEZ but these two species are not special status species. The Tucson shovel-nosed snake occupies the eastern-most portion of the species' range in Maricopa and Pinal Counties. The Tucson shovel-nosed snake is found in low desert regions where it inhabits creosote-mesquite communities with soft sandy substrates. The species is usually found near sandy washes, dunes, or bajadas. The nearest quad-level occurrence for this species is approximately 20 mi (32 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately 98,500 acres (399 km^2) of potentially suitable habitat for the western shovel-nosed snake (not specifically the Tucson subspecies) may occur in the affected area of the SEZ (Figure 8.3.12.1-1; Table 8.3.12.1-1). However, this area is situated in an intergrade zone where all three subspecies of the western shovel-nosed snake may co-occur and interbreed.

Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo is a neotropical migrant bird that inhabits large riparian woodlands in the western United States. Although the SWReGAP habitat suitability model for the western yellow-billed cuckoo does not identify any suitable habitat for this species within the affected area, quad-level occurrences for this species intersect the affected area, and these occurrences are presumably from riparian habitats along the Hassayampa and Gila Rivers east of the SEZ within the area of indirect effects and the assumed access road corridor (Figure 8.3.12.1-1). On the basis of the SWReGAP land cover model, approximately 2,000 acres (8 km^2) of riparian habitat occurs within the affected area (Table 8.3.12.1-1). This riparian habitat and other riparian habitat areas further downstream along the Gila River may be dependent on surface discharges from the lower Hassayampa River Groundwater Basin.

8.3.12.1.3 Species That Are under Review for Listing under the ESA

In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS identified one species under ESA review that may be directly or indirectly affected by solar energy development on the SEZ—the Sonoran population of the desert tortoise. This distinct population segment of desert tortoise occurs south and east of the Colorado River (Mojave populations north and west of the Colorado River are currently listed as threatened under the ESA, but are outside of the affected area of the Gillespie SEZ). The Sonoran population of the desert tortoise was petitioned for listing under the ESA on October 9, 2008 (WildEarth Guardians and Western Watersheds Project 2008). Quad-level occurrences for this species intersect the Gillespie SEZ and other portions of the affected area (Figure 8.3.12.1-1). According to the SWReGAP land cover model, approximately 2,618 acres (11 km^2) of potentially suitable for this species occurs on the SEZ; approximately 76,700 acres (310 km^2) of potentially suitable habitat occurs in the area of indirect effects (Table 8.3.12.1-1). The USGS desert tortoise model (Nussear et al. 2009) does not encompass the same geographic area as the Gillespie SEZ; however, BLM-developed Category II habitats for the Sonoran desert tortoise exist immediately south and east of the SEZ at Gila Bend. These BLM habitat categories are used for BLM planning and land management (as reviewed in WildEarth Guardians and Western Watersheds Project 2008). Category I habitats are the most essential for the maintenance of large long-term populations; Category II habitats are intermediate in the maintenance of large long-term populations; Category III habitats are not essential to the maintenance of viable long-term populations and are identified to limit further declines in the population size to the extent practical. Additional basic information on life history, habitat needs, and threats to populations of these species is provided in Appendix J.

8.3.12.1.4 BLM-Designated Sensitive Species

There are 14 BLM-designated sensitive species that may occur in the affected area of the Gillespie SEZ (Table 8.3.12.1-1). These BLM-designated sensitive species include the following (1) plants: Hohokam agave and Tumamoc globeberry; (2) fish: roundtail chub; (3) amphibian: lowland leopard frog; (4) reptiles: Mexican rosy boa, Sonoran desert tortoise, and Tucson shovel-nosed snake; (5) birds: ferruginous hawk, great egret, snowy egret, and western burrowing owl; and (5) mammals: California leaf-nosed bat, western red bat, and western yellow bat. Of these BLM-designated sensitive species with potentially suitable habitat in the affected area, only quad-level occurrences of the roundtail chub, lowland leopard frog, Sonoran desert tortoise, and California leaf-nosed bat intersect the affected area of the Gillespie SEZ. Habitats in which BLM-designated sensitive species are found, the amount of potentially suitable habitat in the affected area, and known locations of the species relative to the SEZ are presented in Table 8.3.12.1-1. Two of these species—the Sonoran desert tortoise and Tucson shovel-nosed snake—have been previously discussed due to their known or pending status under the ESA (Sections 8.3.12.1.2 and 8.3.12.1.3). All other BLM-designated sensitive species as related to the SEZ are described in the remainder of this section. Additional life history information for these species is provided in Appendix J.

Hohokam Agave

The Hohokam agave is a perennial shrub endemic to Arizona and adjacent Sonora, Mexico. It occurs on desert benches or alluvial terraces near bajadas, washes, or other major drainages in desert scrub communities. Nearest quad-level occurrences of this species are approximately 45 mi (72 km) north of the SEZ. Although it is not known to occur in the affected area, potentially suitable desert riparian habitat may occur in the access road corridor and other portions of the affected area (Table 8.3.12.1-1).

Tumamoc Globeberry

The Tumamoc globeberry is a perennial herb that is known from southern Arizona and adjacent Sonora, Mexico. It occurs in xeric situations, primarily along hillsides and washes. Nearest quad-level occurrences of this species are approximately 35 mi (56 km) southeast of the SEZ. Although it is not known to occur in the affected area, potentially suitable desert wash and riparian habitat may occur in the access road corridor and other portions of the affected area (Table 8.3.12.1-1).

Roundtail Chub

The roundtail chub is known from larger tributaries in the Colorado Basin, from Wyoming south to Arizona and New Mexico. It occupies cool to warm water streams and rivers consisting of pools adjacent to riffles and runs. Historic quad-level occurrences for this species intersect the affected area from the Gila River, within 5 mi (8 km) east of the SEZ. The species is currently not known to occur in the affected area. On the basis of an evaluation of surface water features in the SEZ region, about 300 mi (483 km) of potentially suitable habitat within the Gila and Hassayampa Rivers occurs within the SEZ region (Table 8.3.12.1-1).

Lowland Leopard Frog

The lowland leopard frog is a medium-sized frog primarily known from central and southern Arizona, although the species is also known to occur in western New Mexico and northern Mexico. It inhabits aquatic to mesic systems such as grasslands, pinyon-juniper forests, agricultural areas, lakes, streams, and reservoirs. Nearest quad-level occurrences of this species intersect the affected area of the Gillespie SEZ. Occurrences of this species are known from the Gila River, within 5 mi (8 km) east of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs on the SEZ and throughout portions of the affected area (Table 8.3.12.1-1).

Mexican Rosy Boa

The Mexican rosy boa is a snake known from the Sonoran Desert in Arizona and adjacent Mexico. This snake inhabits arid scrublands, rocky deserts, and canyons near washes or streams. Nearest quad-level occurrences of this species are approximately 20 mi (32 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs on the SEZ and throughout portions of the affected area (Table 8.3.12.1-1).

Ferruginous Hawk

The ferruginous hawk is known to occur throughout the western United States. According to the SWReGAP habitat suitability model, only potentially suitable winter foraging habitat for this species may occur within the affected area of the Gillespie SEZ. This species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. This species is known to occur in Maricopa County, Arizona. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur within the area of direct effects; however, potentially suitable foraging habitat occurs in portions of the area of indirect effects outside of the SEZ (Table 8.3.12.1-1).

Great Egret

The great egret is a year-round resident in the lower Colorado River Valley. This species is primarily associated with open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. The nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi (18 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur in the area of direct effects; however, potentially suitable habitat may occur in portions of the area of indirect effects, primarily along the Hassayampa and Gila Rivers (Table 8.3.12.1-1). In addition potentially suitable aquatic and riparian habitats associated with the Gila River may be influenced by groundwater discharge from the Lower Hassayampa River Groundwater Basin.

Snowy Egret

The snowy egret is considered to be a year-round resident in the lower Colorado River Valley in southwestern Arizona and southeastern California. This species is primarily associated with open water areas such as marshes, lakes, ponds, and reservoirs. The nearest quad-level occurrence is from Painted Rock Reservoir, approximately 11 mi (18 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs on the SEZ and throughout portions of the affected area (Table 8.3.12.1-1). However, there are no permanent surface water features in the area of direct effects that may provide suitable habitat; therefore, this species would only be expected to occur in the area of direct effects as a transient. In addition, potentially suitable aquatic and riparian habitats associated with the Hassayampa and Gila Rivers may be influenced by groundwater discharge from the Lower Hassayampa River Groundwater Basin.

Western Burrowing Owl

The western burrowing owl is known to occur in the SEZ region, where it forages in grasslands, shrublands, open disturbed areas, and nests in burrows usually constructed by mammals. According to the SWReGAP habitat suitability model for the western burrowing owl, potentially suitable year-round foraging and nesting habitat may occur in the affected area of the Gillespie SEZ. Nearest recorded quad-level occurrences of this species are approximately 14 mi (22 km) south of the SEZ. Potentially suitable foraging and breeding habitat is expected to occur in the area of direct effects and in other portions of the affected area (Table 8.3.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

California Leaf-Nosed Bat

The California leaf-nosed bat is a large-eared bat with a leaflike flap of protective skin on the tip of its nose. It primarily occurs along the Colorado River from southern Nevada, through Arizona and California, to Baja California and Sinaloa Mexico. The species forages in a variety of desert habitats including desert riparian, desert wash, desert scrub, and palm oasis. It roosts in caves, crevices, and mines. Quad-level occurrences of this species intersect the affected area of the Gillespie SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat for this species may occur on the SEZ, portions of the access road corridor, and throughout the affected area (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, however, there is no suitable roosting habitat (rocky cliffs and outcrops) within the affected area.

Western Red Bat

The western red bat is an uncommon year-round resident in the Gillespie SEZ region where it forages in desert riparian and other woodland areas. This species may occasionally forage in desert shrubland habitats. The species primarily roosts in trees in riparian areas. Nearest recorded occurrences of this species are approximately 50 mi (80 km) north of the SEZ. According to the SWReGAP habitat suitability model, there is no suitable habitat within the area of direct effects; however, potentially suitable habitat may occur in the area of indirect effects outside the SEZ (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, riparian woodland habitat that may be potentially suitable roosting habitat could occur in the area of indirect effects.

Western Yellow Bat

The western yellow bat is an uncommon year-round resident in the Gillespie SEZ region where it forages in desert riparian and desert oasis habitats. The species roosts in trees. Nearest recorded occurrences of this species are approximately 40 mi (64 km) northeast of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat for this species may occur on the SEZ, portions of the access road corridor, and throughout the affected area (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, riparian woodland habitat that may be potentially suitable roosting habitat could occur in the area of indirect effects.

8.3.12.1.5 State-Listed Species

There are 18 species listed by the State of Arizona that may occur in the Gillespie SEZ affected area (Table 8.3.12.1-1). These state-listed species include the following (1) plants: California barrel cactus, Hohokam agave, straw-top cholla, and Tumamoc globeberry; (2) fish: roundtail chub; (3) amphibian: lowland leopard frog; (4) reptile: Sonoran desert tortoise; (5) birds: Sonoran bald eagle, ferruginous hawk, great egret, snowy egret, southwestern willow flycatcher, western snowy plover, western yellow-billed cuckoo, and Yuma clapper rail; and (6) mammals: California leaf-nosed bat, western red bat, and western yellow bat. All of these species are protected in Arizona under the Arizona Native Plant Law or by the AZGFD as Wildlife of Special Concern (WSC). Of these species, the following 3 species have not been previously described due to their known or pending status under the ESA (Section 8.3.12.1.1, 8.3.12.1.2, or 8.3.12.1.3) or BLM-designated sensitive (Section 8.3.12.1.4): California barrel cactus, straw-top cholla, and western snowy plover. These species as related to the SEZ are described in this section and Table 8.3.12.1-1. Additional life history information for these species is provided in Appendix J.

California Barrel Cactus

The California barrel cactus is a perennial cactus endemic to western Arizona and southeastern California. This species occurs on gravelly or rocky hillsides, canyon walls, alluvial fans, and desert washes. Nearest quad-level occurrences intersect the affected area of the Gillespie SEZ (Table 8.3.12.1-1). According to the SWReGAP land cover model, potentially suitable desert riparian habitat does not occur on the SEZ but potentially suitable desert wash or riparian habitat occurs within the access road corridor and portions of the area of indirect effects.

Straw-Top Cholla

The straw-top cholla is a perennial shrub-like cactus that is known from the southwestern United States. This species occurs on sandy or gravelly soils on desert flats, mesas, and washes. Quad-level occurrences of this species intersect the affected area of the Gillespie SEZ (Table 8.3.12.1-1). According to the SWReGAP land cover model, potentially suitable desert riparian habitat does not occur on the SEZ but potentially suitable desert wash or riparian habitat occurs within the access road corridor and in portions of the area of indirect effects.

Western Snowy Plover

The western snowy plover is known throughout the western United States and breeds on alkali flats around reservoirs and sandy shorelines. This species is a known summer breeder and winter resident in portions of the six-state solar energy region. The nearest quad-level occurrence of this species is 7 mi (11 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur anywhere within the SEZ or within the access road corridor; however, some potentially suitable aquatic or riparian habitat may occur in the area of indirect effects.

8.3.12.1.6 Rare Species

There are 22 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern by the USFWS) that may be affected by solar energy development on the Gillespie SEZ (Table 8.3.12.1-1). Of these species, there are eight rare species that have not been discussed previously. These include the following (1) plants: arid tansy-aster and California snakewood; (2) invertebrate: Maricopa tiger beetle; (3) amphibian: Arizona toad; (4) reptile: Gila monster; (5) birds: cattle egret and long-eared owl; and (6) mammal: cave myotis. These species as related to the SEZ are described in Table 8.3.12.1-1.

8.3.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Gillespie SEZ is presented in this section. The types of impacts that special status species could incur from construction and operation of utility-scale solar energy facilities are discussed in Section 5.10.4.

The assessment of impacts to special status species is based on available information on the presence of species in the affected area as presented in Section 8.3.12.1 following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys would be conducted to determine the presence of special status species and their habitats in and near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA consultations, and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid, minimize, or mitigate impacts on special status species (see Section 8.3.12.3).

Solar energy development within the Gillespie SEZ could affect a variety of habitats (see Sections 8.3.9 and 8.3.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on ANHP records, quad-level occurrences for the following 10 special status species intersect the Gillespie affected area: California barrel cactus, straw-top cholla, roundtail chub, lowland leopard frog, Sonoran desert tortoise, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, California leaf-nosed bat, and cave myotis. Suitable habitat for each of these species may occur in the affected area. Suitable aquatic or riparian habitat associated with the Gila River within 10 mi (16 km) downgradient (east-southeast) of the SEZ could be affected by groundwater withdrawals from the Lower Hassayampa River Groundwater Basin to serve solar energy development on the Gillespie SEZ. Special status species with aquatic or riparian habitats associated with the Gila River that may be affected by groundwater withdrawals to serve development on the SEZ include the following: roundtail chub, Arizona toad, lowland leopard frog, cattle egret, great egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma clapper rail. Other special status species may occur on the SEZ or within the affected area based on the presence of potentially suitable habitat. As discussed in Section 8.3.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur in the affected area, and may therefore overestimate impacts to some special status species.

Potential direct and indirect impacts on special status species within the SEZ, access road corridor, and in the area of indirect effects outside the SEZ are presented in Table 8.3.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming programmatic design features are in place) is presented along with any potential species-specific mitigation measures that could further reduce impacts.

Impacts on special status species could occur during all phases of development (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy project within the SEZ. Construction and operation activities could result in short- or long-term impacts on individuals and their habitats, especially if these activities are sited in areas where special status species are known to or could occur. As presented in Section 8.3.1.2, it is assumed that a new 3-mile (5-km) long access road would be created to connect existing infrastructure to the SEZ (Figure 8.3.12.1-1). No new transmission development is assumed due to the proximity of an existing transmission ROW.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ and access road corridor where ground-disturbing activities are expected to occur. Indirect impacts could result from depletions of groundwater resources, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, harassment, and lighting. No ground disturbing activities associated with project developments are anticipated to occur within the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts to individuals and habitats adjacent to project areas, but long-term benefits would accrue if original land contours and native plant communities were restored in previously disturbed areas.

The successful implementation of programmatic design features (discussed in Appendix A) would reduce direct impacts on some special status species, especially those that depend on habitat types that can be easily avoided (e.g., desert riparian habitats). Indirect impacts on special status species could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce groundwater consumption, runoff, sedimentation, spills, and fugitive dust.

8.3.12.2.1 Impacts on Species Listed under the ESA

In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS expressed concern for impacts of project development within the SEZ on the southwestern willow flycatcher and Yuma clapper rail—two bird species listed as endangered under the ESA. In addition to these species, the Sonoran bald eagle—listed as threatened under the ESA – may also be affected by project developments on the SEZ. Impacts to these species are discussed below and summarized in Table 8.3.12.1-1.

Sonoran Bald Eagle

The Sonoran population of the bald eagle is currently listed as threatened under the ESA[6] and is known to occur along the Gila River, approximately 15 mi (24 km) south of the SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, only winter foraging habitat is expected to occur in the affected area. Approximately 2,618 acres (11 km^2) of potentially suitable foraging habitat within the SEZ and 22 acres (0.1 km^2) of potentially suitable foraging habitat within the access road corridor could be directly affected by construction and operations of solar energy development on the Gillespie SEZ. This direct effects area represents about 0.1% of available suitable habitat in the region. About 98,500 acres (399 km^2) of suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.1% of the available suitable habitat in the region (Table 8.3.12.1-1). On the basis of SWReGAP land cover data, there is relatively little suitable aquatic and riparian habitat (2,100 acres [8 km^2]) in the affected area. Therefore, most of this potentially suitable foraging habitat is desert shrubland.

6 A recent finding by the USFWS has indicated that listing of this species under the ESA is no longer warranted (USFWS 2010b).

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of potentially suitable foraging habitats for this species is not a feasible means of mitigating impacts because these habitats (desert scrub) are widespread throughout the area of direct effect.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) on the Sonoran population of the bald eagle, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, would require consultation with the USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also occur to determine any state mitigation requirements.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is listed as endangered under the ESA and is known to occur in the affected area of the Gillespie SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur anywhere within the affected area. However, quad-level occurrences of the species in the area of indirect effects and the assumed access road corridor are presumably from the Hassayampa and Gila Rivers to the east of the SEZ. On the basis of SWReGAP land cover types, approximately 2,000 acres (8 km^2) of potentially suitable riparian shrubland and woodland habitat occurs within the affected area; about 2 acres (<0.01 km^2) of riparian habitat occurs within the assumed access road corridor (Figure 8.3.12.1-1). The riparian habitat within the indirect effects area represents about 4.0% of the available suitable habitat in the region; that within the access road corridor represents less than 0.1% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1). On the basis of SWReGAP habitat suitability and land cover models, potentially suitable habitat for this species does not occur within the area of direct effects.

Riparian habitats within the affected area of the Gillespie SEZ that may provide suitable nesting and foraging habitat for the southwestern willow flycatcher may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. Impacts of groundwater depletion from solar energy development in the Gillespie SEZ cannot be quantified without identification of the cumulative amount of groundwater withdrawals needed to support development on the SEZ. Consequently, the overall impact on the southwestern willow flycatcher could range from small to large, and would depend in part on the solar energy technology deployed, the scale of development within the SEZ, the type of cooling system used, and the degree of influence water withdrawals in the SEZ would have on drawdown and surface water discharges in habitats supporting these species (Table 8.3.12.1-1).

The implementation of programmatic design features, avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the southwestern willow flycatcher to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) on the southwestern willow flycatcher, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, would require consultation with the USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also occur to determine any state mitigation requirements.

Yuma Clapper Rail

The Yuma clapper rail is listed as endangered under the ESA and is known to occur in the affected area of the Gillespie SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur anywhere within the affected area. However, quad-level occurrences of the species in the area of indirect effects and the assumed access road corridor are presumably from the Hassayampa and Gila Rivers to the east of the SEZ. On the basis of SWReGAP land cover types, approximately 2,000 acres (8 km^2) of potentially suitable riparian shrubland and woodland habitat occurs within the affected area; about 2 acres (<0.01 km^2) of riparian habitat occurs within the assumed access road corridor (Figure 8.3.12.1-1). The riparian habitat within the indirect effects area represents about 4.0% of the available suitable habitat in the region; that within the access road corridor represents less than 0.1% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1). On the basis of SWReGAP habitat suitability and land cover models, potentially suitable habitat for this species does not occur within the area of direct effects.

Aquatic and riparian habitats outside of the area of direct effects that may provide suitable habitat for the Yuma clapper rail may be dependent on surface discharges from the Lower Hassayampa River Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher, impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features, avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the Yuma clapper rail to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) on the southwestern willow flycatcher, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, would require consultation with the USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take statements per Section 10 of the ESA (if necessary). Consultation with AZGFD should also occur to determine any state mitigation requirements.

8.3.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA

In their scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS expressed concern for impacts of project development within the SEZ on 2 species that are candidates for listing under the ESA: the Tucson shovel-nosed snake and the western yellow-billed cuckoo. Impacts to these species are discussed below and summarized in Table 8.3.12.1-1.

Tucson Shovel-Nosed Snake

The Tucson shovel-nosed snake is one of three subspecies of the western shovel-nosed snake (*Chionactis occipitalis*) that are known to occur in Arizona. The Gillespie SEZ is situated in a zone of integration where all three subspecies may occur and interbreed. The other two subspecies—Colorado Desert shovel-nosed snake (*C. o. annulata*) and Mojave shovel-nosed snake (*C. o. occipitalis*)—are not special status species and are therefore not analyzed in this PEIS. The Tucson shovel-nosed snake occupies eastern-most portion of the species' range in Maricopa and Pinal Counties, Arizona. The Tucson shovel-nosed snake is found in low desert regions where it inhabits creosote-mesquite communities with soft sandy substrates. The nearest quad-level occurrences of this species are approximately 20 mi (32 km) southeast of the SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, approximately 384 acres (2 km^2) of potentially suitable habitat within the SEZ and 7 acres (<0.1 km^2) of potentially suitable habitat within the access road corridor could be directly affected by construction and operations of solar energy development on the Gillespie SEZ. This direct effects area represents less than 0.1% of available suitable habitat in the SEZ region. About 31,400 acres (127 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 2.2% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the Tucson shovel-nosed snake from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the region. The implementation of programmatic design features may be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats for this species is not a feasible means of mitigating impacts because these habitats (desert scrub) are widespread throughout the area of direct effect. Direct impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization are not feasible options, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

Development of mitigation for the Tucson shovel-nosed snake, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS. Coordination with AZGFD should also occur to determine any state mitigation requirements.

Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo is known to occur in the affected area of the Gillespie SEZ (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur anywhere within the affected area. However, quad-level occurrences of the species in the area of indirect effects and the assumed access road corridor are presumably from the Hassayampa and Gila Rivers to the east of the SEZ. On the basis of SWReGAP land cover types, approximately 2,000 acres (8 km^2) of potentially suitable riparian shrubland and woodland habitat occurs within the affected area; about 2 acres (<0.01 km^2) of riparian habitat occurs within the assumed access road corridor (Figure 8.3.12.1-1). The riparian habitat within the indirect effects area represents about 4.0% of the available suitable habitat in the region; that within the access road corridor represents less than 0.1% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1). On the basis of SWReGAP habitat suitability and land cover models, potentially suitable habitat for this species does not occur within the area of direct effects.

Aquatic and riparian habitats outside of the area of direct effects that may provide suitable habitat for the western yellow-billed cuckoo may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features, avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor, and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the western yellow-billed cuckoo to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified.

Development of mitigation for the western yellow-billed cuckoo, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, should be developed in coordination with the USFWS. Coordination with AZGFD should also occur to determine any state mitigation requirements.

8.3.12.2.3 Impacts on Species That Are under Review for Listing under the ESA

In scoping comments on the proposed Gillespie SEZ (Stout 2009), the USFWS identified one species under ESA review that may be directly or indirectly affected by solar energy development on the SEZ, the Sonoran population of the desert tortoise. This distinct population segment of desert tortoise occurs south and east of the Colorado River (Mojave populations north and west of the Colorado River are currently listed as threatened under the ESA, but are outside of the affected area of the Gillespie SEZ). Quad-level occurrences for this species intersect the Gillespie SEZ and other portions of the affected area (Figure 8.3.12.1-1). According to the SWReGAP habitat suitability model, approximately 2,618 acres (11 km^2) of potentially suitable habitat on the SEZ and 20 acres (0.1 km^2) of potentially suitable habitat within the access road corridor could be directly affected by construction and operations of solar energy development on the SEZ (Table 8.3.12.1-1). This direct effects area represents about 0.1% of available suitable habitat of the desert tortoise in the region. About 76,700 acres (310 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 2.0% of the available suitable habitat in the region (Table 8.3.12.1-1).

The overall impact on the Sonoran population of the desert tortoise from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the region. The implementation of programmatic design features alone is unlikely to reduce these impacts to negligible levels. Avoidance of potentially suitable habitats for this species is not a feasible means of mitigating impacts because these habitats (desert scrub) are widespread throughout the area of direct effect. Pre-disturbance surveys to determine the abundance of desert tortoises on the SEZ and the implementation of a desert tortoise translocation plan and compensation plan could reduce direct impacts.

Development of actions to reduce impacts for the desert tortoise, including a survey protocol, avoidance measures, minimization measures, and, potentially, translocation actions, and compensatory mitigation, should be conducted in coordination with the USFWS and AZDFG.

There are inherent dangers to tortoises associated with their capture, handling, and translocation from the SEZ. These actions, if done improperly, can result in injury or death. To minimize these risks, the desert tortoise translocation plan should be developed in consultation with the USFWS, and follow the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the USFWS or other state agencies. If considered appropriate, consultation will identify potentially suitable recipient locations, density thresholds for tortoise populations in recipient locations, procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing and post-translocation monitoring and reporting requirements. Despite some risk of mortality or decreased fitness, translocation is widely accepted as a useful strategy for the conservation of the desert tortoise (Field et al. 2007).

To offset impacts of solar development on the SEZ, compensatory mitigation may be needed to balance the acreage of habitat lost with acquisition of lands that would be improved and protected for desert tortoise populations (USFWS 1994). Compensation can be accomplished by improving the carrying capacity for the desert tortoise on the acquired lands. Other mitigation actions may include funding for the enhancement of desert tortoise habitat on existing federal lands. Coordination with the USFWS and AZGFD would be necessary to determine the appropriate mitigation ratio to acquire, enhance, and preserve desert tortoise compensation lands.

8.3.12.2.4 Impacts on BLM-Designated Sensitive Species

There are 12 BLM-designated sensitive species that are not previously discussed as listed under the ESA, candidates, or under review for ESA listing. Impacts to these BLM-designated sensitive species that may be affected by solar energy development on the Gillespie SEZ are discussed below.

Hohokam Agave

The Hohokam agave is not known to occur in the affected area of the Gillespie SEZ and suitable habitat does not occur on the SEZ; however, approximately 2 acres (<0.1 km^2) of potentially suitable riparian habitat in the access road corridor may be directly affected by construction and operations of solar energy development on the SEZ (Table 8.3.12.1-1). This direct effects area represents less than 0.1 % of available suitable habitat in the region. About 2,000 acres (8 km^2) of potentially suitable riparian habitat occurs in the area of potential indirect effects; this area represents about 3.9% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the Hohokam agave from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor could reduce direct impacts on the Hohokam agave to negligible levels. For this species and other special status plants, impacts also could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization are not feasible options, plants could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

Tumamoc Globeberry

The Tumamoc globeberry is not known to occur in the affected area of the Gillespie SEZ and suitable habitat does not occur on the SEZ; however, approximately 2 acres (<0.1 km^2) of potentially suitable riparian habitat in the access road corridor may be directly affected by construction and operations of solar energy development on the SEZ (Table 8.3.12.1-1). This direct effects area represents less than 0.1 % of available suitable habitat in the region. About 2,000 acres (8 km^2) of potentially suitable riparian habitat occurs in the area of potential indirect effects; this area represents about 3.9% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the Tumamoc globeberry from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian habitats in the area of direct effects and the implementation of other mitigation measures described previously for the Hohokam agave could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Roundtail Chub

The roundtail chub is known from larger tributaries in the Colorado Basin, and is historically known to occur in the affected area of the Gillespie SEZ from the Gila River, within 5 mi (8 km) east of the SEZ. However, the species is currently not known to occur in the affected area. On the basis of and evaluation of surface water features in the SEZ region, potentially suitable habitat for this species does not occur in the area of direct effects. However, approximately 9 mi (14 km) of potentially suitable aquatic habitat within the Gila River occurs in the area of potential indirect effects; this area represents about 3.0% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

Aquatic habitats outside of the area of direct effects that may provide suitable habitat for the roundtail chub may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the roundtail chub to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified.

Lowland Leopard Frog

Quad-level occurrences for the lowland leopard frog intersect the affected area of the Gillespie SEZ. Approximately 288 acres (1 km^2) of potentially suitable habitat on the SEZ and 2 acres (<0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents about 0.1% of potentially suitable habitat in the SEZ region. About 7,480 acres (30 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 3.0% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1).

Aquatic and riparian habitats outside of the area of direct effects that may provide suitable habitat for the lowland leopard frog may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features, avoiding or minimizing disturbance to riparian habitats in the access road corridor, and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the lowland leopard frog to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified. In addition, impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization are not feasible options, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

Mexican Rosy Boa

The Mexican rosy boa is known to occur within the SEZ region and potentially suitable habitat is expected to occur in the affected area. Approximately 2,618 acres (11 km^2) of potentially suitable habitat on the SEZ and 20 acres (0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations

(Table 8.3.12.1-1). This direct impact area represents about 0.2% of potentially suitable habitat in the SEZ region. About 84,700 acres (343 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.2% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the Mexican rosy boa from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable habitats to mitigate impacts on the Mexican rosy boa is not feasible because potentially suitable desert scrub and wash habitats are widespread throughout the area of direct effect. However, direct impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization are not feasible options, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

Ferruginous Hawk

The ferruginous hawk is a winter resident in the Gillespie SEZ region and potentially suitable foraging habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur within the area of direct effects. However, about 10,600 acres (43 km^2) of potentially suitable foraging habitat occurs in the area of indirect effects; this area represents about 2.7% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Great Egret

The great egret is a year-round resident in the Gillespie SEZ region and potentially suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability model, suitable aquatic and riparian habitat for this species does not occur in the area of direct effects. However, approximately 1,000 acres (4 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 3.5% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). The majority of this suitable habitat occurs in association with the Gila River east and southeast of the SEZ.

The great egret is not expected to occur in the area of direct effects. Aquatic and riparian habitats outside of the area of direct effects that may provide suitable nesting and foraging habitat for this species may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the great egret to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified. In addition, avoiding or minimizing disturbance to riparian areas within the access road corridor would further reduce impacts.

Snowy Egret

The snowy egret is a year-round resident in the Gillespie SEZ region and potentially suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability model, approximately 425 acres (2 km^2) of potentially suitable habitat on the SEZ and 3 acres (<0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. Approximately 15,000 acres (61 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.2% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). The majority of the suitable habitat for this species occurs in association with the Gila River east and southeast of the SEZ.

Aquatic and riparian habitats in the affected area that may provide suitable nesting and foraging habitat for this species may be dependent on surface discharges from the Lower Hassayampa River Groundwater Basin and may be affected by groundwater withdrawals to serve development on the Gillespie SEZ. As discussed for the southwestern willow flycatcher (Section 8.3.12.2.1), impacts on this species could range from small to large depending upon the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals (Table 8.3.12.1-1).

The implementation of programmatic design features and avoidance or limitations of groundwater withdrawals from the regional groundwater system could reduce impacts on the snowy egret to small or negligible levels. Impacts can be better quantified for specific projects once water needs are identified. In addition, avoiding or minimizing disturbance to riparian areas within the SEZ and access road corridor would further reduce impacts.

Western Burrowing Owl

The western burrowing owl is a year-round resident in the Gillespie SEZ region and potentially suitable foraging and nesting habitat is expected to occur in the affected area. Approximately 2,618 acres (11 km^2) of potentially suitable habitat on the SEZ and 20 acres (0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 97,000 acres (393 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.2% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). Most of this area could serve as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting in the affected area has not been determined.

The overall impact on the western burrowing owl from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts on the western burrowing owl because potentially suitable desert scrub habitats are widespread throughout the area of direct effect and readily available in other portions of the SEZ region. Impacts on the western burrowing owl could be reduced to negligible levels through the implementation of programmatic design features and by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied burrows in the area of direct effects. If avoidance or minimization are not feasible options, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

California Leaf-Nosed Bat

The California leaf-nosed bat is a year-round resident within the Gillespie SEZ region. On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do not occur in the affected area. However, approximately 2,618 acres (11 km^2) of potentially suitable habitat on the SEZ and 21 acres (0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 85,900 acres (348 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.2% of the available suitable foraging habitat in the region (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP landcover types, there are no potentially suitable roosting habitats (rocky cliffs and outcrops) in the affected area.

The overall impact on the California leaf-nosed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the region. The implementation of programmatic design features may be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to mitigate impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Western Red Bat

The western red bat is an uncommon year-round resident within the Gillespie SEZ region. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur in the area of direct effects. However, about 625 acres (3 km^2) of potentially suitable foraging or roosting habitat occurs in the area of indirect effect; this area represents about 3.6% of the available suitable foraging habitat in the region (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there are no potentially suitable roosting habitats (woodlands) in the area of direct effects. However, approximately 1,000 acres (4 km^2) of riparian woodlands that may be potentially suitable roosting habitat occurs in the area of indirect effects.

The overall impact on the western red bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Western Yellow Bat

The western yellow bat is an uncommon year-round resident within the Gillespie SEZ region. According to the SWReGAP habitat suitability model, approximately 2,618 acres (11 km^2) of potentially suitable habitat on the SEZ and 20 acres (0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 8.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 87,500 acres (354 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.0% of the available suitable foraging habitat in the region (Table 8.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there are no potentially suitable roosting habitats (woodlands) in the area of direct effects.

However, approximately 1,000 acres (4 km^2) of riparian woodlands that may be potentially suitable roosting habitat occurs in the area of indirect effects.

The overall impact on the western yellow bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the region. The implementation of programmatic design features may be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to mitigate direct impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

8.3.12.2.5 Impacts on State-Listed Species

There are a total of 18 species listed by the State of Arizona that may occur in the Gillespie SEZ affected area (Table 8.3.12.1-1). Of these species, impacts to the following 3 state-listed species have not been previously described: California barrel cactus, straw-top cholla, and western snowy plover. Impacts on each of these 3 species are discussed below and summarized in Table 8.3.12.1-1.

California Barrel Cactus

The California barrel cactus is known to occur in the affected area of the Gillespie SEZ on the basis of quad-level occurrences for the species. According to the SWReGAP land cover model, potentially suitable desert riparian habitat for this species does not occur on the SEZ. However, approximately 2 acres (<0.1 km^2) of potentially suitable desert wash or riparian habitat does occur in the assumed access road corridor (Table 8.3.12.1-1). This direct effects area represents less than 0.1 % of available suitable habitat in the region. About 2,000 acres (8 km^2) of potentially suitable desert wash or riparian habitat occurs in the area of potential indirect effects; this area represents about 3.9% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the California barrel cactus from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor and the implementation of other mitigation measures described previously for the Hohokam agave (Section 8.3.12.2.4) could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

Straw-Top Cholla

The straw-top cholla is known to occur in the affected area of the Gillespie SEZ on the basis of quad-level occurrences for the species. According to the SWReGAP land cover model, potentially suitable desert riparian habitat for this species does not occur on the SEZ. However, approximately 2 acres (<0.1 km^2) of potentially suitable desert wash or riparian habitat does occur in the assumed access road corridor (Table 8.3.12.1-1). This direct effects area represents less than 0.1 % of available suitable habitat in the region. About 2,000 acres (8 km^2) of potentially suitable desert wash or riparian habitat occurs in the area of potential indirect effects; this area represents about 3.9% of the available suitable habitat in the SEZ region (Table 8.3.12.1-1).

The overall impact on the straw-top cholla from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to riparian habitats in the assumed access road corridor and the implementation of other mitigation measures described previously for the Hohokam agave (Section 8.3.12.2.4) could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Western Snowy Plover

The western snowy plover is known throughout the western United States and breeds on alkali flats around reservoirs and sandy shorelines. According to the SWReGAP habitat suitability model, suitable aquatic and riparian habitat for this species does not occur in the area of direct effects. However, approximately 1,100 acres (4 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 0.3% of the potentially suitable habitat in the SEZ region (Table 8.3.12.1-1). The majority of the suitable habitat for this species occurs in association with the Gila River east and southeast of the SEZ.

The western snowy plover is not expected to occur in the area of direct effects. The overall impact on the western snowy plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the Gillespie SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

8.3.12.2.6 Impacts on Rare Species

There are 22 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern by the USFWS) that may be affected by solar energy development on the Gillespie SEZ

(Table 8.3.12.1-1). Impacts to 8 rare species have not been discussed previously. These include the following (1) plants: arid tansy-aster and California snakewood; (2) invertebrates: Maricopa tiger beetle; (3) amphibians: Arizona toad; (4) reptiles: Gila monster; (5) birds: cattle egret and long-eared owl; and (6) mammals: cave myotis. Impacts on these species are presented in Table 8.3.12.1-1.

8.3.12.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A would greatly reduce or eliminate the potential for effects of utility-scale solar energy development on special status species. While some SEZ-specific design features are best established when specific project details are being considered, some design features can be identified at this time, including the following:

- Pre-disturbance surveys should be conducted within the SEZ and access road corridor to determine the presence and abundance of special status species, including those identified in Table 8.3.12.1-1; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.

- Consultation with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Sonoran bald eagle, southwestern willow flycatcher, and Yuma clapper rail. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary).

- Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the following species that are candidates or under review for listing under the ESA: Sonoran desert tortoise, Tucson shovel-nosed snake, and western yellow-billed cuckoo. The Sonoran desert tortoise is a species under review for listing under the ESA; the Tucson shovel-nosed snake and western yellow-billed cuckoo are candidates for listing under the ESA. Coordination would identify an appropriate survey protocol, and mitigation, which may include avoidance, minimization, translocation, or compensation.

- Avoiding or minimizing disturbance to desert riparian habitat within the assumed access road corridor could reduce or eliminate impacts to the following 17 special status species: Arid tansy-aster, California barrel cactus, California snakewood, Hohokam agave, straw-top cholla, Tumamoc globeberry, Maricopa tiger beetle, Arizona toad, lowland leopard frog, cattle egret, great egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, and western yellow bat.

- Avoidance or minimization of groundwater withdrawals to serve solar energy development on the SEZ could reduce or eliminate impacts to the following 9 special status species with habitats dependent upon groundwater discharge in the SEZ region: roundtail chub, Arizona toad, lowland leopard frog, cattle egret, great egret, snowy egret, southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma clapper rail. In particular, impacts to aquatic and riparian habitat associated with the Gila River should be avoided.

- Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and AZGFD.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on the special status and rare species could be reduced.

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8.3.13 Air Quality and Climate

8.3.13.1 Affected Environment

8.3.13.1.1 Climate

The proposed Gillespie SEZ is located in the west-central portion of Maricopa County in south-central Arizona. At an average elevation of 930 ft (284 m), the SEZ is located on relatively flat terrain, gently sloping downward to the northeast and scattered by low hills and buttes mostly to the south. The SEZ is in the northern portion of the Sonoran Desert, which covers southwest Arizona, southern California, and northwestern Mexican states. The area experiences a desert-like arid climate, characterized by hot summers, mild winters, light precipitation, a high rate of evaporation, low relative humidity, abundant sunshine, and large temperature ranges (NCDC 2010a). Meteorological data collected at Wintersburg, about 8 mi (13 km) north of the Gillespie SEZ, and at Tonopah, about 13 mi (21 km) north–northwest, are summarized below.

A wind rose from Wintersburg, for the 5-year period 1994 to 1998, taken at a level of 33 ft (10 m), is presented in Figure 8.3.13.1-1 (Mao 2010). During this period, the annual average wind speed at the airport was about 8.7 mph (3.9 m/s); the prevailing wind direction was from the southwest (about 16.6% of the time) and secondarily from the south–southwest (about 9.6% of the time) and the west–southwest (about 9.3% of the time). Winds blew more frequently from the southwest from March to October and from the north–northeast from November to February. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred infrequently (about 0.3% of the time). Average wind speeds by season were the highest in summer at 9.9 mph (4.4 m/s); lower in spring and fall at 9.7 mph (4.3 m/s) and 7.9 mph (3.5 m/s), respectively; and lowest in winter at 7.4 mph (3.3 m/s).

Topography plays a large role in determining the temperature of any specific location in Arizona. For the 1951 to 2010 period, the annual average temperature at Tonopah was 70.4°F (21.3°C) (WRCC 2010a). January was the coldest month, with an average minimum temperature of 36.5°F (2.5°C) in December, and July was the warmest month, with an average maximum of 106.8°F (41.6°C). In summer, daytime maximum temperatures higher than 100°F (37.8°C) were common, and minimums were in the 70s. The minimum temperatures recorded were below freezing (≤32°F [0°C]) during the colder months (about 9 days in December and January), but subzero temperatures have never been recorded. During the same period, the highest temperature, 121°F (49.4°C), was reached in June 1990, and the lowest, 14°F (−10.0°C), in December 1990. In a typical year, about 168 days had a maximum temperature of ≥90°F (32.2°C), while about 25 days had minimum temperatures at or below freezing.

Throughout Arizona, precipitation patterns largely depend on elevation and the season of the year. In Arizona, rain comes mostly in two distinct seasons (winter and summer monsoon season) (NCDC 2010a). For the 1951 to 2010 period, annual precipitation at Tonopah averaged about 7.60 in. (19.3 cm) (WRCC 2010a). On average, there are 24 days annually with measurable

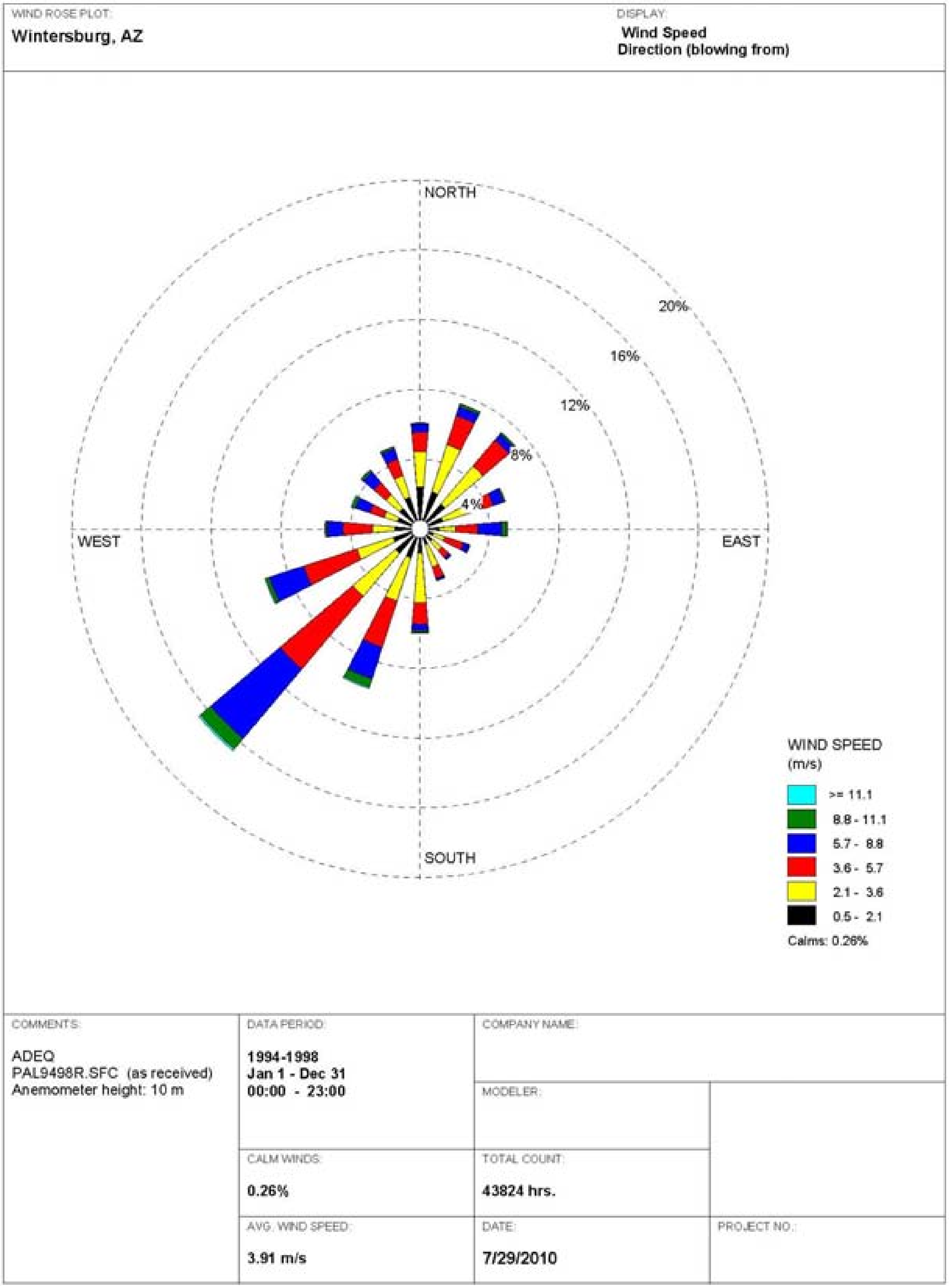

FIGURE 8.3.13.1-1 Wind Rose at 33 ft (10 m) at Wintersburg, Arizona, 1994 to 1998 (Source: Mao 2010)

precipitation (0.01 in. [0.025 cm] or higher). Seasonally, precipitation is the highest in winter and the lowest in spring. No snowfall at Tonopah has been reported.

The proposed Gillespie SEZ is far from major water bodies (about 130 mi [210 km] to the Gulf of California). Severe weather events, such as floods, hail, and thunderstorm winds, have been reported in Maricopa County, which encompasses the Gillespie SEZ (NCDC 2010b).

In Arizona, flood conditions occur infrequently, but heavy thunderstorms during the summer thunderstorm season at times cause floods that do considerable local damage. Since 1993, 93 floods (three-fourths of which were flash floods) were reported in Maricopa County, most of which occurred far from the SEZ. These floods caused seven deaths, three injuries, and considerable property and crop damage.

In Maricopa County, 109 hail events have been reported since 1960, which occurred more frequently from August to October and caused no deaths but resulted in three injuries and some property damage. Hail size of 2.75 in. (7.0 cm) in diameter was reported in 1990. Since 1955, 631 thunderstorm winds have been reported, and those up to a maximum wind speed of 115 mph (51 m/s) occurred mostly during summer months and caused 2 deaths, 80 injuries, and considerable property damage (NCDC 2010b).

Eight dust storm events have been reported in Maricopa County since 1994 (NCDC 2010b). The ground surface of the SEZ is covered predominantly with gravelly sandy loams, which have moderate dust storm potential. On occasion, high winds accompanied by thunderstorms and dry soil conditions could result in blowing dust in Maricopa County. Dust storms can deteriorate air quality and visibility and have adverse effects on health.

Hurricanes and tropical storms formed off the coast of Central America and Mexico weaken over the cold waters off the California coast. Accordingly, hurricanes rarely hit Arizona through California. Historically, one tropical storm/depression from the Gulf of California passed within 100 mi (160 km) of the proposed Gillespie SEZ (CSC 2010). In the period from 1950 to April 2010, 57 tornadoes (1 per year each) were reported in Maricopa County (NCDC 2010b). Most tornadoes occurring in Maricopa County were relatively weak (i.e., 7 were F [uncategorized[7]]; 23 were F0; 20 were F1; 6 were F2; and 1 was F3 on the Fujita tornado scale), and these tornadoes caused no deaths but resulted in 57 injuries and considerable property damage. Several of these tornadoes occurred not far from the SEZ, the nearest one of which hit the area about 5 mi (8 km) southeast of the SEZ.

8.3.13.1.2 Existing Air Emissions

Maricopa County has many industrial emission sources, mostly in and around Phoenix. Several power-generating plants (Palo Verde Nuclear Generating Station and three natural gas–fired power plants) and a compressor station are located north and east of the SEZ, but their emissions are relatively small. Several major roads exist in Maricopa County, such as I-8, I-10,

[7] Not categorized by the Fujita tornado scale because damage level was not reported.

I-17, U.S. 60, and many state routes. Thus, onroad mobile source emissions are substantial compared with emissions from other sources in Maricopa County. Data on annual emissions of criteria pollutants and VOCs in Maricopa County are presented in Table 8.3.13.1-1 for 2002 (WRAP 2009). Emission data are classified into six source categories: point, area (including fugitive dust), onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires, agricultural fires, structural fires). In 2002, onroad sources were major contributors to total SO_2, NO_x, and CO emissions (about 48%, 71%, and 49%, respectively). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions accounted for about two-thirds of the VOC emissions (about 67%). Area sources accounted for about 81% of PM_{10} and 61% of $PM_{2.5}$. In Maricopa County, nonroad sources were secondary contributors to SO_2, NO_x, CO, and $PM_{2.5}$ emissions. Point sources were minor contributors to criteria pollutants and VOCs, while fire sources were insignificant contributors.

TABLE 8.3.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Maricopa County, Arizona, Encompassing the Proposed Gillespie SEZ, 2002[a]

Pollutant	Emissions (tons/yr)
SO_2	2,538
NO_x	118,816
CO	792,331
VOCs	379,411
PM_{10}	35,459
$PM_{2.5}$	13,702

a Includes point, area (including fugitive dust), onroad and nonroad mobile, biogenic, and fire emissions.

b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOC = volatile organic compounds.

Source: WRAP (2009).

In 2010, Arizona is projected to produce about 116.6 MMt of *gross*[8] carbon dioxide equivalent (CO_2e)[9] emissions, which is about 1.6% of total U.S. GHG emissions in 2007 (Bailie et al. 2005). Gross GHG emissions in Arizona increased by about 77% from 1990 to 2010 because of Arizona's rapid population growth and attendant economic growth, compared to 16% growth in U.S. GHG emissions during the 1990 to 2005 period. In 2005, electricity use (about 40.0%) and transportation (about 38.9%) were the primary contributors to gross GHG emission sources in Arizona. Fuel use in the residential, commercial, and industrial (RCI) sectors combined accounted for about 15.4% of total state emissions. Arizona's *net* emissions were about 109.9 MMt CO_2e, considering carbon sinks from forestry activities and agricultural soils throughout the state. The EPA (2009b) also estimated 2005 emissions in Arizona. Its estimate of CO_2 emissions from fossil fuel combustion was 97.2 MMt, which was comparable to the state's estimate. Electric power generation and transportation accounted for about 51.8% and 38.8% of the CO_2 emissions total, respectively, while the RCI sectors accounted for the remainder (about 9.4%).

8 Excluding GHG emissions removed as a result of forestry and other land uses and excluding GHG emissions associated with exported electricity.

