13 AFFECTED ENVIRONMENT AND IMPACT ASSESSMENT FOR PROPOSED SOLAR ENERGY ZONES IN UTAH

13.1 ESCALANTE VALLEY

13.1.1 Background and Summary of Impacts

13.1.1.1 General Information

The proposed Escalante Valley solar energy zone (SEZ) is located in Iron County in southwestern Utah (Figure 13.1.1.1-1). The SEZ has a total area of 6,614 acres (27 km^2). In 2008, the county population was 45,833, while adjacent Washington County to the south had a population of 148,256. The largest nearby town is Cedar City on Interstate 15 (I-15) in Iron County; Cedar City had a 2008 population of 28,667 and is located about 30 mi (48 km) to the east-southeast. Several small towns are located closer to the SEZ; Lund is about 4 mi (6 km) to the north, and Zane is about 5 mi (8 km) to the west. Salt Lake City is located about 220 mi (354 km) to the north–northeast.

The nearest major road is State Route 56, about 15 mi (24 km) south of the SEZ. Access to the Escalante Valley SEZ is via county road; Lund Highway passes northeast of the SEZ. Access to the interior of the SEZ is by dirt roads. The Union Pacific (UP) Railroad passes to the west and has a rail stop in Lund. A rail spur off the main line at Lund passes through the northeastern edge of the SEZ. Both state and private lands are nearby. The nearest public airport is the Cedar City Regional Airport near Cedar City. A 138-kV transmission line ends about 3 mi (5 km) from the southeastern area of the southernmost part of the SEZ.

As of February 2010, there were no right-of-way (ROW) applications for solar projects within the SEZ.

The proposed Escalante Valley SEZ is in a rural area. The overall character of the surrounding land is rural. The SEZ is located in the south-central portion of the Escalante Desert, a large, southwest–northeast trending valley. The Escalante Desert is bounded by the Mineral Mountains to the northeast, the Black Mountains and the Antelope Range to the south and southeast, and the Shauntie Hills and Wah Wah Mountains to the northwest. Land within the SEZ is undeveloped scrubland characteristic of a high-elevation, semiarid basin.

The proposed Escalante Valley SEZ and other relevant information are shown in Figure 13.1.1.1-1. The criteria used to identify the proposed Escalante Valley SEZ in Utah as an appropriate location for solar energy development included proximity to existing transmission lines 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 U.S. Fish and Wildlife Service (USFWS)-designated critical habitat for threatened and endangered species, Areas of Critical Environmental Concern

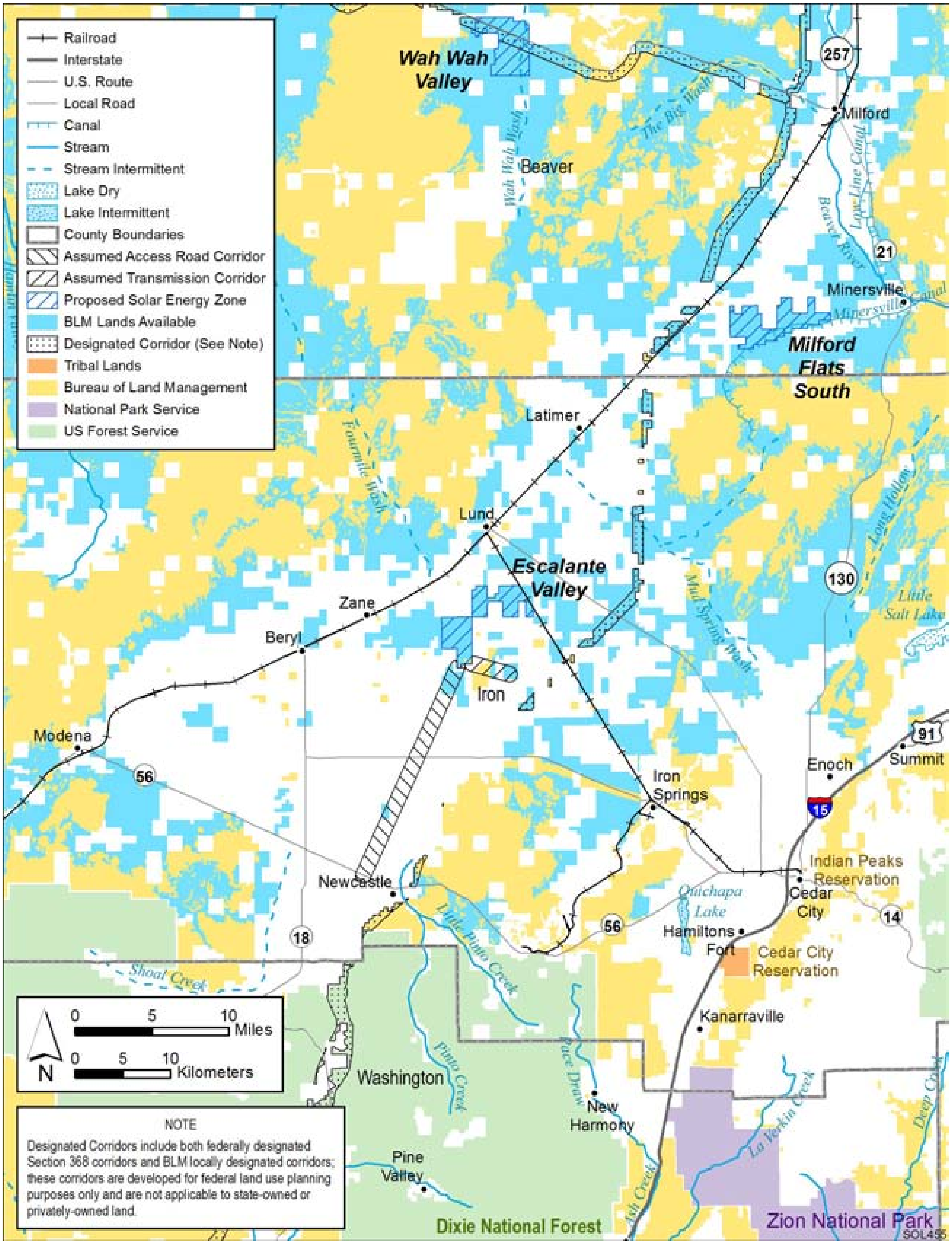

FIGURE 13.1.1.1-1 Proposed Escalante Valley SEZ

(ACECs), Special Recreation Management Areas (SRMAs), and National Landscape Conservation System (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 Escalante Valley SEZ, other restrictions may be appropriate. The analyses in the following sections evaluate the affected 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 Escalante Valley SEZ encompassed 6,581 acres (27 km^2). Subsequent to the study area scoping period, the boundaries of the proposed SEZ were altered somewhat to facilitate the Bureau of Land Management's (BLM's) administration of the SEZ area. Borders with irregularly shaped boundaries were adjusted to match the section boundaries of the Public Lands Survey System (PLSS) (BLM and USFS 2010a). Some small, higher slope areas internal to and at the borders of the site were also added to the SEZ; although included in the SEZ, these higher slope areas would not likely be utilized for solar facilities. The revised SEZ is approximately 33 acres (0.13 km^2) larger than the original SEZ as published in June 2009.