9 A measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO_2. The CO_2e for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

8.3.13.1.3 Air Quality

The State of Arizona has adopted the NAAQS for six criteria pollutants: SO_2, NO_2, CO, O_3, PM (PM_{10} and $PM_{2.5}$), and Pb (ADEQ 2009; EPA 2010a). The NAAQS for criteria pollutants is presented in Table 8.3.13.1-2.

Maricopa County is located administratively within the Maricopa Intrastate AQCR (Title 40, Part 81, Section 36 of the *Code of Federal Regulations* [40 CFR 81.36]). Currently, the Maricopa AQCR is designated by the U.S. EPA as a nonattainment area for 8-hour O_3 and PM_{10} and as a maintenance area for CO. The Gillespie SEZ is located far outside of the PM_{10} nonattainment area and CO maintenance area but just outside of the 8-hour O_3 nonattainment area (ADEQ 2010a). Maricopa County is designated as an unidentifiable/attainment area for all other criteria pollutants (40 CFR 81.303).

Because of relatively high population density and many industrial activities, Maricopa County has many significant industrial emission sources of its own, but mobile emissions along major highways account for considerable NO_x and CO emissions. Outside urban areas, ambient air quality in Maricopa County is relatively good, except for O_3 and PM. Currently, more than 20 air monitoring stations are established in downtown Phoenix and the surrounding areas in Maricopa County. Buckeye, about 15 mi (24 km) east–northeast of the Gillespie SEZ, is the nearest air monitoring station where NO_2, CO, O_3, and PM_{10} are monitored. To characterize ambient air quality for SO_2 and $PM_{2.5}$ around the SEZ, the two closest monitoring stations located in the Phoenix area were chosen. For SO_2 and $PM_{2.5}$, the highest concentrations at two monitoring stations in the Phoenix area, which are about 47 mi (76 km) and 43 mi (69 km) east–northeast of the SEZ, respectively, were presented. No Pb measurements have been made in the state of Arizona because of low Pb concentration levels after the phaseout of leaded gasoline. The highest background concentrations of criteria pollutants at these stations for the period 2004 to 2008 are presented in Table 8.3.13.1-2 (EPA 2010b). The highest concentration levels were lower than their respective standards (up to 23%), except O_3, PM_{10}, and $PM_{2.5}$, which approached or exceeded their respective NAAQS. These criteria pollutants are of regional concern in the area because of high temperatures, abundant sunshine, and windblown dust from occasional high winds and dry soil conditions.

The PSD regulations (see 40 CFR 52.21), which are designed to limit the growth of air pollution in clean areas, apply to a major new source or modification of an existing major source within an attainment or unclassified area (see Section 4.11.2.3). As a matter of policy, EPA recommends that the permitting authority notify the Federal Land Managers when a proposed PSD source would locate within 62 mi (100 km) of a sensitive Class I area. There are several Class I areas around the Gillespie SEZ, none of which is situated within the 62-mi (100-km) distance in Arizona. The nearest Class I area is Superstition WA (40 CFR 81.403), about 79 mi (127 km) east of the Gillespie SEZ. This Class I area is not located downwind of prevailing winds at the Gillespie SEZ (Figure 8.3.13.1-1). The next nearest Class I areas include Mazatzal WA and Pine Mountain WA, which are about 84 mi (135 km) and 89 mi (143 km) northeast of the SEZ, respectively.

TABLE 8.3.13.1-2 NAAQS and Background Concentration Levels Representative of the Proposed Gillespie SEZ in Maricopa County, Arizona, 2004 to 2008

			Background Concentration Level	
Pollutant[a]	Averaging Time	NAAQS	Concentration[b,c]	Measurement Location, Year
SO_2	1-hour	75 ppb[d]	– [e]	–
	3-hour	0.5 ppm	0.013 ppm (2.6%)	Phoenix, Maricopa County, 2007
	24-hour	0.14 ppm	0.008 ppm (5.7%)	Phoenix, Maricopa County, 2004
	Annual	0.030 ppm	0.003 ppm (10%)	Phoenix, Maricopa County, 2004
NO_2	1-hour	100 ppb[f]	–	–
	Annual	0.053 ppm	0.012 ppm (23%)	Buckeye, Maricopa County, 2005
CO	1-hour	35 ppm	1.6 ppm (4.6%)	Buckeye, Maricopa County, 2007
	8-hour	9 ppm	0.9 ppm (10%)	Buckeye, Maricopa County, 2005
O_3	1-hour	0.12 ppm[g]	0.080 ppm (67%)	Buckeye, Maricopa County, 2006
	8-hour	0.075 ppm	0.068 ppm (91%)	Buckeye, Maricopa County, 2008
PM_{10}	24-hour	150 $\mu g/m^3$	204 $\mu g/m^3$ (136%)	Buckeye, Maricopa County, 2008
	Annual	50 $\mu g/m^3$ [h]	53 $\mu g/m^3$ (106%)	Buckeye, Maricopa County, 2007
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	42.3 $\mu g/m^3$ (121%)	Phoenix, Maricopa County, 2005
	Annual	15.0 $\mu g/m^3$	13.5 $\mu g/m^3$ (90%)	Phoenix, Maricopa County, 2006
Pb	Calendar quarter	1.5 $\mu g/m^3$	–	–
	Rolling 3-month	0.15 $\mu g/m^3$ [i]	–	–

[a] Notation: CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; SO_2 = sulfur dioxide.

[b] Monitored concentrations are the second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O_3 and the 98th percentile for 24-hour $PM_{2.5}$; and arithmetic mean for annual SO_2, NO_2, PM_{10}, and $PM_{2.5}$.

[c] Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO_2 and NO_2 to NAAQS was not made, because no measurement data based on new NAAQS are available.

[d] Effective August 23, 2010.

[e] A dash indicates not applicable or not available.

[f] Effective April 12, 2010.

[g] The EPA revoked the 1-hour O_3 standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

[h] Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 $\mu g/m^3$ but annual PM_{10} concentrations are presented for comparison purposes.

[i] Effective January 12, 2009.

Sources: ADEQ (2009); EPA (2010a,b).

8.3.13.2 Impacts

Potential impacts on ambient air quality associated with a solar project would be of most concern during the construction phase. Impacts on ambient air quality from fugitive dust emissions resulting from soil disturbances are anticipated, but they would be of short duration. During the operations phase, only a few sources with generally low-level emissions would exist for any of the four types of solar technologies evaluated. A solar facility would either not burn fossil fuels or burn only small amounts during operation. (For facilities using HTFs, fuel could be used to maintain the temperature of the HTFs for more efficient daily start-up.) Conversely, solar facilities would displace air emissions that would otherwise be released from fossil fuel power plants.

Air quality impacts shared by all solar technologies are discussed in detail in Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific to the proposed Gillespie SEZ are presented in the following sections. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 8.3.13.3 below identifies SEZ-specific design features of particular relevance to the Gillespie SEZ.

8.3.13.2.1 Construction

The Gillespie SEZ has a relatively flat terrain; thus only a minimum number of site preparation activities, perhaps with no large-scale earthmoving operations, would be required. However, fugitive dust emissions from soil disturbances during the entire construction phase would be a major concern because of the large areas that would be disturbed in a region with windblown dust problems. Fugitive dusts, which are released near ground level, typically have more localized impacts than similar emissions from an elevated stack with additional plume rise induced by buoyancy and momentum effects.

Methods and Assumptions

Air quality modeling for PM_{10} and $PM_{2.5}$ emissions associated with construction activities was performed using the EPA-recommended AERMOD model (EPA 2009c). Details for emissions estimation, the description of AERMOD, input data processing procedures, and modeling assumption are described in Section M.13 of Appendix M. Estimated air concentrations were compared with the applicable NAAQS levels at the site boundaries and nearby communities and with Prevention of Significant Deterioration (PSD) increment levels at nearby Class I areas.[10] However, no receptors were modeled for PSD analysis at the nearest

[10] To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS levels and the PSD Class I increment levels. Although the Clean Air Act exempts construction activities from PSD requirements, a comparison with the Class I increment levels was used to quantify potential impacts. Only monitored data can be used to determine the attainment status. Modeled data are used to assess potential problems and as a consideration in the permitting process.

Class I area, Superstition WA, because it is about 79 mi (127 km) from the SEZ, which is over the maximum modeling distance of 31 mi (50 km) for the AERMOD. Rather, several regularly spaced receptors in the direction of the Superstition WA were selected as surrogates for the PSD analysis. For the Gillespie SEZ, the modeling was conducted based on the following assumptions and input:

- It was assumed that 80% of the 2,618-acre (10.6-km^2) area would be disturbed within the SEZ in the peak construction year. Emissions were modeled for a disturbance of 2,094 acres (8.5 km^2) uniformly distributed over the entire SEZ.

- Surface hourly meteorological data came from Phoenix Sky Harbor International Airport, upper air sounding data from Tucson, and onsite data from Wintersburg for the 1994 to 1998 period (Mao 2010).

- A receptor grid was spaced regularly over a modeling domain of 62 mi × 62 mi (100 km × 100 km) centered on the proposed SEZ, and additional discrete receptors were present at the SEZ boundaries.

Results

The modeling results for concentration increments and total concentrations (modeled plus background concentrations) for both PM_{10} and $PM_{2.5}$ that would result from construction-related fugitive emissions are summarized in Table 8.3.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled to occur at the site boundaries would be an estimated 683 $\mu g/m^3$, which far exceeds the relevant standard level of 150 $\mu g/m^3$. Total 24-hour PM_{10} concentrations of 887 $\mu g/m^3$ would also exceed the standard level at the SEZ boundary. However, high PM_{10} concentrations would be limited to the immediate areas surrounding the SEZ boundary and would decrease quickly with distance. Predicted maximum 24-hour PM_{10} concentration increments would be about 65 $\mu g/m^3$ at the nearby residences about 4.1 mi (6.6 km) southeast of the SEZ, about 40 $\mu g/m^3$ at the nearest receptors about 1.8 mi (2.9 km) east of the SEZ, about 20 $\mu g/m^3$ at Arlington, about 15 $\mu g/m^3$ at Palo Verde and Wintersburg, and about 10 $\mu g/m^3$ at Buckeye and Gila Bend. Annual average modeled concentration increments and total concentrations (increment plus background) for PM_{10} at the SEZ boundary would be about 135 $\mu g/m^3$ and 188 $\mu g/m^3$, respectively, which are higher than the NAAQS level of 50 $\mu g/m^3$, which was revoked by the EPA in December 2006. Annual PM_{10} increments would be much lower, about 2.0 $\mu g/m^3$ at the nearby residences about 3 mi (5 km) north of the SEZ, about 0.8 $\mu g/m^3$ at Arlington, about 0.4 $\mu g/m^3$ at Palo Verde and Wintersburg, and less than 0.3 $\mu g/m^3$ at Buckeye and Gila Bend.

TABLE 8.3.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Gillespie SEZ

			Concentration ($\mu g/m^3$)				Percentage of NAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background[c]	Total	NAAQS	Increment	Total
PM_{10}	24 hours	H6H	683	204	887	150	455	591
	Annual	–[d]	135	53.0	188	50	269	375
$PM_{2.5}$	24 hours	H8H	48.2	42.3	90.5	35	138	258
	Annual	–	13.5	13.5	27.0	15.0	90	180

a $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm.

b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-yr period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-yr period. For the annual average, multiyear averages of annual means over the 5-yr period are presented. Maximum concentrations are predicted to occur at the site boundaries.

c See Table 8.3.13.1-2.

d Not applicable.

Total 24-hour $PM_{2.5}$ concentrations would be 90.5 $\mu g/m^3$ at the SEZ boundary, which is higher than the NAAQS level of 35 $\mu g/m^3$; modeled increments contribute about the same as background concentration to this total. The total annual average $PM_{2.5}$ concentration would be 27.0 $\mu g/m^3$, which exceeds the NAAQS level of 15.0 $\mu g/m^3$. At the nearby residences about 3 mi (5 km) north of the SEZ, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about of about 2.0 and 0.2 $\mu g/m^3$, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the surrogate receptors for the nearest Class I Area—Superstition WA—would be about 6.7 and 0.21 $\mu g/m^3$, or 84% and 5.2% of the PSD increments for the Class I area, respectively. These surrogate receptors are more than 48 mi (77 km) from the Superstition WA, and thus predicted concentrations in Superstition WA would be much lower than the above values (about 33% of the PSD increments for 24-hour PM_{10}), considering the same decay ratio with distance.

In conclusion, predicted 24-hour and annual PM_{10} and $PM_{2.5}$ concentration levels could exceed the standard levels at the SEZ boundaries and in the immediate surrounding areas during the construction of solar facilities. To reduce potential impacts on ambient air quality and in compliance with programmatic design features, aggressive dust control measures would be used. Potential air quality impacts on nearby communities would be much lower. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM_{10} increments at the nearest federal Class I area (Superstition WA). Construction activities are not subject to the PSD program, and the comparison provides only a screen for gauging the size of the impact. Accordingly, it is anticipated that impacts of construction activities on ambient air quality would be moderate and temporary.

Construction emissions from the engine exhaust from heavy equipment and vehicles have the potential to affect AQRVs (e.g., visibility and acid deposition) at the nearby federal Class I area. However, SO_X emissions from engine exhaust would be very low, because programmatic design features would require ultra-low-sulfur fuel with a sulfur content of 15 ppm. NO_X emissions from engine exhaust would be primary contributors to potential impacts on AQRVs. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

Construction of a new transmission line has not been assessed for the Gillespie SEZ, assuming connection to the existing 500-kV line would be possible; impacts on air quality would be evaluated at the project-specific level if new transmission construction or line upgrades would occur. In addition, some construction of transmission lines could occur within the SEZ and over a short distance (0.6 mi [1.0 km]) to the regional grid. Potential impacts on ambient air quality would be a minor component of construction impacts in comparison with solar facility construction and would be temporary.

8.3.13.2.2 Operations

Emission sources associated with the operation of a solar facility would include auxiliary boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the parabolic trough or power tower technology if wet cooling were implemented (drift comprises low-level PM emissions). Some of these sources may need to comply with emissions standards including, but not limited to, the New Source Performance Standards (NSPS) for boilers (40 CFR 60), the NSPS for stationary diesels (40 CFR 60 Subpart IIII), federal requirements for nonroad diesels (40 CFR 89), and the NESHAP for stationary reciprocating engines (40 CFR 63 Subpart ZZZZ). In addition, given the typically small emissions, it is unlikely that PSD requirements would apply to typical solar energy facilities.

Potential air emissions displaced by solar project development at the Gillespie SEZ are presented in Table 8.3.13.2-2. Total power generation capacity ranging from 233 to 419 MW is estimated for the Gillespie SEZ for various solar technologies (see Section 8.3.2). The estimated amount of emissions avoided for the solar technologies evaluated depends only on the megawatts of conventional fossil fuel–generated power displaced, because a composite emission factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009d). If the Gillespie SEZ were fully developed, it is expected that emissions avoided would be fairly modest. Development of solar power in the SEZ would result in avoided air emissions ranging from 0.59 to 1.1% of total emissions of SO_2, NO_X, Hg, and CO_2 from electric power systems in the state of Arizona (EPA 2009d). Avoided emissions would be up to 0.27% of total emissions from electric power systems in the six-state study area. When compared with all source categories, power production from the same solar facilities would displace up to 0.51% of SO_2, 0.24% of

TABLE 8.3.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Gillespie SEZ

Area Size (acres)	Capacity (MW)[a]	Power Generation (GWh/yr)[b]	Emissions Displaced (tons/yr; 10^3 tons/yr for CO_2)[c]			
			SO_2	NO_x	Hg	CO_2
2,618	233–419	408–734	314–565	483–870	0.004–0.008	347–624
Percentage of total emissions from electric power systems in Arizona[d]			0.59–1.1%	0.59–1.1%	0.59–1.1%	0.59–1.1%
Percentage of total emissions from all source categories in Arizona[e]			0.28–0.51%	0.13–0.24%	–[f]	0.32–0.58%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.13–0.23%	0.13–0.24%	0.15–0.27%	0.13–0.24%
Percentage of total emissions from all source categories in the six-state study area[e]			0.07–0.12%	0.02–0.03%	–	0.04–0.07%

[a] It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km^2) per MW (for parabolic trough technology) to 9 acres (0.036 km^2) per MW (power tower, dish engine, and PV technologies) would be required.

[b] A capacity factor of 20% was assumed.

[c] Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 1.54, 2.37, 2.2×10^{-5}, and 1,700 lb/MWh, respectively, were used for the state of Arizona.

[d] Emission data for all air pollutants are for 2005.

[e] Emission data for SO_2 and NO_x are for 2002, while those for CO_2 are for 2005.

[f] Not estimated.

Sources: EPA (2009b,d); WRAP (2009).

NO_x, and 0.58% of CO_2 emissions in the state of Arizona (EPA 2009b; WRAP 2009). These emissions would be up to 0.12% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for about 68% of the total electric power generated in Arizona; contribution of coal combustion is about 40%, followed by natural gas combustion of about 28%, and nuclear generation of about 25%. Thus, solar facilities to be built in the Gillespie SEZ could reduce fuel combustion-related emissions in Arizona to some extent, but relatively less so than those built in other states with higher fossil fuel use rates.

As discussed in Section 5.11.1.5, the operation of associated transmission lines would generate some air pollutants from activities such as periodic site inspections and maintenance. However, these activities would occur infrequently, and the amount of emissions would be small. In addition, transmission lines could produce minute amounts of O_3 and its precursor,

NO_X, associated with corona discharge (i.e., the breakdown of air near high-voltage conductors), which is most noticeable for high-voltage lines during rain or very humid conditions. Since the Gillespie SEZ is located in an arid desert environment, these emissions would be small, and potential impacts on ambient air quality associated with transmission lines would be negligible, based on the infrequent occurrences and small amount of emissions from corona discharges.

8.3.13.2.3 Decommissioning/Reclamation

As discussed in Section 5.11.1.4, decommissioning/reclamation activities are similar to construction activities but are on a more limited scale and of shorter duration. Potential impacts on ambient air quality would be correspondingly less than those from construction activities. Decommissioning activities would last for a short period, and their potential impacts would be moderate and temporary. The same mitigation measures adopted during the construction phase would also be implemented during the decommissioning phase (Section 5.11.3).

8.3.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the proposed Gillespie SEZ (through such measures as increased watering frequency or road paving or treatment) is a required design feature under BLM's Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM levels as low as possible during construction.

8.3.14 Visual Resources

8.3.14.1 Affected Environment

The proposed Gillespie SEZ is located in Maricopa County in southwestern Arizona. The SEZ occupies 2,618 acres (10.6 km^2) and extends approximately 6.9 mi (11.1 km) in a northwest to southeast direction and is approximately 2 mi (3.2 km) wide. The SEZ is within the Sonoran basin and range physiographic province, typified by scattered low mountains and containing large tracts of federally owned land, most of which are used for military training. The Sonoran basin and range is slightly hotter than the Mojave basin and range and has large areas of paloverde-cactus shrub and giant saguaro cactus (EPA 2002, 2007). The SEZ slopes gently toward the southeast, with elevations ranging from 984 ft (300 m) in the northwestern portion to 885 ft (270 m) in the southeastern portion.

The SEZ lies in an area of undulating topography, however, it is relatively flat. Woolsey Peak dominates views to the south of the SEZ, and Webb Mountain, Signal Mountains, Black Butte, and Yellow Medicine Hills are prominently visible to the south, southwest, and western sides of the SEZ, respectively. These nearby mountains add significantly to the scenic value of the SEZ. Mountains to the north and east are too far away to have a significant effect on scenic values. The blocky form of Woolsey Peak, located about 4 mi (6.4 km) south of the SEZ (elevation of 3,270 ft [997 m]), is particularly prominent from the western portion of the SEZ, and is a geographical landmark visible from much of southwestern Arizona. The mountains to the southwest and west of the SEZ range in elevation from 1,200 ft (365.8 m) to 1,570 ft (478.5 m). Webb Mountain dominates views from much of the SEZ, and the juxtaposition of its pointed peak with the blocky summit of Woolsey Peak is striking from some viewpoints within the SEZ. The mountain slopes and peaks surrounding the SEZ generally are visually pristine

The SEZ is located within a relatively flat, desert floor, with the strong horizon line and surrounding mountain ranges being the dominant visual features. Several intermittent washes run through the SEZ in a southwest to northeast direction. The surrounding mountains are generally red to brown in color, with distant mountains appearing blue to purple. In contrast, pink to tan gravels dominate the desert floor, which is sparsely dotted with the greens of vegetation. The SEZ also contains areas with dark volcanic rock. Washes contain light-colored tan soils mixed with gray gravel, rocks, and boulders. No permanent surface water is present within the SEZ. The location of the SEZ and surrounding mountain ranges are shown in Figure 8.3.14.1-1.

Vegetation is generally sparse in much of the SEZ, with widely spaced shrubs growing on more or less barren gravel flats. Vegetation within the SEZ is predominantly scrubland, with creosotebush and other low shrubs dominating the desert floor within the SEZ. During a September 2009 site visit, the vegetation presented a range of greens (mostly the olive green of creosotebushes) with some grays and tans (from lower shrubs), with medium to coarse textures. The desert floor is sparsely dotted with the olive green of creosotebush and the light greens of saguaros, paloverde, and other trees. Saguaros and denser, deeper green vegetation along some washes add some visual interest; however, visual interest is generally low.

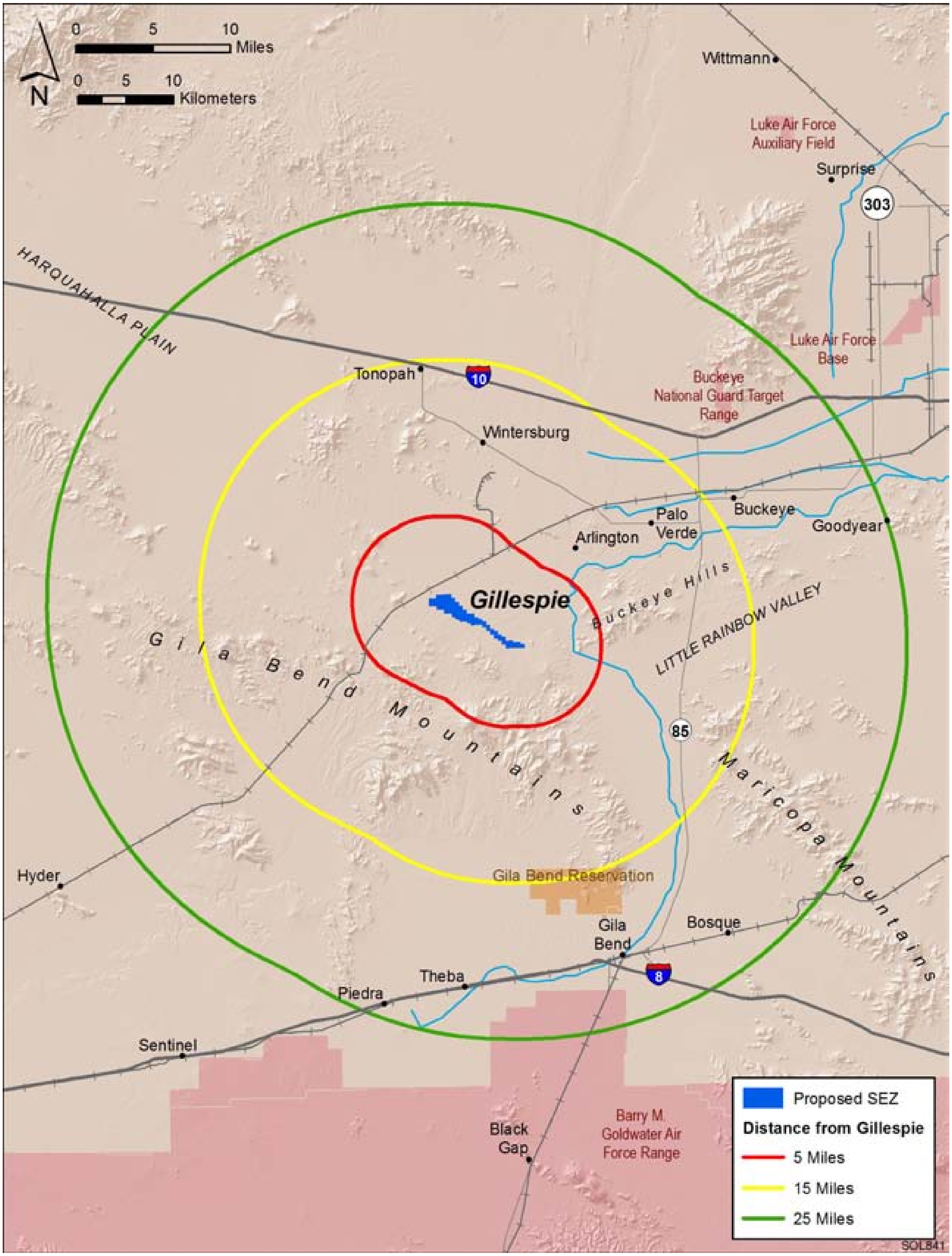

FIGURE 8.3.14.1-1 Proposed Gillespie SEZ and Surrounding Lands

Cultural disturbances visible within the SEZ include a graded, county gravel road and other unpaved roads, and fencing. Outside the SEZ, visible cultural modifications include the Palo Verde nuclear power plant (prominently visible from the SEZ), three natural gas power plants, a railroad, transmission lines, and a pipeline ROW. These cultural modifications generally detract from the scenic quality of the SEZ.

The general lack of topographic relief, water, and physical variety results in low scenic value within the SEZ itself; however, because of the flatness of the landscape, the lack of trees, and the breadth of the open desert, the SEZ presents a vast panoramic landscape with sweeping views of the surrounding mountains that add significantly to the scenic values within the SEZ viewshed. In general, the mountains appear to be devoid of vegetation, and their varied and irregular forms, and red to brown colors, provide visual contrasts to the strong horizontal line, green vegetation, and pink to tan gravels of the valley floor, particularly when viewed from nearby locations within the SEZ. Panoramic views of the SEZ are shown in Figures 8.3.14.1-2, 8.3.14.1-3, and 8.3.14.1-4.

The BLM conducted a VRI for the SEZ and surrounding lands in 2010 (BLM 2010a). The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of public concern for preservation of scenic values in the evaluated lands; and distance from travel routes or KOPs. Based on these three factors, BLM-administered lands are placed into one of four VRI Classes, which represent the relative value of the visual resources. Class I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the highest rating for lands without special designation. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The VRI values for the SEZ and immediate surroundings are VRI Class III, indicating moderate visual values. The inventory indicates low scenic quality for the SEZ and its immediate surroundings. Positive scenic quality attributes included adjacent scenery. The inventory indicates high sensitivity for the SEZ and its immediate surroundings, primarily because of its immediate proximity to Agua Caliente Road, a BLM-proposed backcountry byway, and a scenic, high-use travel corridor with a high degree of public interest.

Lands in the Lower Sonoran FO within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ include 23,785 acres (96.255 km^2) of VRI Class I areas, primarily Woolsey Peak and Signal Mountain WA’s south and southeast of the SEZ; 16,835 acres (68.129 km^2) of VRI Class II areas, primarily west of the SEZ; 115,948 acres (469.225 km^2) of Class III areas, primarily surrounding the SEZ; and 226,461 acres (916.455 km^2) of VRI Class IV areas, concentrated primarily north, south, and east of the SEZ.

The VRI map for the SEZ and surrounding lands is shown in Figure 8.3.14.1-5. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

FIGURE 8.3.14.1-2 Approximately 120° Panoramic View of the Proposed Gillespie SEZ from Central Portion of the SEZ Facing Southwest, with Webb Mountain in Foreground and Woolsey Peak in Background

FIGURE 8.3.14.1-3 Approximately 180° Panoramic View of the Proposed Gillespie SEZ from Western Portion of SEZ Facing Southwest, Webb Mountain and Woolsey Peak at Left, Black Butte and Yellow Medicine Hills at Right

FIGURE 8.3.14.1-4 Approximately 120° Panoramic View of the Proposed Gillespie SEZ from Central Portion of SEZ Facing Northwest, with Black Butte at Far Left, Yellow Medicine Hills at Left Center, Saddle Mountain at Center, and Palo Verde Hills at Right Center

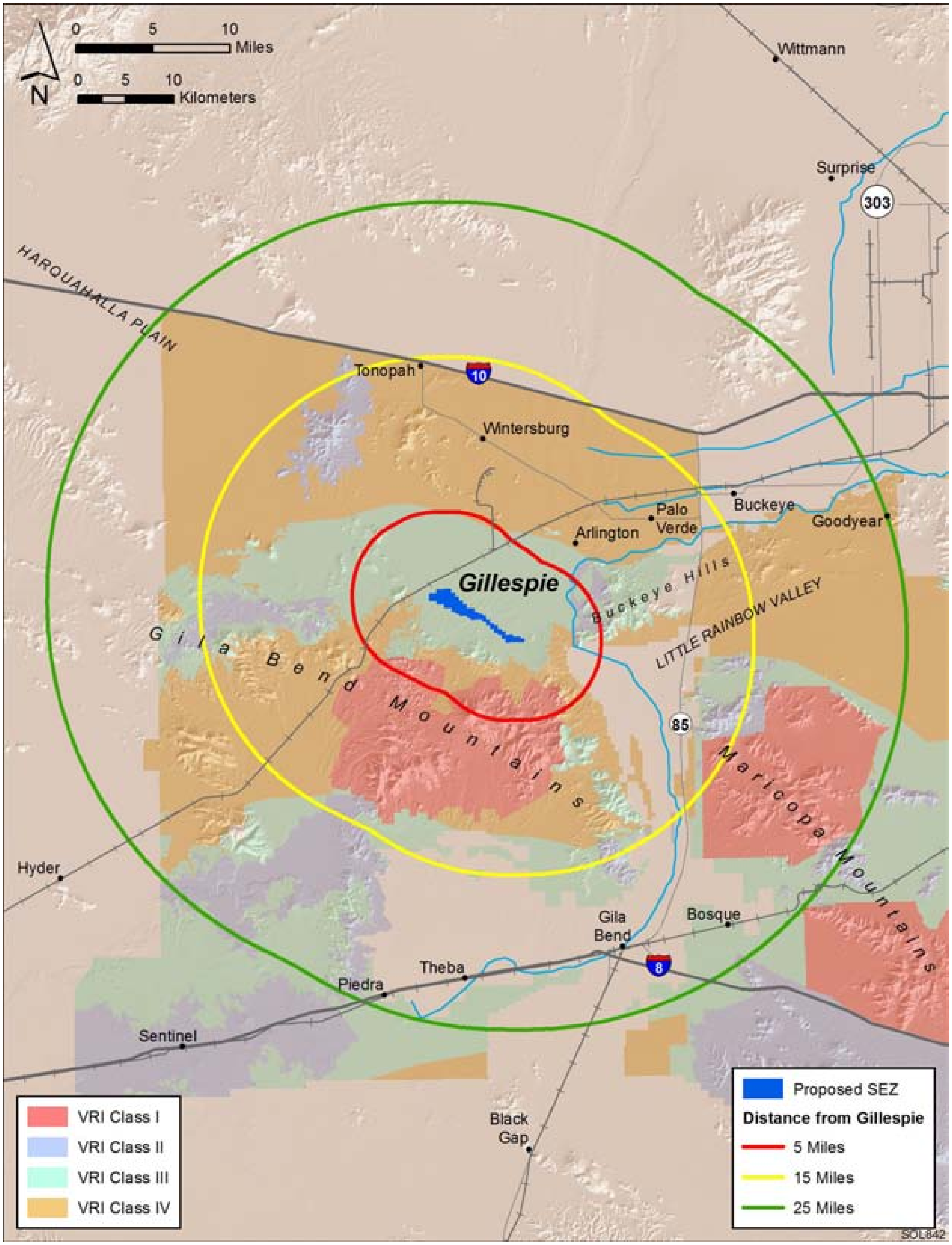

FIGURE 8.3.14.1-5 Visual Resource Inventory Values for the Proposed Gillespie SEZ and Surrounding Lands

The *Approved Amendment to the Lower Gila North Management Framework Plan and the Lower Gila South Resource Management Plan and Decision Record* (BLM 2005) indicate that the SEZ is managed as VRM Class IV. VRM Class IV permits major modification of the existing character of the landscape. More information about the BLM VRM program is available in Section 5.12 and in *Visual Resource Management,* BLM Manual Handbook 8400 (BLM 1984).

8.3.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Gillespie SEZ and surrounding lands, as well as the impacts of related developments (e.g., access roads and transmission lines) outside of the SEZ, is presented in this section.

Site-specific impact assessment is needed to systematically and thoroughly assess visual impact levels for a particular project. Without precise information about the location of a project, a relatively complete and accurate description of its major components, and their layout, it is not possible to assess precisely the visual impacts associated with the facility. However, if the general nature and location of a facility are known, a more generalized assessment of potential visual impacts can be made by describing the range of expected visual changes and discussing contrasts typically associated with these changes. In addition, a general analysis can identify sensitive resources that may be at risk if a future project is sited in a particular area. Detailed information about the methodology employed for the visual impact assessment used in this PEIS, including assumptions and limitations, is presented in Appendix M.

Potential Glint and Glare Impacts. Similarly, the nature and magnitude of potential glint- and glare-related visual impacts for a given solar facility is highly dependent on viewer position, sun angle, the nature of the reflective surface and its orientation relative to the sun and the viewer, atmospheric conditions, and other variables. The determination of potential impacts from glint and glare from solar facilities within a given proposed SEZ would require precise knowledge of these variables, and is not possible given the scope of the PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size, landscape setting, or technology type. The occurrence of glint and glare at solar facilities could potentially cause large, but temporary, increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas discussed in the following analysis do not account for potential glint and glare effects; however, these effects would be incorporated into a future site- and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more information about potential glint and glare impacts associated with utility-scale solar energy facilities, see Section 5.12.

8.3.14.2.1 Impacts on the Proposed Gillespie SEZ

Some or all of the SEZ could be developed for one or more utility-scale solar energy projects, utilizing one or more of the solar energy technologies described in Appendix F. Because of the industrial nature and large size of utility-scale solar energy facilities, large visual impacts on the SEZ would occur as a result of the construction, operation, and decommissioning of solar energy projects. In addition, large impacts could occur at solar facilities utilizing highly reflective surfaces or major light-emitting components (solar dish, parabolic trough, and power tower technologies), with lesser impacts associated with reflective surfaces expected from PV facilities. These impacts would be expected to involve major modification of the existing character of the landscape and would likely dominate the views nearby. Additional, and potentially large impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines. While the primary visual impacts associated with solar energy development within the SEZ would occur during daylight hours, lighting required for utility-scale solar energy facilities would be a potential source of visual impacts at night, both within the SEZ and on surrounding lands.

Common and technology-specific visual impacts from utility-scale solar energy development, as well as impacts associated with electric transmission lines, are discussed in Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and decommissioning, and some impacts could continue after project decommissioning. Visual impacts resulting from solar energy development in the SEZ would be in addition to impacts from solar energy development and other development that may occur on other public or private lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of cumulative impacts, see Section 8.3.22.4.13.

The changes described above would be expected to be consistent with BLM VRM objectives for VRM Class IV, as seen from nearby KOPs. VRM Class IV is the current VRM Class designation for the proposed Gillespie SEZ. More information about impact determination using the BLM VRM program is available in Section 5.12 and in *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).

Implementation of the programmatic design features intended to reduce visual impacts (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specific level. Given the large scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas would be the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited, but would be important to reduce visual contrasts to the greatest extent possible.

8.3.14.2.2 Impacts on Lands Surrounding the Proposed Gillespie SEZ

Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts related to construction, operation, and decommissioning of utility-scale solar energy facilities. The affected areas and extent of impacts would depend on a number of visibility factors and viewer distance (for a detailed discussion of visibility and related factors, see Section 5.12). A key component in determining impact levels is the intervisibility between the project and potentially affected lands; if topography, vegetation, or structures screen the project from viewer locations, there is no impact.

Preliminary viewshed analyses were conducted to identify which lands surrounding the proposed SEZ would have views of solar facilities in at least some portion of the SEZ (see Appendix M for information on the assumptions and limitations of the methods used). Four viewshed analyses were conducted, assuming four different heights representative of project elements associated with potential solar energy technologies: PV and parabolic trough arrays (24.6 ft [7.5 m]), solar dishes and power blocks for CSP technologies (38 ft [11.6 m]), transmission towers and short solar power towers (150 ft [45.7 m]), and tall solar power towers (650 ft [198.1 m]). Viewshed maps for the SEZ for all four solar technology heights are presented in Appendix N.

Figure 8.3.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored segments indicate areas with clear lines of sight to one or more areas within the SEZ and from which solar facilities within these areas of the SEZ would be expected to be visible, assuming the absence of screening vegetation or structures and adequate lighting and other atmospheric conditions. The light brown areas are locations from which PV and parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for CSP technologies would be visible from the areas shaded in light brown and the additional areas shaded in light purple. Transmission towers and short solar power towers would be visible from the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power tower facilities located in the SEZ could be visible from areas shaded light brown, light purple, dark purple, and at least the upper portions of power tower receivers would be visible from the additional areas shaded in medium brown.

For the following visual impact discussion, the tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds are shown in the figures and discussed in the text. These heights represent the maximum and minimum landscape visibility for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]), and for transmission towers and short solar power towers (150 ft [45.7 m]) are described in Appendix N. The visibility of these facilities would fall between that for tall power towers and PV and parabolic trough arrays.

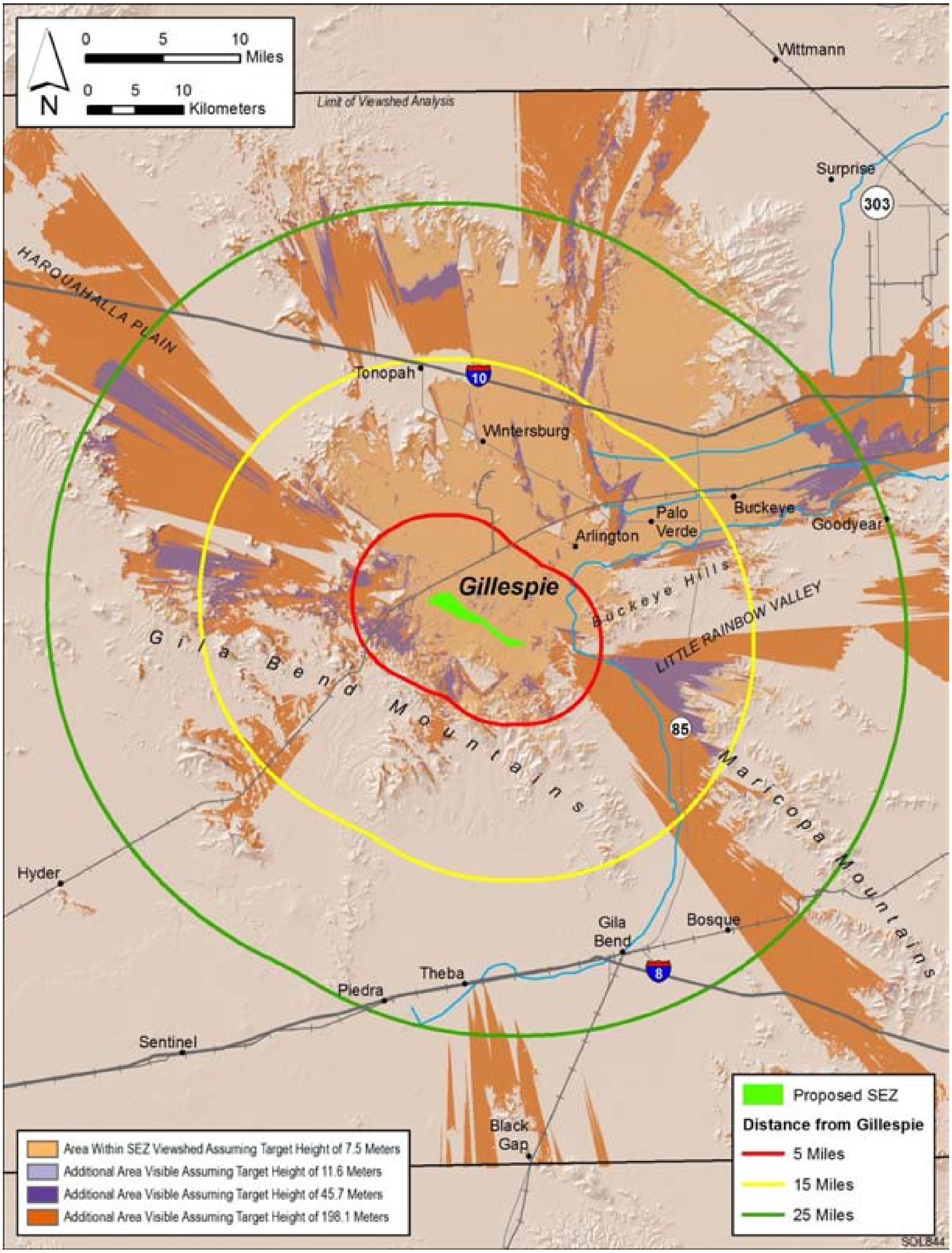

FIGURE 8.3.14.2-1 Viewshed Analyses for the Proposed Gillespie SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual Resource Areas

Figure 8.3.14.2-2 shows the results of a GIS analysis that overlays selected federal, state, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds in order to illustrate which of these sensitive visual resource areas would have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi [24 km]), and a 25-mi (40-km) distance zone are shown as well, in order to indicate the effect of distance from the SEZ on impact levels, which are highly dependent on distance.

The scenic resources included in the analyses were as follows:

- National Parks, National Monuments, National Recreation Areas, National Preserves, National Wildlife Refuges, National Reserves, National Conservation Areas, National Historic Sites;
- Congressionally authorized Wilderness Areas;
- Wilderness Study Areas;
- National Wild and Scenic Rivers;
- Congressionally authorized Wild and Scenic Study Rivers;
- National Scenic Trails and National Historic Trails;
- National Historic Landmarks and National Natural Landmarks;
- All-American Roads, National Scenic Byways, State Scenic Highways, and BLM- and USFS-designated scenic highways/byways;
- BLM-designated Special Recreation Management Areas; and
- ACECs designated because of outstanding scenic qualities.

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Gillespie SEZ are discussed below. The results of this analysis are also summarized in Table 8.3.14.2-1. Further discussion of impacts on these areas is available in Sections 8.3.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and Section 8.3.17 (Cultural Resources).

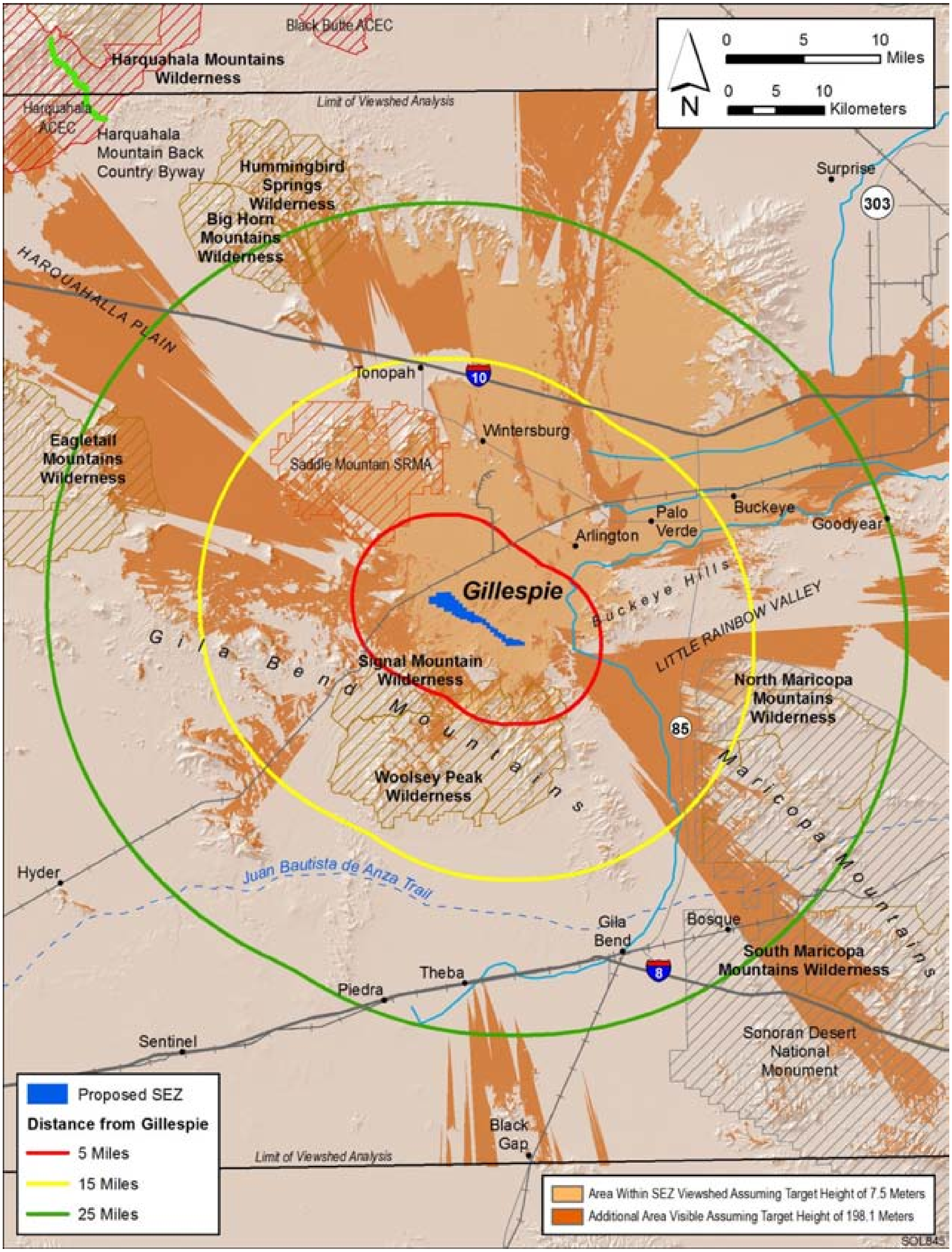

FIGURE 8.3.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Gillespie SEZ

TABLE 8.3.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Gillespie SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[b]		
			Visible between	
Feature Type	Feature Name (Total Acreage/Highway Length)[a]	Visible within 5 mi	5 and 15 mi	15 and 25 mi
National Monument	Sonoran Desert National Monument (496,513 acres)	0 acres	8,356 acres (2%)	18,931 acres (4%)
National Historic Trail	Juan Bautista de Anza (1,210 mi)	0 mi	0 mi	4.7 mi
WAs	Big Horn Mountains (20,954 acres)	0 acres	0 acres	2,303 acres (11%)
	Eagletail Mountains (98,544 acres)	0 acres	0 acres	11,918 acres (12%)
	Hummingbird Springs (31,429 acres)	0 acres	0 acres	4,501 acres (14%)
	North Maricopa Mountains (64,247 acres)	0 acres	1,331 acres (2%)	8,540 acres (13%)
	Signal Mountain (13,467 acres)	1,920 acres (14%)	594 acres (4%)	0 acres
	South Maricopa Mountains (60,446 acres)	0 acres	0 acres	3 acres (0.01%)
	Woolsey Peak (64,465 acres)	5,552 acres (9%)	5,837 acres (9%)	0 acres
SRMA	Saddle Mountain (47,696 acres)	661 acres (1%)	26,562 acres (56%)	14 acres (0.03%)

[a] To convert acres to km^2, multiply by 0.004047. To convert mi to km, multiply by 1.609.

[b] Percentage of total feature or road length viewable.

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including changes in the forms, lines, colors, and textures of objects seen in the landscape. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity, based on viewer characteristics, including attitudes and values, expectations, and other characteristics that that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers for a given development and their characteristics and expectations, specific locations from which the project might be viewed, and other variables that were not available or not feasible to incorporate in the PEIS analysis. These variables would be incorporated into a future site- and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more discussion of visual contrasts and impacts, see Section 5.12.

National Monument

- *Sonoran Desert National Monument*—Sonoran Desert National Monument contains 496,513 acres (2,009.32 km^2) and is located about 12 mi (19 km) southeast of the SEZ at the point of closest approach. The monument contains three distinct mountain ranges, the Maricopa, Sand Tank and Table Top Mountains, as well as the Booth and White Hills, all separated by wide valleys. The monument contains three congressionally designated WAs, many significant archaeological and historic sites, and remnants of several important historic trails.

  As shown in Figure 8.3.14.2-2, within the National Monument, visibility of solar facilities within the SEZ would be limited to two general areas: the peaks and northwestern slopes of the Maricopa Mountains and portions of the Gila River valley between the Gila Bend Mountains and the Maricopa Mountains. The area within the National Monument with views of the SEZ includes about 27,287 acres (110.43 km^2) in the 650-ft (198.1-m) viewshed, or 6% of the total National Monument acreage, and 5,424 acres (21.95 km^2) in the 24.6-ft (7.5-m) viewshed, or 1% of the total National Monument

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ, and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in this PEIS, but it should be noted that the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.

acreage. The visible area of the National Monument extends to beyond 25 mi (40 km) from the southeastern boundary of the SEZ.

On the Gila River valley floor, visibility of solar facilities within the SEZ would be limited to taller facility components, with visibility for most of the valley floor limited to the upper portions of taller power towers. Views of the SEZ from the valley floor are through a roughly 3-mi (5-km) gap between the Gila Bend Mountains and the Buckeye Hills. Low hills within the gap would screen views of lower height solar facilities within the SEZ because the valley floor is at nearly the same elevation as the SEZ. The SEZ would be viewed along its long and narrow southeast to northwest axis and would be far enough away from the viewpoint that it would occupy a very small portion of the horizontal field of view. For the portions of the valley floor within the National Monument with maximum visibility of solar development within the SEZ, transmission lines, as well as the upper portions of transmission towers and power towers receivers (and the tower structures) could be visible just above the horizon within the gap between the Gila Bend Mountains and the Buckeye Hills. At a distance of 11+ mi (18+ km), operating power tower receivers within the SEZ would likely appear as points of light against a sky backdrop. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the National Monument at night. Expected visual contrasts would be weak at locations with maximum visibility and minimal at other locations within the National Monument on the valley floor.

For peaks and northwest-facing ridges in the Maricopa Mountains, views of the SEZ would also be through the gap between the Gila Bend Mountains and the Buckeye Hills; however, the viewpoint elevations are generally high enough that lower height facilities in one or more parts of the SEZ would be visible.

Figure 8.3.14.2-3 is a Google Earth visualization of the SEZ as seen from Margies Peak in the far northwestern portion of the National Monument, about 14 mi (23 km) from the southeast corner of the SEZ, and within the National Monument, near the point of maximum visibility of solar development within the SEZ. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility. The model was placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver tower depicted in the visualization is a properly scaled model of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, and the tower/heliostat system represents about 100 MW of electric generating capacity. One model was placed in the western portion of the SEZ for this and other visualizations shown in this section of this PEIS. In the visualization, the SEZ area is depicted in orange, the heliostat fields in blue.

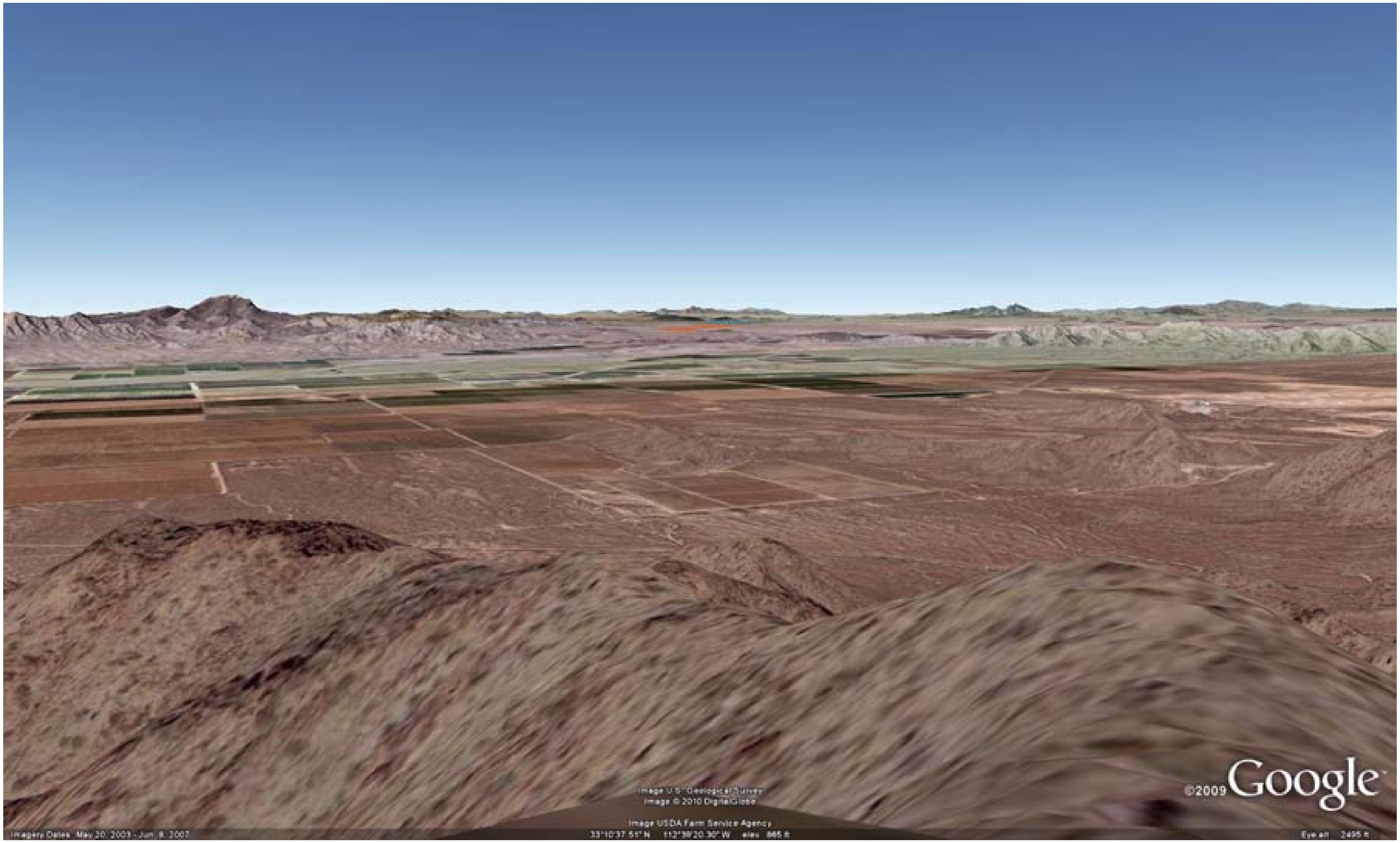

FIGURE 8.3.14.2-3 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Margies Peak in the Sonoran Desert National Monument

The viewpoint in the visualization is about 1,550 ft (472 m) higher in elevation than the SEZ. Despite the elevated viewpoint, because of the long distance to the SEZ, collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, and they would repeat the line of the valley floor in which the SEZ is located, which would tend to reduce visual contrast. The edge-on view would also tend to reduce their apparent size and conceal their strong regular geometry, which would also reduce visual contrast. The SEZ is viewed along its long and narrow southeast to northwest axis, and is far enough away from the viewpoint that it would occupy a very small portion of the horizontal field of view.

Operating power tower receivers within the SEZ would likely appear as points of light against the floor of the valley in which the SEZ is located, or against the base of the Yellow Medicine Hills. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night.

Visual contrasts associated with solar facilities within the SEZ would depend on the numbers, types, sizes and locations of solar facilities in the SEZ, and other visibility factors. Under the 80% development scenario analyzed in the PEIS, weak visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

In general, visual contrasts associated with solar facilities within the SEZ would depend on viewer location within the National Monument, the numbers, types, sizes and locations of solar facilities in the SEZ, and other project- and site-specific factors. Under the 80% development scenario analyzed in the PEIS, where there were unobstructed views, contrasts would be expected to be minimal to weak.

Wilderness Areas

- *Big Horn Mountains*—Big Horn Mountains is a 20,954-acre (84.800-km^2) congressionally designated WA located 22 mi (35 km) northwest of the SEZ. The WA is noted for its exceptional scenic values.

  As shown in Figure 8.3.14.2-2, within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ could be visible from the southeastern portions of the WA (about 2,303 acres [9.320 km2] in the 650-ft [198.1-m] viewshed, or 11% of the total WA acreage, and 86 acres [0.4 km2] in the 25-ft [7.5-m] viewshed, or 0.4% of the total WA acreage). The visible area of the WA extends to beyond 25 mi (40 km) from the southwestern boundary of the SEZ.

  Viewpoints in the WA within the 25-mi (40 km) viewshed of the SEZ are either on scattered peaks in the Bighorn Mountains, or at lower elevations immediately southeast of the Bighorn Mountains in the Tonopah Desert. Lower height solar facilities within the SEZ could be visible from some of the higher elevation viewpoints in the WA. For viewpoints in the Tonopah Desert within the WA, visibility would be restricted to taller solar facilities, including transmission towers and lower power towers in a few areas, but only the upper portions of tall power towers in most of Tonopah Desert viewpoints within the WA. Where operating power towers were visible within the SEZ, they would likely appear as distant star-like points of light against a backdrop of the Gila Bend Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night.

Burnt Mountain, Saddle Mountain, and the Palo Verde Hills provide substantial partial screening of the SEZ for nearly all WA viewpoints within the 25-mi (40 km) SEZ viewshed, although there are viewpoints outside the 25-mi (40 km) viewshed high enough to have nearly unobstructed views of the SEZ. Views toward the SEZ would be oblique to the long and narrow northwest–southeast axis of the SEZ, so that the SEZ would occupy a relatively narrow portion of the horizontal field of view. Due to the partial screening and the relatively long distance to the SEZ (22+ mi [35+ km]), expected visual contrast levels associated with solar energy development within the SEZ would be minimal to weak for WA viewpoints within the 25-mi (40-km) SEZ viewshed. The highest contrast levels would be expected for the peaks in the Bighorn Mountains, with lower contrasts expected for lower elevation viewpoints in the Tonopah Desert.

- *Eagletail Mountains*—Eagletail Mountains is a 98,544-acre (398.79-km^2) congressionally designated WA located 18 mi (29 km) at the point of closest approach northwest of the SEZ. Recreation such as extended horseback riding and backpacking trips, sightseeing, photography, rock climbing and day hiking are enhanced by the topographic diversity, scenic character, size, as well as the botanical, wildlife, and cultural values of the area.

  As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities within the SEZ could be visible from portions of the eastern slopes of the mountains within the WA. Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 11,918 acres (48.230 km2) in the 650-ft (198.1-m) viewshed, or 13% of the total WA acreage, and 422 acres (1.71 km2) in the 24.6-ft (7.5-m) viewshed, or 0.4% of the total WA acreage. The visible area of the WA extends to beyond 25 mi (40 km) from the western boundary of the SEZ.

  For nearly all of the portions of the WA within the 25-mi (40 km) viewshed of the SEZ, visibility of solar facilities within the SEZ would be limited to taller facility components, such as transmission towers and power towers. Visibility of lower-height solar facilities, such as solar dishes, parabolic trough and PV arrays, would be limited to very small areas along the crest of the Eagletail Mountains, including Eagletail Peak.

Figure 8.3.14.2-4 is a Google Earth visualization of the SEZ as seen from an Eagletail Peak in the WA, about 23 mi (37 km) from the northwest corner of the SEZ, and at the point of maximum visibility of solar development within the SEZ. The viewpoint is elevated approximately 2,350 ft (716 m) above the SEZ.

The visualization suggests that from this viewpoint, portions of the SEZ would be screened from view by the Yellow Medicine Hills and other hills close to the SEZ. The SEZ would occupy a very small portion of the horizontal field of view. Despite the elevated viewpoint, because of the very long distance to the SEZ, collector/reflector arrays within the SEZ would be viewed nearly edge-on, which would reduce their apparent size and conceal their strong regular geometry, and they would appear to repeat the horizon line, which would lessen their visual contrast. If operating power towers were visible within the SEZ, they would likely appear as distant star-like points of light against the distant Maricopa Mountains during the day and, if more than 200 ft (61 m) tall, would have navigation warning lights at night that could be visible from this location. Depending on solar facility location within the SEZ, the types of solar facilities and their designs, and other visibility factors, weak visual contrasts from solar energy development within the SEZ would be expected at this location. Expected visual contrasts would be lower for almost all other viewpoints within the WA, because while some viewpoints could be as much as 5 mi (8 km) closer to the SEZ, their elevations would be much lower, and substantially more of the SEZ (including any lower-height solar facilities within the SEZ) would be screened from view. In addition, the already low vertical angle of view would be even lower for viewpoints at lower elevations, which would tend to reduce visual contrasts further.

- *Hummingbird Springs*—Hummingbird Springs is a 31,429-acre (127.19-km^2) congressionally designated WA located 22 mi (35 km) at the point of closest approach northwest of the SEZ. The WA is noted for its exceptional scenic values.

  Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 4,501 acres (18.21 km^2) in the 650-ft (198.1-m) viewshed, or 14% of the total WA acreage, and 1,257 acres (5.087 km^2) in the 24.6-ft (7.5-m) viewshed, or 4% of the total WA acreage. The visible area of the WA extends to beyond 25 mi (40 km) from the northwestern corner of the SEZ.

  As shown in Figure 8.3.14.2-2, viewpoints in the WA within the 25-mi (40-km) viewshed of the SEZ are at lower elevations near the northern edge of the Tonopah Desert. Lower height solar facilities within the SEZ could be visible from some of viewpoints in the 25-mi (40-km) viewshed within the

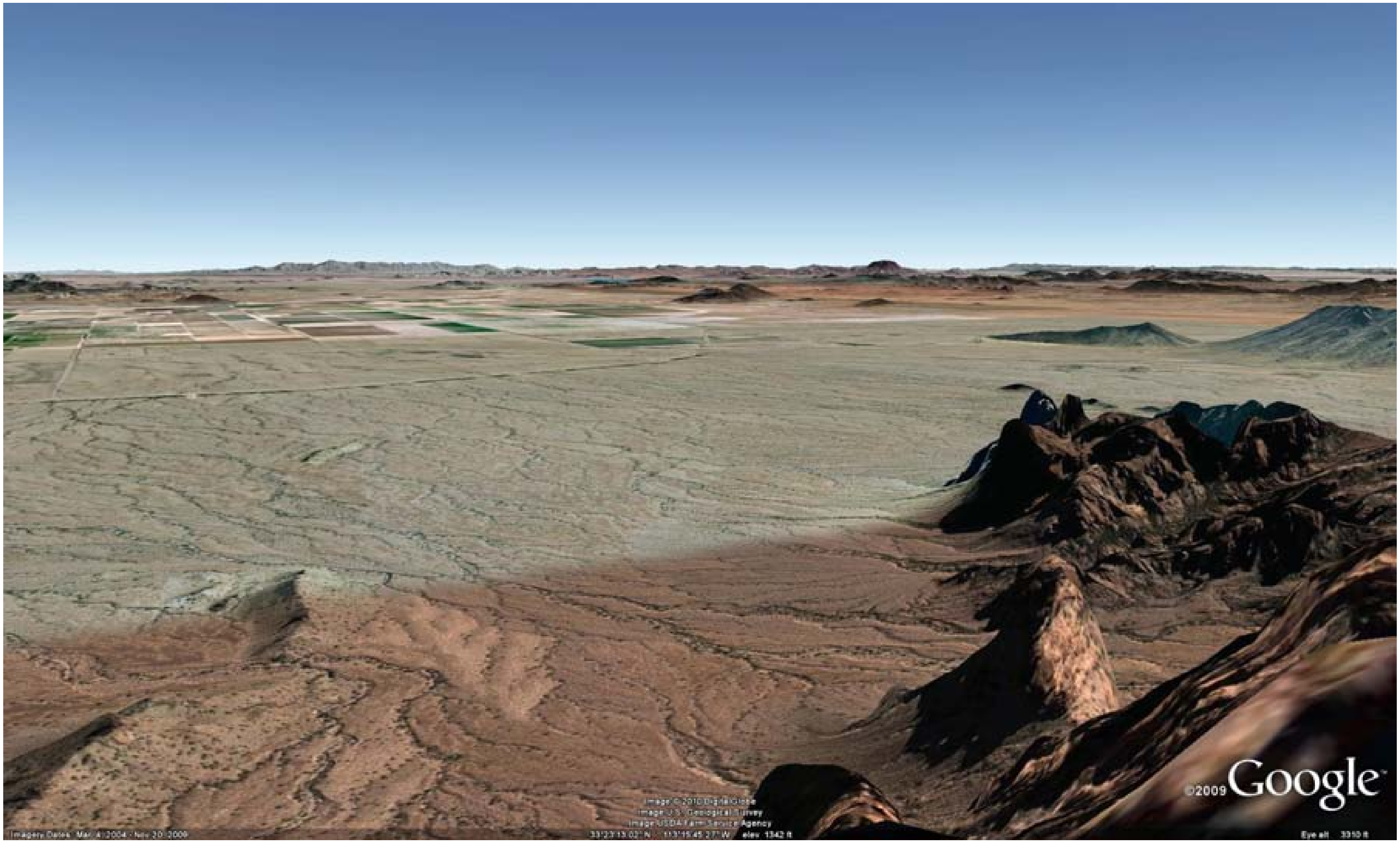

FIGURE 8.3.14.2-4 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Eagletail Peak in Eagletail Mountains WA

WA, but for most viewpoints visibility would be restricted to taller solar facilities. Where operating power towers within the SEZ were visible, they would likely appear as distant star-like points of light against the backdrop of the Gila Bend Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night.

Saddle Mountain and the Palo Verde Hills provide substantial partial screening of the SEZ for nearly all WA viewpoints within the 25-mi (40-km) SEZ viewshed. Views toward the SEZ would be oblique to the long and narrow northwest–southeast axis of the SEZ, so that the SEZ would occupy a relatively narrow portion of the horizontal field of view. Due to the partial screening and the relatively long distance to the SEZ (22+ mi [35+ km]), under the 80% development scenario analyzed in the PEIS, expected visual contrast levels associated with solar energy development within the SEZ would be minimal for WA viewpoints within the 25-mi (40 km) SEZ viewshed.

- *North Maricopa Mountains*—North Maricopa Mountains is a 64,247-acre (260.00-km^2) congressionally designated WA located 13 mi (21 km) at the point of closest approach southeast of the SEZ. The WA provides outstanding opportunities for solitude and primitive recreation, including hiking, backpacking, horseback riding, camping, wildlife observation and photography.

  Within 25 mi (40 km), solar energy facilities within the SEZ could be visible from portions of the northwestern slopes of the Maricopa Mountains within the WA, as well as portions of the eastern side of the Gila River valley. Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 9,871 acres (39.95 km^2) in the 650-ft (198.1-m) viewshed, or 15% of the total WA acreage, and 1,650 acres (6.677 km^2) in the 24.6-ft (7.5-m) viewshed, or 3% of the total WA acreage. The visible area of the WA extends about 23 mi (37 km) from the southern boundary of the SEZ.

  On the Gila River valley floor, visibility of solar facilities within the SEZ would be limited to taller facility components, with visibility for most of the valley floor limited to the upper portions of taller power towers. Views of the SEZ from the valley floor are through a roughly 3-mi (5-km) gap between the Gila Bend Mountains and the Buckeye Hills. Low hills within the gap would screen views of lower-height solar facilities within the SEZ because the valley floor is at nearly the same elevation as the SEZ. The SEZ would be viewed along its long and narrow southeast to northwest axis and would be far enough away from the viewpoint that it would occupy a very small portion of the horizontal field of view. For the portions of the valley floor within the WA with maximum visibility of solar development within the SEZ, transmission lines, as well as the upper portions of transmission towers and power tower receivers (and the tower structures), could be visible just above the horizon within the gap between the Gila Bend Mountains and the Buckeye Hills. At a distance of 13+ mi (21+ km), operating power tower receivers within the SEZ would likely appear as points of light against a sky backdrop. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night. Expected visual contrasts would be weak at locations with maximum visibility and minimal at other locations within the WA on the valley floor.

For peaks and northwest-facing ridges in the Maricopa Mountains, views of the SEZ would also be through the gap between the Gila Bend Mountains and the Buckeye Hills; however, the viewpoint elevations are generally high enough that lower-height facilities in one or more parts of the SEZ would be visible.

Figure 8.3.14.2-5 is a Google Earth visualization of the SEZ as seen from an unnamed peak in the far northwestern portion of the WA, about 15 mi (24 km) from the southeast corner of the SEZ, and within the WA, near the point of maximum visibility of solar development within the SEZ. In the visualization, the SEZ area is depicted in orange, the heliostat fields in blue.

The viewpoint in the visualization is about 960 ft (293 m) higher in elevation than the SEZ. Solar facilities within the SEZ would be seen just above peaks in the Maricopa Mountains between the viewpoint and the SEZ. Despite the elevated viewpoint, because of the long distance to the SEZ, collector/ reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, which would reduce their apparent size and conceal their strong regular geometry, and would also cause them to appear to repeat the line of the valley floor in which the SEZ is located, which would tend to reduce visual contrast. The SEZ is viewed along its long and narrow southeast to northwest axis and is far enough away from the viewpoint that it would occupy a very small portion of the horizontal field of view. Operating power tower receivers within the SEZ would likely appear as points of light against the floor of the valley in which the SEZ is located, or against the base of the Yellow Medicine Hills or the Eagletail Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night. Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, weak visual contrasts from solar energy development within the SEZ could be expected at this viewpoint. Weak or minimal visual contrasts would be expected for other elevated viewpoints in the Maricopa Mountains within the WA.

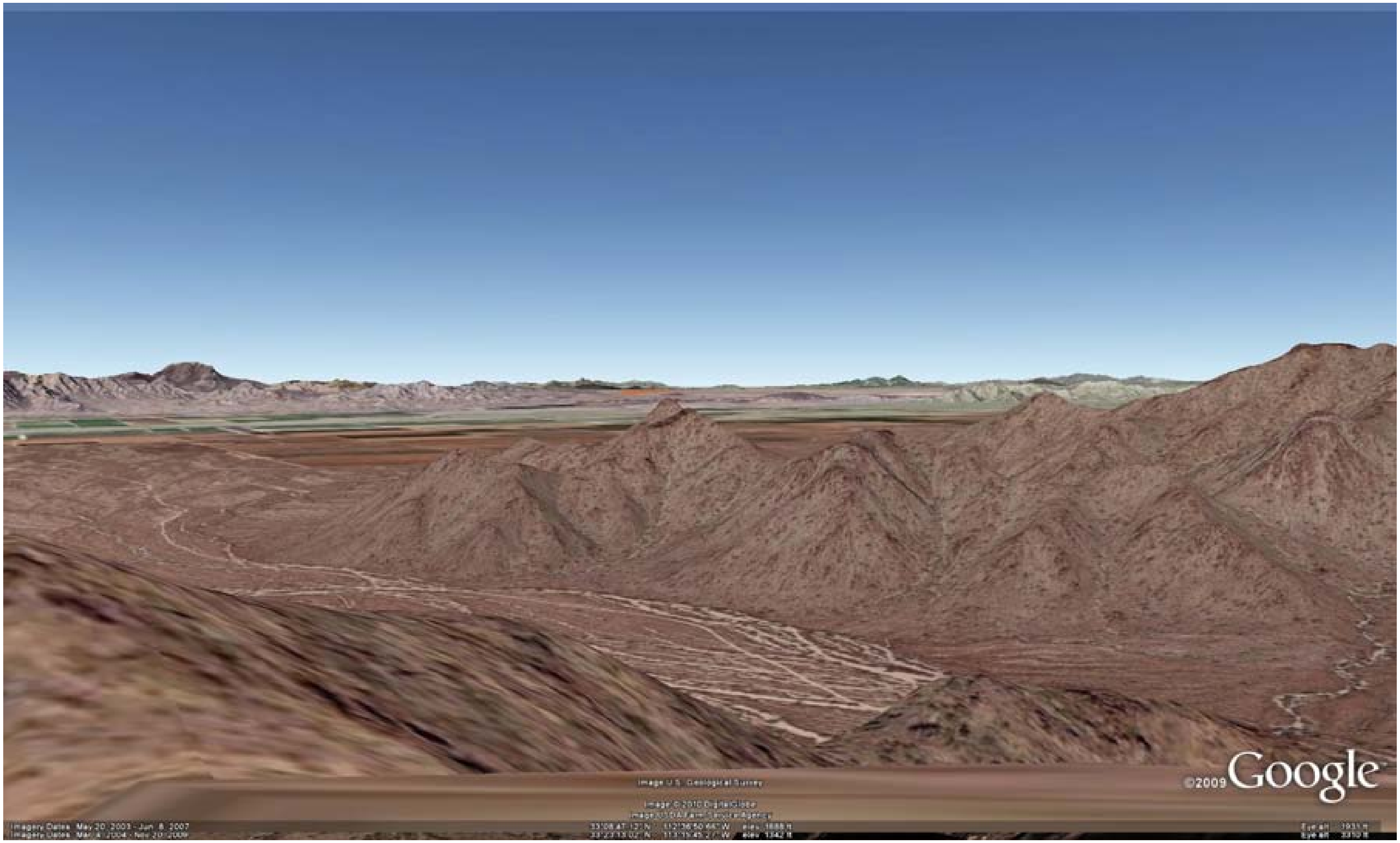

FIGURE 8.3.14.2-5 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Unnamed Peak in North Maricopa Mountains WA

- *Signal Mountain*—Signal Mountain is a 13,467-acre (54.499-km^2) congressionally designated WA located 3.5 mi (5.6 km) at the point of closest approach southwest of the SEZ. Scenic resources within the WA include sharp volcanic peaks, steep-walled canyons, arroyos, craggy ridges and outwash plains. The tallest peak in the WA, Signal Mountain, rises 1,200 ft (366 m) above the desert floor to an elevation of 2,182 ft (857 m). The WA provides primitive recreation opportunities, such as rock climbing around Signal Mountain, hiking, rock collecting, and hunting.

  As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities within the SEZ could be visible primarily from portions of the northeastern slopes of the mountains within the WA and from lower elevations in the far northeastern section of the WA. There are isolated areas farther west and south in the WA with limited visibility of the SEZ, where visibility of solar facilities would be restricted to taller facility components. Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 2,514 acres (10.17 km^2) in the 650-ft (198.1-m) viewshed, or 19% of the total WA acreage, and 941 acres (3.81 km^2) in the 24.6-ft (7.5-m) viewshed, or 7% of the total WA acreage. The visible area of the WA extends about 6.5 mi (10.5 km) from the southwestern boundary of the SEZ.

  Figure 8.3.14.2-6 is a Google Earth visualization of the SEZ as seen from a low rise in the far northeastern portion of the WA, about 3.7 mi (6.0 km) from the SEZ, and near to the closest point in the WA to the SEZ. The viewpoint is within the BLM VRM program‘s foreground-middleground distance of 3 to 5 mi (5 to 8 km).

  The viewpoint in the visualization is about 240 ft (73 m) higher in elevation than the SEZ. Because of the small elevation difference between the viewpoint and the SEZ, the vertical angle of view would be very low, and low hills and ridges between the viewpoint and the SEZ would partially screen lower-height solar facilities in much of the SEZ. The SEZ would be visible as a very thin band of development between Webb Mountain and the Palo Verde nuclear power plant. The SEZ would be viewed perpendicular to its long and narrow southeast to northwest axis, and would be close enough to the viewpoint that it would occupy most if not all of the horizontal field of view.

  Where visible, collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, which would reduce their apparent size, conceal their strong regular geometry, and would also cause them to appear to repeat the line of the valley floor in which the SEZ is located, which would tend to reduce visual contrast. The screening landforms are relatively low in height, so that any taller solar facility components, such as buildings, cooling towers, and transmission towers, as well as any plumes would likely be partially visible, and at a distance of 3 to 5 mi (6 to 9 km) could be

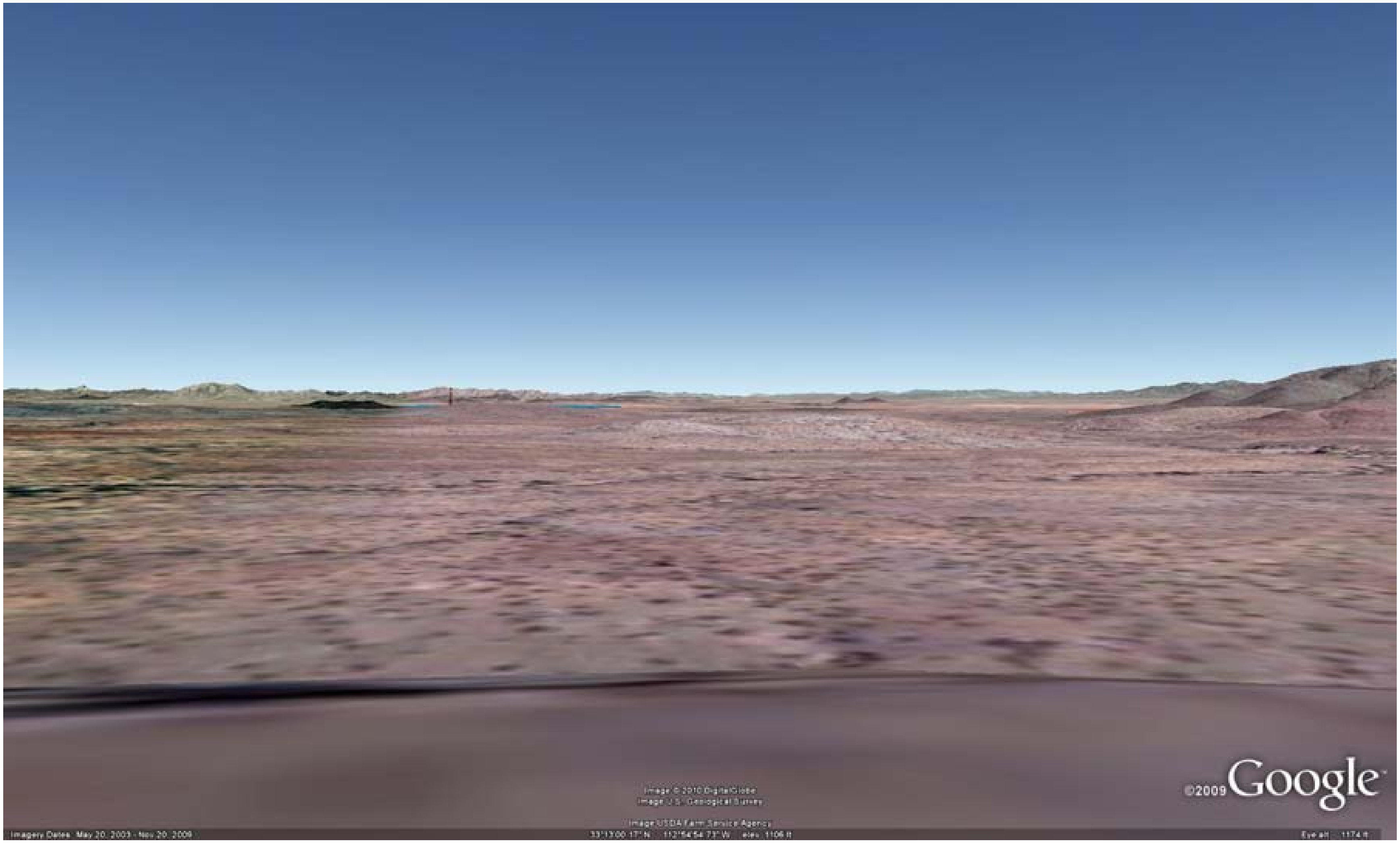

FIGURE 8.3.14.2-6 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Low Rise in Northeastern Portion of Signal Mountain WA

conspicuous, depending on their location, height, and other characteristics, as well as other visibility factors.

Operating power tower receivers within the SEZ would likely appear as very bright, non-point light sources atop the tower structures, against a backdrop of the floor of the valley in which the SEZ is located and could strongly attract visual attention if located in the nearer portions of the SEZ. The tower structures would add short vertical line contrasts to a predominantly horizontal landscape setting. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that could be visually conspicuous in the area‘s typically dark night sky conditions. Other lighting associated with solar facilities could be visible as well.

Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, weak to strong visual contrasts from solar energy development within the SEZ could be expected at this viewpoint, with weaker contrast levels expected if power towers and other tall structures were absent from the closest portions of the SEZ, and higher contrast levels if they were present in the closest portions of the SEZ.

Figure 8.3.14.2-7 is a Google Earth visualization of the SEZ as seen from the peak of Signal Mountain in the central portion of the WA, and the highest elevation within the WA, located about 4.6 mi (7.5 km) from the closest point in the SEZ. The viewpoint is within the BLM VRM program‘s foreground-middleground distance of 3 to 5 mi (5 to 8 km).

The viewpoint in the visualization is about 1,240 ft (378 m) higher in elevation than the SEZ. The western end of the Gila Bend Mountains would screen the far eastern end of the SEZ from view. The visible portions of the SEZ would be viewed perpendicular to its long and narrow southeast to northwest axis, and the SEZ would be close enough to the viewpoint that it would occupy most of the horizontal field of view. Solar facilities within the SEZ would appear as a thin band of developed area that would stretch across the horizontal field of view. Because of the large elevation difference between the viewpoint and the SEZ and the relatively short distance to the SEZ, the vertical angle of view would be high enough that the tops of collector/reflector arrays within the SEZ would be visible, which would increase their apparent size (relative to lower-angle views). The higher angle of view would also make the strong regular geometry of solar collector/reflector arrays within the SEZ more apparent, and they would contrast strongly with the largely natural-appearing landscape.

Taller ancillary facilities, such as buildings, transmission structures, and cooling towers, and plumes (if present), would likely be visible projecting above the collector/reflector arrays, and their structural details could be evident at least for nearby facilities. The ancillary facilities could create form

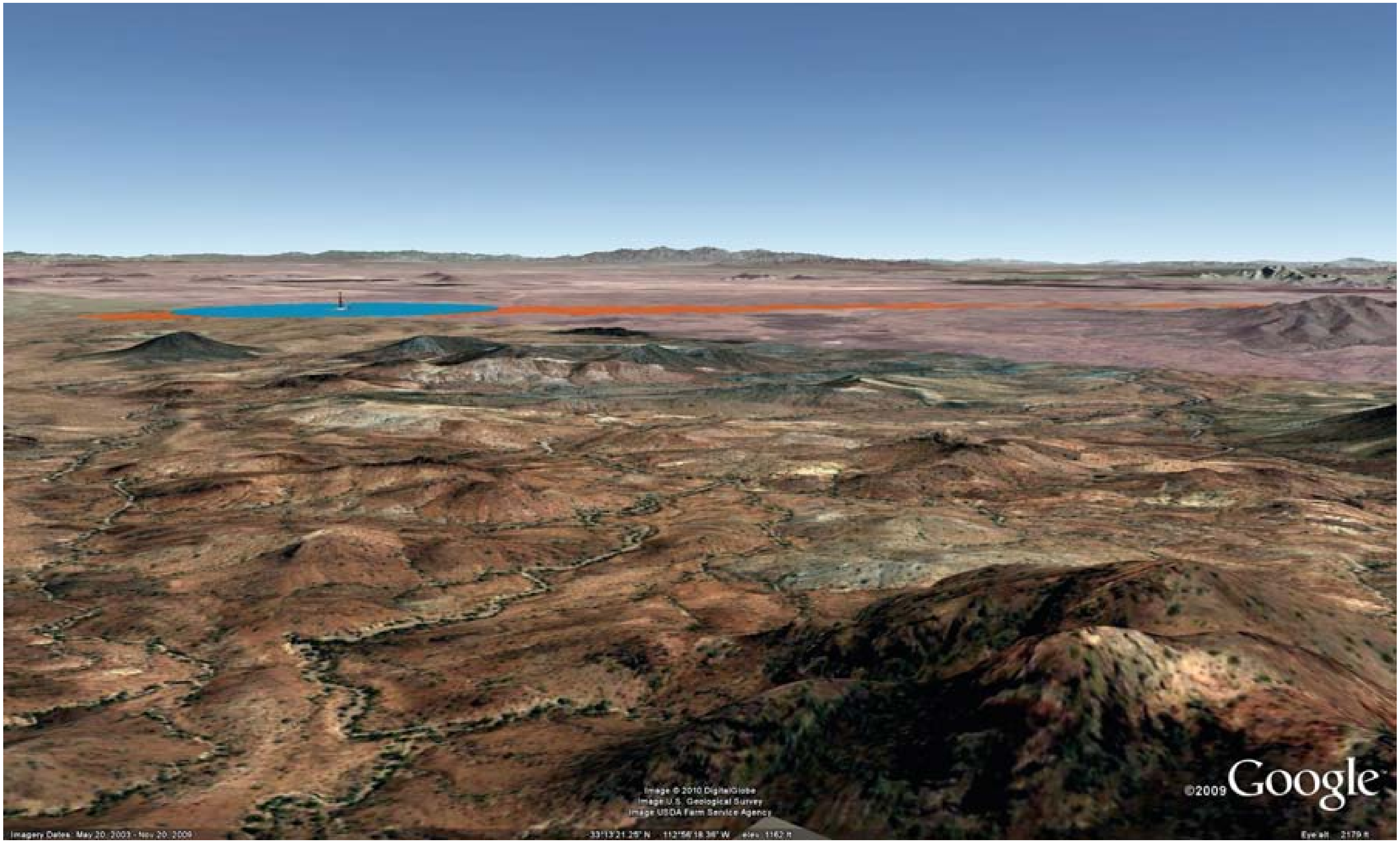

FIGURE 8.3.14.2-7 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Peak of Signal Mountain in the Central Portion of Signal Mountain WA

and line contrasts with the strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments utilized in the facilities.

Operating power tower receivers within the SEZ would likely appear as very bright, non-point light sources atop the tower structures and could strongly attract visual attention if located in the nearer portions of the SEZ. The tower structures would add short vertical line contrasts to a predominantly horizontal landscape setting. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that could be visually conspicuous in the area's typically dark night sky conditions, although there would be other lights visible in the valley beyond the SEZ. Other lighting associated with solar facilities could be visible as well.

Depending on project locations within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, strong visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

In summary, portions of the WA are within a relatively short distance of the SEZ, and regardless of the elevation of the viewpoints, where open views of the SEZ existed, viewers in these areas could be subjected to strong visual contrasts from solar facilities in the SEZ. In other portions of the WA, topographic screening of portions of the SEZ and of lower-height facilities would tend to reduce visual contrasts levels, as would decreased elevation of viewpoints and increased distance from the SEZ.

- *South Maricopa Mountains*—South Maricopa Mountains is a 60,446-acre (244.62-km^2) congressionally designated WA located 25 mi (40 km) at the point of closest approach southeast of the SEZ. This wilderness includes 13 mi (21 km) of the Maricopa Mountain range, a low elevation Sonoran Desert range, and extensive desert plains.

  As shown in Figure 8.3.14.2-2, within the 25-mi (40-km) SEZ viewshed, the upper portions of tall power towers located within the SEZ could be visible from a very small area in the far northwestern portion of the WA. Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 3 acres (0.01 km^2) in the 650-ft (198.1-m) viewshed, or 0.1% of the total WA acreage. None of the WA is in the 24.6-ft (7.5-m) viewshed. The visible area of the WA extends to beyond 25 mi (40 km) from the western boundary of the SEZ.

  Within the WA, the 3-acre (0.01 km^2) area that falls within the 650-ft (198.1-m) viewshed is located on the Gila River valley floor. Because of nearly full screening of views to the SEZ from this area, only the upper portions of operating power towers at particular locations within the SEZ could be seen, and if they were located at these positions, the receivers might be seen as distant star-like points of light just above the intervening mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the WA at night. Because of the very limited visibility of potential solar facilities within the SEZ and very long distance to the SEZ, under the 80% development scenario analyzed in this PEIS, minimal levels of visual contrast would be expected from solar energy development within the SEZ, as seen from viewpoints in the WA.

- *Woolsey Peak*—Woolsey Peak is a 64,465-acre (260.88-km^2) congressionally designated WA located 2.1 mi (3.4 km) at the point of closest approach south of the SEZ. This wilderness encompasses a major part of the Gila Bend Mountains. The diverse topography and geology include sloping lava flows, basalt mesas, rugged peaks and ridges. The 3,270-ft (1,134-m) Woolsey Peak, rising 2,500 ft (762 m) above the Gila River, is a geographic landmark visible throughout southwestern Arizona.

  As shown in Figure 8.3.14.2-2, within 25 mi (40 km), solar energy facilities within the SEZ could be visible from the north- and northeast-facing slopes of the mountains throughout the WA, as well as scattered areas at lower elevations in the northern portion of the WA. Visible areas of the WA within the 25-mi (40-km) radius of analysis total about 11,389 acres (46.090 km^2) in the 650-ft (198.1-m) viewshed, or 18% of the total WA acreage, and 4,595 acres (18.59 km^2) in the 24.6-ft (7.5-m) viewshed, or 7% of the total WA acreage. The visible area of the WA extends about 12.5 mi (20 km) from the southern boundary of the SEZ.

  Figure 8.3.14.2-8 is a Google Earth visualization of the SEZ as seen from the summit of Woolsey Peak in the north–central portion of the WA, and the highest elevation within the WA, located about 5.0 mi (8.0 km) from the closest point in the SEZ. The viewpoint is just within the BLM VRM program's foreground-middleground distance of 3-5 mi (5-8 km).

  The viewpoint in the visualization is about 2,200 ft (670 m) higher in elevation than the SEZ. The SEZ would appear as a thin band of development just above Webb Mountain and the hills to the southeast of Webb Mountain, and below the Palo Verde nuclear power plant. The SEZ would be viewed roughly perpendicular to its long and narrow southeast-to-northwest axis, and would be close enough to the viewpoint that it would occupy most of the horizontal field of view. Because of the large elevation difference between the viewpoint and the SEZ and the relatively short distance to the SEZ, the vertical angle of view would be high enough that the tops of collector/reflector arrays within the SEZ would be visible, which would increase their apparent

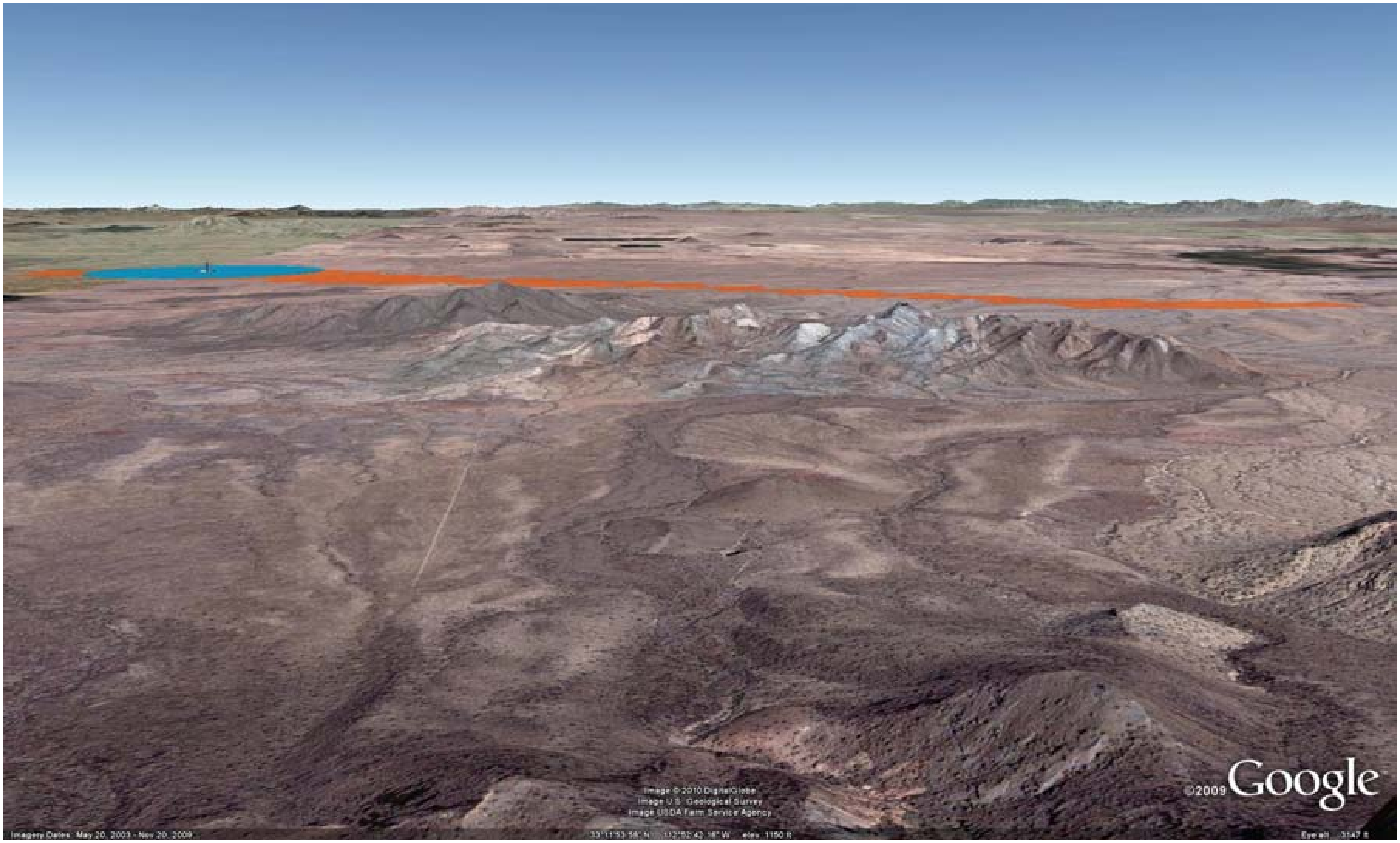

FIGURE 8.3.14.2-8 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Woolsey Peak in the Woolsey Peak WA

size (relative to lower-angle views). The higher angle of view would also make the strong regular geometry of solar collector/reflector arrays within the SEZ more apparent, and they would contrast strongly with the largely natural-appearing landscape. Ancillary facilities, such as buildings, cooling towers, and transmission towers, as well as any plumes, would likely be visible, and could be conspicuous, depending on their location, height, and other characteristics, as well as other visibility factors.

Operating power tower receivers within the SEZ would likely appear as very bright, non-point (i.e., having visible cylindrical or rectangular surfaces) light sources atop the tower structures and could strongly attract visual attention if located in the nearer portions of the SEZ. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that could be visually conspicuous in the area‘s typically dark night sky conditions, although there would be other lights visible in the valley. Other lighting associated with solar facilities could be visible as well.

Depending on project locations within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, strong visual contrasts from solar energy development within the SEZ would be expected at this viewpoint.

Figure 8.3.14.2-9 is a Google Earth visualization of the SEZ as seen from a low hill in the far northeastern portion of the WA, about 3.2 mi (5.2 km) from the SEZ, and just inside the WA‘s northern boundary. The viewpoint is within the BLM VRM program‘s foreground-middleground distance of 3 to 5 mi (5 to 8 km).

The viewpoint in the visualization is about 600 ft (183 m) higher in elevation than the SEZ. Webb Mountain and the nearby hills southeast of Webb Mountain would screen the western portion of the SEZ from view, more than half of the total SEZ acreage. The visible portions of SEZ would be seen as a very narrow band of development stretching across the valley floor, and occupying much of the horizontal field of view. The SEZ would be viewed roughly perpendicular to its long and narrow southeast-to-northwest axis.

Where visible, collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on. The edge-on viewing angle would reduce their apparent size, conceal their strong regular geometry, and cause them to appear to repeat the strong line of the horizon, tending to reduce visual contrast.

Operating power tower receivers within the SEZ would likely appear as very bright, non-point light sources atop the tower structures, against a backdrop of the floor of the valley in which the SEZ is located, and could strongly attract visual attention if located in the nearer portions of the SEZ. At night, if sufficiently tall, the towers would have red flashing lights, or white or red

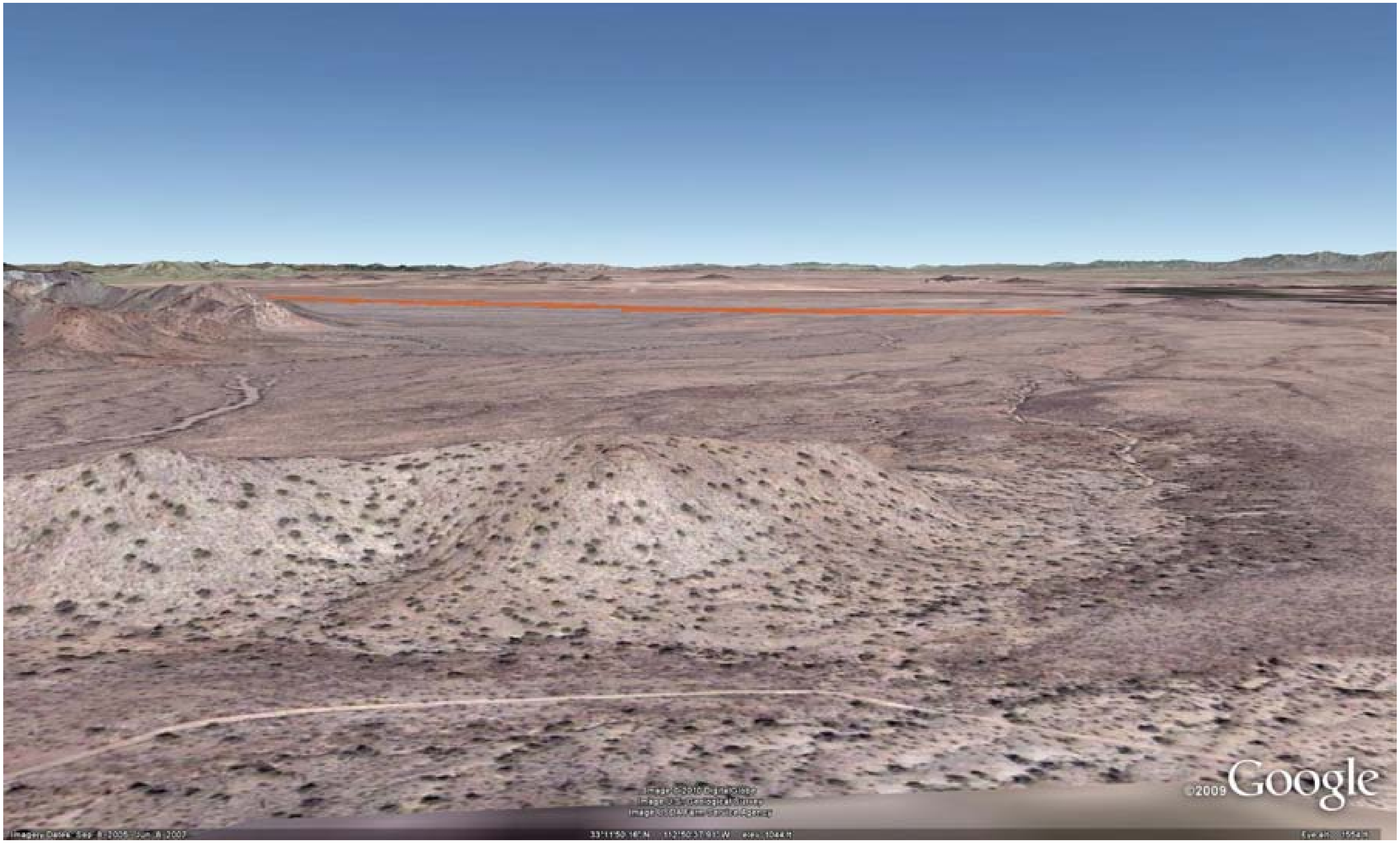

FIGURE 8.3.14.2-9 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, as Seen from a Hill in the Far Northeastern Portion of the Woolsey Peak WA

flashing strobe lights that could be very conspicuous from this viewpoint, given the area's typically dark night sky conditions, although lights from the Palo Verde nuclear power plant would be visible beyond the SEZ. Other lighting associated with solar facilities could be visible as well.

Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, moderate to strong visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

Figure 8.3.14.2-10 is a Google Earth visualization of the SEZ as seen from the summit of Bunyan Peak in the southwestern portion of the WA, located about 11 mi (18 km) from the closest point in the SEZ.

The viewpoint in the visualization is about 1,500 ft (460 m) higher in elevation than the SEZ. Signal Mountain and surrounding peaks would screen the far western portion and a small part of the central portion of the SEZ from view, while Webb Mountain and the hills southeast of Webb Mountain would screen the eastern half of the SEZ from view. The visible portions of the SEZ would be viewed roughly perpendicular to the SEZ's long and narrow southeast-to-northwest axis, but because of the screening and distance to the SEZ, the SEZ would occupy a small portion of the horizontal field of view.

There is a relatively large elevation difference between the viewpoint and the SEZ, but the SEZ is far enough away that the vertical angle of view would be low. Collector/reflector arrays for solar facilities within the SEZ would be seen nearly on edge, which would decrease their apparent size (relative to higher-angle views), and make them appear to repeat the strong line of the horizon, tending to decrease visual contrast with the surrounding landscape. Ancillary facilities, such as buildings, cooling towers, and transmission towers, as well as any plumes, could be visible as well.

Operating power tower receivers within the SEZ would likely appear as point light sources atop the tower structures, which would likely be visible under normal viewing conditions. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that would be visible from this viewpoint, although there might be other lights visible in the valley. Other lighting associated with solar facilities could be visible as well.