13.1.1.2 Development Assumptions for the Impact Analysis

Maximum solar development of the proposed Escalante Valley SEZ is assumed to be 80% of the SEZ area over a period of 20 years, a maximum of 5,291 acres (21 km^2). These values are shown in Table 13.1.1.2-1, along with other development assumptions. Full development of the Escalante Valley SEZ would allow development of facilities with an estimated total of 588 MW of electrical power capacity if power tower, dish engine, or photovoltaic (PV) technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 1,058 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 138-kV line 3 mi (5 km) southeast of the SEZ. It is possible that this existing line could be used to provide access from the SEZ to the transmission grid, but the 138-kV capacity of that line would be inadequate for 588 to 1,058 MW of new capacity (a 500-kV line can approximately accommodate the load of one 700-MW facility). At full build-out capacity, it is clear that new transmission and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Escalante Valley 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.

To evaluate locations and amount of disturbed acreage for new transmission lines, it was assumed that a transmission line segment would be constructed from the proposed Escalante Valley SEZ to the nearest existing transmission line to connect the SEZ to the transmission

TABLE 13.1.1.2-1 Proposed Escalante Valley SEZ—Assumed Development Acreages, Maximum 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 Transmission Corridor[e]
6,614 acres and 5,291 acres[a]	588 MW[b] and 1,058 MW[c]	State Route 56: 15 mi[d]	3 mi and 138 kV	91 acres and 109 acres	4 mi

[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.

grid. This assumption was made without additional information on whether the nearest existing transmission line would actually be available for connection of future solar facilities. Establishing a connection to the line closest to the Escalante Valley SEZ would involve the construction of about 3 mi (5 km) of new transmission line outside of the SEZ. The ROW for this transmission line would occupy approximately 91 acres (0.37 km^2) of land, assuming a 250-ft (76-m) wide ROW, a typical width for such an ROW. If a connecting transmission line was constructed in the future to connect facilities within the SEZ to a different offsite 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 were needed.

State Route 56 lies about 15 mi (24 km) to the southeast of the proposed Escalante Valley SEZ. Assuming construction of a new access road to reach State Route 56 would be needed to support construction and operation of solar facilities, approximately 109 acres (0.44 km^2) of land disturbance would occur (a 60-ft [18.3-m] wide ROW is assumed).

13.1.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 13.1.2 through 13.1.21 for the proposed Escalante Valley SEZ are summarized in tabular form. Table 13.1.1.3-1 is a comprehensive list of the impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment.

TABLE 13.1.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Escalante Valley SEZ and SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ (80% of the total area) could disturb up to 5,291 acres (21.4 km^2). Solar development would introduce a new and discordant land use into the area.	None.
	Establishing connection to the existing 138-kV transmission line located about 3 mi (5 km) to the southeast would disturb as much as 91 acres (0.37 km^2) of land.	None.
	Construction of a new access road could disturb up to 109 acres (0.44 km^2).	Priority consideration should be given to utilizing existing roads to provide construction and operational access to the SEZ.
Specially Designated Areas and Lands with Wilderness Characteristics	None.	None.
Rangeland Resources: Livestock Grazing	Up to 6,482 acres (26.2 km^2) of the Butte grazing allotment (~20% of the allotment) could be removed from grazing with potential adverse economic impacts on two permittees.	Consideration should be given to the feasibility of replacing all or part of the lost AUMs through changes in grazing management or in development of additional range improvements on public lands remaining in the allotment.
Rangeland Resources: Wild Horses and Burros	None.	None.
Recreation	Recreation use would be excluded from developed portions of the SEZ, but the loss of recreation use is expected to be minimal.	None.
Military and Civilian Aviation	None.	None.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
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) 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)	Existing oil and gas leases represent a prior existing right that could affect solar energy development of the SEZ.	None.
Water Resources	Ground-disturbance activities (affecting up to 45% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Water requirements for dust suppression and potable water supply during the peak construction year could be as high as 1,261 ac-ft (1.5 million m^3). Potential impacts on water resources related to land-disturbance activities associated with utility-scale solar energy development include direct and indirect impacts on surface waters and groundwater. Runoff of water and sediments from the proposed SEZ could potentially impact natural drainage patterns and natural groundwater recharge and discharge properties. Up to 74 ac-ft (91,000 m^3) of sanitary wastewater could be generated during the peak construction year.	Wet-cooling options would not be feasible; 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 being within a 100-year floodplain; Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes and dry lake present on the site; Groundwater rights must be obtained from the Utah Division of Water Rights (Utah DWR 2005);