Depending on project locations within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, weak visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

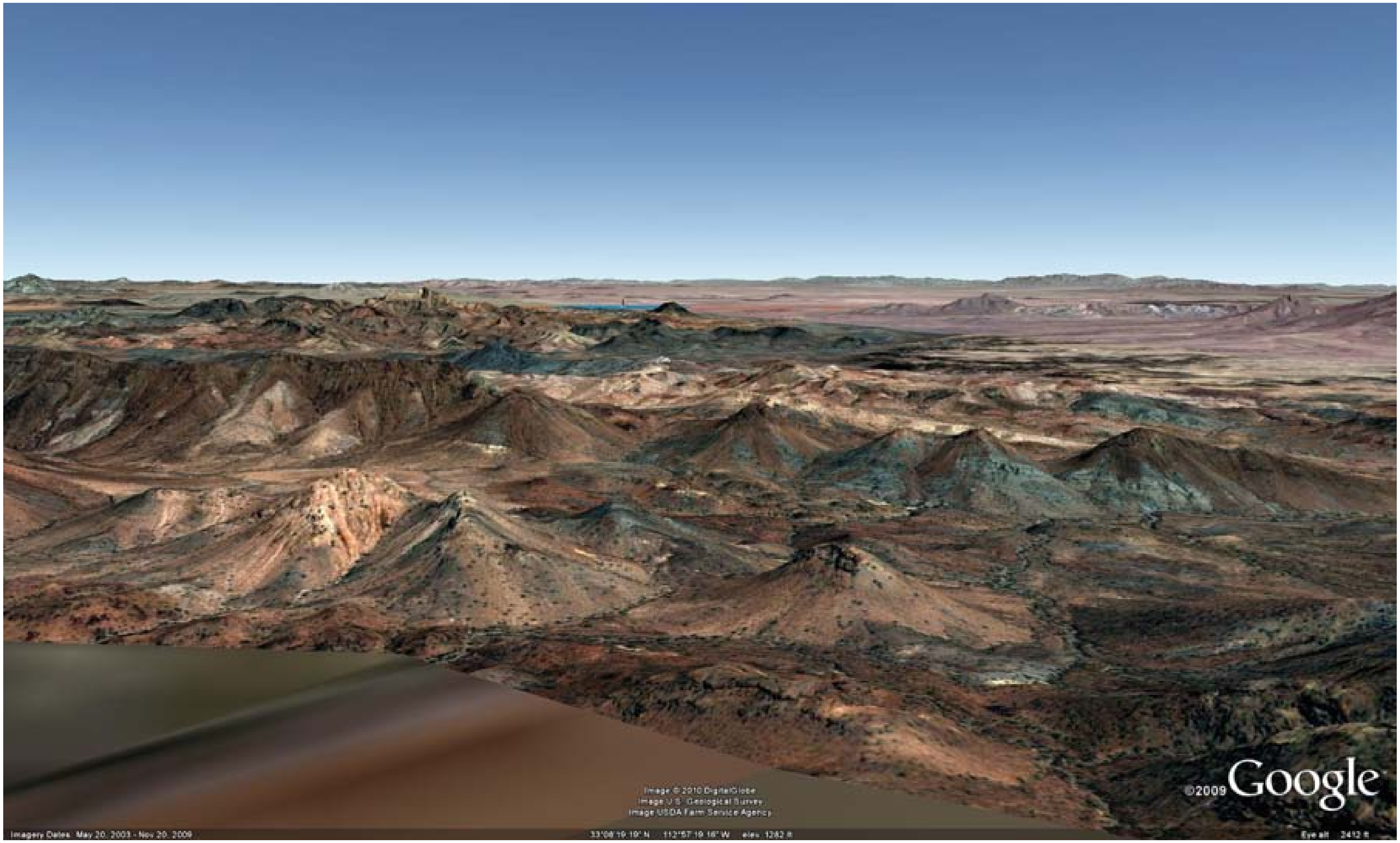

FIGURE 8.3.14.2-10 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model (shown in blue), as Seen from Bunyan Peak in the Woolsey Peak WA

In summary, the Woolsey Peak WA is sufficiently close to the SEZ that for many viewpoints within the WA, and particularly for elevated viewpoints in the northern portion of the WA, solar energy development within the SEZ would be expected to result in strong visual contrast levels. Visibility of the

SEZ is not confined to the northern portions of the WA, however. Lower contrast levels would be expected for lower elevation viewpoints throughout the WA, and for higher elevation viewpoints deeper in the interior of the WA.

Special Recreation Management Area

- *Saddle Mountain*—The Saddle Mountain SRMA is a BLM-designated SRMA located 4.3 mi (6.9 km) northwest of the SEZ at the point of closest approach. It encompasses 47,696 acres (193.02 km^2).

  As shown in Figure 8.3.14.2-2, the area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 27,237 acres (110.22 km^2), or 57% of the total SRMA acreage. The area of the SRMA within the 24.6-ft (7.5-m) viewshed of the SEZ includes 19,760 acres (79.966 km^2), or 41% of the total SRMA acreage. The visible area extends from the point of closest approach to 12 mi (19 km) into the SRMA.

  The northern portions of the Saddle Mountain SRMA include Saddle Mountain and the western portion of the Palo Verde Hills, but much of the southern portions of the SRMA consist of relatively flat low-elevation lands of the Harquahala Plains. Because the SEZ is southeast of the SRMA, visibility of the SEZ within the SRMA is good, with solar development likely to be plainly visible from most of the low-elevation areas in the SRMA, as well as the south and east facing slopes of Saddle Mountain and the Palo Verde Hills.

  Figure 8.3.14.2-11 is a Google Earth visualization of the SEZ as seen from the intersection of West Elliot Rd. and S. 419th Ave. in the far southeastern portion of the SRMA, about 4.8 mi (7.8 km) from the SEZ and just inside the SRMA's southeast boundary. The viewpoint is just within the BLM VRM program's foreground-middleground distance of 3 to 5 mi (5 to 8 km).

  The viewpoint in the visualization is about 25 ft (7 m) lower in elevation than the nearest point in the SEZ. The SEZ would be viewed obliquely along its long and narrow southeast-to-northwest axis, which would decrease the apparent width of the SEZ as seen from this viewpoint. The SEZ would occupy a moderate amount of the horizontal field of view. Solar facilities within the SEZ would be seen in a very narrow band along the horizon at the base of Webb Mountain, Woolsey Peak, and other mountains in the Gila Bend range.

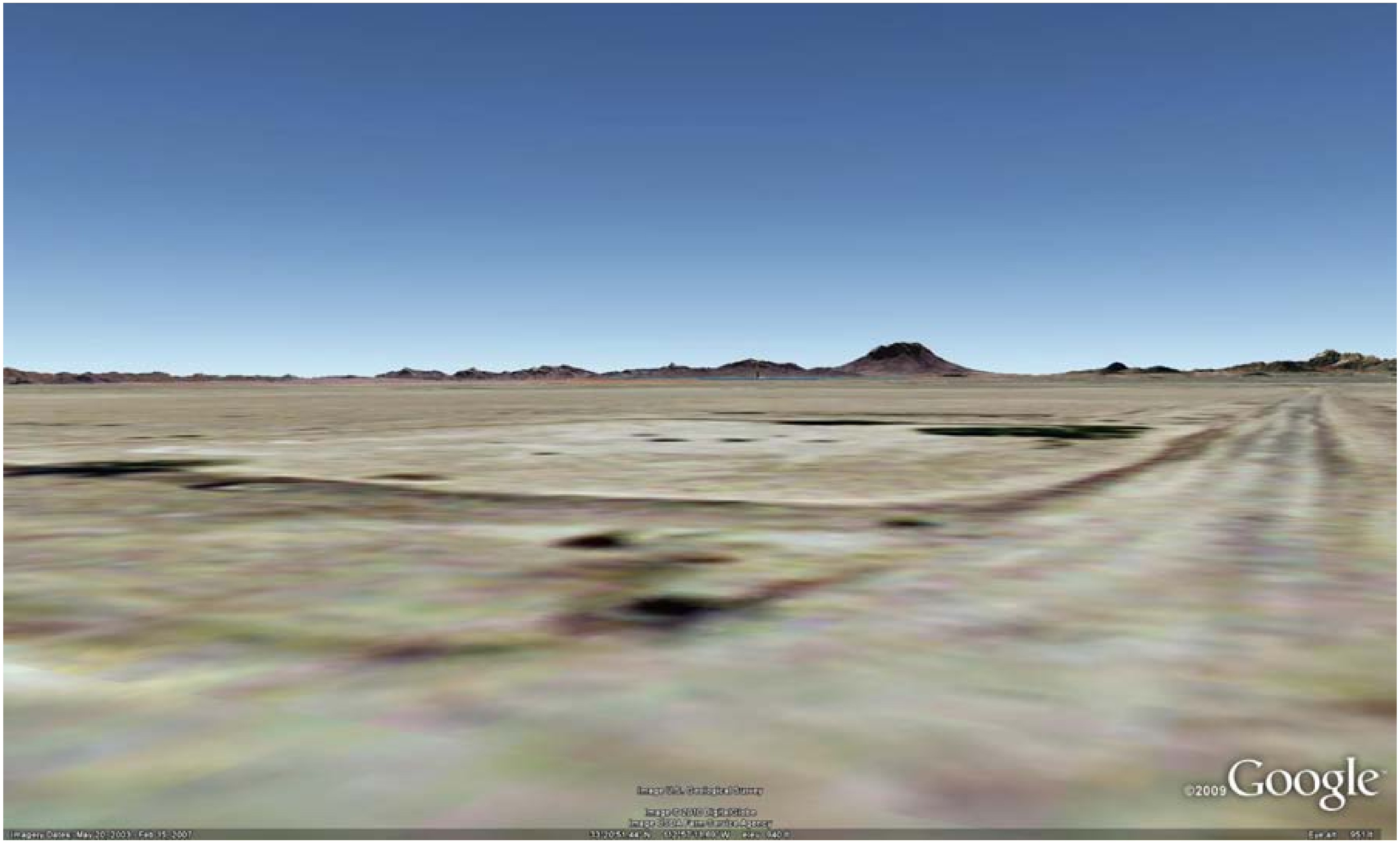

FIGURE 8.3.14.2-11 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Intersection of West Elliot Rd. and S. 419th Ave. in the Southeastern Portion of Saddle Mountain SRMA

Because the viewpoint and the SEZ are at essentially the same elevation, the vertical angle of view is extremely low. Collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, which would reduce their apparent size, conceal the arrays' strong regular geometry, and would also cause them to appear to repeat the strong line of the horizon, tending to reduce visual contrast.

Taller ancillary facilities, such as buildings, transmission structures, and cooling towers, and plumes (if present), would likely be visible projecting above the collector/reflector arrays, and their structural details could be evident at least for nearby facilities. The ancillary facilities could create form and line contrasts with the strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments utilized in the facilities.

Operating power tower receivers within closer portions of the SEZ would likely appear as very bright, non-point light sources atop the tower structures, against a backdrop of the mountains, and could strongly attract visual attention. Power tower receivers in the more distant southeast portion of the SEZ (up to 11 mi [17 km] away from the viewpoint) could have substantially lower levels of impact. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that could be conspicuous as seen from this location, although other lights would be visible in surrounding areas. Other lighting associated with solar facilities could be visible as well.

Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, moderate to strong visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

Figure 8.3.14.2-12 is a Google Earth visualization of the SEZ as seen from an unnamed peak in the northeastern portion of the SRMA, about 9.5 mi (15.3 km) from the SEZ.

The viewpoint in the visualization is about 1,200 ft (370 m) higher in elevation than the SEZ. The SEZ would be viewed at about a 45° angle to its long and narrow southeast-to-northwest axis. The SEZ would occupy a moderate amount of the horizontal field of view. Solar facilities within the SEZ would be seen in a narrow, wedge-shaped band along the horizon at the base of Webb Mountain, Woolsey Peak, and other mountains in the Gila Bend range, with the point of the wedge toward the southeast, along the long axis of the SEZ.

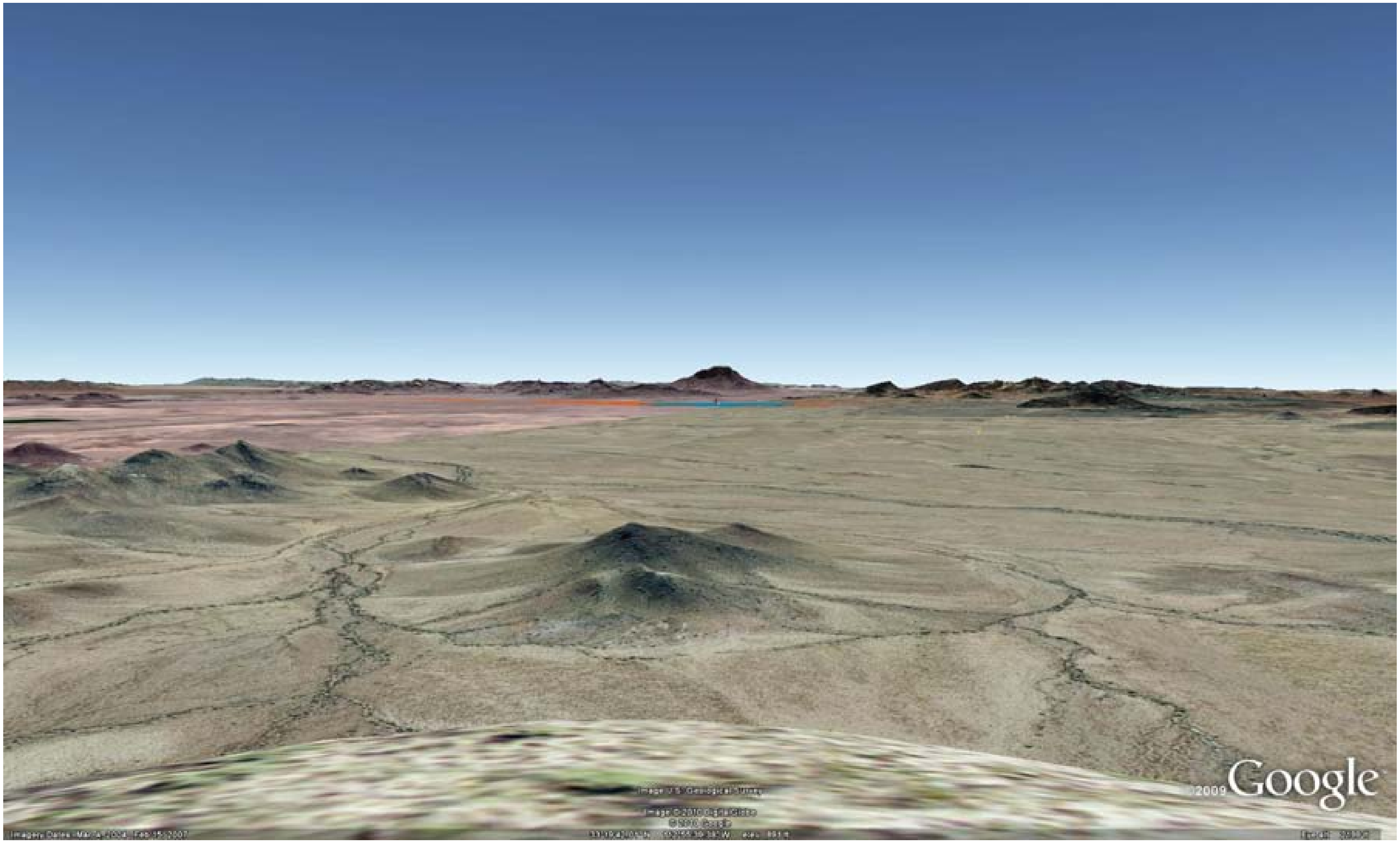

FIGURE 8.3.14.2-12 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from an Unnamed Peak in the Northeastern Portion of Saddle Mountain SRMA

The viewpoint is elevated with respect to the SEZ, but because the nearest point in the SEZ is about 10 mi (16 km) from the SEZ, the vertical angle of view is low. Collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, which would reduce their apparent size, partially conceal the arrays' strong regular geometry, and would also cause them to appear to repeat the strong line of the horizon, tending to reduce visual contrast. Ancillary facilities, such as buildings, cooling towers, and transmission towers, as well as any plumes, would likely be visible.

Operating power tower receivers within closer portions of the SEZ would likely appear as non-point light sources atop the tower structures, against a backdrop of the mountains, and could attract visual attention, depending on their location within the SEZ, height, other characteristics, and visibility factors. Power tower receivers (and solar facilities in general) in the more distant southeast portion of the SEZ (up to almost 15 mi [24 km] away from the viewpoint) would have somewhat lower levels of impact. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights that could be visually conspicuous in the area's typically dark night sky conditions, although other lights, particularly those of the Palo Verde nuclear power plant, would be visible in surrounding areas.

Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, moderate visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

Figure 8.3.14.2-13 is a Google Earth visualization of the SEZ as seen from the summit of Saddle Mountain in the northwestern portion of the WA, located about 12.6 mi (20.3 km) from the closest point in the SEZ.

The viewpoint in the visualization is about 2,100 ft (640 m) higher in elevation than the SEZ. The entire SEZ would be in view. The SEZ would be viewed roughly parallel to the SEZ's long and narrow southeast-to-northwest axis, which would reduce the apparent width of the SEZ. The SEZ would occupy a small portion of the horizontal field of view. There is a relatively large elevation difference between the viewpoint and the SEZ, but the SEZ is far enough away that the vertical angle of view would be low. The tops of collector/reflector arrays for solar facilities within the SEZ would be visible, but the arrays would be seen nearly on edge, which would decrease their apparent size (relative to higher-angle views) and make them appear to repeat the strong line of the horizon, tending to decrease visual contrast with the surrounding landscape. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

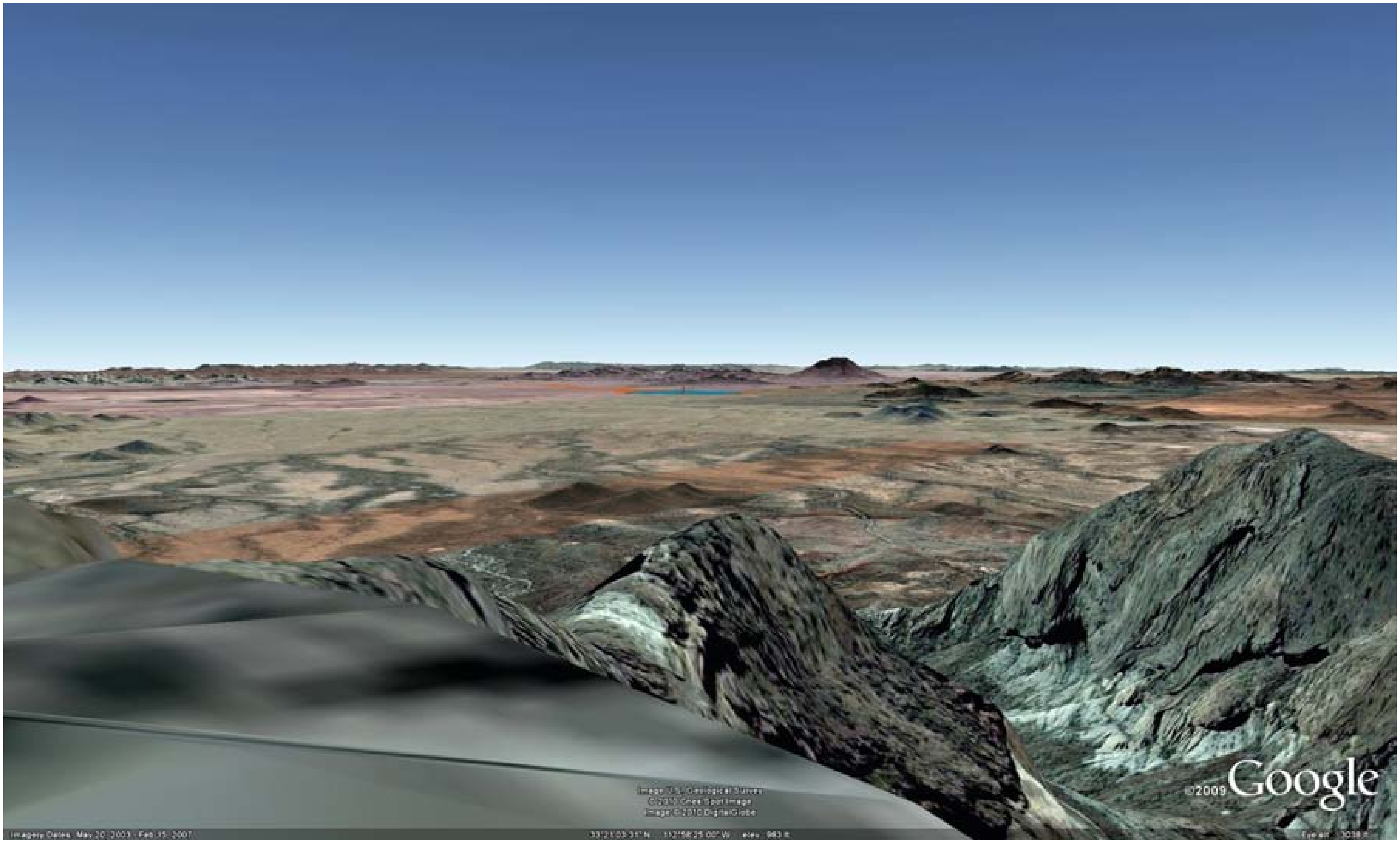

FIGURE 8.3.14.2-13 Google Earth Visualization of the Proposed Gillespie SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Saddle Mountain Summit in the Saddle Mountain SRMA

Operating power tower receivers within closer portions of the SEZ would likely appear as point light sources atop visible tower structures. Power tower receivers (and solar facilities in general) in the more distant southeast portion of the SEZ (up to almost 19 mi [30 km] away from the viewpoint) would have substantially lower levels of impact. At night, if sufficiently tall, the towers would have red flashing lights, or white or red flashing strobe lights visible from this viewpoint, although other lights, particularly those of the Palo Verde nuclear power plant, would be visible in surrounding areas.

Depending on project locations within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, weak visual contrasts from solar energy development within the SEZ could be expected at this viewpoint.

In summary, the Saddle Mountain SRMA is sufficiently close to the SEZ that for some viewpoints within the SRMA, solar energy development within the SEZ would be expected to result in moderate to strong visual contrast levels. Lower contrast levels would be expected for lower elevation viewpoints throughout the SRMA, and for higher elevation viewpoints in the northwestern portion of the SRMA, farther from the SEZ.

National Historic Trail

- *Juan Bautista de Anza*—The Juan Bautista de Anza National Historic Trail is a congressionally designated multistate and two-country historic trail that passes within approximately 18 mi (29 km) of the SEZ at the point of closest approach on the southeast side of the SEZ. Approximately 4.7 mi (7.6 km) of the historic trail is located within the 650-ft (198.1-m) viewshed of the SEZ, and the visible area ranges from 20.3 mi (32.7 km) southeast of the southeastern boundary of the SEZ. The historic trail is not within the lower-height viewsheds.

  As shown in Figure 8.3.14.2-2, the portion of the historic trail within the 650-ft (198.1- m) SEZ viewshed is partly within and immediately west of the western boundary of the Sonoran Desert National Monument (see discussion above). Regardless of height, solar energy facilities within most of the SEZ would be screened from view of the historic trail by the Gila Bend Mountains. In the absence of vegetative or other screening, the upper portions of sufficiently tall operating power towers located in the far eastern portion of the SEZ could be visible just above the Gila Bend Mountains southeast of the SEZ, but the SEZ would occupy a very small portion of the field of view, as it would be viewed along the very narrow northwest–southeast axis, which is generally less than 0.5 (0.8 km) wide. If visible within the SEZ, operating power tower receivers would appear as distant lights immediately above the mountains, viewed against the background of the sky. If more than 200 ft

(61 m) tall, power towers would have navigation warning lights that could potentially be visible from the trail at night. Expected visual impacts on trail users would be minimal.

Additional scenic resources exist at the national, state, and local levels, and impacts may occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. Note that in addition to the resource types and specific resources analyzed in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other sensitive visual resources, and communities close enough to the proposed project to be affected by visual impacts. Selected other lands and resources are included in the discussion below.

In addition to impacts associated with the solar energy facilities themselves, sensitive visual resources could be affected by other facilities that would be built and operated in conjunction with the solar facilities. With respect to visual impacts, the most important associated facilities would be access roads and transmission lines, the precise location of which cannot be determined until a specific solar energy project is proposed. A 500-kV transmission line runs almost adjacent to the proposed SEZ (within approximately 0.5 mi [0.8 km]), so there would be minimal construction required outside of the SEZ to connect to that line. For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that the existing 500-kV transmission line might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be done for new transmission construction or line upgrades. Roads and transmission lines would be constructed within the SEZ as part of the development of the area. Note that depending on project- and site-specific conditions, visual impacts associated with access roads, and particularly transmission lines, could be large. Detailed information about visual impacts associated with transmission lines is presented in Section 5.12.1. A detailed site-specific NEPA analysis would be required to determine visibility and associated impacts precisely for any future solar projects, based on more precise knowledge of facility location and characteristics.

Impacts on Selected Other Lands and Resources

Agua Caliente Road (Agua Caliente Scenic Drive). Agua Caliente Road, also known as Agua Caliente Scenic Drive, is a 49-mi (79-km) unpaved county road that is a BLM-proposed backcountry byway and a scenic, high-use travel corridor. The generally east-to-west route begins off Old U.S. 80 (see impact discussion below) south of Arlington Arizona, and about 1.6 mi (2.6 km) from the southeastern boundary of the SEZ, Agua Caliente Road crosses the SEZ three times before passing out of the SEZ viewshed west of the Yellow Medicine Hills, approximately 13 mi (21 km) (by road) west of the SEZ. Approximately 18 mi (29 km) of the road are within the SEZ 650-ft (198.1-m) viewshed, with about 7.3 mi (12 km) of the road within the 24.6-ft (7.5-m) viewshed of the SEZ, including all of the roadway within and east of the SEZ, and about 2.5 mi (4.0 km) of the road west of the SEZ. Approximately 2.2 mi (3.5 km) of the road is within the SEZ.

As noted below, westbound travelers on Agua Caliente Road would already be subject to large to very large visual contrasts from solar facilities within the SEZ as they approached Agua Caliente Road from Old U.S. 80. As they began westward travel on Agua Caliente Road, the SEZ would occupy much of the horizontal field of view, and while the viewing angle would be very low because the road is lower in elevation than the SEZ in this area, the apparent size of solar facilities within the SEZ and associated contrast levels would increase rapidly as the road approached the SEZ, winding somewhat but heading generally west. Estimating travel speeds of 30 mph on the unpaved road, the SEZ would be reached in about 9 minutes.

As west-bound travelers approached the SEZ, solar facilities within the SEZ would be in prominent view on the left side of vehicles. Travel would be roughly parallel to the long axis of the SEZ. Facilities located within the southeastern portion of the SEZ would strongly attract the eye and would dominate the view from the road. Structural details of some facility components would be visible. Views of the Gila Bend Mountains could be partially screened by taller solar facilities, depending on the layout of solar facilities within the SEZ. Because of the short distance from the roadway, strong visual contrasts would be expected, depending on solar project characteristics and project location within the SEZ.

Visual contrast would increase further as travelers entered the SEZ. If power tower facilities were located in the SEZ, the operating receivers could appear as brilliant light sources on either side of the road, and would likely strongly attract views during the day and, if more than 200 ft (61 m) tall, would have navigation warning lights at night that could be very conspicuous from the roadway. In addition, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). Looking ahead down the road, if solar facilities were located on both the north and south sides of the road, the banks of solar collectors on both sides of the byway could form a visual "tunnel" that travelers would pass through briefly and successively as the road left then re-entered the SEZ. If solar facilities were located close to the roadway (as they would have to be, given the narrowness of the SEZ in this area), given the 80% development scenario analyzed in this PEIS, they would be expected to dominate views from the road and would create strong visual contrasts. After passing through the section of SEZ, the SEZ would still be very close to the road on one or the other side.

As travelers approached and successively passed through the SEZ, depending on the solar technologies present, facility layout, and mitigation measures employed, there would be the potential for reflections from the various facility components to cause visual discomfort for travelers and distraction for drivers. These potential impacts could be reduced by siting reflective components away from the byway, employing various screening mechanisms, and/or adjusting the mirror operations to reduce potential impacts, however, because of their height, the receivers of power towers located close to the roadways could be difficult to screen.

Eastbound travelers would have a similar visual experience to westbound travelers in and around the SEZ, but solar facilities in the SEZ could come into view about 13 mi (21 km) (by road) west of the SEZ. For much of this distance, visibility of solar facilities within the SEZ would be intermittent because of screening by the Yellow Medicine Hills and other hills near Dixie Peak. In these areas, expected visual contrasts from solar facilities within the SEZ would be expected to be weak. As travelers rounded the main summit in the Yellow Medicine Hills, the SEZ would come into full view, at a distance of about 1.7 mi (2.7 km). The SEZ would be located directly in front of east-bound vehicles, and although views would be down the long and narrow northwest-southeast axis of the SEZ, visual contrasts would be strong, and would rapidly increase as travelers entered the SEZ after 3 to 4 minutes.

In summary, visual contrast levels arising from solar facilities within the SEZ would vary depending on viewer location and direction on Agua Caliente Road; the type, size, location, and layout of solar facilities within the SEZ; and other visibility factors. However, under the 80% development scenario analyzed in this PEIS, weak to strong levels of visual contrast would be expected for travelers on Agua Caliente Road, primarily because the road crosses the SEZ several times and otherwise passes very near the SEZ.

Interstate 10. I-10 passes within 14 mi (23 km) of the northern boundary of the proposed Gillespie SEZ. The AADT value for I-10 in the vicinity of the SEZ in 2008 was about 23,000 (ADOT 2010).

As shown in Figure 8.3.14.2-2, within 25 mi (40 km) of the SEZ, about 25.8 mi (41.5 km) of I-10 are within the SEZ viewshed. Eastbound I-10 travelers approaching Tonopah from the west would be exposed to brief intermittent views of the upper parts of sufficiently tall operating power towers about 7.3 mi (11.8 km) west of Tonopah, about 18 mi (29 km) from the SEZ. Where visible, the operating power tower receivers would appear briefly as distant lights just above the southern horizon, well way from the direction of travel. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the roadway at night.

About 3.6 mi (5.8 km) east of Tonopah, about 15 mi (25 km) directly north of the SEZ, an extended period of visibility of lower-height solar facilities within the SEZ would begin and would last until vehicles passed the community of Buckeye well east of the SEZ, although the SEZ would be behind the vehicles for over half the distance. At highway speeds, the total duration of views of solar facilities within the SEZ would be about 18 minutes. Near the point of maximum visibility of the SEZ, the view would be roughly perpendicular to the long axis of the SEZ, and the SEZ would occupy a substantial portion of the horizontal field of view; however, in this area, I-10 is about 200 to 250 ft (60-75 m) higher in elevation than the SEZ, and because of the long distance to the SEZ, the angle of view would be very low. In some areas, some portions of the SEZ would be briefly screened from view from I-10 by intervening hills. The collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, so that they would repeat the line of the horizon, which would tend to reduce visual contrast. If power tower facilities were located within the SEZ, when operating, the receivers would likely be visible as points of light against a backdrop of the Gila Bend Mountains just south of the SEZ. Because of the distance to the SEZ, low viewing angle, and partial screening of the SEZ, expected visual contrast levels would be weak.

Westbound travelers on I-10 would have a somewhat different visual experience of solar facilities within the SEZ. Depending on their height and location within the SEZs, solar facilities within the SEZ would first become visible to travelers on I-10 outside the 25-mi (40-km) radius of analysis of this PEIS. However, views would be limited to the upper portions of sufficiently tall power towers until lower height facilities came into view about 6 mi (10 km) northeast of the community of Buckeye, almost 23 mi (37 km) northeast of the SEZ. Unlike east-bound travelers, west-bound travelers would be facing the SEZ as they came into the viewshed on I-10; however, because of the long distance to the SEZ and the minimal elevation difference between the SEZ and I-10, the angle of view would be quite low, and expected visual contrast levels weak.

Expected visual contrast levels would rise somewhat as travelers approached the SEZ over the next few minutes. Within about 5 minutes after entering the viewshed for low-height solar facilities, I-10 turns to the northwest, so that travelers would for a time travel parallel to the long axis of the SEZ, although at a distance of about 14 to 18 mi (22.5 to 29 km) from the SEZ. Views would be similar to those for eastbound travelers, but with the SEZ visible to the left of the direction of travel rather than the right.

In summary, visual contrast levels arising from solar facilities within the SEZ would vary depending on viewer location and direction on I-10; the type, size, location, and layout of solar facilities within the SEZ; and other visibility factors. However, under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected for travelers on I-10, primarily because of the long distance to the SEZ (almost 15 mi [24 km] at the point of maximum visibility) and the very low angle of view to the SEZ from I-10.

State Route 85. Approximately 22 mi (35 km) of State Route 85 are within the viewshed of the SEZ about 11 mi (18 km) east of the SEZ. State Route 85 runs generally north–south between I-8 and I-10. The AADT value for State Route 85 in the vicinity of the SEZ was about 11,500 vehicles in 2009 (ADOT 2010).

As shown in Figure 8.3.14.2-2, solar energy facilities within the SEZ would be visible from two sections of State Route 85: a more southerly section of the road south of the Buckeye Hills, where visibility would be limited to taller solar facility components; and a more northerly section north of the Buckeye Hills, where lower height solar facilities within the SEZ could be visible as well. The more southerly section with visibility includes about 14 mi (23 km) of the roadway, while the northern section includes about 7.9 mi (13 km).

For travelers within the southern section of visibility on State Route 85, partial views of taller solar energy facility components, such as power towers and transmission towers, would be through a gap between the Gila Bend Mountains and the Buckeye Hills, about 2 to 3 mi (3 to 5 km) in width. Topography would screen lower-height facilities from view, and within much of the section of road, only the upper portions of tall power towers could be visible. Views of the SEZ would be along the very narrow southeast–northwest axis of the SEZ, so that the visible facilities would occupy only a very small portion of the field of view. And because the SEZ and the roadway are at nearly the same elevation, the angle of view would be very low, so that visible collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, tending to reduce visual contrast. At about 11 mi (18 km) from the SEZ, operating power tower receivers could appear as bright points of light viewed against a sky backdrop through the gap, and the tower structure could also be visible in favorable viewing conditions. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the roadway at night. Other lighting associated with solar facilities could be visible as well. Weak visual contrast levels would be expected. At highway speeds, view duration would be about 12 minutes, with the SEZ visible to the far left of the vehicle for northbound travelers and to the far right of the vehicle for southbound travelers.

Travelers on State Route 85 within the northern section of the roadway with visibility to the SEZ would be able to see lower-height facilities within the SEZ, but at a very low viewing angle, and at distances ranging from 13 to 19 mi (21 to 31 km). Operating power tower receivers could appear as points of light viewed against a sky backdrop above the Gila Bend Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the roadway at night. Minimal to weak visual contrast levels would be expected, with the lowest levels experienced in the northernmost part of this section of State Route 85, which is farther from the SEZ. At highway speeds, view duration would be about 7 minutes. The SEZ would be visible behind and to the left of the vehicle for northbound travelers and in front of but to the far right of the vehicle for southbound travelers. Northbound travelers would therefore be less likely to see solar facilities within the SEZ.

In summary, visual contrast levels arising from solar facilities within the SEZ would vary depending on viewer location and direction on State Route 85; the type, size, location, and layout of solar facilities within the SEZ; and other visibility factors, but under the 80% development scenario analyzed in this PEIS, minimal to weak levels of visual contrast would be expected for travelers on State Route 85, primarily because of the long distance to the SEZ and the very low angle of view to the SEZ from State Route 85.

Salome Highway. Approximately 11 mi (18 km) of the Salome Highway are within the viewshed of the SEZ about 9 to 10 mi (14 to 16 km) northeast of the SEZ. Salome Highway runs southeast to northwest, paralleling the long axis of the SEZ.

Viewpoints to the SEZ on the Salome Highway are at approximately the same elevation as the SEZ, and the angle of view is very low. Collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, which would reduce their visible surface area and cause them to appear to repeat the strong horizontal line of the horizon, thereby potentially reducing visual contrast; however, because the views would be perpendicular to the long axis of the SEZ, under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would occupy a substantial portion of the horizontal field of view. Taller facility components and plumes could be visible above the collector/reflector arrays in favorable viewing conditions, and operating power tower receivers within the SEZ would likely be visible as bright points of light above visible tower structures. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the roadway at night, and other lighting associated with solar facilities could be visible as well. While Arlington Mesa would screen some portions of the SEZ from view, in general, moderate levels of visual contrast would be expected for most viewpoints on the Salome Highway.

Old U.S. 80. Approximately 29 mi (47 km) of Old U.S. 80 are within the viewshed of the SEZ at distances ranging from 2 to 15 mi (3 to 24 km) southeast to northeast of the SEZ, with the point of closest approach about 2 mi (3.2 km) northeast of the southeast corner of the SEZ.

Viewpoints along Old U.S. 80 are generally slightly lower in elevation than the SEZ, particularly in the southern sections of the road within the SEZ viewshed. Visibility of solar facilities within the SEZ within the southern 14 mi (22.5 km) of the roadway in the viewshed would be limited to the upper portions of sufficiently tall power towers, which could be visible through a gap between the Gila Bend Mountains and the Buckeye Hills, about 2 to 3 mi (3 to 5 km) in width. At longer distances from the SEZ, northbound travelers on Old U.S. 80 would likely see operating power tower receivers as points of light above the Gila Bend Mountains; however, they would grow in apparent size and brightness as travelers approached the SEZ. By the time travelers reached the Gila River, the eastern end of the SEZ would be within the BLM VRM program's foreground-middleground distance of 5 mi (8 km). The lower portions of power towers and other tall solar facilities would be screened from view. Operating power tower receivers could be visible as conspicuously bright, non-point light sources that could attract views, but they would not be expected to dominate views. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from the roadway at night.

After crossing the Gila River, the SEZ would be screened from view by a low hill for 2 to 3 minutes but would then come back into view to the far left for viewers in northbound vehicles, at a distance of about 2.2 mi (3.6 km). At this distance, the SEZ would occupy most of the horizontal field of view, and while the viewing angle would be very low because the road is lower in elevation than the SEZ in this area, under the 80% development scenario analyzed in this PEIS, strong visual contrasts could result. In this area, southbound travelers would have even more exposure to the SEZ, as the long axis of the SEZ would be more or less in front of vehicles as they approached the Gila River crossing. The SEZ would fill up almost the entire horizontal field of view near the point of closest approach, and structural details of facility components could be visible, with taller solar facility components and plumes plainly projecting above the collector/reflector arrays. Operating power tower receivers would likely be seen as very bright non-point light sources, and would likely strongly command visual attention if located in the far eastern portion of the SEZ. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could be conspicuous from the roadway at night. Other lighting associated with solar facilities could be visible as well. Under the 80% development scenario analyzed in this PEIS, strong levels of visual contrast would be expected to result from solar energy development within the SEZ, as seen from nearby locations on Old U.S. 80.

Communities of Arlington, Palo Verde, Buckeye, and Wintersburg. The viewshed analyses indicate visibility of the SEZ from the communities of Arlington (approximately 7 mi [11.3 km] northeast of the SEZ), Palo Verde (approximately 11 mi [18 km] northeast of the SEZ), Buckeye (approximately 17 mi [27 km] northeast of the SEZ), and Wintersburg (approximately 10 mi [16.1 km] north of the SEZ). A site visit in September 2009 indicated visibility particularly from the town of Arlington. Within these communities, at least partial screening of ground-level views of the SEZ are likely, due either to slight variations in topography, structures, vegetation, or a combination of these screening types. A detailed future site-specific NEPA analysis is required to determine visibility precisely. Even with the existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the development could potentially be tall enough to exceed the height of the screening and could in some cases cause visual impacts on these communities.

As shown in Figure 8.3.14.2-2, the community of Arlington is located approximately 7 mi (11.3 km) northeast of the SEZ. The SEZ would occupy a very large portion of the horizontal field of view from viewpoints within Arlington, because views from Arlington toward the SEZ would be perpendicular to the long axis of the SEZ and also because of the relatively short distance to the SEZ. The elevation of Arlington is slightly lower than the SEZ, so the vertical angle of view from Arlington to the SEZ would be very low. The SEZ would fill up almost the entire horizontal field of view, and structural details of facility components could be visible, with taller solar facility components and plumes projecting above the collector/reflector arrays. Operating power tower receivers would likely be seen as very bright point or non-point light sources against either a sky backdrop, or against the Gila Bend Mountains, depending on their location within the SEZ. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could be conspicuous as viewed from Arlington at night, and other lighting associated with solar facilities could be visible as well. Under the 80% development scenario analyzed in this PEIS, strong levels of visual contrast would be expected to result from solar energy development within the SEZ, as seen from unscreened viewpoints within Arlington.

The community of Palo Verde is located approximately 11 mi (18 km) northeast of the SEZ. The SEZ would occupy a moderate portion of the horizontal field of view from viewpoints within Palo Verde. Views from Palo Verde toward the SEZ would be perpendicular to the long axis of the SEZ, but the far eastern portion of the SEZ would be screened from viewpoints within Palo Verde by the Buckeye Hills. The elevation of Palo Verde is slightly lower than the SEZ, so the vertical angle of view from Palo Verde to the SEZ would be very low. Collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, which would reduce their apparent size, conceal their strong regular geometry, and cause them to appear to repeat the strong horizon line, tending to reduce visual contrast. Taller solar facility components and plumes could be visible projecting above the collector/reflector arrays. Operating power tower receivers would likely be seen as bright points of light against either a sky backdrop, or against the Gila Bend Mountains, depending on their location within the SEZ. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from Palo Verde at night. Other lighting associated with solar facilities could be visible as well. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected to result from solar energy development within the SEZ, as seen from unscreened viewpoints within Palo Verde.

The community of Buckeye is located approximately 17 mi (27 km) northeast of the SEZ at the point of closest approach. The SEZ would occupy a small portion of the horizontal field of view from viewpoints within Buckeye. Views from Buckeye toward the SEZ would be perpendicular to the long axis of the SEZ, but the far eastern portion of the SEZ would be screened from viewpoints within Buckeye by the Buckeye Hills. A small additional portion of the SEZ would be screened by Powers Butte. The elevation of Buckeye is about the same as the

SEZ, so the vertical angle of view from Buckeye to the SEZ would be very low. Collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, which would reduce their apparent size, conceal their strong regular geometry, and cause them to appear to repeat the strong horizon line, tending to reduce visual contrast. Operating power tower receivers would likely be seen as distant points of light against either a sky backdrop, or the Gila Bend Mountains, depending on their location within the SEZ. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from Buckeye at night. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected to result from solar energy development within the SEZ, as seen from unscreened viewpoints within Buckeye.

The community of Wintersburg is located approximately 10 mi (16 km) north of the SEZ at the point of closest approach. Views from Wintersburg toward the SEZ would be roughly perpendicular to the long axis of the SEZ, but most of the SEZ would be screened from viewpoints within Wintersburg by the Palo Verde nuclear power plant and the Palo Verde Hills. The SEZ would occupy a large portion of the horizontal field of view from viewpoints within Wintersburg, but only small portions of the SEZ would be visible west of the power plant and in gaps between summits in the Palo Verde Hills. The elevation of Wintersburg is only slightly higher than the SEZ, so the vertical angle of view from Wintersburg to the SEZ would be very low. Collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, conceal their strong regular geometry, and cause them to appear to repeat the strong horizon line, tending to reduce visual contrast. Taller solar facility components and plumes could be visible projecting above the collector/reflector arrays. Operating power tower receivers would likely be seen as bright points of light against the Gila Bend Mountains. If more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from Wintersburg at night. Other lighting associated with solar facilities could be visible as well. Primarily because of extensive screening of the SEZ as seen from Wintersburg, under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected to result from solar energy development within the SEZ.

Other impacts. In addition to the impacts described for the resource areas above, nearby residents and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) from their residences, or as they travel area roads, including but not limited to I-10, State Route 85, Salome Highway, and Old U.S. 80, as noted above. The range of impacts experienced would be highly dependent on viewer location, project types, locations, sizes, and layouts, as well as the presence of screening, but under the 80% development scenario analyzed in the PEIS, strong visual contrasts from solar development within the SEZ could potentially be observed from some locations.

8.3.14.2.3 Summary of Visual Resource Impacts for the Proposed Gillespie SEZ

The proposed Gillespie SEZ is in an area of low scenic quality and with a variety of cultural disturbances visible in the surrounding areas. Because under the 80% development scenario analyzed in this PEIS there could be numerous solar facilities within the SEZ, a variety of technologies employed, and a range of supporting facilities that would contribute to visual impacts, a visually complex, manmade-appearing industrial landscape could result. This essentially industrial-appearing landscape would contrast greatly with the surrounding generally natural-appearing lands. Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with solar energy development within the SEZ due to major modification of the character of the existing landscape. There would be additional impacts from construction and operation of transmission lines and access roads within the SEZ.

Under the 80% development scenario analyzed in the PEIS, utility-scale solar energy development within the proposed Gillespie SEZ is likely to result in strong visual contrasts for some viewpoints within the Signal Mountain WA, which is within 3.5 mi (5.6 km) of the SEZ at the point of closest approach. Strong visual contrasts could also be observed at the Woolsey Peak WA, located 2.1 mi (3.4 km) from the SEZ. Moderate to strong visual contrasts could be observed by visitors to the Saddle Mountain SRMA, located 4.3 mi (6.9 km) from the SEZ. Minimal to weak visual contrasts would be expected for some viewpoints within other sensitive visual resource areas within the SEZ 25-mi (40-km) viewshed.

Approximately 18 mi (29 km) of Agua Caliente Road (also known as the Agua Caliente Scenic Drive) is within the SEZ viewshed, and approximately 2.2 mi (3.5 km) of the road is within the SEZ. Because the road passes through the SEZ, strong visual contrasts could be observed by road users, but because the western approach to the SEZ affords limited visibility of the SEZ, much lower visual contrasts levels would be observed in those parts of the road. Approximately 29 mi (47 km) of Old U.S. 80 is within the SEZ viewshed. Strong visual contrasts could be observed within and near the SEZ by travelers on Old U.S. 80. Approximately 10.8 mi (17.4 km) of the Salome Highway is within the SEZ viewshed, and moderate visual contrast would be expected for most viewpoints on the highway. Residents of nearby areas, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel other area roads.

The communities of Arlington, Palo Verde, Buckeye, and Wintersburg are located within the viewshed of the SEZ, although slight variations in topography and vegetation provide some screening. Strong visual contrasts could be observed within Arlington. Weak visual contrasts could be observed within the other communities.

8.3.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

The presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into nonindustrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. However, the use of mitigation measures would reduce the magnitude of visual impacts experienced. General mitigation measures that may apply are identified in Section 5.12.3. Programmatic design features are presented in Appendix A, Section A.2.2. While the applicability and appropriateness of some mitigation measures would depend on site- and project-specific information that would be available only after a specific solar energy project had been proposed, the following SEZ-specific measure can be identified for the proposed Gillespie SEZ at this time:

- The development of power tower facilities should be prohibited within the SEZ.

The height of solar power tower receiver structures, combined with the intense light generated by the receiver atop the tower, would be expected to create strong visual contrasts that could not be effectively screened from view for most areas surrounding the SEZ, given the broad, flat, and generally treeless expanse of the valley in which the SEZ is located. In addition, for power towers exceeding 200 ft (61 m) in height, hazard navigation lighting that could be visible for very long distances would likely be required. Prohibiting the development of power tower facilities would remove this source of impacts, thus substantially reducing potential visual impacts on Woolsey Peak WA, the Sonoran Desert National Monument, the North Maricopa Mountains WA, the Saddle Mountain SRMA, and Agua Caliente Scenic Drive.

Implementation of programmatic design features intended to reduce visual impacts (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specific level. Given the large scale, reflective surfaces, strong regular geometry of utility-scale solar energy facilities, and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas is the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited.

8.3.15 Acoustic Environment

8.3.15.1 Affected Environment

The proposed Gillespie SEZ is located in the west-central portion of Maricopa County in south-central Arizona. Neither the State of Arizona nor Maricopa County has established quantitative noise-limit regulations applicable to solar energy development.

The Gillespie SEZ sits on the edge of an industrial energy zone, the overall character of which is considered rural to industrial. Old U.S. 80 and State Route 85 run north–south as close as 2 mi (3 km) and 10 mi (16 km) east of the SEZ, respectively. I-10 and I-8 run east–west as close as about 14 mi (22.5 km) north and 20 mi (32 km) south of the SEZ, respectively. A graded gravel county road goes through the western portion of the SEZ. The nearest railroads run about 0.5 mi (0.8 km) northwest of the SEZ and about 21 mi (34 km) south. There are several airports around the SEZ: privately owned Watts Airport, about 10 mi (16 km) north; Mauldin Airstrip, 14 mi (23 km) north–northwest; and Pierce Airport, 15 mi (24 km) northeast. Buckeye Municipal Airport is about 15 mi (24 km) northeast, while Gila Bend Municipal Airport is about 21 mi (34 km) south–southeast. In addition, Gila Bend Air Force Auxiliary Field is located about 24 mi (39 km) south-southeast of the SEZ. Large-scale irrigated agricultural lands are developed as close as 2 mi (3 km) east along old U.S. 80. Grazing is present around the SEZ, and water development has occurred on adjacent lands. To the north and east is the Palo Verde Nuclear Generating Station, three natural gas–fired power plants, an occupied transmission line corridor, several natural gas pipelines and a compressor station, landfills (owned by the City of Phoenix and one private), and Arizona State Prison Complex–Lewis. No sensitive receptors (e.g., residences, hospitals, schools, or nursing homes) exist around the proposed Gillespie SEZ. The nearest residences are about 1.8 mi (2.9 km) east–northeast of the southeastern boundary of the SEZ. The nearest population center with schools is Arlington, about 7 mi (11 km) northeast of the SEZ. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal grazing, and industrial activities. To date, no environmental noise survey has been conducted in the vicinity of the proposed Gillespie SEZ. On the basis of the population density, the day-night average noise level (L_{dn} or DNL) is estimated to be 47 dBA for Maricopa County, in the upper end of the range of 33 to 47 dBA L_{dn} typical of a rural area (Eldred 1982; Miller 2002).[11]

8.3.15.2 Impacts

Potential noise impacts associated with solar projects in the Gillespie SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts associated with operation of heavy equipment and vehicular traffic on the nearest residences (about 1.8 mi [2.9 km] to the southeastern boundary of the SEZ) would be anticipated, albeit of

[11] Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, nighttime levels are 10 dBA lower than daytime levels, and they can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

short duration. During the operations phase, potential impacts on nearby residences would be anticipated, depending on the solar technologies employed. Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed Gillespie SEZ are presented in this section. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional SEZ-specific design features applied (see Section 8.3.15.3 below). This section discusses potential noise impacts on human beings only. Potential noise impacts on wildlife is presented in Section 5.10.2.

8.3.15.2.1 Construction

The proposed Gillespie SEZ has a relatively flat terrain; thus, minimal site preparation activities would be required, and associated noise levels would be lower than those during general construction (e.g., erecting building structures and installing equipment, piping, and electrical).