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	Assuming full development of the SEZ, the following amounts of water would be used during operations: • For parabolic trough facilities (1,058-MW capacity), 756 to 1,602 ac-ft/yr (0.93 to 2.0 million m^3/yr) for dry-cooled systems; and 5,306 to 15,888 ac-ft/yr (6.5 to 20 million m^3/yr) for wet-cooled systems; • For power tower facilities (588-MW capacity), 418 to 888 ac-ft/yr (0.51 to 1.1 million m^3/yr) for dry-cooled systems; and 2,946 to 8,825 ac-ft/yr (3.6 to 11 million m^3/yr) for wet-cooled systems; • For dish engine facilities (588-MW capacity), 301 ac-ft/yr (0.37 million m^3/yr); and • For PV facilities (588-MW capacity), 30 ac-ft/yr (37,000 m^3/yr). Assuming full development of the SEZ, operations would generate up to 15 ac-ft/yr (18,000 m^3/yr) of sanitary wastewater and up to 301 ac-ft/yr (0.37 million m^3/yr) of blowdown water.	Groundwater monitoring and production wells should be constructed in accordance with Utah standards (Utah DWR 2008); Stormwater management plans and BMPs should comply with standards developed by the Utah Division of Water Quality (UDWQ 2008); and Water for potable uses would have to meet or be treated to meet Utah drinking water standards as defined by Utah Administrative Code Rule R309-200.
Vegetation[b]	Up to 80% (5,291 acres [21.4 km^2]) of the SEZ would be cleared of vegetation. Additional acreage would be cleared for transmission line construction and road improvements. Re-establishment of shrub communities in temporarily disturbed areas would likely be very difficult because of the arid conditions. Project disturbance could potentially increase the prevalence of noxious weeds and invasive species in the disturbed areas of the proposed SEZ and increase the probability that weeds could be transported into adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.	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 affected habitats and minimize the potential for the spread of invasive species, such as those occurring in Iron County, that could be introduced as a result of solar energy project activities. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*	The deposition of fugitive dust from disturbed soil areas in habitats outside the SEZ and transmission line and access road ROWs could result in reduced productivity or changes in plant community composition.	All playa, sand dune and sand transport areas, and dry wash habitats shall be avoided to the extent practicable, and any impacts shall be minimized and mitigated. A buffer area should be maintained around playas and dry washes to reduce the potential for impacts on these habitats on or near the SEZ. Appropriate engineering controls should be used to minimize impacts on dry wash and dry lake habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers, best management practices, and engineering controls would be determined through agency consultation. Groundwater withdrawals should be limited to reduce the potential for indirect impacts on springs located in the vicinity of the Escalante Valley SEZ.
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 programmatic design features, indirect impacts would be expected to be negligible.	Avoid the ephemeral washes and dry lakebed in the southwestern portion of the SEZ. Indirect impacts should be reduced by implementing design features and engineering controls that reduce runoff, sedimentation, spills, and fugitive dust.
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) for all but one species (Le Conte’s thrasher would experience moderate impacts, with 1.1% of potentially suitable habitat in the SEZ region lost).	The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Wildlife: Birds[b] *(Cont.)*	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.	Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and UDWR. A permit may be required under the Bald and Golden Eagle Protection Act. The steps outlined in the *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* should be followed. Ephemeral washes and the dry lakebed in the southwestern portion of the SEZ should be avoided.
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). The pronghorn is the only big game species with crucial habitat contained within the SEZ; however, direct impacts could occur to only about 0.3% of crucial habitat; thus impacts on pronghorn would be expected to be small.	The fencing around the solar energy development should not block the free movement of mammals, particularly big game species. Avoid the ephemeral washes and dry lakebed in the southwestern portion of the SEZ. Indirect impacts should be reduced by implementing design features and engineering controls that reduce runoff, sedimentation, spills, and fugitive dust.
Aquatic Biota[b]	Because there are no intermittent or permanent water bodies, streams, or wetlands present within the boundaries of either the Escalante Valley SEZ or the presumed access road and transmission line corridors, there would be no direct impacts on aquatic habitats or aquatic biota. Likewise, indirect effects to aquatic habitats would be unlikely because there are no perennial aquatic habitats within 13 mi (21 km) of the SEZ or within approximately 2 mi (3 km) of the access road corridor.	None.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Special Status Species[b]	Potentially suitable habitat for 18 special status species occurs in the affected area of the Escalante Valley SEZ. For all of these special status species, <1% of the potentially suitable habitat in the region occurs in the area of direct effects.	Pre-disturbance surveys should be conducted within the SEZ to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided, or impacts on occupied habitats minimized to the extent practicable. If avoiding or minimizing impacts on 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. Avoidance of pinyon-juniper and oak/mahogany woodlands in the area of direct effects could reduce impacts on two special status species. Consultation with the USFWS and the UDWR should be conducted to address the potential for impacts on the Utah prairie dog, a species listed as threatened under the ESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Coordination with the USFWS and the UDWR should be conducted to address the potential for impacts on the greater sage-grouse, a candidate species for listing under the ESA. Coordination would identify an appropriate pre-disturbance survey protocol, avoidance measures, and any potential compensatory mitigation actions. 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 UDWR.
Air Quality and Climate	*Construction*: Temporary exceedances of AAQS for PM_{10} and $PM_{2.5}$ at the SEZ boundaries possible during construction; higher concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. In addition, construction emissions from the engine exhaust from heavy equipment and vehicles could cause some impacts on air quality-related values (e.g., visibility and acid deposition) at the nearest federal Class I area, Zion NP, which is not located directly downwind of prevailing winds, but would be temporary in nature. *Operations*: Positive impact due to avoided emission of air pollutants from combustion-related power generation: 2.8 to 5.0% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Utah avoided (up to 1,845 tons/yr of SO_2, 3,528 tons/yr of NO_x, 0.007 tons/yr of Hg, and 2,000,000 tons/yr of CO_2).	None.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Visual Resources	The SEZ is in an area of low scenic quality. 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. Residents nearest to the SEZ could be subjected to large visual impacts from solar energy development within the SEZ. The SEZ and surrounding lands within the SEZ viewshed would incur large visual impacts due to major modification of the character of the existing landscape. Utility-scale solar energy development within the proposed Escalante Valley SEZ is unlikely to cause even moderate visual impacts on highly sensitive visual resource areas, the closest of which is more than 6 mi (10 km) from the SEZ. The closest community is approximately 15 mi (24 km) from the SEZ and is likely to experience minimal visual impacts from solar development within the SEZ. The communities of Modena, Enterprise, and Newcastle are located within the 25-mi (40-km) viewshed of the SEZ. Slight variations in topography and vegetation provide some screening. Visual impacts on these communities would be expected to be minimal.	None.
Acoustic Environment	*Construction*. For construction activities occurring near the nearest residences (about 1.1 mi [1.8 km]) beyond the northwestern SEZ boundary, estimated noise levels at these residences would be about 42 dBA, which is below the Iron County regulation of 50 dBA for a solar facility but a little higher than typical daytime mean rural background level of 40 dBA.	Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residences to the northwest 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.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Acoustic Environment *(Cont.)*	*Operations*. For a facility located near the northwestern corner of the SEZ, the predicted noise level for parabolic trough or power tower technologies would be about 40 dBA at the nearest residences, located about 1.1 mi (1.8 km) from the SEZ boundary, which is lower than the Iron County regulation of 50 dBA and the same as typical daytime mean rural background levels of 40 dBA. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residences would be 50 dBA, which is equivalent to the Iron County regulation of 50 dBA but much higher than typical nighttime mean rural background levels of 30 dBA. The day-night average noise level is estimated to be about 52 dBA L_{dn}, which is lower than the EPA guideline of 55 dBA for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level of 45 dBA at the nearest residences would be lower than the Iron County regulation of 50 dBA but higher than a typical daytime mean rural background level of 40 dBA. Assuming 12-hour daytime operation, the estimated 44 dBA L_{dn} at these residences would be well below the EPA guideline of 55 dBA L_{dn} for residential areas.	Dish engine facilities within the Escalante Valley 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 eastern or southwestern area of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.
Paleontological Resources	Few, if any, impacts on significant paleontological resources are likely to occur in the proposed Escalante Valley SEZ or in the additional ROWs for the associated access road and transmission line. However, a more detailed look at the geological deposits of the SEZ and within the ROWs is needed to determine whether a paleontological survey is warranted.	None.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Cultural Resources	Direct impacts on significant cultural resources could occur during site preparation and construction activities in the proposed SEZ. A cultural resource survey of the entire area of potential effect would first be required to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would follow to determine whether any are eligible for listing in the NRHP. The proposed SEZ has a high potential for containing archeological sites in the dune area in the southwest portion of the SEZ. The potential for direct impacts on cultural resources from access road construction from the southwest corner of the SEZ to State Route 56 exists, but would depend on the results of a cultural resources survey.	SEZ-specific design features would be determined in consultation with the Utah SHPO and affected Tribes. Avoidance of the dune area within the southwest portion of the proposed SEZ is recommended.
Native American Concerns	While no specific concerns regarding the proposed Escalante Valley SEZ have been expressed, as consultation with the Tribes continues and project-specific analyses are undertaken, it is possible that Native American concerns over potential effects of solar energy development within the SEZ will emerge.	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.
Socioeconomics	*Construction of solar facilities within the SEZ:* 264 to 3,518 total jobs; \$13.4 million to \$177.6 million income in ROI for facilities in the SEZ. Ten total jobs and \$0.4 million in total income for peak-year transmission line construction. *Operations of solar facilities within the SEZ:* 16 to 380 annual total jobs; \$0.5 million to \$11.6 million annual income in the ROI for facilities in the SEZ. No jobs and less than \$0.1 million total income annually for transmission line operation. *Construction of new transmission line:* 15 total jobs; \$0.6 million income. *Construction of access road:* 346 total jobs; \$10 million income.	None.