For the parabolic trough and power tower technologies, the highest construction noise levels would occur at the power block area, where key components (e.g., steam turbine/ generator) needed to generate electricity are located; a maximum of 95 dBA at a distance of 50 ft (15 m) is assumed, if impact equipment such as pile drivers or rock drills is not being used. Typically, the power block area is located in the center of the solar facility, at a distance of more than 0.5 mi (0.8 km) from the facility boundary. Noise levels from construction of the solar array would be lower than 95 dBA. When geometric spreading and ground effects are considered, as explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural background levels. In addition, mid- and high-frequency noise from construction activities is significantly attenuated by atmospheric absorption under the low-humidity conditions typical of an arid desert environment and by temperature lapse conditions typical of daytime hours; thus, noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (370 m) from the power block area, which would be well within the facility boundary. For construction activities occurring near the residences closest to the southeastern boundary of the SEZ, estimated noise levels at the nearest residences would be about 35 dBA, which is below the typical daytime mean rural background level of 40 dBA. This noise might be masked to some extent by noises from road traffic on old U.S. 80 and other nearby industrial and agricultural activities. In addition, an estimated 41 dBA L_{dn} at these residences[12] is well below the EPA guideline of 55 dBA L_{dn} for residential areas.

In addition, noise levels were estimated at the specially designated areas within a 5-mi (8-km) range of the proposed Gillespie SEZ, which is the farthest distance at which noise (other

[12] For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, were conservatively assumed, which result in a day-night average noise level (L_{dn}) of 40 dBA.

than extremely loud noise) would be discernable. There are three specially designated areas within this area: Woolsey Peak WA, Signal Mountain WA, and Saddle Mountain SRMA, located about 2.1 mi (3.4 km) south, 3.5 mi (5.6 km) southwest, and 4.3 mi (6.9 km) northwest of the SEZ, respectively. For construction activities occurring near the specially designated areas, noise levels are estimated to be about 34, 28, and 26 dBA at the boundaries of Woolsey Peak WA, Signal Mountain WA, and Saddle Mountain SRMA, respectively, all of which are below the typical daytime mean rural background level of 40 dBA. Therefore, construction noise from the SEZ is not likely to adversely affect any of the nearby specially designated areas (Manci et al. 1988), as discussed in Section 5.10.2.

Depending on soil conditions, pile driving might be required for installation of solar dish engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively small and quiet, in contrast to the impulsive impact pile drivers frequently seen at large-scale construction sites. Potential impacts on the nearest residences would be anticipated to be negligible, considering the distance (about 1.8 mi [2.9 km] from the SEZ boundary).

It is assumed that most construction activities would occur during the day, when noise is better tolerated than at night because of the masking effects of background noise. In addition, construction activities for a utility-scale facility are temporary (typically a few years). Construction within the proposed Gillespie SEZ would cause minor but unavoidable and localized short-term noise impacts on neighboring communities, even when construction occurs near the southeastern boundary of the SEZ, close to the nearest residences.

Construction activities could result in various degrees of ground vibration, depending on the equipment used and construction methods employed. All construction equipment causes ground vibration to some degree, but activities that typically generate the most severe vibrations are high-explosive detonations and impact pile driving. As is the case for noise, vibration would diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction phase, no major construction equipment that can cause ground vibration would be used, and no residences or sensitive structures are close. Therefore, no adverse vibration impacts are anticipated from construction activities, including pile driving for dish engines.

Construction of a new transmission line has not been assessed for the Gillespie SEZ, assuming connection to the existing 500-kV line would be possible; impacts on the acoustic environment would be evaluated at the project-specific level if new transmission construction or line upgrades were to occur. In addition, some construction of transmission lines could occur within the SEZ and over a short distance (0.6 mi [1.0 km]) to the regional grid. Potential noise impacts on nearby residences from such construction would be a minor, temporary component of construction impacts.

8.3.15.2.2 Operations

Noise sources common to all or most types of solar technologies include equipment motion from solar tracking, maintenance and repair activities (e.g., washing mirrors or replacing broken mirrors) at the solar array area, commuter/visitor/support/delivery traffic within and around the solar facility, and control/administrative buildings, warehouses, and other auxiliary buildings/structures. Diesel-fired emergency power generators and firewater pump engines would be additional sources of noise, but their operations would be limited to several hours per month (for preventive maintenance testing).

For the main solar energy technologies, noise-generating activities in the PV solar array area would be minimal, related mainly to solar tracking, if used. On the other hand, dish engine technology, which employs collector and converter devices in a single unit, generally has the strongest noise sources.

For the parabolic trough and power tower technologies, most noise sources during operations would be in the power block area, including the turbine generator (typically in an enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically located in the center of the facility. On the basis of a 250-MW parabolic trough facility with a cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels around the power block would be more than 85 dBA, but about 51 dBA at the facility boundary, about 0.5 mi (0.8 km) from the power block area. For the power block near the southeastern boundary of the SEZ (no 0.5-mi [0.8-km] buffer distance due to a narrow strip of the SEZ), the predicted noise level would be about 39 dBA at the nearest residences, about 1.8 mi (2.9 km) from the SEZ boundary, which is comparable to the typical daytime mean rural background level of 40 dBA. However, this noise might be masked to some extent by noises from road traffic on old U.S. 80 and other nearby industrial and agricultural activities. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[13]), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block area and thus would be just outside the proposed boundary of the SEZ. At the nearest residences, about 41 dBA L_{dn} would be estimated, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, day-night average noise levels higher than those estimated above by using simple noise modeling would be anticipated if TES were used during nighttime hours, as explained below and in Section 4.13.1.

On a calm, clear night typical of the proposed Gillespie SEZ setting, the air temperature would likely increase with height (temperature inversion) because of strong radiative cooling. Such a temperature profile tends to focus noise downward toward the ground. There would be little, if any, shadow zone[14] within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions add to the effect of noise being more discernable during nighttime hours, when the background noise levels are

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[13] Twelve hours is the maximum possible number of operating hours at the summer solstice, but 7 to 8 hours is the maximum at the winter solstice.

[14] A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

lowest. To estimate the day-night average noise level (L_{dn}), 6-hour nighttime generation with TES is assumed after 12-hour daytime generation. For nighttime hours under temperature inversion, 10 dB is added to noise levels estimated from the uniform atmosphere (see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the nearest residences (about 1.8 mi [2.9 km] from the SEZ boundary) would be 49 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 51 dBA L_{dn}, which is below the EPA guideline of 55 dBA L_{dn} for residential areas. These assumptions were conservative in terms of operating hours, and no credit was given to other attenuation mechanisms, so it is likely that noise levels would be lower than 51 dBA L_{dn} at the nearest residences, even if TES were used at a solar facility. Consequently, operating parabolic trough or power tower facilities using TES and located near the southeastern boundary of the SEZ could result in some noise impacts on the nearest residences, depending on background noise levels and meteorological conditions.

Estimated noise levels associated with the operation of a parabolic trough or power tower solar facility would be about 37, 32, and 30 dBA at the boundaries of Woolsey Peak WA, Signal Mountain WA, and Saddle Mountain SRMA, respectively, all of which are below the typical daytime mean rural background level of 40 dBA. Therefore, operation noise from the SEZ is not likely to adversely affect any of nearby specially designated areas (Manci et al. 1988).

In the permitting process, refined noise propagation modeling would be warranted along with measurement of background noise levels.

The solar dish engine is unique among CSP technologies, because it generates electricity directly and does not require a power block. A single, large solar dish engine has relatively low noise levels, but a solar facility might employ tens of thousands of dish engines, which would cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar Two, LLC 2008). At the proposed Gillespie SEZ, on the basis of the assumption of dish engine facilities of up to 233-MW total capacity (covering 80% of the total area, or 2,094 acres [8.47 km^2]), up to 9,308 25-kW dish engines could be employed. For a large dish engine facility, about 100 step-up transformers would be embedded in the dish engine solar field, along with a substation; however, the noise from these sources would be masked by dish engine noise.

The composite noise level of a single dish engine would be about 88 dBA at a distance of 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA (typical of the mean rural daytime environment) within 330 ft (100 m). However, the combined noise level from hundreds of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, for example, about 47 dBA at 1.0 mi (1.6 km) and 42 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both values are higher than the typical daytime mean rural background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residences, it was assumed dish engines were placed all over the Gillespie SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residences, about 1.8 mi (2.9 km) from the SEZ boundary, would be about 38 dBA, which is below the typical daytime mean rural background level of 40 dBA. This noise might be masked to some extent by noises from road traffic on old U.S. 80 and other nearby industrial and agricultural activities. On the basis of 12-hr daytime operation, the estimated 41 dBA L_{dn} at these residences is well below the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other noise attenuation mechanisms, noise levels at the nearest residences would be lower than the values estimated above. However, noise from dish engines could cause adverse impacts on the nearest residences, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, estimated noise levels would be about 39, 38, and 34 dBA at the boundaries of Woolsey Peak WA, Signal Mountain WA, and Saddle Mountain SRMA, respectively, all of which are below the typical daytime mean rural background level of 40 dBA. Therefore, dish engine noise from the SEZ is not likely to adversely affect any of nearby specially designated areas (Manci et al. 1988).

Consideration of minimizing noise impacts is very important during the siting of dish engine facilities. Direct mitigation of dish engine noise through noise control engineering could also limit noise impacts.

During operations, no major ground-vibrating equipment would be used. In addition, no sensitive structures are located close enough to the proposed Gillespie SEZ to experience physical damage. Therefore, during operation of any solar facility, potential vibration impacts on surrounding communities and vibration-sensitive structures would be negligible.

Transformer-generated humming noise and switchyard impulsive noises would be generated during the operation of solar facilities. These noise sources would be located near the power block area, typically near the center of a solar facility. Noise from these sources would generally be limited within the facility boundary and not be heard at the nearest residences, assuming a 1.8-mi (2.9-km) distance (for the power block next to the southeastern boundary of the SEZ). Accordingly, potential impacts of these noise sources on the nearest residences would be negligible.

For impacts from transmission line corona discharge noise during rainfall events (Section 5.13.1.5), the noise level at 50 ft (15 m) and 300 ft (91 m) from the center of a 230-kV transmission line tower would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of daytime and nighttime mean background noise levels in rural environments. The noise levels at 65 ft (20 m) and 300 ft (91 m) from the center of 500-kV transmission line towers would be about 49 and 42 dBA, typical of high-end and mean, respectively, daytime background noise levels in rural environments. Corona noise includes high-frequency components, which may be judged to be more annoying than other environmental noises. However, corona noise would not likely cause impacts, unless a residence was located close to the source (e.g., within 500 ft [152 m] of a 230-kV transmission line and 0.5 mi [0.8 km] of a 500-kV transmission line). The proposed Gillespie SEZ is located in an arid desert environment, and incidents of corona discharge would be infrequent. Therefore, potential impacts on nearby residents along the transmission line ROW would be negligible.

8.3.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation would include dismantling of solar facilities and support facilities such as buildings/structures and mechanical/electrical installations, disposal of debris, grading, and revegetation as needed. Activities for decommissioning would be similar to those for construction but more limited. Potential noise impacts on surrounding communities would be correspondingly lower than those for construction activities. Decommissioning activities would be of short duration, and their potential impacts would be minor and temporary. The same mitigation measures adopted during the construction phase could also be implemented during the decommissioning phase.

Similarly, potential vibration impacts on surrounding communities and vibration-sensitive structures during decommissioning of any solar facility would be lower than those during construction and thus negligible.

8.3.15.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, measures that can be identified at this time include the following:

- Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residences to the east of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.

- Dish engine facilities within the Gillespie SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be located in the central or northwestern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at the nearest residences.

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8.3.16 Paleontological Resources

8.3.16.1 Affected Environment

The surface geology of the proposed Gillespie SEZ is composed predominantly of residual materials developed in sedimentary rocks. These discontinuous residual deposits account for 1,427 acres (5.8 km^2), or 55% of the SEZ. Portions of the SEZ are composed of more than 100-ft (30-m) thick alluvial deposits ranging in age from the Pliocene to Holocene. The alluvial deposits cover 1,191 acres (4.8 km^2), or 45%, of the SEZ. In the absence of a PFYC map for Arizona, a preliminary classification of PFYC Class 3b is assumed for the alluvial deposits and the residual materials (see also Sections 8.1.16.1 and 8.2.16.1). Class 3b indicates that the potential for the occurrence of significant fossil materials is unknown and needs to be investigated further (see Section 4.14 for a discussion of the PFYC system). There is also a potential for Miocene fauna from the basin fill deposits. Rhinoceros and camel have been documented at Anderson Mine in southwestern Yavapai County (Morgan and White 2005). These finds indicate the potential for other similar finds in the region.

8.3.16.2 Impacts

The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the discontinuous residual materials developed in sedimentary rocks as well as the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed following consultation with the BLM. The appropriate course of action would be determined as established in BLM IM2008-9 and IM2009-011 (BLM 2007b, 2008b). Section 5.14 discusses the types of impacts that could occur on any significant paleontological resources found within the Gillespie SEZ. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2.

Indirect impacts on paleontological resources outside of the SEZ, such as through looting or vandalism, are unknown but possible if any such resources are at or near the surface. Areas adjacent to the SEZ should be investigated for surface outcrops of potential fossil-bearing formations during the paleontological survey of the SEZ. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

Approximately 3 mi (5 km) of new road is anticipated to be needed to access the proposed Gillespie SEZ from Old Highway 80, resulting in about 22 acres (0.09 km^2) of disturbance to alluvial sediments (classified as PFYC Class 3b deposits) and volcanic rocks (classified as PFYC Class 1) east of the SEZ. Class 1 indicates that the occurrence of significant fossils is nonexistent or extremely rare. The potential for impacts on significant paleontological resources in the anticipated access road corridor is unknown for the alluvial deposits and very low for the volcanic areas. Similar to the SEZ footprint, a more detailed investigation of the alluvial deposits is needed and a paleontological survey will likely be required, but no further work is anticipated for the PFYC Class 1 volcanic areas. No new transmission lines are currently anticipated for the Gillespie SEZ, assuming the existing transmission system would be used; therefore, no impacts on paleontological resources are anticipated related to the creation of new transmission corridors. However, impacts on paleontological resources related to the creation of new corridors not assessed in this PEIS would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur.

Programmatic design features requiring a stop-work order in the event of an inadvertent discovery of paleontological resources would reduce impacts by preserving some information and allowing possible excavation of the resource, if warranted. Depending on the significance of the find, it could also result in some modification to the project footprint. Since the SEZ is located in an area classified as PFYC Class 3b, a stipulation would be included in permitting documents to alert solar energy developers of the possibility of a delay if paleontological resources are uncovered during surface-disturbing activities.

8.3.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, including a stop-work stipulation in the event that paleontological resources are encountered during construction, as described in Appendix A, Section A.2.2.

The need for and the nature of any SEZ-specific design features would depend on the findings of the paleontological surveys. Mitigation is not likely to be needed in the PFYC Class 1 volcanic areas located within a portion of the access road corridor.

8.3.17 Cultural Resources

8.3.17.1 Affected Environment

8.3.17.1.1 Prehistory

The proposed Gillespie SEZ is located in the northern Sonoran Desert, within the basin and range province in western Arizona. The earliest known use of the area was likely during the Paleoindian Period, sometime between 12,000 and 10,000 B.P. Surface finds of isolated Paleoindian projectile points, the hallmark of the Clovis culture, have been discovered in the Painted Rocks area, 14 mi (23 km) southwest of the proposed Gillespie SEZ; south of the SEZ in the interior desert south of Gila Bend on the Barry M. Goldwater Range; and at Ventana Cave, about 74 mi (119 km) southeast of the SEZ. The southeastern portion of Arizona has the one of the highest concentrations of Paleoindian cultural material in North America, but the area around the proposed Gillespie SEZ likely was not as conducive to Late Pleistocene occupation as other areas. The majority of Paleoindian sites occur in the transition zone between mountain and desert environments, and most of the sites that have been found in the desert are located close enough to the transition zone to assume that they were likely located there during Paleoindian times. In addition to projectile points, the Clovis culture is characterized by a hunting and gathering subsistence economy, following migrating herds of Pleistocene megafauna. Paleoindian sites are typically characterized by either fluted or unfluted projectile points, extinct mega fauna, chipped stone tools, and bone and horn implements. Sites related to Paleoindian occupation are usually either kill sites, where large numbers of animals were slaughtered, or sites that are thought to be base camps. Tools were fashioned from either chert or obsidian; sources of obsidian are located in the Sand Tank Mountains 34 mi (54 km) southeast, the South Sauceda Mountains 37 mi (60 km) south, and the Vulture Mountains 42 mi (67 km) north of the SEZ (BLM 2010b; Martin and Plog 1973; NROSL 2009; Reid and Whittlesey 1997).

The Archaic Period began at the end of the Pleistocene, about 10,000 to 8,000 B.P., and continued until the advent of ceramics, about 2,000 B.P. Also referred to as the Cochise Culture, the Archaic lifeways were similar to those of their Paleoindian predecessors, hunting and gathering wild animals and plants, yet plants took on a greater role because there were no longer the megafauna on which to subsist, and smaller animals such as deer, antelope, and rabbits were hunted. Consequently, plant grinding tools, such as manos and metates, are more prevalent in the archaeological record. Archaic people likely followed a seasonal round of movement, harvesting and hunting what was available at that place and time; therefore these ephemeral sites are difficult to distinguish. Within 5 mi (8 km) of the proposed Gillespie SEZ, an Archaic Period lithic scatter and fire cracked rock (AZ T:9:27 [ASM]) was found. In addition, Archaic Period sites have been discovered in the Harquahala Mountains, 43 mi (69 km) north of the SEZ, in the Centennial Wash area on the Harquahala Plain, 15 mi (24 km) northwest of the SEZ, as well as at Ventana Cave. Because Archaic Period people were so mobile, they maintained light and portable equipment; baskets, milling stones, and spear points are the hallmarks of the Archaic culture. It is assumed that Archaic Period groups would have lived and traveled with groups of related families when local resources were abundant, but during hard times groups likely dispersed, separated from other families or bands by environmental features such as deserts or mountain ranges. It is possible that groups may have isolated themselves in resource-rich regions for sustained periods of time, resulting in vast tracts of land that would have been unpopulated for long spans of time. Other artifacts associated with southern Arizonan Archaic Period lifeways are sleeping circles or camp clearings, trails, shrines, rock alignments, petroglyphs, and zoomorphic intaglios. Three petroglyph sites (AZ T:13:32[ASM], AZ T:13:17[ASM], and AZ T:13:120[ASM]) have been documented east of the SEZ, one of which, AZ T:13:120[ASM], is made up of more than 100 glyphs (Reid and Whittlesey 1997).

The Late Archaic Period saw the beginnings of agriculture in Arizona. The Sonoran Desert is believed to have been the heartland from which corn agriculture spread to the rest of Arizona. In the middle of the twentieth century it was proposed that corn agriculture spread to Arizona, from Mexico via the Sierra Madre corridor, to the Mogollon highlands, into the Colorado Plateau, and then into the Sonoran Desert, prior to being adopted by the rest of the region. More recent research has suggested the opposite, that the Sonoran Desert's warm growing conditions and the planting of corn at low elevations using well-watered floodplains was more conducive to corn agriculture and the technology spread widely from the Sonoran Desert into the rest of Arizona. While these Late Archaic farmers were growing corn, it was not their only means of subsistence, and therefore they continued to maintain a seasonal round of hunting and gathering, while retaining a residence for a period of time near their fields to plant and harvest their crops. Their base camps were located in lowlands, likely occupied in the summer; these clusters of houses usually formed a generally circular arrangement with pits located in the floors of houses or in areas between houses for the storage of tools and food. Often the floors of houses were completely taken up by the storage pits and there were no hearths in the houses, leading some archaeologists to believe that the primary function of the houses was for storage and not habitation. Some Late Archaic sites have been found to have large, domed-shaped structures, believed to be ceremonial in nature. The artifacts found in these structures were likely used in a religious context, for example, a baton made of phyllite, pigments, figurines, bone tubes, and worked shell pieces. It is believed that these structures were the predecessors to the subsurface kivas constructed by later southwestern groups. Late Archaic groups were also known to have produced ceramics, although they were not fashioned into containers but figurines and beads (Matson 1991; Reid and Whittlesey 1997).

With the end of the Archaic Period, two distinct groups occupied the area in the vicinity of the proposed Gillespie SEZ. The Hohokam people were largely centered around the Gila River and its tributaries, and the Patayan culture was focused on the Colorado River and its tributaries. The proposed Gillespie SEZ is located on the far western portion of the known Hohokam area, so both Patayan and Hohokam are discussed.

There are two branches of the Hohokam culture, the River Hohokam and the Desert Hohokam, the tradition beginning around A.D. 300 and extending until A.D. 1450. The River Hohokam lived in large villages, sometimes occupied for hundreds of years, and utilized the river to irrigate their crops through the construction of canals. The ability to establish long-term occupations because of the river as a reliable water source allowed extensive public architectural projects to be undertaken and craft specialization to occur. At some River Hohokam sites, platform mounds and ball courts have been excavated, site AZ T 9:1[ASM], was found to the east of the SEZ within 5 mi (8 km), consisting of a ball court and ceramic sherd scatter. It has been suggested that the construction of large-scale irrigation projects, platform mounds, and ball courts is reflective of a complex social and political relationship among the Hohokam. The area around the Gila Bend and the Painted Rocks Reservoir, just 12 mi (20 km) south of the SEZ, is rich in Hohokam Period sites and artifacts. The Desert Hohokam relied on flood water and rainwater for farming. They lived in the valleys and bajadas that were not near the river zones and planted their fields on alluvial fans and at the mouth of washes. Because the Desert Hohokam relied on more ephemeral sources of water, they did not develop the long-term occupation of sites and social complexity that the River Hohokam were able to. Both the River and Desert Hohokam groups supplemented their diet through the collection of wild plants and hunting, helping to provide some subsistence reliability during difficult agricultural times. During the course of the Hohokam culture, settlements became more and more densely populated, with material culture shifting and ceremonial and agricultural practices changing. The archaeological assemblage associated with the Hohokam cultural tradition consists of ceramics (vessels and figurines); bedrock mortars; carved, ground, and flaked stone artifacts; shell jewelry; and stone bowls with effigies. In addition to the previously mentioned site, four Hohokam Period sites have been found within 5 mi (8 km) of the SEZ, all east of the SEZ toward the Gila River. Site AZ T:13:14[ASM] is a Hohokam Period ceramic sherd scatter, as is site AZ T:9:2[ASM]. A ceramic sherd and lithic scatter, AZ T:13:21[ASM], also consisting of historic trash, with about 11,500 total artifacts, is a site eligible for inclusion on the NRHP. Another multicomponent site, AZ T:13:18[ASM], is a Hohokam and Patayan village with burials and both a historic and prehistoric canal. Evidence of Hohokam occupation in the archaeological record becomes very sparse during the late fourteenth and fifteenth centuries, suggesting that either the culture changed its lifeways significantly enough to affect interpretation of cultural materials related to the Hohokam or the Hohokam left the area, possibly due to excessive flooding, oversalinization of agricultural fields, or conflicts with competing groups (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007; Reid and Whittlesey 1997).

The Patayan culture occupied different regions of the Colorado River Valley; some groups were concentrated in the upland environments, others in the lowlands. Similar to the Desert Hohokam, the Patayan culture used floodwater to irrigate their crops, with the first evidence of the Patayan culture seen about A.D. 700. Most Patayan sites were not permanent, generally indicating temporary habitation or activity camps, although a few large Patayan sites have been located on the southwestern portion of the Gila River representing longer term village settlements. It is believed that the Patayan and Hohokam maintained a friendly relationship, with interaction between the groups increasing through time. The Patayan moved seasonally, occupying the river valleys in the summer, maintaining their horticultural endeavors, and moving to the uplands to exploit piñon nuts and other upland resources. Trade was important for the Patayan people; they created a vast network of trails, used not only for trade but also for travel and connecting ceremonial territories. Along the trails, cairns and shrines can be found, as well as campsites, intaglios, cleared circles, and petroglyphs. It is believed that the Patayan culture was the antecedent culture to some of the contemporary Native American groups that were in the area—the Maricopa, Mohave, Quechan, and Yavapai, but some suggest Hohokam derivation instead. Pima groups are thought to have been descended from the Hohokam culture (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007; Reid and Whittlesey 1997).

8.3.17.1.2 Ethnohistory

The proposed Gillespie SEZ is situated in the traditional tribal use area of a community of Yuman-speaking groups that came to be known as the Maricopa. They ranged along the Salt and Gila River system from the Superstition Mountains in the east to the Mohawk Mountains in the west. To the east they were interspersed with their allies, the Akimel O'odham or Pima (Harwell and Kelly 1983).

Maricopa

The term "Maricopa" is an English abbreviation of the Spanish term "Cocomaricopa," applied to Yuman speakers occupying an area stretching from the lower Gila River east of the Quechan to the Colorado River south of the Mohave, sometimes referred to as the Panya (Bean et al. 1978). Probable descendants of the prehistoric Patayan culture, they seem to have arrived along the Gila River near Gila Bend during the thirteenth century (Harwell and Kelly 1983). The Panya group living along the Colorado River was also known as the Halchidhoma. As with their Yuman neighbors, the Panya appear to have lived in dispersed settlements near areas suitable for floodplain agriculture. From these settlements they dispersed to hunt and gather upland resources in a seasonal round. Part of a trading network that stretched as far as the Pacific Ocean, they were allied with the Cahuilla on the west and the Pima on the east. Until the early nineteenth century they remained beyond the direct control of Spanish authorities, but retained sufficient contact to selectively adopt elements of Euro-American culture, among the most important of which was winter wheat, which allowed them to raise both summer (maize) and winter crops. Also important were horses, for which they traded captives as slaves (Bean et al. 1978).

In 1827, the Panya living along the Colorado and the neighboring Kahwan came under attack by an alliance among the Mohave, Quechan, and Yavapai. The Kahwan were taken captive and the Halchidhoma Panya were driven from their valley and upland ranges. They initially took refuge in Sonora, but later established themselves on the middle Gila River, where they were eventually joined by the Kahwan and the remnants of other Yuman-speaking groups, the Kavelchadom and Halyikwamai (Bean et al. 1978; Harwell and Kelly 1983). Partly as a defense against raiding Apache, this Maricopa amalgam allied itself with the neighboring Pima, who practiced irrigation agriculture. Beginning in the late 1840s, the Maricopa and Pima were producing crops they could sell to Americans beginning to pass through to California—first contingents of the U.S. Army and then Euro-American forty-niners. Maricopa and Pima agriculture continued to supply travelers. Congress granted them a reservation in the middle Gila Valley in 1859. However, after the Civil War, gold was discovered in western Arizona. American farmers began to arrive, settling upstream and diverting the water used by the Pima and Maricopa. With reduced agricultural production, the Maricopa and Pima relied more on the gathering of wild foods, and many moved to the Salt River Valley, where a second reservation had been established by 1879. With the coming of the railroad in 1877, there was no longer a market for supplying travelers on the road west. However, the trains brought tourists, who purchased intricate baskets and pottery produced by Maricopa women. Men became involved in the new economy as wage laborers. After the passage of the Indian Reorganization Act of 1934, the Gila River and Salt River reservations organized under its provisions (Bean et al. 1978; Harwell and Kelly 1983). While few Maricopa now farm, recently the Maricopa and Pima have actively sought to regain their water rights in the hopes of restoring an agricultural base to their communities (Lewis and Hestand 2006).

In the summer, the Maricopa took shelter in open-sided ramadas. For winter use they built flattened dome-shaped, earth-covered structures built on a rectangular four-post frame tied together by mesquite or ironwood beams, similar to the winter houses of the Quechan. As with other mobile groups in the Southwest, they were expert basket makers but were well-versed in the making of pottery by the paddle and anvil method. Using small looms, they wove cloth bands. Stone manos and metates along with wooden mortars were used to process plant material. Other traditional material culture included stone knives and stone tipped arrows, along with netting used in rabbit drives (Spier 1970). Maricopa descendants can be found on the Gila Bend and Salt River Pima–Maricopa Reservations.

Akimel O'odham (Pima)

The Native Americans commonly referred to as Pima call themselves Akimel O'odham, "the river people," to distinguish themselves from the Tohono O'odham or "desert people," commonly known as Papago. Linguists describe their language as belonging to the Piman branch of the Uto-Aztecan family. Traditionally they lived along the Gila and Salt Rivers and their tributaries from west of the Salt–Gila confluence to as far east as the San Pedro River. Located in the core area of the prehistoric Hohokam culture, they are very likely descended from it. Like the Hohokam, their subsistence base included irrigation agriculture supplemented by hunting and gathering (Ezell 1983; Fontana 1983a).

Regular contact with the Spanish, beginning in 1690, resulted in important changes for the Akimel O'odham. Prior to Mexican independence in 1821, there was little or no direct Hispanic colonization of the Salt–Gila valley. Rather, the Pima were treated as important trading partners. The Spanish introduced wheat, which the Pima could plant in the winter to supplement their traditional summer crops of maize, beans, and squash. Surplus yield was traded with the Spanish. The Pima were drawn into a market economy, and their population appears to have increased (Ezell 1983; Hackenberg 1983). Cultural exchange with the Spanish continued, and the Akimel O'odham adopted some aspects of Christianity.

Traditionally, the Akimel O'odham dwelt in circular brush dwellings with earthen roofs supported by mesquite or ironwood posts with mesquite or saguaro cross ties. These dwellings were grouped into household compounds. Settlements included compounds, public buildings, and ceremonial space often surrounded by agricultural fields. Traditional artifacts include a variety of basketry used for carrying and storing food as well as winnowing. Stone manos and metates and wooden mortars were used to process grains and mesquite. The Pima were competent potters (Bahr 1983; Ezell 1983; Fontana 1983a).

Already tied to the Maricopa by trade ties and military alliance, the Akimel O'odham received Maricopa refugees driven from the Colorado River Valley by the Quechan and

Mohave in 1827. The Maricopa and other Yuman speakers mainly settled downstream along the Gila, but interaction and intermarriage resulted in shared occupation of the area. By 1846, the U.S. military appeared in the area followed by Americans and Mexicans heading for the gold fields of California. Already accustomed to engaging in agricultural production for the market, the Pima and Maricopa profited by selling food to those traveling through the area. Initially, the Pima and Maricopa aided the U.S. Cavalry against their common enemy, the Apache. The discovery of mineral wealth in western Arizona in the 1860s brought an influx of permanent American settlers, among whom were ranchers and farmers who sought the same limited water supply used by the Pima. They obtained it by diverting water upstream from the Native American irrigation systems, forcing an increased reliance on wild foods and a change from independent farmers to wage laborers. Even with the establishment of reservations beginning in 1879, water continued to be diverted from Piman fields. After reorganization under the Indian Reorganization Act of 1934 and the return of those who served in the military in World War II, the Akimel O'odham became more assertive in developing their resources, including reclaiming their water rights (DeJong 2004, 2007; Ezell 1983). Akimel O'odham descendants can be found on the Gila River, Salt River, and Ak Chin reservations, as well as in the surrounding communities (Fontana 1983a).

Tohono O'odham (Papago)

The Tohono O'odham are the southern neighbors of the Akimel O'odham, both of which are Upper Piman Tribes speaking dialects of the same language. Their traditional use area was away from permanent streams but in the Arizona Upland vegetation zone of the Sonoran Desert, which receives somewhat more rainfall than the desert lands to the west. They were transhumant, spending winters in mountain foothills near permanent springs and summers in intermontane plains, where they depended on summer rains to farm the mouths of mountain washes. Typically, their dwellings were made of brush (Fontana 1983b).

Spanish contact with Upper Pimans was initiated by the Jesuits in 1687, introducing wheat, horses, and cattle. Friars were able to recruit natives for their missions, where they encountered European culture, Christianity, and diseases. Discovery of silver in 1736 near the current international border attracted Spanish prospectors followed by military and civilian farmers and ranchers. The Upper Pimans allied with the Spanish against their common enemy, the Apache; however, Spanish settlers never penetrated the Tohono O'odham heartland. In 1821, Mexico gained independence from Spain, and there was an increase of Mexican immigration. At about the same time, trappers from Canada and the United States penetrated as far as the Gila River in search of beaver pelts. The Treaty of Hidalgo, ending the Mexican War, left the Tohono O'odham in Mexico. However, the Gadsen Purchase moved the border southward, dividing the Tohono O'odham Nation. Initially, the international boundary had no meaning for the Tohono O'odham, who continued to travel throughout their traditional territory. However, by the 1890s most had migrated north of the border. Tohono O'odham interaction with the newly arriving Americans was similar to that of the Akimel O'odham, with some Tohono O'odham adapting to the new economy as wage laborers. Reservations were set aside for the Tohono O'odham at Mission San Xavier near Tucson in 1874 and at Gila Bend in 1882. The latter proved to be something of a northern outlier. A much larger reservation was created within their traditional use area in 1916 extending from the Mexican border into Pinal and Maricopa Counties. In 1937, the Tribe organized under the Indian Reorganization Act of 1934. Except for San Xavier lands allotted to individuals under the Dawes Act of 1887, reservation lands belong to the Tribe. Successful enterprises on the reservation include cattle ranching, mining leases, and gaming (Fontana 1983b). The Gila Bend Reservation included a successful 750-acre farm until it was inundated by the construction of the Painted Rock Dam.

8.3.17.1.3 History

After Christopher Columbus landed in the Caribbean in 1492, Spanish exploration of the Americas quickly ensued, with Spain claiming vast tracts of land in the New World in the name of King Ferdinand and Queen Isabella. There is some debate as to which of the Spanish explorers made the first entry into Arizona. Some historians believe it was Alvar Nunez Cabeza de Vaca, a Spaniard who shipwrecked off the coast of Texas in 1528 and developed friendly relations with the Native Americans, who then helped to guide him to Mexico City. It has been suggested that Cabeza de Vaca may have passed through the southeastern corner of Arizona on his travels, but because he did not have any way of recording where he was, his exact route is unknown. Cabeza de Vaca is important to the history of Arizona, not only because he may have been the first European presence in the state but also because he claimed to have been told and seen some of the "Seven Cities of Cibola," fictitious cities full of gold and wealth, ripe for Spanish plundering. When Cabeza de Vaca eventually got to Mexico City in 1536, he spread the rumors of these fabled cities, which led to the desire of other Spaniards to search for riches in the hope of finding another civilization rich in gold similar to the Aztec in Mexico. The first documented expedition into what is today Arizona was headed by Fray Marcos de Niza, in 1539. Fray Marcos wanted to assure the Native Americans who he encountered on his expedition that they would be treated well, as news of the poor treatment of Native Americans by European explorers had preceded the actual presence of the explorers. Accompanying Fray Marcos was an African slave, Estebanico, who had survived the journey along with Cabeza de Vaca, and Francisco Vazquez de Coronado, the governor of a northern Mexican province. After stopping in Mexico at Vacapa, Fray Marcos sent Estebanico ahead with orders to scout the area and wait for the rest of the explorers. Estebanico did not follow Fray Marcos' orders and entered Arizona, where he may have reached the Piman villages near Tucson, before heading farther north to the Zuni pueblo, Cibola. Estebanico was killed by the Zuni, and Fray Marcos followed his trail north, claiming all the land along the way in the name of New Spain. He claimed to have made his way to Cibola and, after returning to Mexico City, also claimed to have seen vast riches at the city. In 1540 Francisco Vazquez de Coronado led an expedition to officially lay claim to these rumored cities of gold and led his expedition into eastern Arizona, following the Sonora and San Pedro Rivers and then into New Mexico, and may have made his way as far as Kansas before heading back to Mexico City empty-handed. Also funded by the Coronado expedition was Hernando de Alarcon, who sailed up the Gulf of California and explored the Colorado delta area, perhaps going as far north as the Gila and Colorado confluence. When Coronado came back without any gold or any prospects for further exploration, the Spanish stayed out of most of the hostile desert southwest for the next 40 years (BLM 2010b; Farish 1915; Kessell 2002; Sheridan 1995).

Antonia de Espejo explored portions of northern and central Arizona in 1583 in an effort to find precious metals. Espejo traded with the Hopi and discovered silver and copper deposits east of Prescott, Arizona, about 85 mi (137 km) north of the proposed Gillespie SEZ. In 1604 Juan de Onate, a Mexican-born Spaniard who had settled in northern New Mexico, explored portions of Arizona north of the SEZ along the Bill Williams Fork, to its confluence with the Colorado River, and followed the Colorado River south to the Gulf of California, likely coming within 95 mi (153 km) west of the proposed Gillespie SEZ.

The Spanish did not maintain an established presence in Arizona, other than a few short-lived missions in the south central portion of the state, until the 1736 discovery of large silver deposits near Nogales, 177 mi (285 km) southeast of the proposed Gillespie SEZ. Most of the prospectors who came to mine the silver and stayed in Arizona were forced to make their living as subsistence farmers and ranchers, because mining did not prove lucrative for another 100 years. The first permanent Spanish settlement in Arizona was at Tubac, just north of Nogales, in an effort to prevent uprisings of the O'odham Tribe. The Spanish attempted to build permanent settlements along the Lower Colorado River, but hostile Yuman Tribes prevented any sustained development. With Apache hostility in the northern and eastern portions of the state, Spanish settlement was basically restricted to the Tucson area and south (Kessell 2002; Sheridan 1995).

Missionary explorer Eusebio Francisco Kino made nine different expeditions into the territories of California and Arizona, establishing relationships with the Yuman and Piman groups in the area. Kino was one of the first Europeans to explore the area around the proposed Gillespie SEZ, as he was known to have explored the Gila Bend area in 1699. In 1775 Juan Batista de Anza was authorized by the viceroy of New Spain to lead a group of settlers from Tubac to the San Francisco Bay area. De Anza set out along the Santa Cruz River, which he followed to the Gila River, then to the confluence with the Colorado River, and into California. This expedition established a trail that eventually became a congressionally designated National Historic Trail, passing just 17 mi (27 km) south of the proposed Gillespie SEZ (Kessell 2002).

In 1810 Mexicans declared their independence from Spanish colonial rule and in 1821 won the war. Mexican authority and control in Arizona was disjointed, and often states would act independently from the rest of the country. Increasingly tense relations between Native Americans and the non-Native occupiers were intensified with the expansion of ranchers and homesteaders into Native American areas, leading to several conflicts. The Mexican-American War began in 1846 with the United States eyeing the Rio Grande River and California Territory, and two years later the Treaty of Guadalupe was signed, giving the United States control of Texas, New Mexico (which included Arizona north of the Gila River), and California. When the Gadsden Purchase was made in 1854, the United States gained control of Arizona south of the Gila River and the Mesilla Valley of New Mexico, and settlement of the area increased to previously unseen levels (Kessell 2002; Sheridan 1995).

Prior to the Mexican-American War, Americans had ventured into Arizona on fur-trapping expeditions. The first known American fur-trappers in Arizona were Sylvester Pattie and his son James in 1825, trapping along the San Francisco, Gila, and San Pedro Rivers in the southeastern portion of Arizona. Frequently hostilities broke out between Native Americans and fur trappers, but the trappers did not remain in the state long enough to make much of an economic or ecological impact. One of the first and largest U.S. expeditions to cross Arizona at the time was made by the Mormon Battalion in 1846. Led by Lieutenant Colonel Phillip St. George Cooke, the group intended to establish a wagon trail across the southern Great Plains and the Southwest. The Mormon Battalion was the first representative of the U.S. Government to encounter the Mexican population, a nonconfrontational meeting. The trail that the Mormon Battalion took later became a part of the Gila Route, or Southern Overland Route, a network of Native American and European trails that entered the state in the east, converged on the Pima villages on the Gila River, and traversed the Gila River floodplain to the Colorado and Gila River confluence, likely passing just 17 mi (27 km) south of the SEZ (Sheridan 1995).

Most occupation of Arizona after the acquisition of the territory by the U.S. Government was concentrated in the southern part of the state in mining ventures. It was not until the establishment of Fort Yuma on the California side of the Colorado River, and other nearby military garrisons, when Americans began to settle in the region near the proposed Gillespie SEZ. The forts provided the necessary security against Native Americans who resented the American occupation of their land and who were competing for the same resources as the miners and ranchers settling in the desert. After the start of the Civil War, most of the military personnel in Arizona were withdrawn, leaving the settlers to their own defenses until the end of the war (Sheridan 1995; Stone 1982).

In 1857, 20 mi (32 km) up the Gila River from the Colorado junction, Arizona's first boomtown, Gila City, was established after a gold strike. The largest and most prosperous gold mine in Arizona occurred at Vulture Mine, near Wickenburg, about 40 mi (64 km) north of the proposed Gillespie SEZ. The creation of canals, roads, and other infrastructure helped to increase the population of Arizona and their ability to grow crops, export and import goods, and maintain the mines. The Phoenix Stage Route was established as part of this infrastructure, leading to Wickenburg becoming a transportation hub and the headquarters of the Arizona-California Stage Company. During the 1870s copper, silver, gold, and other less valuable minerals were mined fervently throughout the state, and with the construction of railroads in 1881 and 1882, mining only increased. The Southern Pacific Railroad was an important rail line that connected Los Angeles, California, to Deming, New Mexico. A spur connected to this line passes less than 1 mi (1.6 km) north of the SEZ, designated as site AZ T:10:84[ASM]. Construction of the railroad was completed in 1881, and it was the second transcontinental railroad in the United States. Associated with the railroad is the Crag Railroad Station, site AZ T:9:25[ASM], located within 5 mi (8 km) of the proposed Gillespie SEZ (Stone 1982; Sheridan 1995).

Settlement, ranching, and mining in Arizona are dependent upon water regulation and dispersal, and consequently water control projects were started early in the development of Arizona. Often prehistoric canals were used and/or expanded in order to facilitate water usage. Just as in prehistoric times, people would generally settle only in places where water was available. Numerous canals were constructed using the water from the Gila River, and in the vicinity of the proposed Gillespie SEZ are the historic Enterprise Canal, the Arlington Canal, the Gila Bend Canal, and the Buckeye Canal.

The U.S. military has a long relationship with the southwestern desert. The vast, uninhabited lands make it prime real estate for training exercises. Large amounts of the desert west of the proposed Gillespie SEZ were used for training troops for the North African invasion in World War II, with bases and air fields placed throughout the desert. Most of those bases are not very close to the proposed SEZ, except for Luke Air Force Base, southeast of the SEZ. Luke Air Force Base was established for training pilots during World War II and continues to operate as a training facility for the U.S. Air Force. Under the control of the Luke Air Force Base are the Barry M. Goldwater Range and the Gila Bend Auxiliary Air Field, just 23 mi (37 km) south of the SEZ, and the proposed Gillespie SEZ is in the Airspace Consultation Area of the DoD. The YPG was established in 1963, covering 990,000 acres (4,006 km^2) north of the Gila River, the closest portion to the proposed Gillespie SEZ being about 43 mi (69 km) west. While the YPG was not established until the mid-twentieth century, the presence of the U.S. Army in the Yuma area has been felt since the construction of the first fort there in 1850 and subsequent periodic occupation of the area by the military. The YPG consists of the Yuma Test Center, the Tropic Regions Test Center, and the Cold Regions Test Center, each center specializing in a specific type of military testing. The purpose of the YPG is as a test facility for all branches of the military, from artillery and bomb testing to automotive and helicopter tests (Stone 1982, 1986; Wullenjohn 2010).

8.3.17.1.4 Traditional Cultural Properties—Landscape

According to Maricopa beliefs, certain features of the landscape house beings or spirits of power; all are culturally important. Some of these are places where dreams of power may be sought. In traditional Maricopa culture, power and success are achieved through dreaming. Others define cultural boundaries and have protective powers. Caves of power are reported from the Painted Rocks Mountains, 16 mi (26 km) south of the SEZ on the other side of the Gila Bend Mountains, to “Bat’s House,” a butte south of Tempe. Other mountains have protective spirits that define the Maricopa homeland and may fight the spirits of the mountains in enemy lands. These include Sierra Estrella, 38 mi (61 km) east of the SEZ, and Pima Butte, 46 mi (75 km) southeast. Other peaks of power include the Salt River Range, 40 mi (64 km) east; “Water Divider,” 31 mi (50 km) east; an outlier of the Sierra Estrella Range, just west of the Gila–Salt confluence; and the Mohawk Mountains, 61 mi (99 km) southwest along the Gila River (Spier 1970). None of these mountains is close to the proposed SEZ, and those to the east are at least partially obscured by intervening mountains. Closer to the proposed SEZ, the Gila Bend Mountains have been identified as a source of traditional plant resources, known rock art panels, sacred areas, and burials (Bean et al. 1978). While the reservation closest to the proposed SEZ is the San Lucy District of the Tohono O’odham (Gila Bend Indian Reservation), the center of the Tohono O’odham universe, Baboquivari Mountain, is located far to the south, about 50 mi (80 km) west of Tucson (Joseph 1949).

Places sacred to the Pima include locations in the San Tan Hills and near Gila Crossing (Russell 1975). These are well east of the SEZ (65 mi [105 km] and 38 mi [61 km], respectively) behind intervening mountains and would not be visible. In the past, the Akimel O’odham and Tohono O’odham have continued to revere Hohokam sacred places (Russell 1975). Site

AZ T9:1[ASM], a Hohokam platform mound and ball court located less than 5 mi (8 km) from the SEZ, is likely to be of importance to the Pima and Papago.

8.3.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources

In the proposed Gillespie SEZ, five cultural resource surveys, four linear surveys, and one block survey have been conducted, covering a very small percentage of the SEZ. These surveys have not recorded any resources within the boundaries of the SEZ; however, 59 surveys that have been conducted within 5 mi (8 km) of the proposed Gillespie SEZ have recorded 30 sites. Of these 30 sites, 14 are prehistoric, 11 are historic, and 5 are multicomponent sites, consisting of both prehistoric and historic resources. Two of the prehistoric sites within 5 mi (8 km) have been determined eligible for inclusion on the NRHP, one site (AZ T:13:121[ASM]) is a petroglyph site southeast of the SEZ, and the other (AZ T:9:1[ASU]) is a ceramic sherd and lithic scatter northeast of the SEZ. Several other sites with significant prehistoric cultural resources have not been evaluated for NRHP eligibility, but, if assessed, could be added to the list of NRHP-eligible properties. Three of the multicomponent sites are eligible for listing on the NRHP. Site AZ Z:2:66[ASM] is the Gila Bend Canal, both a historic and prehistoric canal. Another site, AZ T:13:18[ASM], is a historic canal and Hohokam and Patayan village considered eligible for inclusion on the NRHP. A site consisting of 11,500 prehistoric and historic artifacts, AZ T:13:21[ASM], is also an NRHP-eligible site. Five NRHP-eligible historic period properties are within 5 mi (8 km) of the proposed Gillespie SEZ. Site AZ T:10:84[ASM] is the Southern Pacific Railroad, just north of the SEZ, and site AZ T:9:25[ASM] is the Crag Railroad Station, associated with the rail line. The Arlington Canal, AZ T:10:80[ASM], northeast of the SEZ, is eligible for inclusion on the NRHP. Arlington Elementary School, AZ T:9:88[ASM], is a historic school that is still currently used by the local school district. East of the proposed Gillespie SEZ is Old Highway State Route 80, originally constructed in 1932 and eligible for inclusion on the NRHP.

The BLM has designated several ACECs and SCRMAs in the vicinity of the proposed Gillespie SEZ, because these areas have been determined to be rich in cultural resources and worthy of having the resources managed and protected by the BLM. The closest designated area to the proposed Gillespie SEZ is the Sears Point ACEC, 27 mi (43 km) southwest of the SEZ. The Harquahala ACEC is 37 mi (60 km) northwest of the SEZ, and contained almost entirely within the ACEC is the Harquahala SCRMA. These ACECs and SCRMAs are designated to protect the Harquahala Peak Observatory and Historic District (which is listed on the NRHP), Ellison's Camp and historic trails, as well as several prehistoric habitation camps, milling areas, and rock art sites. The Black Butte ACEC is 35 mi (56 km) north of the SEZ and is designated to protect an obsidian source used by the Native Americans prehistorically and the ecological resources there. The Wickenburg/Vulture SCRMA is 45 mi (72 km) north of the proposed Gillespie SEZ; this SCRMA was designated to protect the historic sites and roads associated with mining and settlement in the area, as well as a prehistoric obsidian source. Situated just 12 mi (19 km) southeast of the proposed Gillespie SEZ is the Sonoran Desert National Monument, a 487,000-acre (1,971-km^2) parcel of land that protects significant archaeological and historical sites, historic trails, and several WAs. Fifty miles (80 km) east of the proposed Gillespie SEZ is the Hohokam Pima National Monument, a congressionally designated area that protects the archaeological sites affiliated with "Snaketown," a significant Hohokam settlement on the Gila River Indian Reservation (BLM 2007a, 2010c).

National Register of Historic Places

There are no properties in the SEZ listed in the NRHP, but one property is within 5 mi (8 km) of the SEZ. The Gillespie Dam Highway Bridge, spanning the Gila River, was built in 1927 and is situated just 3 mi (5 km) southeast of the SEZ. There are 325 properties in Maricopa County listed in the NRHP, 280 of which are located in the Phoenix metropolitan area, about 40 mi (64 km) east of the proposed Gillespie SEZ. The Wickenburg area, 49 mi (79 km) north of the SEZ, maintains 23 NRHP properties. In the immediate vicinity of the proposed Gillespie SEZ is the Hassayampa River Bridge, 9 mi (14 km) northeast of the SEZ. Painted Rocks is an archaeological site with extensive petroglyphs and other prehistoric resources, 19 mi (30 km) southwest of the proposed Gillespie SEZ. The Gila Bend Overpass, another NRHP-listed property, is 21 mi (34 km) south of the SEZ. In the vicinity of Gila Bend are two archaeological sites situated farther than 10 mi (16 km) south of the SEZ, the Gatlin Site and the Fortaleza Site. The initial point of the Gila and Salt Rivers baseline and meridian, the point which governs surveys in Arizona, is 34 mi (55 km) east of the SEZ. In Morristown, 43 mi (69 km) north of the SEZ, is the Morristown Store. The other properties in Maricopa County listed on the NRHP are far enough from the SEZ so as not to be affected by solar development (in excess of 60 mi [97 km]): Carefree (Brazaletes Pueblo Site and Sears-Kay Ruin), Rio Verde Estates (Azatlan Archaeological Site), Punkin Center (Sunflower Ranger Station), Cave Creek (Cave Creek Service Station and Tubercular Cabin), New River (Sun-Up Ranch), and Fort McDowell, all northeast of the SEZ; and Queen Creek (Rittenhouse Elementary School), Tortilla Flat (Boulder Creek Bridge, Fish Creek Bridge, Lewis and Pranty Creek Bridge, Mormon Flat Bridge, and Pine Creek Bridge), and Apache Junction (Skeleton Cave Massacre), all east of the SEZ.

8.3.17.2 Impacts

Direct impacts on significant cultural resources in the proposed Gillespie SEZ could occur; however, further investigation is needed. A cultural resources survey of the entire APE of a proposed project, including consultation with affected Native American Tribes, would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP as historic properties. The proposed Gillespie SEZ has potential for containing significant prehistoric sites, especially in the eastern portion, because it is close to the Gila River. There is also potential for historic resources, especially in the area north of the SEZ near the Southern Pacific Railroad and also in the area near the Gila River. Section 5.15 discusses the types of effects that could occur on any significant cultural resources found to be present within the proposed Gillespie SEZ. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Programmatic design features to reduce water runoff and sedimentation would prevent the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ boundary (including along ROWs).