TABLE 13.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Escalante Valley SEZ	SEZ-Specific Design Features
Environmental Justice	Low-income populations, as defined by CEQ guidelines, occur within the 50-mi (80-km) radius around the boundary of the SEZ; therefore, although impacts are likely to be small, any adverse impacts of solar projects could disproportionately affect low-income populations. Because there are no minority populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would be no impacts on minority populations.	None.
Transportation	The primary transportation impacts would 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).	None.

Abbreviations: AAQS = ambient air quality standards; AQRV = air quality-related value; AUM = animal unit month; CEQ = Council on Environmental Quality; CO_2 = carbon dioxide; dBA = A-weighted decibel; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; L_{dn} = day-night average sound level; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; $PM_{2.5}$ = 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; PV = photovoltaic; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SO_2 = sulfur dioxide; TES = thermal energy storage; UDWR = Utah Division of Wildlife Resources; USFWS = U.S. Fish and Wildlife Service.

[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 Escalante Valley SEZ.

[b] The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 13.1.10 through 13.1.12.

Section 13.1.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Escalante Valley SEZ are included in Sections 13.1.2 through 13.1.21 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.

13.1.2 Lands and Realty

13.1.2.1 Affected Environment

The proposed Escalante Valley SEZ is located in an area of fragmented public land ownership, and numerous parcels of both state and private land abut portions of the area. The overall character of the land around the SEZ area is rural and undeveloped. There are no surface water resources within the SEZ, but areas with irrigated agriculture served by either surface or groundwater sources are located within 10 mi (16 km). Access to Escalante Valley is via county roads and numerous dirt roads. A railroad spur runs through the eastern edge of the SEZ. Iron County has asserted Revised Statute 2477 Class B and D road ROWs within the Escalante Valley SEZ.

In the Escalante Valley SEZ, there are existing ROWs for two small electric lines and for a railroad. As of February 2010, there were no applications for solar facility ROWs on BLM-administered lands in the vicinity of the Escalante Valley SEZ or in the state of Utah. There is a 138-kV transmission line that ends about 3 mi (5 km) south of the SEZ, and there is a 2-mi (3-km) wide Section 368 (of the Energy Policy Act of 2005) designated energy corridor about 4 mi (6 km) southeast of the area.

13.1.2.2 Impacts

13.1.2.2.1 Construction and Operations

Full development of the proposed Escalante Valley SEZ could disturb up to 5,291 acres (21 km^2) (Table 13.1.1.2-1). Development of the SEZ for utility-scale solar energy production would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is undeveloped and rural, utility-scale solar energy development would be a new and discordant land use to the area. It also is possible that with landowner agreement, the state and private lands adjacent to the SEZ would be developed in the same or a complementary manner as the public lands. Development of additional industrial or support activities also could be induced on additional state and private lands near the SEZ.

Existing ROW authorizations on the SEZ would not be affected by solar energy development because they are prior rights. Should the proposed SEZ be identified as an SEZ in the Record of Decision (ROD) for this programmatic environmental impact statement (PEIS), the BLM would still have discretion to authorize additional 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. Because the area currently has so few ROWs, it is not anticipated that approval of solar energy development would have a significant impact on ROW availability in the area.

13.1.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

Delivery of energy produced in the SEZ would require establishing connection to the regional grid; for analysis it is assumed that connection would be made to the existing 138-kV transmission line located south of the SEZ, since this line might be available to transport the power produced in this SEZ (see Section 13.1.1.2 for a description of analysis assumptions). This connection would likely cross private, state, and BLM-administered lands and could disturb as much as 91 acres (0.37 km^2).

At full build-out capacity, it is clear that additional new transmission lines and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Escalante Valley SEZ to load centers; however, at this time, the location and size of such new transmission facilities is 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 solar projects requiring additional transmission capacity.

Because the SEZ is 15 mi (24 km) from the nearest state highway, it is assumed that a new road would need to be constructed to State Route 56 south of the SEZ, disturbing approximately 109 acres (0.44 km^2) of land, most of which is private land. Existing county roads also could provide access to the SEZ, but upgrades to these roads may be required to support construction and operation. Roads and transmission lines would also be constructed within the SEZ to facilitate development of the area.

13.1.2.3 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. The exceptions may be impacts related to the exclusion of many existing and potential uses of the public land, perhaps in perpetuity; the visual impact of an industrialized-looking solar facility within an otherwise rural area; and any induced changes in land use on private and State lands.

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

- Priority consideration should be given to utilizing existing roads to provide construction and operational access to the SEZ.

13.1.3 Specially Designated Areas and Lands with Wilderness Characteristics

13.1.3.1 Affected Environment

There are two specially designated areas near the proposed SEZ. The first is the route of the Old Spanish National Historic Trail, which lies about 6 mi (10 km) south of the SEZ (see Section 13.1.17 for the description of this area). The second is the Three Peaks SRMA, which is located about 13 mi (21 km) southeast of the SEZ. The SRMA was established cooperatively by the BLM and Iron County to provide recreation opportunities in the area. The area contains unique volcanic rock formations and is popular for horseback riding, mountain biking, and off-highway vehicle (OHV) use (see Figure 13.1.3.1-1 for locations of these areas).

The latest revision to the 1999 Utah inventory for wilderness characteristics within BLM's Cedar City district office was completed in January 2005. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the proposed Escalante Valley SEZ.

13.1.3.2 Impacts

13.1.3.2.1 Construction and Operations

The potential impact from solar development on specially designated areas possessing unique or sensitive visual resources is difficult to quantify and would vary by solar technology employed, the size of area developed for solar energy, the specific area affected, and the perception of individuals viewing the development. In general, the closer a viewer is to solar development, the greater the apparent size and level of detail visible, usually resulting in greater perceived impacts on various resources. Although impact levels are usually "banded" based on distance (e.g., 0 to 5 mi, 5 to 15 mi [0 to 8 km, 8 to 24 km]), in general, actual perceived impacts decrease gradually as distance increases. Additionally, dense solar development and/or large solar facilities may have very large visual impacts, even at longer distances. Section 13.1.14 provides a more thorough discussion of the potential visual impacts associated with solar energy development.

The viewing height above a solar development area also is important to perceived impact levels, as higher-elevation viewpoints show more of the facilities, make the regular, man-made geometry of the solar arrays more apparent, and can cause increased incidence of glare and other reflections from the facilities. An individual viewer's expectations can also influence perceived impacts. For example, recreationists seeking a wilderness experience would likely be more adversely affected by the sight of intensive solar development than workers traveling along the highway for commuting purposes.

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 that were used to assess potential impacts on specially designated areas do not account for potential glint and glare effects; however, these

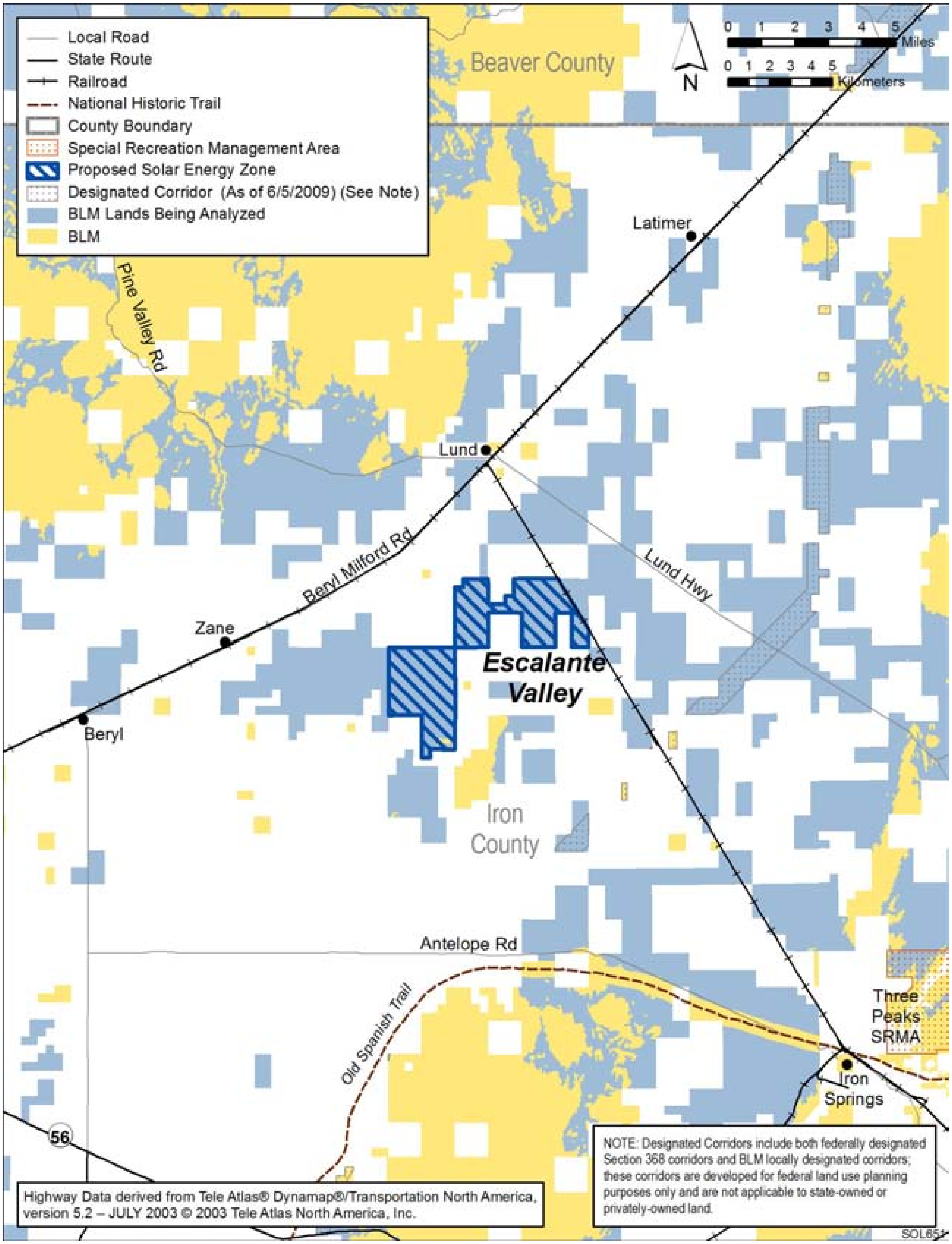

FIGURE 13.1.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Escalante Valley SEZ

effects would be incorporated into a future site- and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects.

Depending on the specific location within the SEZ and the solar technology deployed, solar development may be visible from portions of the route of the Old Spanish National Historic Trail. Because the nearest boundary of the SEZ is about 6 mi (10 km) from the route of the trail, it is not anticipated that there would be any adverse impacts on the management of the trail.

At the closest point, the Three Peaks SRMA is about 13 mi (21 km) from the border of the SEZ, and visitors in about 28% of the SRMA would have a clear but long-distance view of solar development within the SEZ. Because of the distance from the SEZ, the visual contrast caused by solar development would be very weak, and it is anticipated that there would be no impact on visitor use within the SRMA from solar development in the SEZ.

13.1.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

Construction of a new transmission line would add up to 91 acres (0.37 km^2) of surface disturbance, and construction of an access road to State Route 56 would add about 109 acres (0.44 km^2) of surface disturbance to the impact associated with the SEZ facilities. The road and power line would not be sufficiently close to sensitive areas to be likely to cause additional adverse impacts on specially designated areas.

13.1.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required. 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 specially designated areas.

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13.1.4 Rangeland Resources

Rangelands 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 Escalante Valley SEZ are discussed in Sections 13.1.4.1 and 13.1.4.2.

13.1.4.1 Livestock Grazing

13.1.4.1.1 Affected Environment

Grazing is currently authorized for the Butte allotment on the proposed Escalante Valley SEZ. Table 13.1.4.1-1 summarizes the size of the grazing allotment, along with the percentage of the allotment that lies within the SEZ. The allotment is used by two permittees and supports the production of 541 animal unit months (AUMs) of forage per year. These AUMs are allocated to cattle.

13.1.4.1.2 Impacts

Construction and Operations

Should utility-scale solar development occur in this SEZ, grazing would be excluded from the areas that would be developed, as provided for in the BLM grazing regulations (43 CFR 4100). This would include reimbursement of permittees for their portion of the value for any range improvements in the area removed from the grazing allotment. The

TABLE 13.1.4.1-1 Grazing Allotments within the Proposed Escalante Valley SEZ

Allotment	Total Acres[a]	Percentage of the Total in SEZ[b]	Active BLM AUMs	Number of Permittees in the Allotment
Butte	32,258 ($131\ km^2$)	20	541	2

[a] Includes all federal, state, and private acreage in the allotment.

[b] Represents the percentage of public land in the allotment within the SEZ.

Source: Data were derived from BLM (2009a) and are for the 2008 grazing year since these are the most current data available.

impact of this change on the grazing permits would depend on several factors: (1) how much of the allotment each permittee might lose to the development, (2) how important the specific land lost is to each permittee's overall operation, and (3) the amount of actual forage production that would be lost by each permittee. On the basis of an assumed loss of AUMs comparable to the percentage of the allotment included in the SEZ, a total of 109 AUMs could be lost from the allotment. Section 13.1.19 provides more information on the economic impact of the loss of grazing capacity.

Defining the impacts on individual grazing permits and permittees would require a specific analysis of each case on the basis of, at a minimum, the three factors identified above. For this PEIS and on the basis of an assumed loss of 109 AUMs as described above, there would be no significant impact on livestock use within the Cedar City Field Office from the designation and development of the Escalante Valley SEZ. This conclusion was derived from comparison of the loss of the 109 AUMs with the total BLM-authorized AUMs in the Cedar City Field Office for grazing year 2008, which totaled 139,998 AUMs. While small from an overall perspective, the loss of 20% of the AUMS from a relatively small livestock operation could have a significant impact on specific permittees, depending how important the public lands in the allotment are to their overall livestock operation and whether or not any mitigation of the loss (e.g., new range improvements) could be accomplished on the remaining public lands in the allotment.

Although the degree of impact on the permittees in this allotment would vary with their individual situations, there would be an adverse economic impact on each of them from the loss of use of a portion of the allotment. It is possible that solar energy development proponents could pay livestock operators for the loss of all or portions of the existing grazing permits and range improvements for the allotment to facilitate solar operations and to minimize the impact on existing permittees; however, that is not required by BLM regulations.