The nearest road to the SEZ is Old Highway 80, about 3 mi (5 km) east of the proposed Gillespie SEZ. Construction of an access road intersecting Old Highway 80 would result in the disturbance of 22 acres (0.09 km^2). Old Highway 80 is a property eligible for inclusion on the NRHP; a final determination of this property's eligibility status would need to be made prior to modification of the road. Indirect impacts, such as vandalism or theft, could occur if significant resources are close to the ROW. Programmatic design features assume that the necessary surveys, evaluations, and consultations for the ROW will occur, as with the project footprint within the SEZ. No needs for new transmission lines have currently been identified, assuming the existing transmission system would be used; therefore, no additional areas of cultural concern would be made accessible as a result of development within the proposed Gillespie SEZ. However, impacts on cultural resources related to the creation of new corridors not assessed in this PEIS would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur.

8.3.17.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate adverse effects on significant cultural resources, such as avoidance of significant sites and features and cultural awareness training for the workforce, are provided in Appendix A, Section A.2.2.

SEZ-specific design features would be determined in consultation with the Arizona SHPO and affected Tribes following the completion of cultural surveys.

Recordation of historic structures through Historic American Building Survey/Historic American Engineering Record protocols through the NPS would also be appropriate and could be required if any historic structures or features would be affected, for example, if the Gillespie Dam Highway Bridge is to be used as an off-site access route for a solar energy project.

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8.3.18 Native American Concerns

As discussed in Section 8.3.17, Native Americans often view their environment holistically and share many environmental and socioeconomic concerns with other ethnic groups. For a discussion of issues of possible Native American concern shared with the population as a whole, several sections in this PEIS should be consulted. General topics of concern are addressed in Section 4.16. Issues of human health and safety are discussed in Section 5.21. Specifically for the proposed Gillespie SEZ, Section 8.3.17 discusses archaeological sites, structures, landscapes, and traditional cultural properties; Section 8.3.8 discusses mineral resources; Section 8.3.9.1.3 discusses water rights and water use; Section 8.3.10 discusses plant species; Section 8.3.11 discusses wildlife species, including wildlife migration patterns; Section 8.3.13 discusses air quality; Section 8.3.14 discusses visual resources; and Sections 8.3.19 and 8.3.20 discuss socioeconomics and environmental justice, respectively. This section focuses on concerns that are specific to Native Americans and to which Native Americans bring a distinct perspective.

All federally recognized Tribes with traditional ties to the proposed Gillespie SEZ have been contacted so that they could identify their concerns regarding solar energy development. The Tribes contacted with traditional ties to the Gillespie SEZ are listed in Table 8.3.18-1. Appendix K lists all federally recognized Tribes contacted for this PEIS.

To date, no comments have been received from the Tribes specifically referencing the proposed Gillespie SEZ. However, commenting on past transmission line projects in the area, members of the Tohono O'odham Nation expressed concerns with the following resources, in order of importance: game animals (deer, rabbits, peccary), viewshed, wild food plants (yucca, cholla, saguaro, prickly pear, mesquite), rock art, medicinal plants, minerals (copper and clay), sacred areas, and cremation and burial zones (Bean et al. 1978).

8.3.18.1 Affected Environment

Traditionally, the Gila River corridor was occupied by at least three Native American ethnic groups: Maricopa, Akimel O'odham (Pima), and Tohono O'odham (Papago). Long-term allies and in some cases linguistically related, the groups have experienced considerable mixing.

TABLE 8.3.18-1 Federally Recognized Tribes with Traditional Ties to the Proposed Gillespie SEZ

Tribe	Location	State
Ak Chin Indian Community	Maricopa	Arizona
Gila River Indian Community	Sacaton	Arizona
Hopi Tribe	Kykotsmovi	Arizona
Salt River Pima-Maricopa Indian Community	Scottsdale	Arizona
Tohono O'odham Nation	Sells	Arizona

The Handbook of North American Indians (Ortiz 1983) does not draw a territorial dividing line between the Akimel O'odham and the Tohono O'odham. It does distinguish a separate Maricopa territory within the Gila Corridor from the Gila Bend downstream as far as the Mohawk Mountains, yet a modern reservation associated with the Tohono O'odham lies within that territory and Maricopa descendants are living in the Gila and Salt River reservations in what is shown as Pima/Papago territory. The proposed Gillespie SEZ lies within the traditional range of the Maricopa, as shown in the handbook. The Indian Claims Commission included the area in the judicially established Pima-Maricopa traditional territory (Royster 2008).

8.3.18.1.1 Traditional Tribal Use Areas

Maricopa

Traditionally the Maricopa ranged along the Gila and Salt Rivers and their tributaries from the Superstition Mountains in the east– northwest to just below New River, westward to the Hassayampa Valley, and along the Gila River as far west as the Mohawk Mountains (Harwell and Kelly 1983). The Indian Claims Commission included most of these lands in judicially recognized territory of the Pima-Maricopa (Royster 2008). Today, elements of the Maricopa are found at Lehi on the Salt River Reservation and Laveen near the confluence of the Gila and Salt Rivers on the Gila River Reservation. Maricopa descendants also live in nearby urban centers (Harwell and Kelly 1983).

Akimel O'odham (Pima)

Except for the western reach of the Gila River from just above its confluence with the Hassayampa River to the Mohawk Mountains, traditionally Akimel O'odham or Pima villages were scattered over the same territory as the Maricopa. This shared territory was recognized by the Indian Claims Commission in judicially establishing a joint traditional territory. Akimel O'odham can be found on the Ak Chin, Gila River, and Salt River reservations and in nearby communities.

Tohono O'odham (Papago)

The Tohono O'odham traditionally lived in the deserts south of the Akimel O'odham and Maricopa away from the rivers. They extended southwards into modern Sonora Mexico as far as the Gulf of California (Fontana 1983a). The Indian Claims Commission recognized Papago traditional territory as extending south from Pima-Maricopa and Western Apache lands to the international border, and as far west as the eastern borders of the Lower Colorado Valley (Royster 2008). Today, Tohono O'odham communities can be found on the Ak Chin and Tohono O'odham reservations in Arizona and in urban communities in Arizona and California (Fontana 1983b).

8.3.18.1.2 Plant Resources

This section focuses on those Native American concerns that have an ecological as well as a cultural component. For many Native Americans, the taking of game or the gathering of plants or other natural resources may have been seen as both a sacred and secular act (Bean et al. 1978; Stoffle et al. 1990).

Traditionally, the Maricopa, Akimel O'odham, and Tohono O'odham all relied on a diversified subsistence base, including farming, hunting, and gathering and, after the arrival of the Spanish, raising livestock. The degree to which each group relied on each method varied. The Maricopa and Akimel O'odham were more dependent on irrigation agriculture, while the Tohono O'odham relied more heavily on hunting and gathering and for the most part practiced rainfall agriculture in the uplands (Hackenberg 1983). The proposed Gillespie SEZ lies within the traditional Maricopa range but is only 16 mi (26 km) from a Tohono O'odham reservation (San Lucy Village). The reservation is only 3 mi (5 km) from the Gila River and parallel to Centennial Wash, and it is likely that traditionally the SEZ was a hunting and gathering area exploited by groups practicing irrigation agriculture along the Gila. This is supported by the presence of two known prehistoric canal systems within 5 mi (8 km) of the proposed SEZ. The variability of the desert climate rendered a broad resource base necessary for survival. Access to both wild and cultivated resources was desirable (Hackenberg 1983). Rural Native Americans commenting on previous energy development projects in the area have voiced concern over the loss of culturally important plants used for food, medicine, and ritual purposes and for tools, implements, and structures (Bean et al. 1978).

The plant communities observed or likely to be present at the proposed Gillespie SEZ are discussed in Section 8.3.10. According to the southwestern Gap analysis, the land cover at the proposed Gillespie SEZ is predominantly Sonora-Mojave Creosotebush-White Bursage Desert Scrub, interspersed with patches of Sonoran Paloverde-Mixed Cacti Desert Scrub (USGS 2005a).

Native American populations have traditionally made use of hundreds of native plants. Table 8.3.18.1-1 lists plants often mentioned as important by the Maricopa and O'odham that either were observed at the proposed Gillespie SEZ or are probable members of the cover type plant communities identified for the SEZ. These plants are the dominant species; however, other plants important to Native Americans could occur in the SEZ, depending on localized conditions and the season. Overall, creosotebush dominates the SEZ, while cacti, mesquite, and sparse wild grasses are present. Creosotebush is important in traditional Native American medicine and as a food plant. Mesquite was among the most important food plants. Its long, bean-like pods were harvested in the summer, could be stored, and were widely traded; its blossoms are edible. Saltbush seeds were harvested, processed, and eaten.

8.3.18.1.3 Other Resources

Water is an essential prerequisite for life in the arid areas of the Southwest. As long-time desert dwellers, Native Americans have a great appreciation for the importance of water in a

TABLE 8.3.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Gillespie SEZ

Common Name	Scientific Name	Status
Food		
Cat's Claw	*Acacia greggii*	Possible
Cholla Cactus	*Opuntia* spp.	Observed
Creosotebush	*Larrea tridentata*	Observed
Honey Mesquite	*Prosopis Glandolosa*	Possible
Ironwood	*Olneya tesota*	Possible
Prickly Pear Cactus	*Opuntia* spp.	Possible
Saguaro Cactus	*Carnegiea gigantean*	Observed
Saltbush	*Atriplex* spp.	Possible
Screwbean Mesquite	*Prosopis pubescens*	Possible
Wolfberry	*Lycium fremontii*	Possible
Yellow Paloverde	*Parkinsonia microphylla*	Observed
Medicine		
Creosotebush	*Larrea tridentata*	Possible
Screwbean Mesquite	*Prosopis pubescens*	Possible
Unspecified		
Bursage (Burro Bush)	*Ambrosia dumosa*	Possible

Sources: Field visit; Bean et al. (1978); Russell (1975); Hackenberg (1983); USGS (2005a).

desert environment. They have expressed concern over the use and availability of water for solar energy installations (Jackson 2009). Tribes are also sensitive about the use of scarce local water supplies for the benefit of distant communities and recommend that determination of adequate water supplies be a primary consideration for whether a site is suitable for the development of a utility-scale solar energy facility (Moose 2009). Water is a particularly sensitive issue for southern Arizona Tribes, who in the past have seen their ancestral water rights ignored and water they depended on for irrigation diverted by Euro-American settlers (DeJong 2004, 2007). While no surface water flows through the proposed SEZ, the effects of pumping groundwater on Native American water rights is of concern.

Close to riverine settlements and along the trail network that linked the Gila River with the Colorado River, the proposed Gillespie SEZ would have been well known to dwellers along the river. Any plant or animal resources available would have been exploited. The Gila Bend Mountains adjacent to the proposed SEZ on the southwest provide habitat for deer and bighorn sheep, which may occasionally have been present in the valley as well. Pronghorn antelope are possible in the area. While big game was highly prized, smaller animals, such as black-tailed jackrabbits and desert cottontail, traditionally provided a larger proportion of the protein in the Native American diet (Spier 1970). The proposed SEZ provides suitable habitat for both. Wildlife likely to be found in the proposed Gillespie SEZ is described in Section 8.3.11. Native

American game species whose range includes the SEZ are listed in Table 8.3.18.1-2. Native Americans have expressed concern over ecological segmentation, that is, development that fragments animal habitat and does not provide corridors for movement. They would prefer solar energy development take place on land that has already been disturbed, such as abandoned farmland, rather than on undisturbed ground (Jackson 2009).

Mineral resources important to Native Americans in the Sonoran Desert include clay for pottery, stone for making tools, and minerals for pigments. None of these has been reported in the proposed Gillespie SEZ.

8.3.18.2 Impacts

The impact of development of the SEZ on water resources is likely to be of major concern to affected Tribes. The San Lucy District of the Tohono O'odham Reservation (Gila Bend Reservation) is just 16 mi (26 km) south and downstream of the proposed SEZ. Extreme groundwater drawdown in the area of the proposed Gillespie SEZ could result in less groundwater inflow into the Gila Bend groundwater basin, leading to some depletion over time in the aquifer underlying the reservation.

TABLE 8.3.18.1-2 Animal Species Used by Native Americans Whose Range Includes the Proposed Gillespie SEZ

Common Name	Scientific Name	Status
Mammals		
Badger	*Taxidea taxus*	All year
Bighorn sheep	*Ovis Canadensis*	All year
Black-tailed jackrabbit	*Lepus californicus*.	All year
Desert cottontail	*Silvilagus audubonii*	All year
Kit fox	*Vulpes macotis*	All year
Mountain lion	*Puma concolor*	All year
Mule deer	*Odocoileus hemionus*.	All year
Pronghorn	*Antilocapra Americana*	All year
Wood rats	*Neotoma* spp.	All year
Birds		
Doves	*Columbina* spp.	All year
	Zenaida spp.	All year
Gambel's quail	*Callipepla gambelii*	All year

Sources: Hackenberg (1983); Russell (1975); Spier (1970); USGS (2005b).

Other impacts that would be expected from solar energy development within the proposed Gillespie SEZ on resources important to Native Americans fall into two major categories: impacts on the landscape and impacts on discrete localized resources.

Potential landscape-scale impacts are those caused by the presence of an industrial facility within a cultural landscape that includes sacred mountains and other geophysical features often tied together by a network of trails. Impacts may be visual—the intrusion of an industrial feature in sacred space; audible—noise from the construction, operation or decommissioning of a facility detracting from the traditional cultural values of the site; or demographic—the presence of a larger number of outsiders in the area that would increase the chance that the cultural importance of the area would be degraded by increased foot and motorized traffic. In past consultations, the Gila Bend Mountains have been identified as culturally important (Bean et al. 1978). As consultation with the Tribes continues and project-specific analyses are undertaken, it is possible that there will be Native American concerns expressed over potential visual effects on the landscape of solar energy development within the proposed SEZ.

Localized effects could occur both within the proposed SEZ and in adjacent areas. Within the SEZ these effects would include the destruction or degradation of important plant resources, destruction of the habitat of and interference with the movement of culturally important animal species, destruction of archaeological sites and burials, and the degradation or destruction of trails. Plant resources are known to exist in the SEZ. Any ground-disturbing activity associated with development within the SEZ has the potential for destroying localized resources. However, significant tracts of Sonora-Mojave Creosote Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub would remain outside the SEZ, and anticipated overall effects on these plant populations would be small. Animal species important to Native Americans are shown in Table 18.3.18.1-2. While the construction of utility-scale solar energy facilities would reduce the amount of habitat available to many of these species, similar habitat is abundant and the effect on animal populations is likewise likely to be small.

Since solar energy facilities cover large tracts of ground, even taking into account the implementation of programmatic design features, it is unlikely that avoidance of all resources would be possible. Programmatic design features (see Appendix A, Section A.2.2) assume that the necessary cultural surveys, site evaluations, and Tribal consultations will occur. Implementation of programmatic design features, as discussed in Appendix A, Section A.2.2, should eliminate impacts on Tribes' reserved water rights and the potential for groundwater contamination issues.

8.3.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate impacts of potential concern to Native Americans, such as avoidance of sacred sites, water sources, and Tribally important plant and animal species, are provided in Appendix A, Section A.2.2.

The need for and nature of SEZ-specific design features regarding potential issues of concern would be determined during government-to-government consultation with affected Tribes listed in Table 8.3.18-1.

Mitigation of impacts on archaeological sites and traditional cultural properties is discussed in Section 8.3.17.3, in addition to the mitigation strategies for historic properties discussed in Section 5.15.

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8.3.19 Socioeconomics

8.3.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the ROI surrounding the proposed Gillespie SEZ. The ROI is a one-county area consisting of Maricopa County in Arizona. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and nonpayroll expenditures from the construction, operation, and decommissioning phases of potential future facilities in the proposed SEZ are expected to take place.

8.3.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 1,876,247 (Table 8.3.19.1-1). Over the period 1999 to 2008, the annual average employment growth rate in Maricopa County was 2.1%, slightly lower than the 2.3% average rate for Arizona as a whole.

In 2006, the service sector provided the highest percentage of employment in the ROI at 49%, followed by wholesale and retail trade with 18.1% (Table 8.3.19.1-2). Smaller employment shares were held by construction (10.3%), finance, insurance and real estate (9.9%), and manufacturing (7.3%).

8.3.19.1.2 ROI Unemployment

Over the period 1999 to 2008, the average unemployment rate in Maricopa County was 4.2%, slightly lower than the 4.8% average rate for all of Arizona (Table 8.3.19.1-3). The unemployment rate for 2009 (8.3%) contrasts with the rate for 2008 (5.1%). The average rate

TABLE 8.3.19.1-1 ROI Employment for the Proposed Gillespie SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Maricopa County	1,531,553	1,876,247	2.1
Arizona	2,355,357	2,960,199	2.3

Sources: U.S. Department of Labor (2009a,b).

TABLE 8.3.19.1-2 ROI Employment for the Proposed Gillespie SEZ, by Sector, 2006

Industry	Maricopa County	% of Total
Agriculture[a]	11,098	0.7
Mining	1,835	0.1
Construction	171,087	10.3
Manufacturing	120.867	7.3
Transportation and public utilities	83,990	5.0
Wholesale and retail trade	302,087	18.1
Finance, insurance, and real estate	164,953	9.9
Services	815,970	49.0
Other	91	0.0
Total	1,665,052	

[a] Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009).

TABLE 8.3.19.1-3 ROI Unemployment Rates (%) for the Proposed Gillespie SEZ

Location	1999–2008	2008	2009[a]
Maricopa County	4.2	5.1	8.3
Arizona	4.8	5.5	9.1

[a] Rates for 2009 are the average for January through May.

Sources: U.S. Department of Labor (2009a–c).

for Arizona as a whole (9.1%) was also higher during this period than the corresponding average rates for 2008.

8.3.19.1.3 ROI Urban Population

The population of Maricopa County in 2008 was more than 92% urban (Table 8.3.19.1-4). The largest urban area, Phoenix, had an estimated 2008 population of 1,577,812; other large cities include Mesa (459,160), Chandler (252,885), Glendale (250,746), Scottsdale (236,496), Tempe (171,444), and Peoria (158,093). These cities are part of the

TABLE 8.3.19.1-4 ROI Urban Population and Income for the Proposed Gillespie SEZ

	Population			Median Household Income ($ 2008)		
City	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
Phoenix	1,321,045	1,577,812	2.2	53,055	49,933	–0.7
Mesa	396,375	459,160	1.9	55,128	51,180	–0.8
Chandler	176,581	252,885	4.6	75,211	70,924	–0.7
Glendale	218,812	250,746	1.7	57,957	52,083	–1.2
Scottsdale	202,705	236,496	1.9	74,012	72,033	–0.3
Gilbert	109,697	211,892	8.6	87,592	80,705	–0.9
Tempe	158,625	171,444	1.0	54,540	50,147	–0.9
Peoria	108,364	158,093	4.8	67,207	65,730	–0.2
Surprise	30,848	92,679	14.7	56,852	64,465	1.4
Avondale	35,883	81,111	10.7	63,285	61,665	–0.3
Goodyear	18,911	62,170	16.0	74,022	76,823	0.4
Buckeye	6,537	47,340	28.1	45,814	65,514	4.1
Fountain Hills	20,235	25,170	2.8	79,335	81,377	0.3
El Mirage	7,609	24,701	15.9	43,535	52,109	2.0
Queen Creek	4,316	23,850	23.8	82,017	78,828	–0.4
Paradise Valley	13,664	14,949	1.1	193,421	NA[b]	NA
Tolleson	4,974	7,179	4.7	49,921	NA	NA
Wickenburg	5,082	6,618	3.4	40,835	NA	NA
Guadalupe	5,228	5,936	1.6	38,740	NA	NA
Cave Creek	3,728	5,416	4.8	77,171	NA	NA
Litchfield Park	3,810	5,116	3.8	92,540	NA	NA
Youngtown	3,010	4,885	6.2	29,824	NA	NA
Carefree	2,927	3,852	3.5	114,205	NA	NA
Gila Bend	1,980	1,830	–1.0	34,744	NA	NA

[a] Data are averages for the period 2006–2008.

[b] NA = data not available.

Source: U.S. Bureau of the Census (2009b-d).

Phoenix metropolitan region, and most are more than 100 mi (160 km) from the site of the proposed SEZ.

Population growth rates among the cities in Maricopa County have varied over the period 2000 and 2008. Buckeye grew at an annual rate of 28.1% during this period; higher than average growth was also experienced in Queen Creek (23.8%), Goodyear (16%), El Mirage (15.9%), Surprise (14.7%), and Avondale (10.7%). Seven other cities in the county had growth rates that were higher than the state average of 3.5%.

8.3.19.1.4 ROI Urban Income

Median household incomes varied considerably across cities in Maricopa County (Table 8.3.19.1-4). Ten of the cities for which data are available for 2006 to 2008 had median household incomes that were higher than the state average of $56,348. Fountain Hills ($81,377) and Gilbert ($80,705) had the highest incomes. A number of cities, including Paradise Valley ($193,421), Carefree ($114,205), Litchfield Park ($92,540), and Cave Creek ($77,171), had median incomes in 1999 that were higher than the state average of $57,999. Five cities, including Phoenix ($49,933), Tempe ($50,147), and Mesa ($51,180) had median incomes in 2006 to 2008 that were lower than the state average.

Among the cities in Maricopa County for which data are available, median income growth rates between 1999 and 2006 to 2008 were highest in Buckeye (4.1%), El Mirage (2.0%) and Surprise (1.4%), with annual growth rates of less than 1% elsewhere. Ten cities in the county had negative income growth rates between 1999 and 2006 to 2008. The average median household income growth rate for the state as a whole over this period was –0.2%.

8.3.19.1.5 ROI Population

Table 8.3.19.1-5 presents recent and projected population in Maricopa County and in the state as a whole. Population in the county stood at 3,958,263 in 2008, having grown at an average annual rate of 3.2% since 2000. Population growth in the county was slightly higher than the 3.0% experienced by Arizona as a whole over the same period. The county population is expected to increase to 5,374,643 by 2021 and to 5,568,104 by 2023.

8.3.19.1.6 ROI Income

Total personal income in Maricopa County stood at $151.0 billion in 2007 and has grown at an annual average rate of 4.0% over the period 1998 to 2007 (Table 8.3.19.1-6). Per-capita

TABLE 8.3.19.1-5 ROI Population for the Proposed Gillespie SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Maricopa County	3,072,149	3,958,263	3.2	5,374,643	5,568,104
Arizona	5,130,632	6,499,377	3.0	8,945,447	9,271,163

Sources: U.S. Bureau of the Census (2009e,f); Arizona Department of Commerce (2010).

TABLE 8.3.19.1-6 ROI Personal Income for the Proposed Gillespie SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Maricopa County			
Total income[a]	101.7	151.0	4.0
Per-capita income	34,944	38,998	1.1
Arizona			
Total income[a]	149.2	215.8	3.8
Per-capita income	30,551	33,926	1.1

[a] Unless indicated otherwise, values are reported in $ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

income in the county also rose over the same period at a rate of 1.1%, increasing from $34,944 to $38,998. The personal income growth rate in the county was higher than the state rate (3.8%),but the per-capita income growth rate was the same in the county as for Arizona as a whole (1.1%).

Median household income in 2006 to 2008 in Maricopa County stood at $56,555 (U.S. Bureau of the Census 2009d).

8.3.19.1.7 ROI Housing

In 2007, almost 1,536,500 housing units were located in Maricopa County (Table 8.3.19.1-7). Owner-occupied units accounted for about 68% of the occupied units in the county, with rental housing making up 32% of the total. Vacancy rates in 2007 were 12.9% in Maricopa County. There were 198,423 vacant housing units in 2007, of which 63,356 are estimated to be rental units that would be available to construction workers. There were 49,637 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in Maricopa County grew at an annual rate of 3.0% over the period 2000 to 2007, with 286,240 new units added to the existing housing stock (Table 8.3.19.1-7).

The median value of owner-occupied housing in Maricopa County in 2006 to 2008 was $263,600 (U.S. Bureau of the Census 2009g).

TABLE 8.3.19.1-7 ROI Housing Characteristics for the Proposed Gillespie SEZ

Parameter	2000	2007[a]
Maricopa County		
Owner-occupied	764,547	910,811
Rental	368,339	427,237
Vacant units	117,345	198,423
Seasonal and recreational use	49,637	NA[b]
Total units	1,250,231	1,536,471

[a] 2007 data for number of owner-occupied, rental, and vacant units for Arizona counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

[b] NA = data not available.

Sources: U.S. Bureau of the Census (2009h-j).

8.3.19.1.8 ROI Local Government Organizations

The various local and county government organizations in Riverside County are listed in Table 8.3.19.1-8. In addition, there are five Tribal governments located in the county; members of other Tribal groups are located in the state, but their Tribal governments are located in adjacent states.

8.3.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

Schools

Table 8.3.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Maricopa County schools in 2007 was 18.8, while the level of service in Maricopa County was 8.6.

Health Care

There were 11,993 physicians in Maricopa County in 2007, and the number of doctors per 1,000 population was 3.1 (Table 8.3.19.1-10).

TABLE 8.3.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Gillespie SEZ

Government	
City	
Avondale	Litchfield Park
Buckeye	Mesa
Carefree	Paradise Valley
Cave Creek	Peoria
Chandler	Phoenix
El Mirage	Queen Creek
Fountain Hills	Scottsdale
Gila Bend	Surprise
Gilbert	Tempe
Glendale	Tolleson
Goodyear	Wickenburg
Guadalupe	Youngtown
County	
Maricopa County	
Tribal	
Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation, Arizona	
Fort McDowell Yavapai Nation, Arizona	
Gila River Indian Community of the Gila River Indian Reservation, Arizona	
Salt River Pima-Maricopa Indian Community of the Salt River Reservation, Arizona	
Yavapai-Apache Nation of the Camp Verde Indian Reservation, Arizona	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

TABLE 8.3.19.1-9 ROI School District Data for the Proposed Gillespie SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Maricopa County	624,346	33,244	18.8	8.6

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

TABLE 8.3.19.1-10 Physicians in the ROI for the Proposed Gillespie SEZ, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Maricopa County	11,993	3.1

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

Public Safety

Maricopa County has 763 police officers and would provide law enforcement services to the SEZ (Table 8.3.19.1-11). Currently, there are 3,154 professional firefighters in the county. Levels of service of police protection are 0.2 in Maricopa County and 0.8 for fire services.

8.3.19.1.10 ROI Social Change

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase, and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 8.3.19.1-12 and 8.3.19.1-13 present data for a number of indicators of social change, including violent crime and property crime rates, alcoholism and illicit drug use, and mental health and divorce, that might be used to indicate social change.

The violent crime rate in Maricopa County in 2007 was 4.7 crimes per 1,000 population (Table 8.3.19.1-12), while the property-related crime rate was 43.2, producing an overall crime rate of 48.0 per 1,000 people.

Other measures of social change—alcoholism, illicit drug use, and mental health problems—are not available at the county level, and thus are presented for the Substance Abuse and Mental Health Services Administration (SAMHSA) region in which the county is located (Table 8.3.19.1-13).

8.3.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for such activities as hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These areas are discussed in Section 7.4.5.

TABLE 8.3.19.1-11 Public Safety Employment in the ROI for the Proposed Gillespie SEZ

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Maricopa County	763	0.2	3,154	0.8

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2009a); Fire Departments Network (2009).

TABLE 8.3.19.1-12 County and ROI Crime Rates in the ROI for the Proposed Gillespie SEZ[a]

Location	Violent Crime[b]		Property Crime[c]		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
Maricopa County	18,719	4.7	171,143	43.2	189,682	48.0

[a] Rates are the number of crimes per 1,000 population.

[b] Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

[c] Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

Sources: U.S. Department of Justice (2009a,b).

Because the number of visitors using state and federal lands for recreational activities is not available from the various administering agencies, the value of recreational resources in these areas, based solely on the number of recorded visitors, is likely to be an underestimation. In addition to visitation rates, the economic valuation of certain natural resources can also be assessed in terms of the potential recreational destination for current and future users, that is, their nonmarket value (see Section 5.17.1.1.1).

Another method of gauging the importance of recreational activity is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar development, by identifying sectors in the economy in which expenditures on recreational activities occur. Not all activities in these sectors are directly related to recreation on state and federal lands; some activity occurs on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 193,562 people were employed in Maricopa County in the various sectors identified as recreation,

TABLE 8.3.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Gillespie SEZ ROI[a]

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health[b]	Divorce[c]
Arizona Maricopa	8.6	2.8	10.7	–
Arizona	NA[d]	NA	NA	3.9

[a] Data for alcoholism and drug use represent the percentage of the population over 12 years of age with dependence or abuse of alcohol, illicit drugs. Data are averages for 2004 to 2006.

[b] Data for mental health represent the percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[c] Divorce rates are the number of divorces per 1,000 population. Data are for 1990.

[b] Data for mental health represent the percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[d] NA = Not available.

Sources: SAMHSA (2009); CDC (2009).

constituting 10.3% of total county employment (Table 8.3.19.1-14). Recreation spending also produced almost $4,731 million in income in the county in 2007. The primary sources of recreation-related employment were eating and drinking places.

8.3.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts on recreation and on social change. These impacts would occur regardless of the solar technology developed in the SEZ. The impacts of developments employing various solar energy technologies are analyzed in detail in subsequent sections.

8.3.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed Gillespie SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulated through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, and this in-migration would affect population, rental housing, health service employment, and public

TABLE 8.3.19.1-14 ROI Recreation Sector Activity for the Proposed Gillespie SEZ, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	8,968	225.8
Automotive rental	4,535	190.9
Eating and drinking places	140,479	2,935.0
Hotels and lodging places	19,364	706.9
Museums and historic sites	970	57.0
Recreational vehicle parks and campsites	1,302	41.9
Scenic tours	6,607	348.4
Sporting goods retailers	11,337	224.9
Total ROI	193,562	4,731.0

Source: MIG, Inc. (2010).

safety employment. Socioeconomic impacts common to all utility-scale solar energy developments are discussed in detail in Section 5.17. Those impacts would be minimized through the implementation of programmatic design features described in Section Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits; see Section 5.17.1.2.3). While it is clear that some land in the ROI would no longer be accessible for recreation, the majority of popular recreational locations would be precluded from solar development. It is also possible that solar developments in the ROI would be visible from popular recreation locations, and that construction workers residing temporarily in the ROI would occupy accommodation otherwise used for recreational visits, thus reducing visitation and consequently affecting the economy of the ROI.

Social Change

Although an extensive literature in sociology documents the most significant components of social change in energy boomtowns, the nature and magnitude of the social impact of energy facilities in small rural communities are still unclear (see Section 5.17.1.1.4). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be affected, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom period

(Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has been suggested that social disruption is likely to occur once an arbitrary population growth rate associated with solar energy development projects has been reached, with an annual rate of between 5 and 10% growth in population assumed to result in a breakdown in social structures and a consequent increase in alcoholism, depression, suicide, social conflict, divorce, and delinquency, as well as deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

In overall terms, the in-migration of workers and their families into the ROI would represent an increase of less than 0.1% in ROI population during construction and operation of the solar trough technology, with smaller increases for the power tower, dish engine, and PV technologies. It is possible that some construction and operations workers would choose to locate in communities closer to the SEZ. However, because of an insufficient range of housing choices to suit all solar occupations and the lack of available housing in smaller rural communities in the ROI to accommodate all in-migrating workers and families, many workers are likely to commute to the SEZ from larger communities elsewhere in the ROI. This would reduce the potential impact of solar developments on social change. Regardless of the pace of population growth associated with the commercial development of solar resources, and the likely residential location of in-migrating workers and families in communities some distance from the SEZ itself, the number of new residents from outside the ROI is likely to lead to some demographic and social change in small rural communities in the ROI. Communities hosting solar developments are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

Cattle ranching and farming supported 1,108 jobs and $18.1 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed Gillespie SEZ could reduce the amount of land available for livestock grazing within the SEZ, resulting in total (direct plus indirect) impacts of the loss of less than 1 job and less than $0.1 million in income in the ROI. There would also be a decline in grazing fees payable to the BLM and to the USFS by individual permittees based on the number of AUMs required to support livestock on public land. Assuming the 2008 fee of $1.35 per AUM, grazing fee losses would amount to $74 annually on land dedicated to solar developments in the SEZ.

Access Road Impacts

The impacts of construction of an access road connecting the proposed SEZ to the existing road network could include the addition of 244 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 8.3.19.2-1). Road construction activities in the peak year would constitute less than 1% of total ROI employment. Access road construction would also produce $9.4 million in ROI income. Direct sales taxes would be $0.3 million; and direct income taxes would be $0.2 million.

Total operations (maintenance) employment impacts in the ROI (including direct and indirect impacts) of an access road would be less than 1 job during the first year of operation (Table 8.3.19.2-1) and would also produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million in the first year, with direct income taxes of less than $0.1 million.

Construction and operation of an access road would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

TABLE 8.3.19.2-1 ROI Socioeconomic Impacts of an Access Road Connecting the Proposed Gillespie SEZ[a]

Parameter	Maximum Annual Construction Impacts	Operations
Employment (no.)		
Direct	122	<1
Total	244	<1
Income[b]		
Total	9.4	<0.1
Direct state taxes[b]		
Sales	0.3	<0.1
Income	0.2	<0.1
In-migrants (no.)	0	0
Vacant housing[c] (no.)	0	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

a Construction impacts assume 3 mi (5 km) of access road are required for the SEZ. Construction impacts are assessed for the peak year of construction.

b Unless indicated otherwise, values are reported in $ million 2008.

c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

8.3.19.2.2 Technology-Specific Impacts

The economic impacts of solar energy development in the proposed SEZ were measured in terms of employment, income, state tax revenues (sales and income), population in-migration, housing, and community service employment (education, health, and public safety). More information on the data and methods used in the analysis can be found in Appendix M.

The assessment of the impact of the construction and operation of each technology was based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of possible impacts, solar facility size was estimated on the basis of land requirements of various solar technologies, assuming that 9 acres/MW (0.04 km^2/MW) would be required for power tower, dish engine, and PV technologies, and 5 acres/MW (0.02 km^2/MW) would be required for solar trough technologies. Impacts of multiple facilities employing a given technology at each SEZ were assumed to be the same as impacts for a single facility with the same total capacity. Construction impacts were assessed for a representative peak year of construction, assumed to be 2021 for each technology. Construction impact assessments assumed that a maximum of one project could be constructed within a given year, with a corresponding maximum land disturbance of up to 2,094 acres (8.5 km^2). For operations impacts, a representative first year of operations was assumed to be 2023 for trough and power tower; 2022 was assumed for the minimum facility size for dish engine and PV, and 2023 for the maximum facility size for these technologies. The years of construction and operations were selected as representative of the entire 20-year study period, because they are the approximate midpoint; construction and operations could begin earlier.

Solar Trough

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of solar trough technologies would be up to 3,813 jobs (Table 8.3.19.2-2). Construction activities would constitute 0.1% of total ROI employment. A solar development would also produce $236.4 million in income. Direct sales taxes would be $9.6 million, direct income taxes $4.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 519 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 259 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would also affect community service employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, four new teachers, two physicians, and one public safety employee (career firefighters or uniformed police officers) would be required in the ROI. These increases would represent less than 0.1% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 150 jobs (Table 8.3.19.2-2). Such a solar development would also produce $5.9 million in income. Direct sales taxes would be $0.1 million, direct income taxes $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental payments would be $0.5 million, and solar generating capacity payments would total at least $2.8 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 12 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 10 owner-occupied units expected to be occupied in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be up to 1,519 jobs (Table 8.3.19.2-3). Construction activities would constitute 0.1% of total ROI employment. Such a solar development would also produce $94.2 million in income. Direct sales taxes would be around $3.8 million, direct income taxes $1.8 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 207 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 103 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.1% of the vacant rental units expected to be available in the ROI.

TABLE 8.3.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Solar Trough Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,218	91
Total	3,813	150
Income[b]		
Total	236.4	5.9
Direct state taxes[b]		
Sales	9.6	0.1
Income	4.4	0.1
BLM payments ($ million 2008)		
Rental	NA[d]	0.5
Capacity[c]	NA	2.8
In-migrants (no.)	519	12
Vacant housing[e] (no.)	259	10
Local community service employment		
Teachers (no.)	4	0
Physicians (no.)	2	0
Public safety (no.)	1	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 419 MW (corresponding to 2,094 acres [8.5 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 419MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

d NA = not applicable.

e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

TABLE 8.3.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Power Tower Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	485	47
Total	1,519	67
Income[b]		
Total	94.2	2.3
Direct state taxes[b]		
Sales	3.8	<0.1
Income	1.8	0.1
BLM payments ($ million 2008)		
Rental	NA[d]	0.5
Capacity[c]	NA	1.5
In-migrants (no.)	207	6
Vacant housing[e] (no.)	103	5
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	1	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

[d] NA = not applicable.

[e] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, two new teachers and one physician would be required in the ROI. These increases would represent less than 0.1% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using power tower technologies would be 67 jobs (Table 8.3.19.2-3). Such a solar development would also produce $2.3 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental payments would be $0.5 million, and solar generating capacity payments would total at least $1.5 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with six persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with five owner-occupied units expected to be required in the ROI. No new community service employment would be required to meet existing levels of service in the ROI.

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technologies would be up to 617 jobs (Table 8.3.19.2-4). Construction activities would constitute less than 0.1% of total ROI employment. Such a solar development would also produce $38.3 million in income. Direct sales taxes would be $1.6 million, with direct income taxes of $0.7 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 84 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 42 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% of the vacant rental units expected to be available in the ROI.

TABLE 8.3.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with Dish Engine Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	197	46
Total	617	65
Income[b]		
Total	38.3	2.3
Direct state taxes[b]		
Sales	1.6	<0.1
Income	0.7	0.1
BLM payments ($ million 2008)		
Rental	NA[d]	0.5
Capacity[c]	NA	1.5
In-migrants (no.)	84	6
Vacant housing[e] (no.)	42	5
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

[d] NA = not applicable.

[e] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI. This increase would represent less than 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 65 jobs (Table 8.3.19.2-4). Such a solar development would also produce $2.3 million in income. Direct sales taxes would be less than $0.1 million, direct income taxes $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental payments would be $0.5 million, and solar generating capacity payments would total at least $1.5 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a dish engine solar facility means that some in-migration of workers and their families from outside the ROI would be required, with six persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with five owner-occupied units expected to be required in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technologies would be up to 288 jobs (Table 8.3.19.2-5). Construction activities would constitute less than 0.1% of total ROI employment. Such a solar development would also produce $17.8 million in income. Direct sales taxes would be about $0.7 million, direct income taxes $0.3 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 29 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 20 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% of the vacant rental units expected to be available in the ROI.

TABLE 8.3.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Gillespie SEZ with PV Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	92	5
Total	288	6
Income[b]		
Total	17.8	0.2
Direct state taxes[b]		
Sales	0.7	<0.1
Income	0.3	<0.1
BLM payments ($ million 2008)		
Rental	NA[d]	0.5
Capacity[c]	NA	1.2
In-migrants (no.)	39	1
Vacant housing[e] (no.)	20	1
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 233 MW (corresponding to 2,094 acres [8.5 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 233 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] The BLM annual capacity payment was based on a fee of $5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), assuming full build-out of the site.

[d] NA = not applicable.

[e] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

No new community service employment would be required to meet existing levels of service in the ROI.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using PV technologies would be 6 jobs (Table 8.3.19.2-5). Such a solar development would also produce $0.2 million in income. Direct sales taxes would be less than $0.1 million, direct income taxes less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010e), acreage rental payments would be $0.5 million, and solar generating capacity payments would total at least $1.2 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with one person in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with one owner-occupied unit expected to be required in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

8.3.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Gillespie SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for socioeconomic impacts during all project phases.

8.3.20 Environmental Justice

8.3.20.1 Affected Environment

On February 11, 1994, the President signed Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which formally requires federal agencies to incorporate environmental justice as part of their missions (*Federal Register,* Volume 59, page 76297, Feb. 11, 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area is undertaken; (2) an assessment is conducted to determine whether construction and operation would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a determination is made as to whether they disproportionately affect minority and low-income populations.

Construction and operation of solar energy projects in the proposed SEZ could affect environmental justice if any adverse health or environmental impacts resulting from either phase of development are significantly high and if these impacts would disproportionately affect minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. In the event impacts are significant, disproportionality would be determined by comparing the proximity of any high and adverse impacts with the location of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the proposed Gillespie SEZ and within a region encompassing a 50-mi (80-km) radius around the boundary of the SEZ. A description of the geographic distribution of minority and low-income groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,l). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

  Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origin. In addition, persons who classify themselves as being of multiple racial origin may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50%, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The PEIS applies both criteria in using the Census Bureau data for census block groups, wherein consideration is given to the minority population that is both greater than 50% and 20 percentage points higher than in the state (the reference geographic unit).

- **Low-Income.** Individuals are included in the low-income category if they fall below the poverty line. The poverty line takes into account family size and age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children younger than 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (U.S. Bureau of the Census 2009l).

The data in Table 8.3.20.1-1 show the minority and low-income composition of the total population located in the region of proposed SEZ based on 2000 Census data and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number also includes individuals identifying themselves as being part of one or more of the population groups listed in the table.

A large number of minority and low-income individuals are located in the 50-mi (80-km) area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Arizona, 44.5% of the population is classified as minority, while 15.5% is classified as low-income. Although the number of minority individuals does not exceed 50% of the total population in the area, the number of minority individuals exceeds the state average by 20 percentage points or more, meaning that there is a minority population in the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the SEZ region.

Figures 8.3.20.1-1 and 8.3.20.1-2 show the locations of the minority and low-income population groups within the 50-mi (80-km) radius around the boundary of the SEZ.

At the individual block group level there are census block groups where the minority population exceeds the state average by more than 20 percentage points. These groups occur in

TABLE 8.3.20.1-1 Minority and Low-Income Populations within a 50-mi (80-km) Radius Surrounding the Proposed Gillespie SEZ

Parameter	Arizona
Total population	1,584,763
White, non-Hispanic	878,833
Hispanic or Latino	542,160
Non-Hispanic or Latino minorities	163,770
One race	139,040
Black or African American	76,040
American Indian or Alaskan Native	29,739
Asian	29,957
Native Hawaiian or Other Pacific Islander	1,538
Some other race	1,766
Two or more races	24,730
Total minority	705,930
Low-income	240,528
Percentage minority	44.5
State percent minority	24.5
Percentage low-income	15.5
State percent low-income	13.9

Source: U.S. Bureau of the Census (2009k,l).

most of the southern portion of the 50-mile (80-km) radius around the SEZ and northeast of the site, in the greater Phoenix metropolitan area. There are also block groups in the greater Phoenix area where the minority population exceeds 50% of the total population.

There is one census block group west of the SEZ, and numerous such groups in the greater Phoenix area with a low-income population that is more than 20 percentage points higher than the state average. Census block groups in which the low-income population exceeds 50% of the total population are located west of the SEZ in Yuma County, southwest of the site, and east of the site, in the greater Phoenix area.

8.3.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy facilities are described in detail in Section 5.18. These impacts will be minimized through the implementation

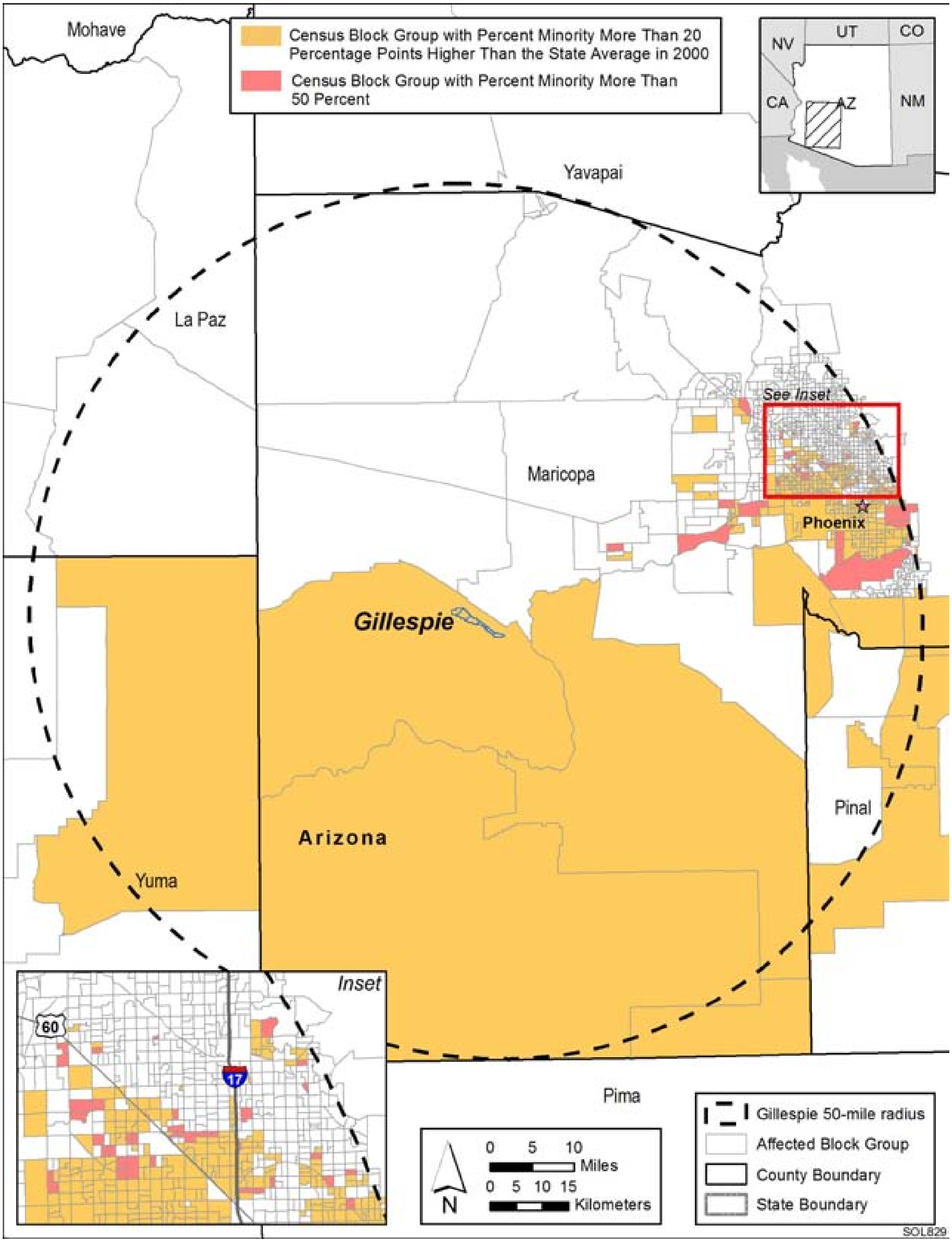

FIGURE 8.3.20.1-1 Minority Population Groups within a 50-mi (80-km) Radius Surrounding the Proposed Gillespie SEZ

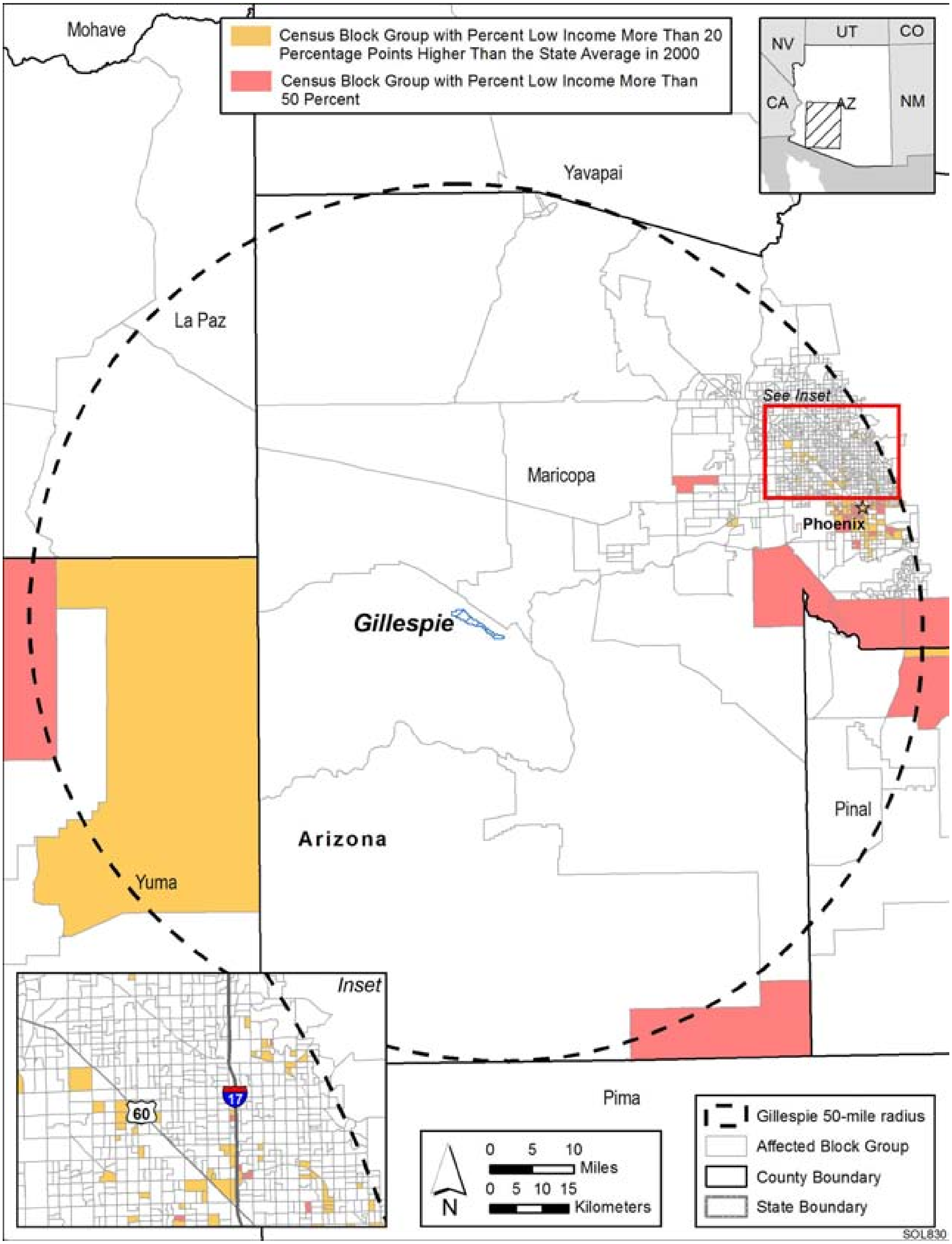

FIGURE 8.3.20.1-2 Low-Income Population Groups within a 50-mi (80-km) Radius Surrounding the Proposed Gillespie SEZ

of programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar developments within the proposed Gillespie SEZ that might potentially affect minority and low-income populations include noise and dust during the construction of solar facilities; noise and EMF effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values.

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar developments involving each of the four technologies. Although impacts are likely to be small, there are minority populations defined by CEQ guidelines (Section 13.1.20.1) within the 50-mi (80-km) radius around the boundary of the SEZ, meaning that any adverse impacts of solar projects could disproportionately affect low-income populations. Because there are low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there could be impacts on minority populations.