Transmission Facilities and Other Off-Site Infrastructure

Construction of a new transmission line would add about 91 acres (0.37 km^2) of surface disturbance and would cross a small portion of the Butte grazing allotment. Construction of an access road to State Route 56, depending on the terminus of the connection, would disturb an additional area of 15 acres (0.06 km^2) within the Butte allotment, but most of the road would be on lands that are not included within a grazing allotment. The total disturbance of 106 acres (0.43 km^2) is so small compared to the size of the Butte allotment there would be no additional impact on grazing use.

13.1.4.1.3 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 some mitigation for some identified impacts. The exception would be any adverse economic impact on the grazing permittees.

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

- Consideration should be given to the feasibility of replacing all or part of the lost AUMs through changes in grazing management or in development of additional range improvements on public lands remaining in the allotment.

13.1.4.2 Wild Horses and Burros

13.1.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Nineteen wild horse and burro herd management areas (HMAs) occur within Utah. Figure 13.1.4.2-1 shows the location of the HMAs within the proposed Escalante Valley SEZ region. The SEZ is about 7 mi (11 km) south of the Four Mile HMA and 6 mi (10 km) north of the Chloride Canyon HMA.

In addition to the BLM-managed HMAs, the U.S. Forest Service (USFS) has 51 established 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). The closest territory to the proposed Utah SEZs is the North Hills Territory within Dixie National Forest. This territory is adjacent to the North Hills HMA managed by the BLM and is located southwest of the SEZ (Figure 13.1.4.2-1). The proposed Escalante Valley SEZ is more than 24 mi (39 km) from the North Hills Territory.

13.1.4.2.2 Impacts

Because the proposed Escalante Valley SEZ is 6 mi (10 km) or more from any wild horse and burro HMA managed by the BLM and more than 24 mi (39 km) from any wild horse and burro territory administered by the USFS, solar energy development within the SEZ would not affect any wild horses and burros managed by these agencies.

13.1.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

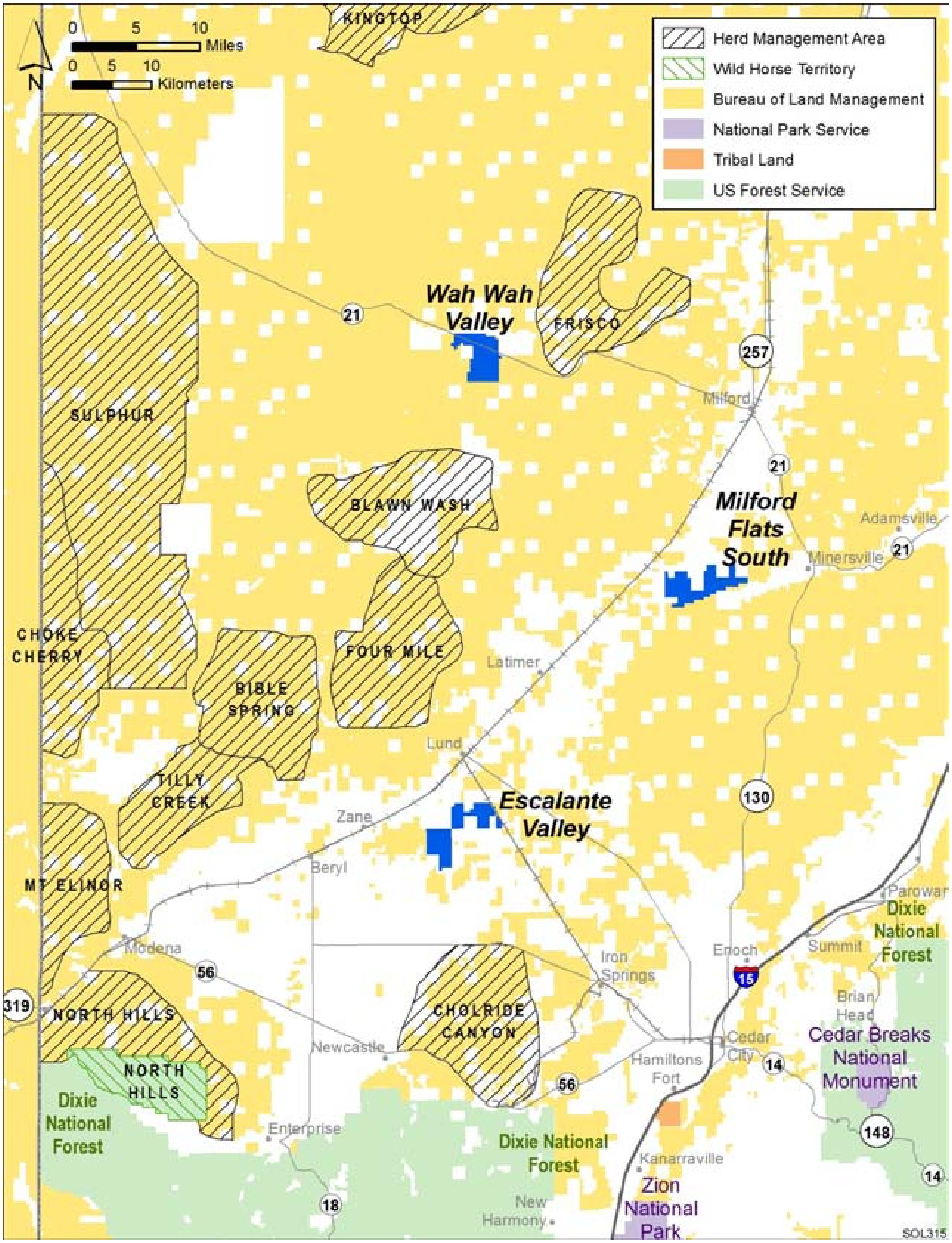

FIGURE 13.1.4.2-1 Wild Horse and Burro Herd Management Areas and Territories within the SEZ Region for the Proposed Escalante Valley SEZ (Sources: BLM 2009b; USFS 2007)

13.1.5 Recreation

13.1.5.1 Affected Environment

The site of the proposed Escalante Valley SEZ is flat, and its unremarkable nature offers little potential for recreation use. The area would not be expected to attract recreational visitors from outside the area; however, it may be used by local residents for general outdoor recreation, including backcountry driving and OHV use, recreational shooting, and small and big game hunting. Site visits in September 2009 showed signs of recent vehicle and OHV use. The SEZ area has not been designated for vehicle travel in a BLM land use plan but will be considered in the upcoming revision of the land use plans in the Cedar City Field Office.

13.1.5.2 Impacts

Recreational users would be excluded from any portions of the SEZ that are developed for solar energy production. Whether recreational visitors would continue to use any remaining undeveloped portions of the SEZ is unknown. Public access through areas developed for solar power production could be lost unless access routes were identified and retained. It is anticipated that the loss of recreational use if the SEZ were developed would be minimal.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. There may be routes designated as open within the proposed SEZ. Such open routes crossing areas granted ROWs for solar facilities 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).

13.1.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required. 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.

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13.1.6 Military and Civilian Aviation

13.1.6.1 Affected Environment

The SEZ is not located under any military training routes (MTRs) or special use airspace (SUA) and is not identified as a DoD consultation area in the BLM's land records (BLM and USFS 2010b).

The closest civilian municipal aviation facility is the Cedar City Regional Airport, about 30 mi (48 km) east-southeast of the Escalante Valley SEZ.

13.1.6.2 Impacts

On the basis of comments received from the military, there are no concerns with respect to military aviation for the proposed Escalante Valley SEZ.

Because the closest municipal airport is about 30 mi (48 km) from the SEZ, no impacts on civilian aviation from solar development of the SEZ are expected.

13.1.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to protect military or civilian aviation uses. The programmatic design features described in Appendix A, Section A.2.2, would require early coordination with the DoD to identify and mitigate, if possible, potential impacts on the use of MTRs.

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13.1.7 Geologic Setting and Soil Resources

13.1.7.1 Affected Environment

13.1.7.1.1 Geologic Setting

Regional Setting

The proposed Escalante Valley SEZ is located in the Escalante Desert region of the Basin and Range physiographic province in southwestern Utah. The SEZ sits in Escalante Valley, which occupies the southernmost portion of the Escalante Desert. Escalante Valley is surrounded by the Indian Peak Range and Wah Wah Mountains on the northwest, the Bull Valley and Pine Valley Mountains on the south, and the Antelope Range on the southeast. The valley opens to the northeast into the Escalante Desert (Figure 13.1.7.1-1).

Escalante Valley has a long depositional history, with thick sequences of marine miogeosynclinal sediments (carbonates, sandstone, siltstone, and shale) deposited throughout the Late Precambrian and Paleozoic, followed by several orogenic episodes (from the Early Triassic to Oligocene). Volcanic activity in southwestern Utah during the Oligocene and Miocene produced extensive deposits of ignimbrites, lava flows, and volcanic breccias in the region. Block faulting associated with crustal extension in the Basin and Range province began in the Miocene, about 20 million years ago. The Escalante Valley SEZ overlies a large northeast-trending gravity low (near Lund) that indicates the presence of a graben (Klauk and Gouley 1983; Mason 1998).

Basin fill sediments are estimated to be up to 4,900 ft (1,490 m) thick, with the uppermost layer consisting of lacustrine deposits of fine-grained clay, silt, and marl in the valley center, intertongued with deltaic and alluvial deposits of clay, silt, sand and gravel along the valley margins (Mason 1998; Lund et al. 2005). The thickness of the upper layer is estimated by Gerston and Smith (1979) to range from 300 ft (90 m) near the valley margins to as much as 3,900 ft (1,190 m) along the valley axis. The lacustrine and deltaic sediments are associated with Lake Bonneville, an ancient (Pleistocene) lake that covered most of western Utah and parts of eastern Nevada and southern Idaho from 32,000 to 14,000 years ago (UGS 2010). Shoreline deposits of Lake Bonneville occur at elevations up to about 5,200 ft (1,585 m) (White 1932; Mason 1998). The composition of deeper sediments (greater than 3,900 ft [1,190 m]) is unknown, but seismic refraction profiles indicate they are more consolidated (i.e., cemented and compacted) than sediments of the upper layer. These sediments overlie basement rocks composed of Precambrian gneiss (Mason 1998).

Exposed sediments in Escalante Valley are predominantly modern alluvium and Lake Bonneville lacustrine deposits (Figure 13.1.7.1-2). Dune sands are common and occur along the edges or in close proximity to the exposed lake deposits. The surrounding mountains are composed of volcanic rocks of Tertiary and Quaternary age (Hintze 1980; Mason 1998).

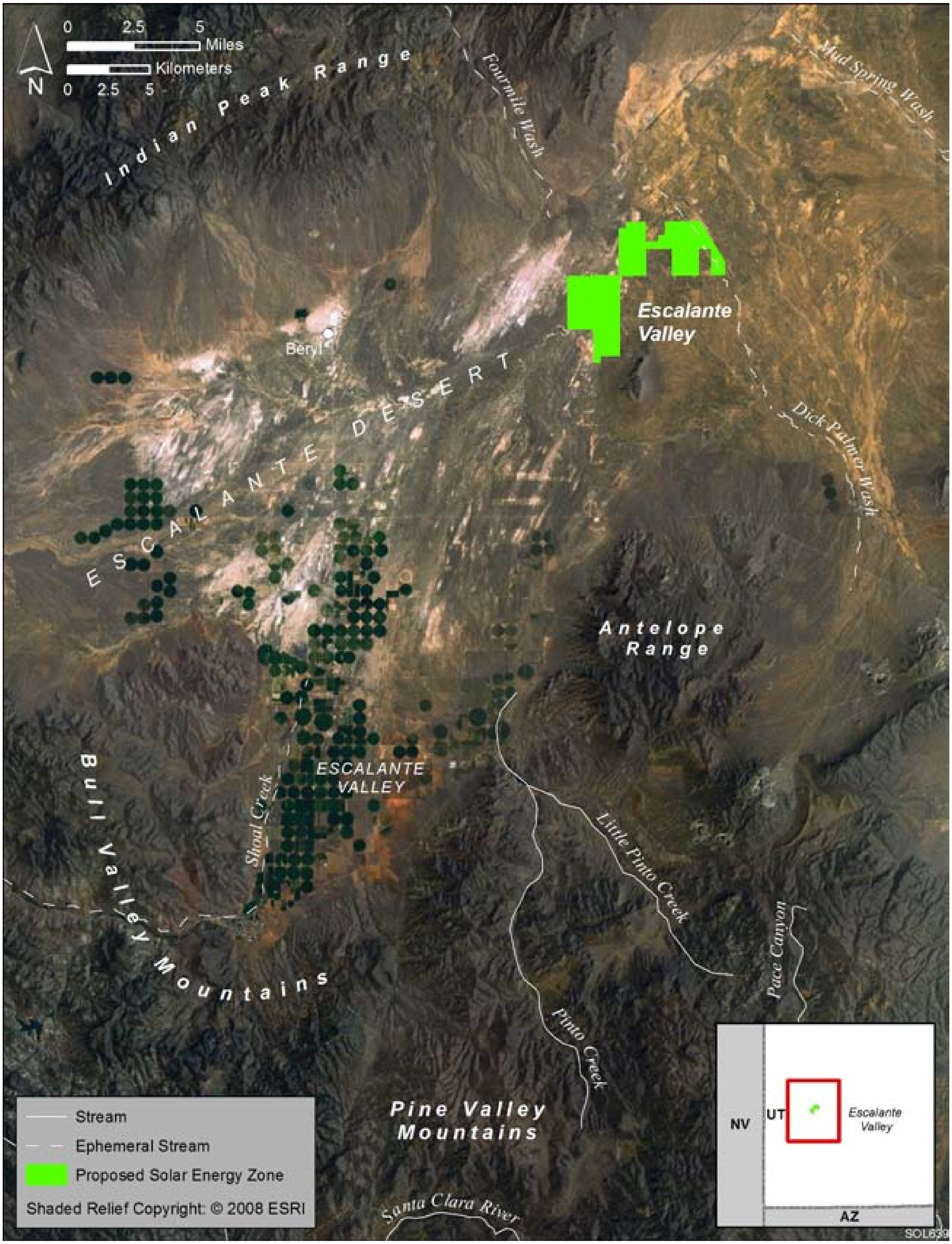

FIGURE 13.1.7.1-1 Physiographic Features of the Escalante Desert Region

Topography

Escalante Valley is a northeast-trending basin with an area of about 1,500 mi^2 (3,885 km^2), a length of about 60 mi (100 km), and a width of 25 mi (40 km) (Lund et al. 2005). Elevations along the valley axis range from about 5,740 ft (1,750 m) along the valley sides to less than 5,120 ft (1,560 m) in the valley center, where the proposed Escalante Valley SEZ is located. Gently sloping alluvial fan deposits occur along the mountain fronts and coalesce toward the valley center. The valley center is flat except for a few sand dunes. It is drained by numerous ephemeral streams.