8.3.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Gillespie SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for environmental justice impacts during all project phases.

8.3.21 Transportation

The proposed Gillespie SEZ is accessible by road and rail. One U.S. highway (Old U.S. 80) serves the immediate area, as does a major railroad. A number of smaller airports and one large airport serve the region. General transportation considerations and impacts are discussed in Section 3.4 and Section 5.19, respectively.

8.3.21.1 Affected Environment

The eastern tip of the Gillespie SEZ lies 3 mi (5 km) from the closest approach of Old U.S. 80 and about 10 mi (16 km) from State Route 85, which runs in a general north–south direction, as shown in Figure 8.3.21.1-1. However, the most direct, existing, driving route from Old U.S. 80, at its closest approach to the SEZ, to State Route 85 would be either a 9-mi (14-km) drive to the south and east along Old U.S. 80 to Galine Road (a dirt road) or a 15-mi (24-km) drive to the north and east along Old U.S. 80. From Galine Road, State Route 85 travels 14 mi (23 km) to the north, where it terminates at I-10; it travels 23 mi (37 km) to the south, where it has a junction with I-8. Old U.S. 80 also travels to the south where it joins State Route 238 about 2 mi (3 km) north–northeast of the State Route 238 exit on I-8. One of the local unimproved dirt roads that cross the SEZ is Agua Caliente Road, which runs west from Old U.S. 80 and crosses the middle section of the SEZ from east to west and then travels northward in the SEZ. As listed in Table 8.3.21.1-1, Old U.S. 80 carries an average traffic volume of about 900 to 1,000 vehicles per day in the vicinity of the Gillespie SEZ (MCDOT 2010).

Data identifying open OHV routes within the proposed SEZ were not available. If such routes are identified during project-specific analyses, the routes would be re-designated as closed and alternative routes would be considered (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

A branch of the UP Railroad passes along the northwestern edge of the Gillespie SEZ at a distance of about 0.5 mi (0.8 km). The nearest railroad stop is in Buckeye to the northeast (UP Railroad 2009), a drive of about 20 mi (30 km). The UP Railroad also has a stop in Gila Bend to the south, just south of I-8 near its junction with Old U.S. 80 and State Route 85.

Five small airports and one major airport open to the public are within driving distance of approximately 60 mi (97 km) of the proposed Gillespie SEZ, as listed in Table 8.3.21.1-2. There are also more small municipal airports in the Phoenix metropolitan area at greater distances from the SEZ. The nearest public airport is the Buckeye Municipal Airport, 20 mi (32 km) northeast of the SEZ. None of the small airports has regularly scheduled passenger service. Phoenix Sky Harbor International Airport is a major airport in Phoenix (59 mi [95 km]) to the northeast with passenger service to most major cities in the United States provided by all major and some regional U.S. carriers. Table 8.3.21.1-3 summarizes the commercial passenger and freight traffic at those airports in the vicinity of the Gillespie SEZ.

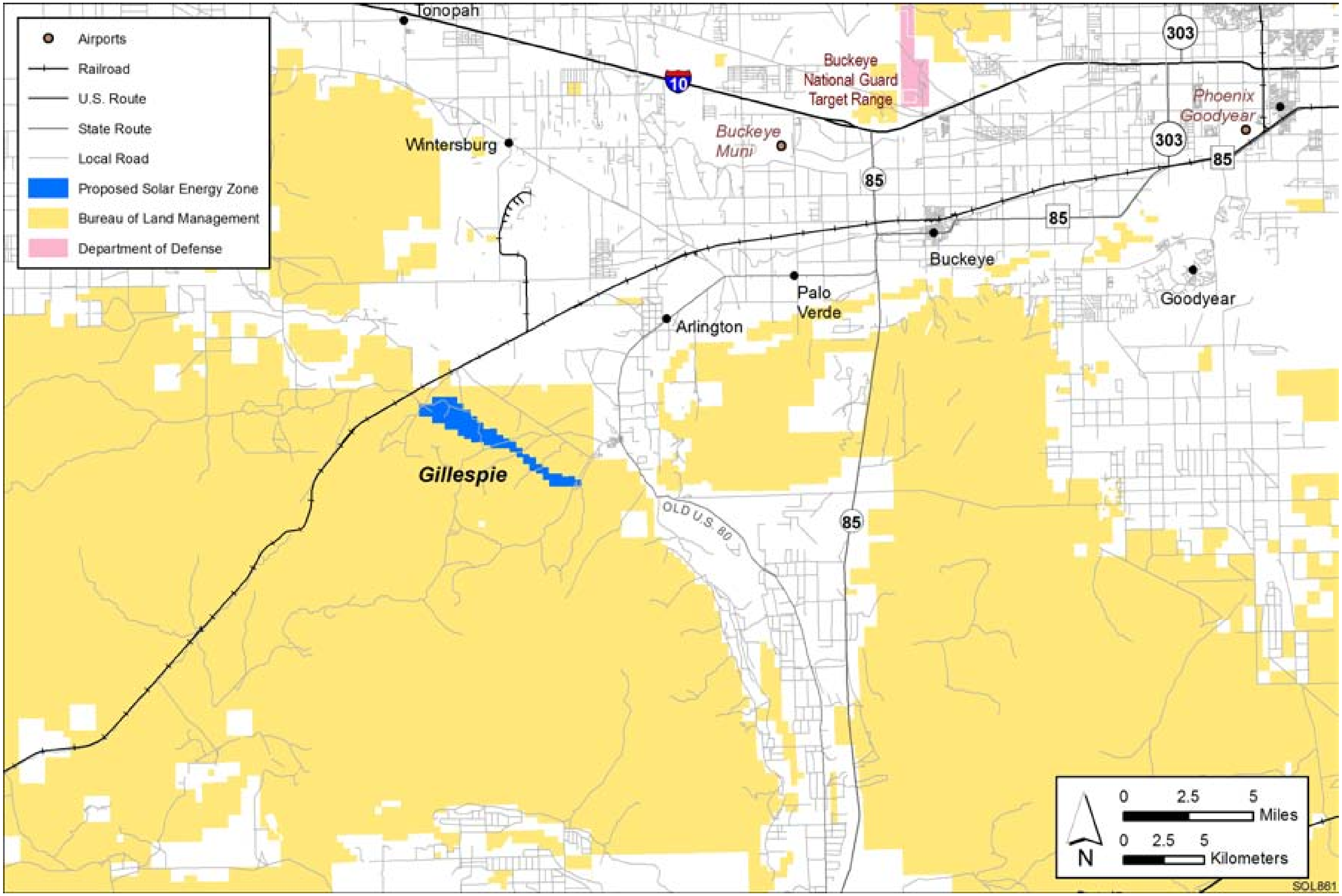

FIGURE 8.3.21.1-1 Local Transportation Network Serving the Proposed Gillespie SEZ

TABLE 8.3.21.1-1 AADT on Major Roads near the Proposed Gillespie SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
I-8	East–west	Exit 111 (Citrus Valley Rd.) to exit 115	10,500
		Exit 115 to exit 116 (State Route 85)	3,800
		Exit 116 (State Route 85) to exit 119 (Butterfield Trail)	4,100
I-10	East–west	Exit 103 (339th Ave.) to exit 109 (Palo Verde Rd.)	33,500
		Exit 109 (Palo Verde Rd. to exit 112 (State Route 85)	32,000
		Exit 112 (State Route 85) to exit 114 (Miller Rd.)	34,000
Old U.S. 80[a]	East–west/north–south	Palo Verde Rd.	3,300
		Salome Highway	2,100
		Agua Caliente Rd.	930
		Patterson Rd.	1,000
		Woods Rd.	970
State Route 85	North–south	Gila Bend to Landfill Entrance Rd. (near Komatke Rd.)	8,700
		Landfill Entrance Rd. to Buckeye Rd. (E. Monroe Ave.)	11,500
		Buckeye Rd. (E. Monroe Ave.) to I-10 (exit 112)	12,500

[a] Values presented are rounded average values taken from MCDOT (2010) that represent counts for only one or two days in each year that data was collected (2002 to 2009) at the stated locations and may reflect a seasonal and or day-of-the-week bias.

Source: ADOT (2010).

TABLE 8.3.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Gillespie SEZ

Airport	Location	Owner/Operator	Runway 1			Runway 2		
			Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Buckeye Municipal	In Buckeye, 20 mi (32 km) northeast, south of I-10 exit 109 on S. Palo Verde Road	Town of Buckeye	5,500 (1,676)	Asphalt	Good	NA[a]	NA	NA
Gila Bend Municipal	In Gila Bend, 26 mi (42 km) south–southeast along State Route 85	Town of Gila Bend	5,200 (1,585)	Asphalt	Good	NA	NA	NA
Phoenix Goodyear	In Goodyear, 40 mi (64 km) northeast in the Phoenix metropolitan area	City of Phoenix	8,500 (2,591)	Asphalt	Good	NA	NA	NA
Glendale Municipal	In Glendale, 49 mi (79 km) northeast of the SEZ	City of Glendale	7,150 (2,179)	Asphalt	Good	NA	NA	NA
Phoenix Sky Harbor International	In Phoenix, 59 mi (95 km) east–northeast	City of Phoenix	7,800 (2,377)	Concrete/ grooved	Good	10,300 (3,139)	Concrete/ grooved	Good
			11,489 (3,502)	Concrete/ grooved	Good	NA	NA	NA
Wickenburg Municipal	In Wickenburg, 60 mi (97 km) north off U.S. 60	Town of Wickenburg	6,100 (1,859)	Asphalt	Good	NA	NA	NA

[a] NA = not applicable.

Source: FAA (2010).

TABLE 8.3.21.1-3 Commercial Passenger and Freight Traffic at Airports in the Vicinity of the Proposed Gillespie SEZ for 2008

	Passengers		Freight (lb [kg])	
Airport	Arrived	Departed	Arrived	Departed
Glendale Municipal	76	109	0	0
Phoenix Sky Harbor International	19.5 million	19.5 million	292 million (132 million)	234 million (106 million)
Wickenburg Municipal	3	2	2,622 (1,189)	1,311 (595)

Source: BTS (2009).

8.3.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This volume of traffic on Old U.S. 80 would represent an increase in traffic of about 200% in the area of the Gillespie SEZ for a project. Such traffic levels would represent about a 20% increase in the traffic levels experienced on State Route 85 near the SEZ if all project traffic were to be routed through State Route 85. Because higher traffic volumes would be experienced during shift changes, traffic on Old U.S. 80 could experience moderate slowdowns during these time periods in the area of any junctions with SEZ site access roads. Local road improvements, in addition to turn lanes, might be necessary on any portion of Old U.S. 80 near any site access point(s).

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If there are any designated as open within the proposed SEZ, open routes crossing areas granted ROWs for solar facilities would be redesignated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

8.3.21.3 Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the proposed Gillespie SEZ. The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride-sharing, would all provide some relief to traffic congestion on local roads leading to the site. Depending on the location of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

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8.3.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Gillespie SEZ in Maricopa County, Arizona. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to the agency (federal or nonfederal), organization, or person that undertakes them. The time frame of this cumulative impacts assessment could appropriately include activities that would occur up to 20 years in the future (the general time frame for PEIS analyses), but little or no information is available for projects that could occur further than 5 to 10 years in the future.

The land surrounding the proposed Gillespie SEZ is undeveloped with few permanent residents living in the area. The nearest population centers are the small communities of Arlington (population 470 in 2000) located about 7 mi (11 km) northeast of the SEZ, and Wintersburg (population 2,966 in 2000) located about 10 mi (16 km) north of the SEZ. The Gila Bend Reservation is located about 14 mi (22 km) south of the SEZ, there are also reservations further to the east and southeast of the SEZ. The Buckeye National Guard Target Range is located about 20 mi (32 km) northeast of the SEZ, the Barry M. Goldwater Air Force Range is located about 22 mi (35 km) south, and the Luke Air Force Base is located about 30 mi (48 km) northeast. The Kofa National Wildlife Refuge is located about 47 mi (75 km) west of the SEZ.

The geographic extent of the cumulative impacts analysis for potentially affected resources near the proposed Gillespie SEZ is identified in Section 8.3.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 8.3.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 8.3.22.3. Cumulative impacts for each resource area are discussed in Section 8.3.22.4.

8.3.22.1 Geographic Extent of the Cumulative Impacts Analysis

The geographic extent of the cumulative impacts analysis for potentially affected resources evaluated near the proposed Gillespie SEZ is provided in Table 8.3.22.1-1. These geographic areas define the boundaries encompassing potentially affected resources. Their extent may vary based on the nature of the resource being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than visual resources). The BLM, the DoD, and the USFS administer most of the land around the SEZ; there are also several Tribal lands east, southeast, and south of the SEZ. The BLM administers approximately 43% of the lands within a 50-mi (80-km) radius of the SEZ.

TABLE 8.3.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Gillespie SEZ

Resource Area	Geographic Extent
Land Use	Maricopa, La Paz, Yuma and Pinal Counties
Specially Designated Areas and Land with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Gillespie SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of the Gillespie SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Recreation	Maricopa, La Paz, Yuma and Pinal Counties
Military and Civilian Aviation	Maricopa, La Paz, Yuma and Pinal Counties
Soil Resources	Areas within and adjacent to the Gillespie SEZ
Minerals	Maricopa, La Paz, Yuma and Pinal Counties
Water Resources	
Surface Water	Gila River, Centennial Wash
Groundwater	Lower Hassayampa groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Gillespie SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Gillespie SEZ, including portions of Maricopa, La Paz, Yuma and Pinal Counties in Arizona
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Gillespie SEZ
Acoustic Environment (noise)	Areas adjacent to the Gillespie SEZ
Paleontological Resources	Areas within and adjacent to the Gillespie SEZ
Cultural Resources	Areas within and adjacent to the Gillespie SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Gillespie SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Gillespie SEZ; viewshed within a 25-mi (40-km) radius of the Gillespie SEZ
Socioeconomics	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Gillespie SEZ
Transportation	U.S. Interstate Highways 8 and 10; Arizona State Highway 85.

8.3.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions

The future actions described below are those that are "reasonably foreseeable;" that is, they have already occurred, are ongoing, are funded for future implementation, or are included in firm near-term plans. Types of proposals with firm near-term plans are as follows:

- Proposals for which NEPA documents are in preparation or finalized;
- Proposals in a detailed design phase;
- Proposals listed in formal NOIs published in the *Federal Register* or state publications;
- Proposals for which enabling legislations has been passed; and
- Proposals that have been submitted to federal, state or county regulators to begin a permitting process.

Projects in the bidding or research phase or that have been put on hold were not included in the cumulative impact analysis.

The ongoing and reasonably foreseeable future actions described below are grouped into two categories: (1) actions that relate to energy production and distribution, including potential solar energy projects within 50 mi (80 km) of the proposed SEZ (Section 8.3.22.2.1); and (2) other ongoing and reasonably foreseeable actions within this distance, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 8.3.22.2.2). Together, these actions and trends have the potential to affect human and environmental receptors within the geographic range of potential impacts over the next 20 years.

8.3.22.2.1 Energy Production and Distribution

In November 2006, the Arizona Corporation Commission adopted final rules to expand the state's Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to be derived from distributed energy (DSIRE 2010).

Reasonably foreseeable future actions related to renewable energy production and energy distribution within 50 mi (80 km) of the proposed Gillespie SEZ are identified in Table 8.3.22.2-1 and are described. One fast-track solar energy project has been identified, and three other solar energy projects have been identified. No wind, geothermal, or major new transmission projects are planned for the reasonably foreseeable future.

TABLE 8.3.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Gillespie SEZ[a]

Description	Status	Resources Affected	Primary Impact Location
Fast-Track Solar Energy Projects on BLM-Administered Land			
Sonoran Solar Energy Project (AZA 034187), 375-MW CST/ trough facility; 3,700 total acres	NOI to prepare an EIS issued on July 8, 2009	Land use, visual, terrestrial habitats, wildlife, groundwater	About 12 mi (19 km) east of Gillespie SEZ
Other Solar Energy Projects			
Mesquite Solar 1; 150-MW PV facility	Construction to begin in 2011	Land use, visual, terrestrial habitats, wildlife	About 4 mi (6 km) northeast of the SEZ
Arlington Valley Solar I; 125 MW/trough or PV facility, 1100 acres	Construction to begin in 2010	Land use, visual, terrestrial habitats, wildlife	About 4 mi (6 km) north of the SEZ
Arlington Valley Solar II; 125 MW, 1100 acres	Construction to begin in 2010	Land use, visual, terrestrial habitats, wildlife	About 1 mi (2 km) north of the SEZ
Transmission and Distribution Systems			
None	NA[a]	NA	NA

[a] NA = not applicable because no projects have been identified.

Renewable Energy Development

Renewable energy ROW applications are considered in two categories, fast-track and regular-track applications. Fast-track applications, which apply principally to solar energy facilities, are those applications on BLM-administered lands for which the environmental review and public participation process is underway and the applications could be approved by December 2010. A fast-track project would be considered foreseeable because the permitting and environmental review processes would be under way. There is one fast-track project application within the ROI of the proposed Gillespie SEZ, the Sonoran Solar Energy Project (serial number AZA 034187). Regular-track proposals are considered potential future projects, but not necessarily foreseeable projects, since not all applications would be expected to be carried to completion. These proposals are considered together as a general level of interest in development of renewable energy in the region and are discussed in the following section.

Figure 8.3.22.2-1 shows the location of the fast-track solar energy project ROW application and 22 pending regular-track ROW applications within 50 mi (80 km) of the proposed Gillespie SEZ.

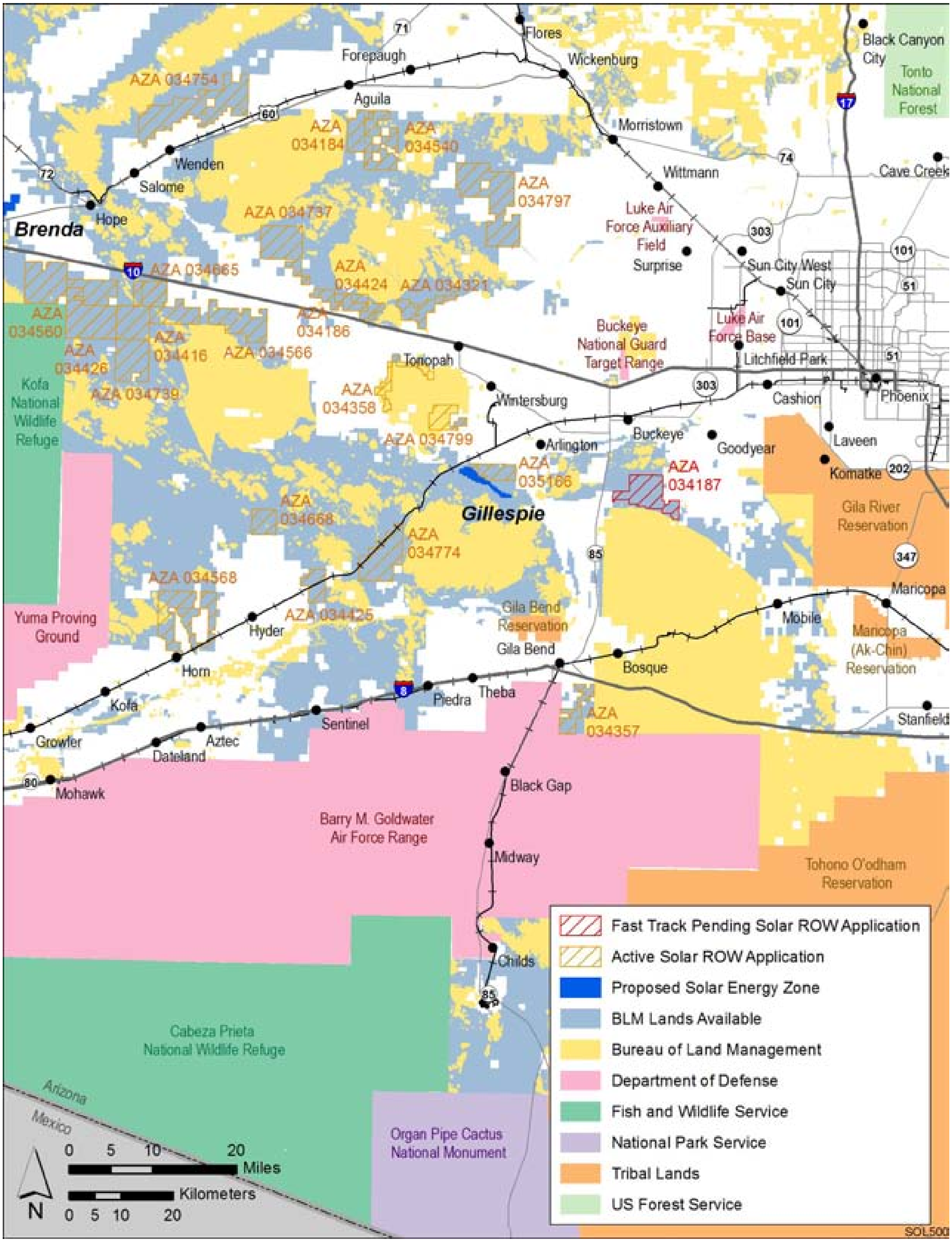

FIGURE 8.3.22.2-1 Locations of Renewable Energy Project ROW Applications within a 50-mi (80-km) Radius of the Proposed Gillespie SEZ

Foreseeable Renewable Energy Projects

Sonoran Solar Energy Project. This proposed fast-track project would be a parabolic trough facility with an output of 375 MW, with options for natural gas backup and/or thermal storage capabilities. The project site would be on BLM-administered land south of Buckeye, Arizona, in the Little Rainbow Valley, about 12 mi (19 km) east of Gillespie SEZ. The proposed facility would occupy approximately 3,700 acres (15.0 km^2). The facility is expected to operate for approximately 30 years and would connect to the electrical grid at the existing Jojoba Substation using a newly-constructed, 3-4 mi (5-6 km), 500-kV tie-line. Once operational, the total water demand for the facility would be 2,305 to 3,003 ac-ft/yr in an average year. About 870 workers would be employed during the construction of the facility (peaking at about 1,500 workers), and 82 full-time employees would be required for operations. The Final EIS for the Sonoran Solar Energy Project will be released in October 2010 (BLM 2010b,c).

Mesquite Solar 1. Sempra Generation intends to construct a PV solar power plant 5 mi (8 km) west of Arlington, Arizona, 4 mi (6 km) north of the SEZ, and adjacent to the existing combined-cycle Mesquite Power Generating Station. The first phase will produce 150 MW, and the site has sufficient land to build up to 600 MW of solar power. Construction is expected to begin in 2011, and will employ about 300 construction workers and 10 operational workers (Sempra Generation 2010a).

Arlington Valley Solar Energy Projects (AVSE) I and II. LS Power intends to construct two 125-MW solar power plants. AVSE I will be located about 6 mi (10 km) west of Arlington, Arizona, and 4 mi (6 km) north of the SEZ. AVSE II will be located about 6 mi (10 km) west of Arlington, Arizona, and about 1 mi (2 km) north of the SEZ. Both sites will occupy a total of 2,200 acres (8.9 km^2). The facilities will utilize either parabolic or PV technology, and each will employ 400 construction workers and 40 operational workers. Construction is expected to start in 2010 (AVSE 2009).

Pending Solar Applications on BLM-Administered Lands. In addition to the fast-track solar project described above, a number of regular track ROW applications for solar projects have been submitted to the BLM that would be located within 50 mi (80 km) of the SEZ. Table 8.3.22.2-2 provides a list of all solar projects that had pending ROW applications submitted to BLM as of March 2010 (BLM and USFS 2010b). Figure 8.3.22.2-1 shows the locations of these applications. There are no pending wind or geothermal ROW applications within this distance.

Within 50 mi (80 km) of the proposed Gillespie SEZ, there are 22 active solar applications. The likelihood of any of the regular-track application projects actually being developed is uncertain but is generally assumed to be less than that for fast-track applications. The projects are all listed in Table 8.3.22.2-2 for completeness and as an indication of the level of interest in development of solar energy in the region. Some number of these applications

TABLE 8.3.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi (80 km) of the Proposed Gillespie SEZ[a]

Serial No.	Project Name	Application Received	Size (acres[b])	MW	Technology	Status (NOI date)	Field Office
Solar Applications							
AZA 034184	Boulevard Assoc., LLC (Aguila)	June 26, 2007	7,375	500	CSP/trough	Pending	Hassayampa
AZA 034186	Boulevard Assoc., LLC (Big Horn)	June 26, 2007	6,232	500	CSP/trough	Pending	Hassayampa
AZA 034187	Nextera/Boulevard Assoc., LLC (Sonoran Solar)	June 28, 2007	4,000	375	CSP/trough	Pending	Lower Sonoran
AZA 034321	Ausra AZ II, LLC (Palo Verde)	Oct. 1, 2007	5,748	840	CSP/CLFR	Pending	Hassayampa
AZA 034357	First Solar (Gila Bend)	Nov. 6, 2007	6,003	500	PV	Pending	Lower Sonoran
AZA 034358	First Solar (Saddle Mtn)	Nov. 6, 2007	5,997	300	PV	Pending	Lower Sonoran
AZA 034416	Pacific Solar Invst., Inc. (Iberdrola) (Eagle Trail)	Dec. 2, 2007	19,000	1,500	CSP/trough	Pending	Yuma
AZA 034424	Pacific Solar Invst., Inc. (Iberdrola) (Big Horn)	Dec. 4, 2007	13,440	900	CSP	Pending	Hassayampa
AZA 034425	Pacific Solar Invst., Inc. (Iberdrola) (Hyder)	Dec. 7, 2007	5,794	300	CSP/trough	Pending	Lower Sonoran; Yuma
AZA 034426	Pacific Solar Invst., Inc. (Iberdrola) (Ranegras)	Dec. 2, 2007	25,860	2,000	CSP/trough	Pending	Yuma
AZA 034540	Horizon Wind Energy, LLC (Aguila)	March 4, 2008	11,535	250	CSP/trough	Pending	Hassayampa
AZA 034560	Nextlight Renewable Power, LLC	March 26, 2008	15,040	500	CSP/trough	Pending	Yuma
AZA 034566	Nextlight Renewable Power, LLC	March 26, 2008	13,428	500	CSP/trough	Pending	Yuma
AZA 034568	Nextlight Renewable Power, LLC (Palomas)	March 26, 2008	20,165	500	CSP/trough	Pending	Yuma
AZA 034665	Solarreserve, LLC (Black Rack Hill)	May 27, 2008	5,600	600	CSP/tower	Pending	Yuma
AZA 034668	Solarreserve, LLC (Agua Caliente)	May 27, 2008	5,678	600	CSP/tower	Pending	Yuma
AZA 034737	Arizona Solar Invst., Inc. (Haraquahala)	July 10, 2008	14,047	500	CSP/trough	Pending	Hassayampa
AZA 034739	IDIT, Inc.	July 9, 2008	15,000	1,000	CSP/trough	Pending	Yuma
AZA 034754	Horizon Wind Energy, LLC	March 4, 2008	28,760	250	CSP/trough	Pending	Lake Havasu
AZA 034774	Arizona Solar Invst., Inc. (Dendora Valley)	Aug. 12, 2008	14,765	500	CSP/trough	Pending	Lower Sonoran
AZA 034797	LSR Jackrabbit, LLC (Jackrabbit)	Aug. 27, 2008	27,036	500	CSP/tower	Pending	Hassayampa
AZA 034799	LSR Palo Verde, LLC (Palo Verde)	Aug. 27, 2008	5,855	600	CSP/trough	Pending	Lower Sonoran
AZA 035166	IDIT, Inc. (Arlington West)	July 27, 2009	5,800	–	PV	Pending	Lower Sonoran

[a] Total 22 Solar acres = 421,268; Total Solar MW = 20,658.

[b] To convert acres to km^2, multiply by 0.004047.

would be expected to result in actual projects. Thus, the cumulative impacts of these potential projects are analyzed in their aggregate effects.

8.3.22.2.2 Other Actions

Other major ongoing and foreseeable actions identified within 50 mi (80 km) of the proposed Gillespie SEZ are listed in Table 8.3.22.2-3 and are described in the following subsections.

TABLE 8.3.22.2-3 Other Major Actions near the Proposed Gillespie SEZ[a]

Description	Status	Resources Affected	Primary Impact Location
Palo Verde–Devers 500-kV Transmission Line	Operating		Corridor passes 6 mi (10 km) north of the SEZ
Palo Verde Nuclear Generating Station	Operating since 1986		6 mi (10 km) north of the SEZ
Redhawk Power Station	Operating		3 mi (6 km) north of the SEZ
West Phoenix Power Station	Operating since 1930		40 mi (64 km) east of the SEZ
Agua Fria Generating Station	Operating since 1968		40 mi (64 km) east of the SEZ
Kyrene Generating Station	Operating since 1951		45 mi (72 km) from the SEZ
Mesquite Power Generating Station	Operating since 2003		4 mi (6 km) north of the SEZ
Arlington Valley Energy Facility	Operating since 2002		4 mi (6 km) north of the SEZ
Harquahala Generating Project	Operating since 2004		14 mi (22 km) north of the SEZ
Impact Area Expansion Yuma Proving Ground	EA March 2010	Terrestrial habitat, wildlife	Boundary about 30 mi (48 km) south and southwest
Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge	EA December 2009	Wildlife	Boundary 48 mi (77 km) west of the SEZ
Proposed Range Enhancements at Barry M. Goldwater Range East	DEIS July 2009		Boundary 22 mi (35 km) south of the SEZ
Beddown of Training F-35A Aircraft	NOI Dec. 28, 2009		35 mi (56 km) northeast of the SEZ

[a] Projects operating or in latter stages of agency environmental review and project development.

Other Ongoing Actions

Palo Verde–Devers 500-kV Transmission Line. The existing Palo Verde–Devers 500-kV transmission line route connects the Palo Verde Nuclear Generating Station with the Devers Substation in California west of Palm Springs. This line is about 6 mi (10 km) north of the Gillespie SEZ at its nearest point.

Palo Verde Nuclear Generating Station. Arizona Public Service (APS) operates the Palo Verde Nuclear Generating Station on a 4,280-acre (17-km^2) site located 55 mi (88 km) west of Phoenix Arizona and 6 mi (10 km) north of the SEZ. The power plant contains three pressurized-water reactors with a net capacity of 3,872 MW, and has operated since 1986. Nine mechanical-draft cooling towers utilize treated sewage water from the city of Phoenix. The plant employs approximately 2,500 workers (DOE 2009b; NRC 2009).

Redhawk Power Station. APS operates the Redhawk Power Station, located 3 mi (5 km) west of Arlington, Arizona and approximately 3 mi (5 km) north of the SEZ. The plant is comprised of two combined cycle natural gas-fired units that produce a total of 1,060 MW. The cooling system utilizes treated sewage water from the city of Phoenix.

West Phoenix Power Station. APS operates the West Phoenix Power Station, located in southwest Phoenix approximately 40 mi (64 km) east of the SEZ. The station began operation in 1930 with an 18-MW generator. The plant now consists of five combined-cycle and two combustion turbine units with a total capacity of about 1,000 MW (South Phoenix Industry Challenge 2010).

Agua Fria Generating Station. The Salt River Project (SRP) operates the Agua Fria Generating Station in Peoria, Arizona, about 40 mi (64 km) east of the SEZ. Unit 2 initially began operation in 1958 and five other units were added by 1975. The station can burn either oil or natural gas, and has a capacity of 626 MW (SRP 2010).

Kyrene Generating Station. SRP operates the Kyrene Generating Station in Tempe Arizona, about 45 mi (72 km) east of the SEZ. The first unit was completed in 1951 and five other units were added, the last in 1996. Capacities are 106 MW from the two original steam units, 165 MW from three combustion turbine units, and 250 MW from one combined-cycle unit. The station can burn either oil or natural gas (SRP 2010).

Mesquite Power Generating Station. Sempra Generation operates the Mesquite Power Generating Station on a 400-acre (1.6-km^2) site located about 5 mi (8 km) west of Arlington, Arizona, and 4 mi (6 km) north of the SEZ. The plant is comprised of two combined-cycle natural gas–fired units that produce a total of 1,250 MW. The plant, which began operating in 2003, employs 33 full-time workers (Sempra Generation 2010b).

Arlington Valley Energy Facility. LS Power operates the Arlington Valley Energy facility on a site located about 6 mi (10 km) west of Arlington, Arizona, and about 4 mi (6 km) north of the SEZ. The facility, which began operating in 2002, is a three-unit, combined-cycle gas-fired plant that produces 570 MW (LS Power 2010).

Harquahala Generating Project. New Harquahala Generating Company operates the Harquahala Generating Project on a site located near Tonopah Arizona and about 14 mi (22 km) north of the SEZ. The plant is comprised of three combined-cycle, natural gas–fired units that produce a total of 1,060 MW. The plant, which began operating in 2004, utilizes two mechanical-draft cooling towers (NHGC, LLC 2007).

Other Foreseeable Actions

Impact Area Expansion Yuma Proving Ground. The Yuma Proving Ground encompasses about 840,000 acres (3,350 km^2). The closest boundary to the SEZ is about 43 mi (69 km) to the south and southwest. The Kota Region, 374,605 acres (1,516 km^2) has been heavily contaminated from munitions testing since the early 1950. This contamination consists of artillery, mortars, mines, mine detection systems, rockets, demolition tools, aerial guided/ unguided bombs, radar sensors, sensor fuzed munitions, guided munitions, Electromagnetic Gun, Jammers, Improvised Explosive Devices, missiles, tank ammunition, small arms, lasers, target evaluation and emplacement. The Army is proposing to expand the existing designated impact areas in the Kofa Region. The proposed impact areas would encompass approximately 80,000 acres (325 km^2) (United States Army 2010).

Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge. The Fish and Wildlife Service proposes to limit predation by mountain lions on desert bighorn sheep in the Kofa National Wildlife Refuge, whose boundary is about 48 mi (77 km) west of the SEZ. This would include removal of “offending” mountain lions by either lethal means or through translocation. An offending mountain lion is defined as one that has killed two or more desert bighorn sheep within a six-month period (USFWS 2009b).

Proposed Range Enhancements at Barry M. Goldwater Range East. The Barry M. Goldwater Range (BMGR) encompasses 1.9 million acres (7,700 km^2). The closest boundary, the eastern portion of the BMGR is about 22 mi (35 km) south of the SEZ. Military pilots use the range to practice air-to-air maneuvers and engage simulated battlefield targets on the ground. The U. S. Air Force (USAF) is proposing to upgrade and improve the training assets and opportunities at BMGR East (USAF 2009a, 2010a).

Beddown of Training F-35A Aircraft at Luke Air Force Base. Luke Air Force Base is located about 18 mi (29 km) northwest of downtown Phoenix and 35 mi (56 km) northeast of the SEZ. It is the only active-duty F-16 training base for more than 160 F-16 aircraft. The base population consists of 5900 military and 15,000 family members. More than 400 pilots graduate every year and receive combat assignments throughout the world. The USAF is proposing the beddown of training F-35A Aircraft at Luke Air Force Base. An Environmental Impact Statement is being prepared, and Luke Air Force Base is the preferred site among the other alternatives (USAF 2009b, 2010b,c).

Grazing Allotments

Four grazing allotments overlap Gillespie SEZ: the Gable-Ming, A Lazy T, Layton, and Jagow-Kreager allotments. Within 50 mi (80 km) of the SEZ, most of the land is covered with grazing allotments with the exception of the land to the northeast and to the south at a distance of 30 to 50 mi (48 to 80 km).

Mining

The BLM GeoCommunicator database (BLM and USFS 2010b) shows several active mining claims on file with BLM. The highest density (51 to 100 claims) is located about 10 mi (16 km) south, 12 mi (19 km) east, and 40 to 50 mi (64 to 80 km) northwest and northeast of the Gillespie SEZ.

8.3.22.3 General Trends

8.3.22.3.1 Population Growth

Maricopa County, the only county defining the ROI, experienced a population growth rate of 3.2% from 2000 to 2008 (see Section 8.3.19.1.5). The population of the Maricopa County in 2008 was 3,958,263. The growth rate for the state of Arizona as a whole was 3.0%.

8.3.22.3.2 Energy Demand

The growth in energy demand is related to population growth through increases in housing, commercial floorspace, transportation, manufacturing, and services. Given that population growth is expected in Maricopa County between 2006 and 2016, an increase in energy demand is also expected. However, the Energy Information Administration (EIA) projects a decline in per-capita energy use through 2030, mainly because of the high cost of oil and improvements in energy efficiency throughout the projection period. Primary energy consumption in the United States between 2007 and 2030 is expected to grow by about 0.5% each year; the fastest growth is projected for the commercial sector (at 1.1% each year).

Transportation, residential, and industrial energy consumption are expected to grow by about 0.5, 0.4, and 0.1% each year, respectively (EIA 2009).

8.3.22.3.3 Water Availability

As described in Section 8.3.9.1, within the Lower Hassayampa basin, pre-disturbance groundwater inflow was estimated to be 32,000 ac-ft/year (39 million m^3/yr) (Freethy and Anderson 1986). However, inflows to the basin are currently much less. Most of the pre-disturbance inflows to the Lower Hassayampa were from adjacent groundwater basins, and these basins are now in overdraft such that only a small amount of groundwater is flowing into the adjacent Lower Hassayampa basin (ADWR 1999).

Pumping groundwater for agricultural purposes in the Lower Hassayampa basin reportedly began in the early 1950s (ADWR 1999). Between the 1950s and 1998, water levels declined by up to 90 ft in the Lower Hassayampa basin (ADWR 1999). In 1998, a large cone of depression was present in the Lower Hassayampa basin due to continued agricultural pumping (ADWR 1999). Land subsidence was measured to be occurring at a rate of up to 0.8 in./yr (2 cm/yr) between 2006 and 2008, primarily in the agricultural areas along the Gila River and near the town of Buckeye (ADWR 2010b).

In 2005, water withdrawals from surface waters and groundwater in Maricopa County were 1.58 million ac-ft/yr (1.95 billion m^3/yr), of which 16% came from surface waters and 84% came from groundwater. The largest water use category was agriculture, at 1.27 million ac-ft/yr (1.57 billion m^3/yr). Thermoelectric water uses accounted for 26,400 ac-ft/yr (32.6 million m^3/yr), with public supply, municipal, and industrial water uses on the order of 25,800 ac-ft/yr (31.8 million m^3/yr), 7,800 ac-ft/yr (9.6 million m^3/yr), and 6,200 ac-ft/yr (7.6 million m^3/yr), respectively (Kenny et al. 2009).

8.3.22.3.4 Climate Change

A report on global climate change in the United States prepared by the U.S. Global Research Program (GRCP 2009) documents current temperature and precipitation conditions and historic trends. Excerpts of the conclusions from this report indicate the following for the Southwest region of the United States, which includes Arizona:

- Decreased precipitation, with a greater percentage of that precipitation coming from rain, will result in a greater likelihood of winter and spring flooding and decreased stream flow in the summer.

- Increased frequency and altered timing of flooding. For example, winter precipitation in Arizona is already becoming more variable, with a trend toward both more frequent extremely dry and extremely wet winters.

- The average temperature in the southwest has already increased by about 1.5 ºF (0.8 ºC) compared to a 1960 to 1979 baseline, and by the end of the century, the average annual temperature is projected to rise 4 ºF to 10 ºF (2 ºC to (6 ºC).

- A warming climate and the related reduction in spring snowpack and soil moisture have increased the length of the wildfire season and intensity of forest fires.

- Later snow and less snow coverage in ski resort areas could force ski areas to shut down before the season would otherwise end.

- Much of the Southwest has experienced drought conditions since 1999. This represents the most severe drought in the last 110 years. Projections indicate an increasing probability of drought in the region.

- As temperatures rise, the landscape will be altered as species shift their ranges northward and upward to cooler climates.

- Temperature increases, when combined with urban heat island effects for major cities such as Phoenix, present significant stress to health and electricity and water supplies.

- Increased minimum temperatures and warmer springs extend the range and lifetime of many pests that stress trees and crops, and lead to northward migration of weed species.

8.3.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Gillespie SEZ on the basis of the following assumptions: (1) because of the small size of the proposed SEZ (<10,000 acres [<40.5 km^2]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 2,094 acres (8.5 km^2) (80% of the entire proposed SEZ). For this analysis, it is also assumed that this total maximum disturbance area would be disturbed in a single year and up to 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. It is also assumed that no new transmission line would need to be constructed to connect to the regional grid, since a 500 kV line runs adjacent to the SEZ. Regarding site access, the nearest major road is Old U.S. 80, which runs just east of the SEZ. It is assumed that 3 mi (5 km) of new access road disturbing an additional 22 acres (0.09 km^2) would need to be constructed to reach this road and to support solar development in the SEZ.

Cumulative impacts that would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ when added to other past, present, and reasonably foreseeable future actions described in the previous section in each resource area are discussed below. At this stage of development, because of the uncertain nature of future projects in terms of size, number, and location within the proposed SEZ, and the types of technology that would be employed, the impacts are discussed qualitatively or semiquantitatively, with ranges given as appropriate. More detailed analyses of cumulative impacts would be performed in the environmental reviews for the specific projects in relation to all other existing and proposed projects in the geographic area.

8.3.22.4.1 Lands and Realty

The area covered by the proposed Gillespie SEZ is largely rural and undeveloped. The areas surrounding the SEZ are both rural and industrial in nature, with several large electric power plants nearby. Old U.S. 80, which runs about 3 mi (5 km) east of the SEZ, would provide access to the southern portion of the SEZ, while unpaved Agua Caliente Road crosses the SEZ (Section 8.3.2.1).

Development of the SEZ for utility-scale solar energy production would establish a new industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the area already includes several large developments, including the Palo Verde Nuclear Generating Station and two large capacity transmission lines, utility-scale solar energy development within the SEZ would not be a new land use in the area, but would convert additional rural land to such use. Access to portions of the SEZ holding solar facilities by both the general public and much wildlife for current uses would be eliminated.

As shown in Table 8.3.22.2-2 and Figure 8.3.22.2-1, there is one fast-track solar application and 22 other pending solar applications on BLM-administered lands within a 50-mi (80-km) radius of the proposed Gillespie SEZ. There are currently no wind or geothermal applications within this distance and no solar applications within the SEZ. The Sonoran Solar Energy Project fast-track solar application lies about 12 mi (19 km) east of the SEZ. The large number of pending solar energy applications indicates strong interest in solar energy development within the geographic extent of effects of the proposed SEZ, but only the fast-track solar application is considered a firmly foreseeable development (Section 8.3.22.2.1).

The other foreseeable projects on private land identified in Section 8.3.22.2.2 are few in number and are located at least 22 mi (35 km) from the SEZ (Section 8.3.22.2.2) and would have minimal impacts on land use near the SEZ.

The development of utility-scale solar projects in the proposed Gillespie SEZ in combination with other ongoing, foreseeable, and potential actions within the 50-mi (80-km) geographic extent of effects could have cumulative effects on land use. Ongoing, foreseeable, and potential actions on and near the SEZ could result in small cumulative impacts on land use through impacts on land access and use for other purposes, on groundwater availability, and on visual resources, especially if the SEZ is fully developed with solar facilities. Cumulative impacts on land use could rise to moderate if a major portion of the pending solar applications in the region were to result in actual projects, but projects within the SEZ would make only a small contribution to cumulative impacts because of its relatively small size.

8.3.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are ten specially designated areas within 25 mi (40 km) of the proposed Gillespie SEZ in Arizona that potentially could be affected by solar energy development within the SEZ. Portions of three of these areas lie within 5 mi (8 km) of the SEZ (Section 8.3.3.1). Potential exists for cumulative visual impacts on these areas from the construction of utility-scale solar energy facilities within the SEZ and outside the SEZ within the geographic extent of effects and from the construction of transmission lines and roads outside the SEZ that would serve both. The exact nature of cumulative visual impacts on the users of these areas would depend on the specific solar technologies employed and the locations of solar facilities, transmission lines, and roads actually built within and outside the SEZ. One fast-track solar project and about 11 pending solar applications lie within 25 mi (40 km) of the proposed SEZ (Figure 8.3.22.2-1), some of which, if built, would affect some of the same sensitive areas as facilities built within the SEZ. Such effects could include visual impacts, wilderness characteristics, reduced accessibility, and ecological effects.

8.3.22.4.3 Rangeland Resources

The proposed Gillespie SEZ includes small portions of three ephemeral grazing allotments and one perennial allotment (Section 8.3.4.1.1). If utility-scale solar facilities were constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. The development of other potential solar energy projects within 50 mi (80 km) of the SEZ could result in cumulative impacts on grazing due to the number and relative proximity of several of the proposed facilities to the SEZ. However, the contribution of such effects from projects within the SEZ would be minimal due to the small area affected.

The proposed Gillespie SEZ is about 47 mi (76 km) from the nearest wild horse and burro HMA managed by BLM and more than 50 mi (80 km) from any wild horse and burro territories administered by the USFS, thus solar energy development within the SEZ would not directly or indirectly affect wild horses and burros (Section 8.3.4.2.2). The SEZ would not, therefore, contribute to cumulative effects on wild horses and burros.

8.3.22.4.4 Recreation

Due to its small size, limited outdoor recreation occurs in the area of the proposed SEZ. The Agua Caliente Road, which passes through the SEZ, provides access to old mines, livestock facilities, and to the Signal Mountain and Woolsey Peak WAs within and outside of the SEZ (Section 8.3.5.1). Construction of utility-scale solar projects on the SEZ would preclude recreational use of the affected lands for the duration of the projects, while access restrictions within the SEZ would affect access to recreational areas within and outside the SEZ. Such effects are expected to be small due to low current use and alternate access routes. Foreseeable and potential actions, mainly one fast-track and 22 pending solar applications, would have similar small effects on current recreational activities individually. Small cumulative impacts on recreation within the geographic extent of effects might be possible from the aggregate presence of several new solar facilities within the area if a large number of projects with pending applications are ultimately built.

8.3.22.4.5 Military and Civilian Aviation

The entire proposed SEZ is covered by an MTR with 300-ft (91-m) AGL operating limits, while the SEZ is located 33 mi (92 km) southwest of Luke Air Force Base and is located within an extensive web of MTRs and SUAs (Section 8.3.6.1). The military has indicated that construction of solar or transmission facilities in excess of 250 ft (76 m) tall would adversely affect the use of the MTR (Section 8.3.6.2). Potential new solar facilities and associated new transmission lines outside the SEZ could present additional concerns for military aviation, depending on the eventual location of such facilities with respect to training routes, and thus could result in cumulative impacts on military aviation. The closest civilian airports in Buckeye and Gila Bend located 15 mi (42 km) northeast and 20 mi (32 km) south-southeast, respectively, of the SEZ are likely too far away to be affected by developments in the SEZ.

8.3.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including the construction of any associated transmission line connections and new roads, would contribute to soil loss due to wind erosion. Road use during construction, operations, and decommissioning of the solar facilities would further contribute to soil loss. Programmatic design features would be employed to minimize erosion and loss. Residual soil losses with these mitigations in place would be in addition to losses from construction of the fast-track Sonoran Solar Energy Project, other potential solar energy facilities, and other ongoing activities, including electric power generation, and agriculture. Cumulative impacts on soil resources from other foreseeable projects within the region are unlikely as these projects are all more than 20 mi (32 km) from the SEZ (Section 8.3.22.2.2). Potential new solar facilities outside the SEZ would contribute incremental impacts on soil erosion, the extent of which would depend on the number and location of facilities actually built. Cumulative impacts, including from any development in the SEZ, would be small with required design features in place.

Landscaping of solar energy facility areas in the SEZ could alter drainage patterns and lead to increased siltation of surface water streambeds, in addition to that from other potential solar projects and other activities outside the SEZ. However, with the required design features in place, cumulative impacts would likewise be small.

8.3.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

As discussed in Section 8.3.8, there are currently no active oil and gas leases within the proposed Gillespie SEZ, and there are proposals for geothermal energy development pending. There are, however, 6 placer mining claims in the very northern portion of the SEZ on about

210 acres (0.8 km^2). Because of the generally low level of mineral production in the proposed SEZ and surrounding area and the expected low impact on mineral accessibility of other foreseeable actions within the geographic extent of effects, no cumulative impacts on mineral resources are expected.

8.3.22.4.8 Water Resources

Section 8.3.9.2 describes the water requirements for various technologies if they were to be employed on the proposed SEZ to develop utility-scale solar energy facilities. The amount of water needed during the peak construction year for all evaluated solar technologies would be about 1,300 ac-ft/yr (1.6 million m^3/yr). During operations, with full development of the SEZ over 80% of its available land area, the amount of water needed for all evaluated solar technologies would range from 12 to 6,289 ac-ft/yr (15,000 to 7.8 million m^3/yr). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. As discussed in Section 8.3.22.3.3, water withdrawals in 2005 from surface waters and groundwater in Maricopa County were 1.58 million ac-ft/yr (1.95 billion m^3/yr), of which 16 % came from surface waters and 84% came from groundwater. The largest water use category was agriculture, at 1.27 million ac-ft/yr (1.57 billion m^3/yr). Therefore, cumulatively the additional water resources needed for solar facilities in the SEZ during operations would constitute from a relatively very small (0.0009%) to a small (0.5%) increment (the ratio of the annual water requirement for operations to the annual amount withdrawn in Maricopa County), depending on the solar technology used (PV technology at the low end and the wet-cooled parabolic trough technology at the high end). As discussed in Section 8.3.9.1.3, the proposed Gillespie SEZ is located within the Lower Hassayampa subbasin of the Phoenix AMA basin. The Phoenix AMA has an estimated annual natural recharge of 24,200 ac-ft (29.8 million m^3). Thus, solar developments on the SEZ would have the capacity to use up to 26% of estimates of the larger Phoenix AMA basin recharge using wet-cooling, while full development with dry-cooled solar trough technologies could require up to 634 ac-ft/yr (0.78 million m^3/yr) (Section 8.3.9.2.2), or 2.6% of estimated recharge in the Phoenix AMA basin.

While solar development of the proposed SEZ with water-intensive technologies that would use groundwater might be judged infeasible due to concerns for groundwater supplies, if employed, intensive groundwater withdrawals could cause drawdown of groundwater, further land subsidence, and disturbance of regional groundwater flow patterns and recharge patterns, potentially affecting ecological habitats (Section 8.3.9.2). Cumulative impacts on groundwater could occur when combined with other future developments in the region. The proposed fast-track Sonoran Solar Energy Project would be located about 12 mi (19 km) east of the SEZ and would use up to 3,000 ac-ft/yr (3.7 million m^3) of groundwater from the Rainbow Valley groundwater basin (BLM 2010c). While the Rainbow Valley basin is also a subbasin of the Phoenix AMA, withdrawals from this basin would not likely contribute to groundwater drawdown in the Lower Hassayampa groundwater where the SEZ is located. However, one or more of the other 22 pending solar applications within 50 mi (80 km) of the proposed SEZ (Section 8.3.22.2.1), if built, could contribute to cumulative effects on groundwater supplies in the Lower Hassayampa basin or other basins and on associated surface ecological habitats from water use, soil erosion, and drainage effects.

Small quantities of sanitary wastewater would be generated during the construction and operation of the potential utility-scale solar energy facilities. The amount generated from solar facilities would be in the range of 7 to 74 ac-ft/yr (9,000 to 91,000 m^3yr) during the peak construction year and would range from 0.3 to 6 ac-ft/yr (up to 7,400 m^3/yr) during operations. Because of the small quantity, the sanitary wastewater generated by the solar energy facilities would not be expected to put undue strain on available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that rely on conventional wet-cooling systems, there would also be 66 to 119 ac-ft/yr (81,000 to 150,000 m^3/yr) of blowdown water from cooling towers. Blowdown water would need to be either treated on-site or sent to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are effectively lined in order to prevent any groundwater contamination. Thus, blowdown water would not contribute to cumulative effects on treatment systems or on groundwater.

8.3.22.4.9 Vegetation

The proposed Gillespie SEZ is located within the Sonoran Basin and Range ecoregion, which supports creosotebush-bur sage plant communities with large areas of paloverde-cactus shrub and saguaro cactus communities. Lands within the SEZ are classified primarily as Sonora–Mojave Creosotebush–White Bursage Desert Scrub. Sensitive habitats on the SEZ include desert dry washes and dry wash woodlands. In the 5-mi (8-km) area of indirect effects, the predominant cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde-Mixed Cacti Desert Scrub (Section 8.3.10.1). If utility-scale solar energy projects were to be constructed within the SEZ, all vegetation within the footprints of the facilities would likely be removed during land-clearing and land-grading operations. Full development of the SEZ over 80% of its area would result in small impacts on all cover types (Section 8.3.10.2.1). Intermittently flooded areas downgradient from solar projects or access roads could be affected by ground-disturbing activities. Alteration of surface drainage patterns or hydrology could adversely affect on-site and downstream riverine wetlands and dry wash communities, including woodland communities of paloverde, ironwood, and mesquite. In addition, mesquite bosque communities and scrub-shrub, emergent, and other wetland habitats along the Gila River could be impacted by lower groundwater levels if solar projects were to draw heavily on this resource.

The fugitive dust generated during the construction of the solar facilities could increase the dust loading in habitats outside a solar project area, in combination with that from other construction, mining, agriculture, recreation, and transportation activities. The cumulative dust loading could result in reduced productivity or changes in plant community composition. Similarly, surface runoff from project areas after heavy rains could increase sedimentation and siltation in areas downstream. Implementation of programmatic design features would reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on plant communities and habitats.

While most of the cover types within the SEZ are relatively common in the SEZ region, a number of species along the assumed access road route are relatively uncommon, representing less than 1 % of the land area within the region. Thus, other ongoing and reasonably foreseeable future actions could have a cumulative effect on these and other rare cover types, as well as on more abundant species. Such effects would likely be small for foreseeable development due to the abundance of the primary species and the relatively small number of foreseeable actions within the geographic extent of effects, mainly the fast-track Sonoran Solar Energy Project located 12 mi (19 km) to the east of the SEZ. However, given the large number of pending solar applications within this area and the large acreages potentially disturbed (Section 8.3.22.2.1), depending on where any eventual projects are located, up to moderate cumulative effects on some rare cover types are possible. In addition, cumulative effects on wetland species could occur from water use, drainage modifications, and stream sedimentation from these and any other potential future developments in the region. The magnitude of such effects is difficult to predict at the current time.

8.3.22.4.10 Wildlife and Aquatic Biota

Wildlife species that could potentially be affected by the development of utility-scale solar energy facilities in the proposed Gillespie SEZ include amphibians, reptiles, birds, and mammals. The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, loss of connectivity between natural areas, and wildlife injury or mortality. In general, species with broad distributions and a variety of habitats would be less affected than species with a narrowly defined habitat within a restricted area. The required design features would reduce the severity of impacts on wildlife. The required design features include pre-disturbance biological surveys to identify key habitat areas used by wildlife, followed by avoidance or minimization of disturbance to those habitats.

As noted in Section 8.3.22.2, other ongoing, reasonably foreseeable and potential future actions within 50 mi (80 km) of the proposed SEZ include one fast-track solar application and 22 other pending solar development applications (Figure 8.3.22.2-1). Impacts from full build-out over 80% of the proposed SEZ would result in small impacts on amphibian, reptile, bird, and mammal species (Section 8.3.11). Impacts from foreseeable development within the 50-mi (80-km) geographic extent of effects could exceed those of the SEZ. The fast-track Sonoran Solar Energy Project would remove over 3,600 acres of Sonora Creosotebush–Bursage Desert Scrub wildlife habitat in an area 12 mi (19 km) to the east of the SEZ (BLM 2010c), an area nearly double that assumed to be removed in the SEZ. In addition, there are 22 other pending solar applications in the region that, if built, would disturb similarly large areas. While many of the wildlife species present within the proposed SEZ have extensive available habitat within the region, cumulative effects from all future development in the region on some species could be moderate, depending on the number and location of pending solar projects actually built.

There are no surface water bodies, perennial or intermittent streams, or mapped wetlands present within the proposed Gillespie SEZ. Several perennial and intermittent streams are present within the 5-mi (8-km) area of indirect effects, including 5 mi (8 km) of the perennial Gila River. However, this portion of the Gila River is not a high quality perennial stream. The intermittent Centennial Wash flows to the Gila River. This and other ephemeral washes are typically dry and flow only after precipitation. They may contain aquatic habitat and aquatic species when sufficient water is present. .Better habitat would lie further out in the 50-mi (80-km) geographic extent of effects, including in high quality portions of the Gila River (Section 8.3.11.2). Aquatic habitats within the area of indirect effects may be affected by solar development in the SEZ, but impacts would be mitigated. Thus, there would be only minor contributions to cumulative impacts on aquatic biota and habitats resulting from groundwater drawdown or soil transport to surface streams from solar facilities within the SEZ. Additional similar impacts may accrue on the affected portions of the Gila River from the foreseeable Sonoran Solar Energy Project located 12 mi (19 km) to the east.

8.3.22.4.11 Special Status Species (Threatened, Endangered, Sensitive, and Rare Species)

On the basis of recorded occurrences or suitable habitat, as many as 29 special status species could occur within the Gillespie SEZ. Of these species, 10 are known or are likely to occur within the affected area of the SEZ (including the SEZ, the 5-mi [8-km] area of indirect effects, and road and transmission ROWs): California barrel cactus, straw-top cholla, roundtail chub, lowland leopard frog, Sonoran desert tortoise, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma clapper rail, California leaf-nosed bat, and cave myotis. Section 8.3.12.1 discusses the nature of the special status listing of these species within state and federal agencies. Numerous additional species that may occur on or in the vicinity of the SEZ are listed as threatened or endangered by the State of Arizona or listed as a sensitive species by the BLM. Design features to be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy facilities in the SEZ and related facilities (e.g., access roads and transmission line connections) outside the SEZ include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. Ongoing effects on special status species include those from roads, transmission lines, and recreational activities in the area. Special status species are also likely present in or around areas identified for future solar developments outside the SEZ within the 50-mi (80-km) geographic extent of effects, as these areas would have similar habitat as the SEZ. For example, BLM-designated habitat for the desert tortoise lies within 1.2 mi (1.9 km) of the project area for the fast-track Sonoran Solar Energy Project (BLM 2010c), which lies 12 mi (19 km) east of the SEZ. Special status species present on or near the SEZ are also likely to be present on or near many of the 22 pending solar applications for solar projects within 50-mi (80-km) of the SEZ. Cumulative impacts on protected species are expected to be relatively low for foreseeable development, but could rise if a large number of the pending solar applications are actually built. Actual impacts would further depend on the location and cooling technologies of projects that are built. Projects would employ mitigation measures to limit effects.

8.3.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other nearby projects outside the proposed Gillespie SEZ or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency or road paving or treatment.

Ozone, PM_{10}, and $PM_{2.5}$, are of regional concern in the area, due to high temperatures, abundant sunshine, and windblown dust from occasional high winds and dry soil conditions. Construction of solar facilities in the SEZ in addition to several ongoing and potential future sources in the geographic extent of effects could contribute cumulatively to short-term PM increases. The fast-track Sonoran Solar Energy Project as well as potential solar projects could produce cumulative PM effects should construction schedules overlap significantly in time and affected area with any projects within the SEZ. Such cumulative air quality effects due to dust emissions during any overlapping construction periods are expected to be small and short-term.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need for energy production that results in higher levels of emissions, such as coal, oil, and natural gas. As discussed in Section 8.3.22.2.2, air emissions from operating solar energy facilities are relatively minor, while the displacement of criteria air pollutants, VOCs, TAPs, and GHG emissions currently produced from fossil fuels could be significant. For small SEZs, such offsets are fairly modest. For example, if the Gillespie SEZ were fully developed (80% of its acreage) with solar facilities, the quantity of pollutants avoided could be as large as 1.1% of all emissions from the current electric power systems in Arizona.

8.3.22.4.13 Visual Resources

The proposed Gillespie SEZ is located is located in Maricopa County within a relatively flat, desert floor, with desert washes, a the strong horizon line, and surrounding mountain ranges being the dominant visual features (Section 8.3.14.1). The area is semi-rural/industrial in character. Cultural modifications within the SEZ include unpaved roads, and fencing, and outside the SEZ include the Palo Verde nuclear power plant, three natural gas power plants, a railroad, transmission lines, and a pipeline ROW. The VRI values for the SEZ and immediate surroundings are VRI Class III, indicating moderate visual values. The inventory indicates low scenic quality for the SEZ and its immediate surroundings; however, the inventory indicates high sensitivity for the SEZ and its immediate surroundings because of the SEZ's proximity to Agua Caliente Road, a BLM-proposed backcountry byway, and a scenic, high-use travel corridor with high levels of public interest.

Construction of utility-scale solar facilities on the SEZ and associated transmission lines outside the SEZ would alter the natural scenic quality of the immediate area. Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy facilities. Visual impacts resulting from solar energy development within the SEZ would be in addition to impacts caused by other potential projects in the area such as other solar facilities on private lands, transmission lines, and other renewable energy facilities, such as wind mills. The presence of new facilities would normally be accompanied by increased numbers of workers in the area, traffic on local roadways, and support facilities, all of which would add to cumulative visual impacts.

There is currently one fast-track solar facility application, the Sonoran Solar Energy Project 12 mi (19 km) east of the SEZ, and 22 other pending solar applications within 50 mi (80 km) of the SEZ (Figure 8.3.22.2-1). While the contribution to cumulative impacts in the area of foreseeable and potential projects would depend on the location of facilities that are actually built, it may be concluded that the general visual character of the landscape within this distance could be cumulatively impacted by the presence of solar facilities, transmission lines, and other new infrastructure. Because of the topography of the region, such developments, located in basin flats, would be visible at great distances from surrounding mountains, which include sensitive viewsheds. Given the proximity of several of the pending solar applications to the proposed SEZ and to each other, it is possible that two or more facilities would be viewable from a single location. In addition, facilities would be located near major roads and thus would be viewable by motorists, who would also be viewing transmission lines, towns, and other infrastructure, as well as the road system itself.

As additional facilities are added, several projects might become visible from one location, or in succession, as viewers move through the landscape, as by driving on local roads. In general, the new facilities would be expected to vary in appearance, and depending on the number and type of facilities, the resulting visual disharmony could exceed the visual absorption capability of the landscape and add significantly to the cumulative visual impact. Considering the above and the large number of pending solar applications in the region, moderate cumulative visual impacts could occur within the geographic extent of effects from future solar and other existing and future development.

8.3.22.4.14 Acoustic Environment

The areas around the proposed Gillespie SEZ are classified as rural to industrial. Existing noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, cattle grazing, and from industrial activities (power plants). The construction of solar energy facilities could increase the noise levels periodically for up to 3 years per facility, but there would be little or minor noise impacts during operation of solar facilities, except from solar dish engine facilities and from parabolic trough or power tower facilities using TES, which could affect nearby residences.

Other ongoing and reasonably foreseeable and potential future activities in the general vicinity of the SEZ are described in Section 8.3.22.2. Because proposed projects and nearest residents are relatively far from the SEZ with respect to noise impacts and the local area is sparsely populated, cumulative noise effects during the construction or operation of solar facilities are unlikely.

8.3.22.4.15 Paleontological Resources

The proposed Gillespie SEZ has unknown potential for the occurrence of significant fossil material over its entire extent and requires further investigation prior to project approval (Section 8.3.16.1). Any paleontological resources encountered during a paleontological survey would be mitigated to the extent possible. Cumulative impacts on paleontological resources would be dependent on whether significant resources are found within the SEZ and in additional project areas in the region.

8.3.22.4.16 Cultural Resources

The proposed Gillespie SEZ is rich in cultural history, with settlements dating as far back as 12,000 years, and has the potential to contain significant cultural resources. Areas with the greatest potential for significant sites within the proposed SEZ include the eastern portion of the SEZ, close to the Gila River, and north of the SEZ near the Southern Pacific Railroad, which have potential for containing prehistoric sites and historic sites (Section 8.5.1.7.2). Five surveys have been conducted within the boundaries and covering a small portion of the SEZ. These surveys have not recorded any resources. However, 59 surveys conducted within 5 mi (8 km) of the SEZ resulted in the recording of 30 sites within this range (Section 8.3.17.1.5). It is possible, but unlikely, that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, could contribute cumulatively to cultural resource impacts occurring in the region. One major foreseeable development, the fast-track Sonoran Solar Energy Project located 12 mi (19 km) to the east, has been identified within the 25-mi (40-km) geographic extent of effects. In addition, 22 potential solar projects with pending applications lie within this distance (Section 8.3.22.2). While any future solar projects would disturb large areas, the specific sites selected for future projects would be surveyed; historic properties encountered would be avoided or mitigated to the extent possible. Through ongoing consultation with the Arizona SHPO and appropriate Native American governments, it is likely that most adverse effects on significant resources in the region could be mitigated to some degree. While avoidance of all NRHP-eligible sites and mitigation of all impacts may not be possible, it is unlikely that any sites recorded in the SEZ would be of such individual significance that development would cumulatively cause an irretrievable loss of information about a significant resource type.

8.3.22.4.17 Native American Concerns

Government-to-government consultation is under way with federally recognized Native American Tribes with possible traditional ties to the Gillespie area. All such Tribes have been contacted and provided an opportunity to comment or consult regarding this PEIS. To date, no specific concerns have been raised to the BLM regarding the proposed Gillespie SEZ. However, impacts of solar development in the SEZ and in the surrounding area on water resources is likely to be of major concern to affected tribes, as are intrusions on the landscape and impacts on plants and game and on traditional resources at specific locations (Section 8.3.18). The development of solar energy facilities in combination with the development of other planned and foreseeable projects in the area would likely reduce the traditionally important plant and animal resources available to the Tribes. Such effects would likely be small for foreseeable development due to the abundance of the most culturally important plant species and the relatively small number of foreseeable actions within the geographic extent of effects. Continued discussions with area Tribes through government-to-government consultation is necessary to effectively consider and address the Tribes' concerns tied to solar energy development in the Gillespie SEZ.

8.3.22.4.18 Socioeconomics

Solar energy development projects in the proposed Gillespie SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZ and in the surrounding multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra income, increased revenues to local governmental organizations through additional taxes paid by the developers and workers) or negative (e.g., added strain on social institutions such as schools, police protection, and health care facilities). Impacts from solar development would be most intense during facility construction, but of greatest duration during operations. Construction would temporarily increase the number of workers in the area needing housing and services in combination with temporary workers involved in other new development in the area, including other renewable energy projects. The number of workers involved in the construction of solar projects (including the transmission line) in the peak construction year could range from about 90 to 1,200, depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 150 (solar PV) to as high as 3,800 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar facilities would occur to the extent that multiple construction projects of any type were ongoing at the same time. It is a reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ occasionally over the 20-year or more solar development period. For example, peak construction employment for the fast-track Sonoran Solar Energy Project located 12 mi (19 km) east of the SEZ is estimated to be over 1,500 in late 2012 (BLM 2010c).

Annual impacts during the operation of solar facilities would be less, but of 20- to 30-year duration, and could combine with those from other new developments in the area, including from the Sonoran Solar Energy Project, which would employ an estimated 80 full time workers (BLM 2010c). Additional employment would occur at some number of the other 22 pending solar applications within 50 mi (80 km) of the proposed SEZ. Based on the assumption of full build-out of the SEZ (Section 8.3.19.2.2), the number of workers needed at the solar facilities in the SEZ would range from 5 to 90, with approximately 6 to 290 total jobs created in the region. Population increases would contribute to general upward trends in the region in recent years. The socioeconomic impacts overall would be positive, through the creation of additional jobs and income. The negative impacts, including some short-term disruption of rural community quality of life, would not likely be considered large enough to require specific mitigation measures.

8.3.22.4.19 Environmental Justice

Any impacts from solar development could have cumulative impacts on minority and low-income populations within 50 mi (80 km) of the proposed SEZ in combination with other development in the area. Such impacts could be both positive, such as from increased economic activity, and negative, such as from visual impacts, noise, and exposure to fugitive dust (Section 8.3.20.2). Actual impacts would depend on where low-income populations are located relative to solar and other proposed facilities and on the geographic range of effects. Overall, effects from facilities within the SEZ are expected to be small, while other foreseeable and potential actions would not likely combine with negative effects from the SEZ on minority or low-income populations, with the possible exception of visual impacts from solar development in the region. Thus, it is not expected that the proposed Gillespie SEZ would contribute to cumulative impacts on minority and low-income populations.

8.3.22.4.20 Transportation

Old U.S. 80 lies 3 mi (5 km) east of the proposed Gillespie SEZ. The nearest public airport is the Buckeye Municipal Airport, 20 mi (32 km) to the northeast of the SEZ. The nearest railroad stop is also in Buckeye. During construction of utility-scale solar energy facilities, up to 1,000 workers could be commuting to the construction site at the SEZ at a given time, which could increase the AADT on these roads by 2,000 vehicle trips for each facility under construction. Traffic on Old U.S. 80 could experience moderate slowdowns during construction shift changes (Section 8.3.21.2). This increase in highway traffic from construction workers could likewise have small cumulative impacts in combination with existing traffic levels and increases from additional future development in the area, including from construction of the fast-track Sonoran Solar Energy Project east of State Route 85, as well as from other potential solar facilities with pending applications in the region, should construction schedules overlap. Local road improvements in addition to turn lanes might be necessary on affected portions of Old U.S. 80. Any impacts during construction activities would be temporary. The impacts can also be mitigated to some degree by staggered work schedules and ride-sharing programs. Traffic increases during operation would be relatively small because of the low number of workers needed to operate the solar facilities and would have little contribution to cumulative impacts.

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8.3.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

ADEQ (Arizona Department of Environmental Quality), 2009, *2009 Air Quality Annual Report*. Available at http://www.azdeq.gov/function/forms/download/2009_Annual_Report-AQD.pdf. Accessed July 24, 2010.

ADEQ, 2010a, *Nonattainment and Attainment with a Maintenance Plan Areas*. Available at http://www.azdeq.gov/environ/air/plan/images/notmeet.jpg. Accessed Aug. 5, 2010.

ADEQ, 2010b, *Water Quality: Permits: Stormwater*. Available at http://www.azdeq.gov/environ/water/permits/stormwater.html. Accessed July 12, 2010.

ADOT (Arizona Department of Transportation), 2010, *Average Annual Daily Traffic (AADT) AADT Reports (Traffic Counts), Current AADTs, 2006 to 2008*, Multimodal Planning Division. Available at http://mpd.azdot.gov/mpd/data/aadt.asp. Accessed July 16, 2010.

ADWR (Arizona Department of Water Resources), 1999, *Third Management Plan for Phoenix Active Management Area, 2000–2010*, Dec.

ADWR, 2010a, *Arizona Water Atlas*. Available at http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/default.htm. Accessed July 8, 2010.

ADWR, 2010b, *Land Subsidence in the Buckeye Area, Western Maricopa County, 02/25/2006 to 04/05/2008*. Available at http://www.azwater.gov/AzDWR/Hydrology/Geophysics/documents/BuckeyeArea2006to2008_8x11.pdf. Accessed July 19, 2010.

ADWR, 2010c, *Overview of the Arizona Groundwater Management Code*. Available at http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf. Accessed June 21, 2010.

ADWR, 2010d, *Water Management Requirements for Solar Power Plants in Arizona*. Available at http://www.azwater.gov/azdwr/WaterManagement/solar/documents/Solar_Regulation_Summary_FINAL.pdf. Accessed June 21, 2010.

ADWR, 2010e, *Types of Recharge Permits*. Available at http://www.adwr.state.az.us/AzDWR/WaterManagement/Recharge/TypesofRechargePermits.htm. Accessed July 20, 2010.

ADWR, 2010f, *About ADWR*. Available at http://www.adwr.state.az.us/azdwr/PublicInformationOfficer/ About_ADWR.htm. Accessed June 21, 2010.

ADWR, 2010g, *A Practical Guide to Drilling a Well in Arizona*. Available at http://www.azwater.gov/AzDWR/WaterManagement/Wells/documents/wellguide.pdf. Accessed July 12, 2010.

ADWR, 2010h, *Long-term Storage Account Summary*. Available at http://www.azwater.gov/AzDWR/WaterManagement/Recharge/RechargeCreditsandAccounting.htm. Accessed July 26, 2010.

ADWR, 2010i, *Active Management Areas (AMAs) & Irrigation Non-expansion Areas (INAs)*. Available at http://www.azwater.gov/AzDWR/WaterManagement/AMAs. Accessed June 22, 2010.

ADWR, 2010j, *Colorado River Management*. Available at http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm. Accessed July 21, 2010.

AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project Design Refinements*. Available at http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf. Accessed Sept. 2009.

Allison, L., 2010, *Arizona Geology—Centennial Wash Flood Prone Areas May Be Explained by Subsidence*, Blog of the State Geologist and Director, Arizona Geological Survey, Coalition on the Public Understanding of Science, Feb. 9.

AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the U.S.*, Chicago, Ill. Available at http://www.ama-assn.org/ama/pub/category/2676.html.

Anderson, T.W., 1995, *Summary of the Southwest Alluvial Basins, Regional Aquifer-system Analysis, South-central Arizona and Parts of Adjacent States*, U.S. Geological Survey Professional Paper 1406-A.

ANHP (Arizona Natural Heritage Program), 2010, *Arizona's Natural Heritage Program: Heritage Data Management System (HDMS)*. Available at http://www.azgfd.gov/w_c/edits/species_concern.shtml. Accessed July 20, 2010.

Arizona Department of Commerce, 2010, *Arizona Population Projections*. Available at http://www.azcommerce.com/EconInfo/Demographics/Population+Projections.htm.

Arizona Field Ornithologists, 2010, *Field Checklist of the Birds of La Paz County*. Available at http://azfo.org/documents/LaPaz.pdf. Accessed July 25, 2010.

AVSE (Arlington Valley Solar Energy), 2009, *Arlington Valley Solar Energy Projects*. Available at http://www.avsepublic.com. Accessed Oct. 18, 2010.

AWBA (Arizona Water Banking Authority), 2010, *Water Storage*. Available at http://www.azwaterbank.gov/awba. Accessed July 22, 2010.

AZDA (Arizona Department of Agriculture), 2010, *Prohibited, Regulated, and Restricted Noxious Weeds*, Plant Services Division.

AZGS (Arizona Geological Survey), 2009, *Earth Fissure Map of the Wintersburg Study Area: Maricopa County, Arizona*, Digital Map Series Earth Fissure Map 10 (DM-EF_10), Feb.

AZGS, 2010, *Locations of Mapped Earth Fissure Traces in Arizona, Digital Information 39 (DI-39), Version 6.22.09*. Available at http://www.azgs.az.gov/efresources.shtml. Accessed July 22, 2010.

Bahr, D.M., 1983, "Pima and Papago Social Organization," pp. 178192 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

Bailie, A., et al., 2005, *Final Arizona Greenhouse Gas Inventory and Reference Case Projections 1990–2020*. Arizona Department of Environmental Quality (ADEQ) and Center for Climate Strategies (CCS), June. Available at http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/statepubs&CISOPTR=2347&CISOBOX=1&REC=4. Accessed July 20, 2010.

Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*, submitted to the California Energy Commission, March. Available at http://www.energy.ca.gov/sitingcases/beacon/index.html.

Bean, L.J., et al., 1978, *Persistence and Power: A Study of Native American Peoples in the Sonoran Desert and the Devers-Palo Verde High Voltage Transmission Line*, prepared for the Southern California Edison Company by Cultural Systems Research, Inc., Menlo Park, Calif.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

BLM (Bureau of Land Management), undated, Sonoran Desert/Phoenix South Planning Reports Web site and associated documents, reports, and maps. Available at http://www.blm.gov/az/st/en/prog/planning/son_des/reports.html. Accessed Aug. 2, 2010.

BLM, 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal,* U.S. Department of the Interior, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program*, U.S. Department of the Interior, Denver, Colo.

BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1996, *White River Resource Area: Proposed Resource Management Plan and Final Environmental Impacts Statement*, White River Resource Area, Craig, Colo.

BLM, 2001, *Arizona Water Rights Fact Sheet*. Available at http://www.blm.gov/nstc/WaterLaws/arizona.html.

BLM, 2005, *Approved Amendment to the Lower Gila North Management Framework Plan and the Lower Gila South Resource Management Plan and Decision Record*, U.S. Department of the Interior, Bureau of Land Management, Phoenix Field Office, Arizona, July.

BLM, 2006, *Lake Havasu Field Office Proposed Resource Management Plan and Final Environmental Impact Statement*, Lake Havasu Field Office, Lake Havasu City, Ariz., Sept.

BLM, 2007a, *Record of Decision and Lake Havasu Field Office Approved Resource Management Plan*, Lake Havasu Field Office, Lake Havasu City, Ariz., May. Available at http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html.

BLM, 2007b, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands*, Instruction Memorandum No. 2008-009, with attachments, Washington, D.C., Oct. 15.

BLM, 2007c, *Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah, and Wyoming and Programmatic Environmental Impact Statement*, U.S. Department of the Interior, Dec.

BLM, 2008a, *Special Status Species Management*, BLM Manual 6840, Release 6-125, U.S. Department of the Interior, Dec. 12.

BLM, 2008b, *Assessment and Mitigation of Potential Impacts to Paleontological Resources*, Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.

BLM, 2008c, *Rangeland Administration System*. Available at http://www.blm.gov/ras/index.htm, last updated Aug. 24, 2009.

BLM, 2010a, *Draft Visual Resource Inventory*, U.S. Department of the Interior, Bureau of Land Management, Lower Sonoran Field Office, Phoenix, Ariz., May.

BLM, 2010b, *Sonoran Solar Energy Project: Draft Environmental Impact Statement*. Available at http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar/maps/DEIS.html.

BLM, 2010c, *Bradshaw-Haquahala Record of Decision Approved Resource Management Plan*. Available at https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=10422.

BLM, 2010d, *Wild Horse and Burro Statistics and Maps*. Available at http://www.blm.gov/wo/st/en/prog/wild_horse_and_burro/wh_b_information_center/statistics_and_maps/ha_and_hma_data.html. Accessed June 25, 2010.

BLM, 2010e, *Solar Energy Interim Rental Policy*, U.S. Department of the Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos and Bulletins/national instruction/2010/IM_2010-141.html.

BLM and USFS, 2010a, *GeoCommunicator: Mining Claim Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

BLM and USFS, 2010b, *GeoCommunicator: Energy Map Viewer*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed March 26, 2010.

Brennan, T.C., 2008, *Online Field Guide to the Reptiles and Amphibians of Arizona*. Available at http://www.reptilesofaz.org/index.html. Accessed July 16, 2010.

BTS (Bureau of Transportation Statistics), 2009, *Air Carriers: T-100 Domestic Segment (All Carriers)*, Research and Innovative Technology Administration, U.S. Department of Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311. Accessed March 5, 2010.

Bui, L., 2010, *Palo Verde Water Deal a Boost for Scottsdale's Coffers*, Azcentral.com, April 15. Available at http://www.azcentral.com/news/articles/2010/04/15/20100415palo-verde-water-deal-scottsdale.html. Accessed July 22, 2010.

CalPIF (California Partners in Flight), 2009, *The Desert Bird Conservation Plan: A Strategy for Protecting and Managing Desert Habitats and Associated Birds in California, Version 1.0*. Available at http://www.prbo.org/calpif/plans.html. Accessed March 3, 2010.

CAP (Central Arizona Project), 2010, *Central Arizona Project Home Page*. Available at http://www.cap-az.com. Accessed July 15, 2010.

CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995, 1999–2007*. Available at http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf.

CDFG (California Department of Fish and Game), 2008, *Life History Accounts and Range Maps—California Wildlife Habitat Relationships System*, California Department of Fish and Game, Sacramento, Calif. Available at http://dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx. Accessed Feb. 19, 2010.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice: Guidance under the National Environmental Policy Act*, Executive Office of the President, Dec. Available at http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf.

Chase, M.K., and G.R. Geupel, 2005, "The Use of Avian Focal Species for Conservation Planning in California," pp. 130–142 in *Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference March 20–24, 2002, Asilomar, Calif.*, Vol. 1, Gen. Tech. Rep. PSW-GTR-191, C.J. Ralph and T.D. Rich (editors), U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, Calif.

Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, N.C.

CSC (Coastal Services Center), 2010, *Historical Hurricane Tracks*, National Oceanic and Atmospheric Administration. Available at http//csc-s-maps-q.csc.noaa.gov/hurricanes. Accessed July 20, 2010.

DeJong, D.H., 2004, "Forced to Abandon Their Farms: Water Deprivation and Starvation among the Gila River Pima, 1892–1904," *American Indian Culture and Research Journal,* 28(2):29–56.

DeJong, D.H., 2007, "Abandoned Little by Little: the 1914 Pima Adjudication Survey, Water Deprivation, and Farming on the Pima Reservation," *Agricultural History,* 81(4):36–69.

Desert Tortoise Council, 1994 (Revised 1999), *Guidelines for Handling Desert Tortoises during Construction Projects*, E.L. LaRue, Jr. (editor), Wrightwood, Calif.

DOE (U.S. Department of Energy), 2009a, *Report to Congress, Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation*, Jan. 13.

DOE, 2009b, *Palo Verde Nuclear Generating Station, Arizona*. Available at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/palo_verde.html. Accessed July 29, 2010.

DSIRE (Database of State Incentives for Renewables & Efficiency), 2010, *Arizona Incentives/Policies for Renewables & Efficiency*, U.S. Department of Energy, North Carolina Solar Center, North Carolina State University. Available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1. Accessed July 14, 2010.

DuBois, S.M., and A.W. Smith, 1980, "Earthquakes Causing Damage in Arizona," in *Fieldnotes from the Arizona Bureau of Geology and Mineral Technology*, Sept.

EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections to 2030*, DOE/EIA-0383, March.

Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control Engineering* 18(1):16–23.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA-550/9-74-004, Washington, D.C., March. Available at http://www.nonoise.org/library/levels74/levels74.htm. Accessed Nov. 17, 2008.

EPA, 2002, *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States, Draft*. Available at http://www.epa.gov/wed/ecoregions/us/useco_desc.doc. Accessed Oct. 2, 2008.

EPA, 2007, *Level III Ecoregions of the Continental United States*, revised March 2007, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, Ore. Available at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm. Accessed Oct. 2, 2008.

EPA 2009a, *National Primary Drinking Water Regulations and National Secondary Drinking Water Regulation*. Available at http://www.epa.gov/safewater/standard/index.html.

EPA, 2009b, *Energy CO_2 Emissions by State*. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html, last updated June 12, 2009. Accessed June 23, 2009.

EPA, 2009c, *Preferred/Recommended Models—AERMOD Modeling System*. Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.

EPA, 2009d, *eGRID*. Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, last updated Oct. 16, 2008. Accessed Jan. 12, 2009.

EPA, 2010a, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated June 3, 2010. Accessed June 4, 2010.

EPA, 2010b, *AirData: Access to Air Pollution Data*. Available at http://www.epa.gov/oar/data. Accessed July 20, 2010.

Ezell, P.H., 1983, "History of the Pima," pp. 149–160 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

FAA (Federal Aviation Administration), 2010, *Airport Data (5010) & Contact Information, Information Current as of 06/03/2010*. Available at http://www.faa.gov/airports/airport_safety/airportdata_5010. Accessed July 19, 2010.

Farish, T.E., 1915, *History of Arizona*, Filmer Brothers Electrotype Company, San Francisco, Calif.

Fellows, L.D., 2000, "Volcanism in Arizona," *Arizona Geology* 30(4):1–4. Available at http://www.azgs.az.gov/hazards_volcanoes.shtml. Accessed July 22, 2010.

FEMA (Federal Emergency Management Agency), 2009, *FEMA Map Service Center*. Available at http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1. Accessed Nov. 20, 2009.

Field, K.J., et al., 2007, "Return to the Wild: Translocation as a Tool in Conservation of the Desert Tortoise (*Gopherus agassizii*)," *Biological Conservation* 136: 232-245.

Fire Departments Network, 2009, *Fire Departments by State.* Available at http://www.firedepartments.net.

Fontana, B.L., 1983a, "Pima and Papago: Introduction," pp. 125–134 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

Fontana, B.L., 1983b, "History of the Papago," pp. 137–148 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

Freethy, G.W., and T.W. Anderson, 1986, *Predevelopment Hydrologic Conditions in the Alluvial Basins of Arizona and Adjacent Parts of California and New Mexico*, USGS Hydrologic Investigations Atlas HA-664.

Galloway, D., et al., 1999, *Land Subsidence in the United States*, U.S. Geological Survey Circular 1182.

GCRP (U.S. Global Change Research Program), 2009, *Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program*, Cambridge University Press, Cambridge, Mass. Available at http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf. Accessed Jan. 25, 2010.

Giffen, R., 2009, "Rangeland Management Web Mail," personal communication from Giffen (USDA Forest Service, Rangelands Management, Washington, D.C.) to W. Vinikour (Argonne National Laboratory, Argonne, Ill.), Sept. 22, 2009.

Hackenberg, R.A, 1983. "Pima and Papago Ecological Adaptations," pp. 161–177 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Harwell, H.O., and M.C.S. Kelly, 1983, "Maricopa," pp. 71–85 in *Handbook of North American Indians, Vol. 10, Southwest*, A. Ortiz (editor), Smithsonian Institution, Washington, D.C.

Hoffmeister, D.F., 1986, *Mammals of Arizona*, The University of Arizona Press, Tucson, Ariz.

Jackson, M., Sr., 2009, "Quechan Indian Tribe's Comments on Programmatic Environmental Impact Statement for Solar Energy Development," letter from Jackson (President, Quechan Indian Tribe, Fort Yuma, Ariz.) to Argonne National Laboratory (Argonne, Ill.), Sept. 3.

Joseph, A., 1949, *The Desert People: A Study of the Papago Indians*, University of Chicago Press, Chicago, Ill.

Kenny, J.F, et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey, Circular 1344. Available at http://pubs.usgs.gov/circ/1344. Accessed Jan. 4, 2010.

Kessell, J.L., 2002, *Spain in the Southwest*, University of Oklahoma Press, Norman, Okla.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Levick, L., et al, 2008, *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*, U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046.

Lewis, R.B., and J.T. Hestand, 2006, "Federal Reserved Water Rights: Gila River Indian Community Settlement," *Journal of Contemporary Water Research and Education* 133:34–42.

Lovich, J., and D. Bainbridge, 1999, "Anthropogenic Degradation of the Southern California Desert Ecosystem and Prospects for Natural Recovery and Restoration," *Environmental Management* 24(3):309–326.

LS Power, 2010, *LS Power Initiates Development of Solar Energy Project near Arlington Valley Plant*. Available at http://www.lspower.com/News/newsArticle030707.htm. Accessed Oct. 18, 2010.

Ludington, S., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States—Western States: California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah*, U.S. Geological Survey Open File Report 2005-1305, Version 1.3, updated Dec. 2007. Available at http://pubs.usgs.gov/of/2005/1305/index.htm.

Lynch, D.J., 1982, "Volcanic Processes in Arizona," *Fieldnotes from the Arizona Bureau of Geology and Mineral Technology* 12(3):1–8. Available at http://www.azgs.az.gov/hazards_volcanoes.shtml. Accessed July 22, 2010.

Manci, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology Research Center, Ft. Collins, Colo.

Mao, F., 2010, personal communication from Mao (Arizona Department of Environmental Quality, Phoenix, Ariz.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), July 17.

Marsh, P., and R. Kesner, 2006, *Analysis of Fish Population Monitoring Data for Selected Waters of the Gila River Basin, Arizona, for the Five-year Period 2000–2004*, prepared for U.S. Bureau of Reclamation. Available at http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/FnlRpt2000tto2004.pdf.

Martin, P.S., and F. Plog, 1973, *The Archaeology of Arizona: A Study of the Southwest Region*, Doubleday/Natural History Press, Garden City, N.Y.

Matson, R.G., 1991, *The Origins of Southwest Agriculture*, University of Arizona Press, Tucson, Ariz.

MCDOT (Maricopa County Department of Transportation), 2010, *Traffic Counts*. Available at http://www.mcdot.maricopa.gov/manuals/trafCounts/counts/o_1a.htm. Accessed July 29, 2010.

McGuire, R., and M. Schiffer, 1982, *Hohokam and Patayan: Prehistory of Southwestern Arizona*, Academic Press, N.Y.

MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," in *Proceedings of Inter-Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at http://www.hmmh.com/cmsdocuments/N011.pdf. Accessed Aug. 30, 2007.

Moose, V., 2009, "Comments on Solar Energy Development Programmatic EIS," personal communication from Moose (Tribal Chairperson, Big Pine Paiute Tribe of the Owens Valley, Big Pine, Calif.) to Argonne National Laboratory (Argonne, Ill.), Sept. 14.

Morgan, G.S., and R.S. White, Jr., 2005, "Miocene and Pliocene Vertebrates from Arizona," pp. 114–135 in *Vertebrate Paleontology in Arizona*, New Mexico Museum of Natural History and Science Bulletin No. 29, A.B. Heckert and S.G. Lucas (editors).

National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding, Water Science and Technology Boar, and Commission on Geosciences, Environment, and Resources, National Academies Press, Washington, D.C.

NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life (Web Application), Version 7.1*, Arlington, Va. Available at http://www.natureserve.org/explorer. Accessed Oct. 1, 2010.

NCDC (National Climatic Data Center), 2010a, *Climates of the States (CLIM60): Climate of Arizona*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed July 10, 2010.

NCDC, 2010b, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent ~Storms. Accessed July 20, 2010.

NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*, U.S. Department of Education. Available at http://www.nces.ed.gov/ccd/districtsearch.

Neusius, S.W., and G.T. Gross, 2007, "Mobility, Flexibility, and Persistence in the Great Basin," in *Seeking Our Past*, Oxford University Press, N.Y.

NHGC (New Harquahala Generating Company), LLC, 2007, *Harquahala Generating Project*, Jan. Available at http://www.maricopa.gov/aq/divisions/permit_engineering/permits/docs/titlev/ V99015.PDF. Accessed Oct. 14, 2010.

NRC (U.S. Nuclear Regulatory Commission), 2009, *Palo Verde Nuclear Generating Station. Applicant's Environmental Report; Operating License Renewal Stage, April*. Available at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/palo/palo-envir-rpt.pdf. Accessed July 29, 2010.

NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO) Database for Maricopa County, Arizona*. Available at: http://SoilDataMart.nrcs.usds.gov.

NRCS, 2010, *Custom Soil Resource Report for Maricopa County (covering the proposed Gillespie SEZ), Arizona*, U.S. Department of Agriculture, Washington, D.C., Oct. 7.

NROSL (Northwest Regional Obsidian Sourcing Laboratory), 2009, *Nevada Obsidian Sources*, April 20. Available at http://www.obsidianlab.com/image_maps/map_obsidian_arizona.jpg. Accessed Aug. 10, 2010.

Nussear, K.E., et al., 2009, *Modeling Habitat for the Desert Tortoise (Gopherus agassizii) in the Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona*, U.S. Geological Survey Open-File Report 2009-1102.

Ortiz, A. (editor), 1983, *Handbook of North American Indians, Vol. 10, Southwest*, Smithsonian Institution, Washington, D.C.

Ragsdale, J., 2010, personal communication from Ragsdale (BLM, Lower Sonoran Field Office, Phoenix, Ariz.) to J. May (Argonne National Laboratory, Denver, Colo.), Aug. 3, 2010.

Reid, J., and S. Whittlesey, 1997, *The Archaeology of Ancient Arizona*, University of Arizona Press, Tucson, Ariz.

Richard, S.M., et al., 2000, *Geologic Map of Arizona (Scale 1:1,000,000)*, Arizona Geological Survey Map M-35. Available at http://www.azgs.state.az.us/services_azgeomapve.shtml. Accessed Oct. 20, 2010.

Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah*, U.S. Geological Survey, HA 730-C.

Royster, J., 2008, "Indian Land Claims," pp. 28–37 in *Handbook of North American Indians, Vol. 2, Indians in Contemporary Society*, G.A. Bailey (editor), Smithsonian Institution, Washington, D.C.

Russell, F., 1975, *The Pima Indians*, University of Arizona Press, Tucson, Ariz. First published 1905.

SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage.

Schwartz, S., 2009, "Arizona TES Data Request," personal communication with attachment from Schwartz (HDMS Program Supervisor, Arizona Game and Fish Department, Phoenix, Arizona) to L. Walston (Argonne National Laboratory, Argonne, Ill.), July 29.

Sempra Generation, 2010a, *Sempra Generation Contracts with GG&E for 150 MW of Solar Power*, Oct. Available at http://public.sempra.com/newsreleases/viewPR.cfm?PR_ID=2536&Co_Short_Nm=SE. Accessed Oct. 14, 2010.

Sempra Generation, 2010b, *Mesquite Power*. Available at http://www.sempragenegeneration.com/mesquite.htm. Accessed Oct. 14, 2010.

SES (Stirling Energy Systems) Solar Two, LLC, 2008, *Application for Certification*, submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php. Accessed Oct. 1, 2008.

Sheridan, T.E., 1995, *Arizona: A History*, University of Arizona Press, Tucson, Ariz.

Shipman, T.C., and M. Diaz, 2008, *Arizona's Earth Fissure Mapping Program: Protocols, Procedures, and Products*, Arizona Geological Survey Open File Report 08-03.

Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.

South Phoenix Industry Challenge, 2010, *APS West Phoenix Power Station*. Available at http://www.phoenixindustrychallenge.com/West%20Phoenix%20Power%20Station.htm. Accessed July 29, 2010.

Spier, L., 1970, *Yuman Tribes of the Gila River*, Cooper Square Publishers, N.Y. First published 1933.

SRP (Salt River Project), 2010, *Agua Fria Generating Station*. Available at http://www.srpnet.com/about/stations/default.aspx. Accessed July 29, 2010.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, New York, N.Y.

Stoffle, R.W., et al., 1990, *Native American Cultural Resource Studies at Yucca Mountain, Nevada*, University of Michigan, Ann Arbor, Mich.

Stone, C.L., 1982, "Historical Overview of Central Western Arizona: Non-aboriginal Use of the Desert," in *Granite Reef, A Study in Desert Archaeology*, Brown, P.E., and C.L. Stone (editors), Anthropological Research Paper No. 28, Arizona State University, Tempe, Ariz.

Stone, C.L., 1986, *Deceptive Desolation: Prehistory of the Sonoran Desert in West Central Arizona, Cultural Resource Series No. 1*, Bureau of Land Management, Phoenix, Ariz.

Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen (Bureau of Land Management, Washington, D.C.) and L. Resseguie (Bureau of Land Management Washington, D.C.), Sept. 14.

Turner, R.M., and D.E. Brown, 1994, "Sonoran Desertscrub," in *Biotic Communities: Southwestern United States and Northwestern Mexico*, D.E. Brown (editor), University of Utah Press, Salt Lake City, Utah.

United States Army, 2010, *Environmental Assessment for Impact Area Expansion Yuma Proving Ground, Arizona*, March. Available at http://www.yuma.army.mil/docs/IAExpansion_EA_Draft_FONSI_25Mar10.pdf. Accessed July 26, 2010.

UP (Union Pacific) Railroad, 2009, *Allowable Gross Weight Map*. Available at http://www.uprr.com/aboutup/maps/attachments/allow_gross_full.pdf. Accessed March 4, 2010.

URS Corporation, 2006, *Aquatic Communities of Ephemeral Stream Ecosystems*, Arid West Water Quality Research Project, prepared for Pima County Wastewater Management Department with funding by EPA Region IX, Assistance Agreement X-97952101.

USAF (United States Air Force), 2009a, *Draft EIS Executive Summary, Proposed Range Enhancements at Barry M. Goldwater Range East*. Available at http://www.luke.af.mil/shared/media/document/AFD-090710-105.pdf. Accessed July 30, 2010.

USAF, 2009b, "Notice of Intent to Prepare an Environmental Impact Statement for Beddown of Training F-35A Aircraft, Dec.," *Federal Register* 74(247): 68597. Available at http://edocket.access.gpo.gov/2009/pdf/E9-30664.pdf. Accessed July 30, 2010.

USAF, 2010a, *Barry M. Goldwater Range Factsheet*. Available at http://www.944fw.afrc.af.mil/library/factsheets/factsheet.asp?id=3550. Accessed July 30, 2010.

USAF, 2010b, *Luke Air Force Base Factsheet*. Available at http://www.luke.af.mil/library/factsheets/factsheet.asp?id=5047. Accessed July 30, 2010.

USAF, 2010c, *Luke AFB News*. Available at http://www.luke.af.mil/news/story.asp?id=123215764. Accessed July 30, 2010.

U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available at http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html.

U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*, Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and Families: 2000*, Census 2000 Summary File (SF 3)—Sample Data. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months*, 2006–2008 American Community Survey 3-Year Estimates. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009e, *GCT-PH1. GCT-PH1. Population, Housing Units, Area, and Density: 2000*, Census 2000 Summary File (SF 1)—100-Percent Data. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009f, *T1. Population Estimates*. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied Housing Units (Dollars)*, 2006–2008 American Community Survey 3-Year Estimates. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000*, Census 2000 Summary File 1 (SF 1) 100-Percent Data. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008*, Population Estimates. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied Housing Units*, 2006–2008 American Community Survey 3-Year Estimates. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov.

U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3)—Sample Data*. Available at http://factfinder.census.gov.

USDA (U.S. Department of Agriculture), 2004*, Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

USDA, 2009a, *Western Irrigated Agriculture, Data Sets*. Available at http://www.ers.usda.gov/data/westernirrigation. Accessed Nov. 20, 2010.

USDA, 2009b, *2007 Census of Agriculture: Arizona State and County Data, Vol. 1*, Geographic Area Series*,* National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp.

USDA, 2010a, *National Agricultural Statistics Service—Quick Stats, Arizona County Data (Crops and Animals)*. Available at http://www.nass.usda.gov/QuickStats/Create_County_Indv.jsp. Accessed July 30, 2010.

USDA, 2010b, *Plants Database*, Natural Resources Conservation Service. Available at http://plants.usda.gov. Accessed June, 23, 2010.

U.S. Department of Commerce, 2009, *Local Area Personal Income, Bureau of Economic Analysis*. Available at http://www.bea.doc.gov/bea/regional/reis.

U.S. Department of the Interior, 2010, *Native American Consultation Database*, National NAGPRA Online Databases, National Park Service. Available at http://grants.cr.nps.gov/nacd/index.cfm.

U.S. Department of Justice, 2009a, "Table 8: Offences Known to Law Enforcement, by State and City," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Justice, 2009b, "Table 10: Offences Known to Law Enforcement, by State and by Metropolitan and Non-metropolitan Counties," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_10.html.

U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual Averages*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/staadata.txt.

U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates for States*, Bureau of Labor Statistics. Available at http://www.bls.gov/web/laumstrk.htm.

U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau.

USFS (U.S. Forest Service), 2007, *Wild Horse and Burro Territories*. Available at http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml. Accessed Oct. 20, 2009.

USFWS (U.S. Fish and Wildlife Service), 1994, *Desert Tortoise (Mojave Population) Recovery Plan*, U.S. Fish and Wildlife Service, Portland, Ore.

USFWS, 2009a, *National Wetlands Inventory*. Available at http://www.fws.gov/wetlands.

USFWS, 2009b, *Final Environmental Assessment Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge*, Dec. Available at http://www.fws.gov/southwest/refuges/arizona/kofa/docs/KofaMtLionContFinalEA.pdf. Accessed July 27, 2010.

USFWS, 2010a, *Environmental Conservation Online System (ECOS)*. Available at http://www.fws.gov/ecos/ajax/ecos/indexPublic.do. Accessed May 28, 2010.

USFWS, 2010b, "Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Sonoran Desert Population of the Bald Eagle as a Threatened or Endangered Distinct Population Segment," *Federal Register* 75:8601–8621.

USGS (U.S. Geological Survey), 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at http://earth.gis.usu.edu/swgap/landcover.html. Accessed March 15, 2010.

USGS, 2005a, *Southwest Regional GAP Analysis Project—Land Cover Descriptions*, RS/GIS Laboratory, College of Natural Resources, Utah State University, Logan, Utah.

USGS, 2005b*, Southwest Regional GAP Analysis Project,* U.S. Geological Survey National Biological Information Infrastructure. Available at http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/Review.asp**.**

USGS, 2007, *National Gap Analysis Program, Digital Animal-Habitat Models for the Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm. Accessed March 15, 2010.

USGS, 2008, *National Seismic Hazard Maps—Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years (Interactive Map)*. Available at http://gldims.cr.usgs.gov/nshmp2008/viewer.htm. Accessed Aug. 4, 2010.

USGS, 2010a, *National Earthquake Information Center (NEIC)—Circular Area Search (within 100-km of the Center of the Proposed Gillespie SEZ)*. Available at http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed July 22, 2010.

USGS, 2010b, *Glossary of Terms on Earthquake Maps—Magnitude*. Available at http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude. Accessed Aug. 8, 2010.

USGS, 2010c, *Water Resources of the United States—Hydrologic Unit Maps*. Available at http://water.usgs.gov/GIS/huc.html. Accessed April 12, 2010.

USGS, 2010d, *National Water Information System*. Available at http://wdr.water.usgs.gov/nwisgmap. Accessed July 20, 2010.

USGS and AZGS (Arizona Geological Survey), 2010, *Quaternary Fault and Fold Database for the United States*. Available at http://earthquake.usgs.gov/regional/qfaults. Accessed Oct. 7, 2010.

WildEarth Guardians and Western Watersheds Project, 2008, *Petition to List the Sonoran Desert Tortoise (Gopherus agassizii) under the U.S. Endangered Species Act*, Petition to the U.S. Fish and Wildlife Service, Oct. 9, 2008.

Wood, C.A., and J. Kienle (editors), 1992, *Volcanoes of North America*, Cambridge University Press.

WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default.aspx. Accessed June 4, 2009.

WRCC (Western Regional Climate Center), 2010a, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed July 10, 2010.

WRCC, 2010b, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed January 19, 2010.

Wullenjohn, C., 2010, *Yuma Proving Ground Continues Army's Area History*. Available at http://www.yuma.army.mil/site_about.shtml.

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