The proposed Escalante Valley SEZ is located just north of the Antelope Range in the Escalante Desert (Figure 13.1.7.1-3). Its surface is relatively flat, with elevations ranging from 5,094 ft (1,553 m) along the northern border of the site to 5,242 ft (1,600 m) in the southeast corner of its lower portion. The highest point in the area is Table Butte, just to the southeast of the SEZ, which has a maximum elevation of 5,845 ft (1,782 m). The Dick Palmer Wash (flowing to the northwest across the northeast corner) and several unnamed ephemeral streams cross the site.

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 5.7.4.2. The following sections provide a preliminary assessment of these hazards at the proposed Escalante Valley 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 mitigation measures to minimize their risk.

Seismicity. Southwestern Utah is tectonically active. The Escalante Desert lies within the Intermountain Seismic Belt (ISB), a north-trending zone of seismic activity that coincides with the eastern margin of the transitional zone between the Basin and Range and Colorado Plateau provinces, stretching from northwestern Montana through Wyoming, Idaho, and Utah to southern Nevada and northern Arizona. The major active faults in southwestern Utah are located within the ISB. Earthquake activity in southwestern Utah typically occurs in dense clusters or swarms with magnitudes less than 4.0 (University of Utah 2009a; UGS 2009; Lund et al. 2007). Historically, several earthquakes with magnitudes greater than 6.0 have occurred in southwestern Utah. A 1992 earthquake in the St. George area (magnitude of 5.9), about 60 mi (100 km) to the south of the proposed Escalante Valley SEZ, caused little damage to local buildings but triggered the largest landslide known for an earthquake of its magnitude (University of Utah 2009a; Christensen 1995).

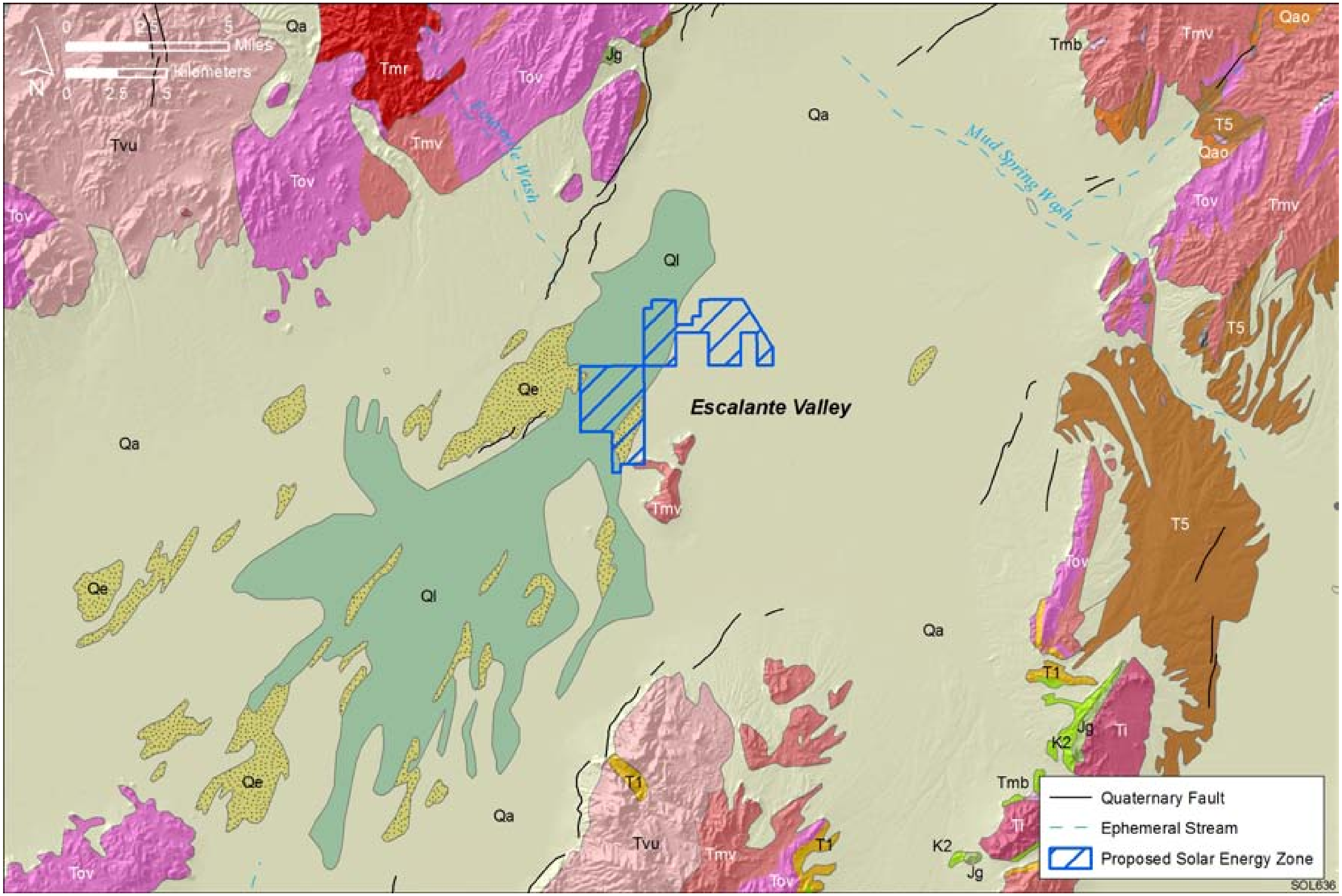

FIGURE 13.1.7.1-2 Geologic Map of the Escalante Desert Region (adapted from Ludington et al. 2007 and Hintze 1980)

Cenozoic (Quaternary, Tertiary)

- Qa Alluvium and colluvium
- Qao Older alluvial deposits
- Ql Lake Bonneville deposits
- Qe Eolian deposits
- T5 Sevier River Formation
- T1 White Sage Formation
- Tmb Basalts
- Tmr Rhyolites
- Tmv Quichapa Group and other volcanic rocks
- Ti Intrusive rocks, mainly granite
- Tov Ash-flow tuffs (Isom, Needles Range, Escalante Desert and Sawtooth Peak Formations; and Tunnel Spring Tuff)
- Tvu Volcanic rocks, undivided (Tertiary)

Mesozoic

- K2 Frontier Formation (marine sandstone and shale)
- Jg San Rafael Group (sandstone and siltstone)

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FIGURE 13.1.7.1-2 (Cont.)

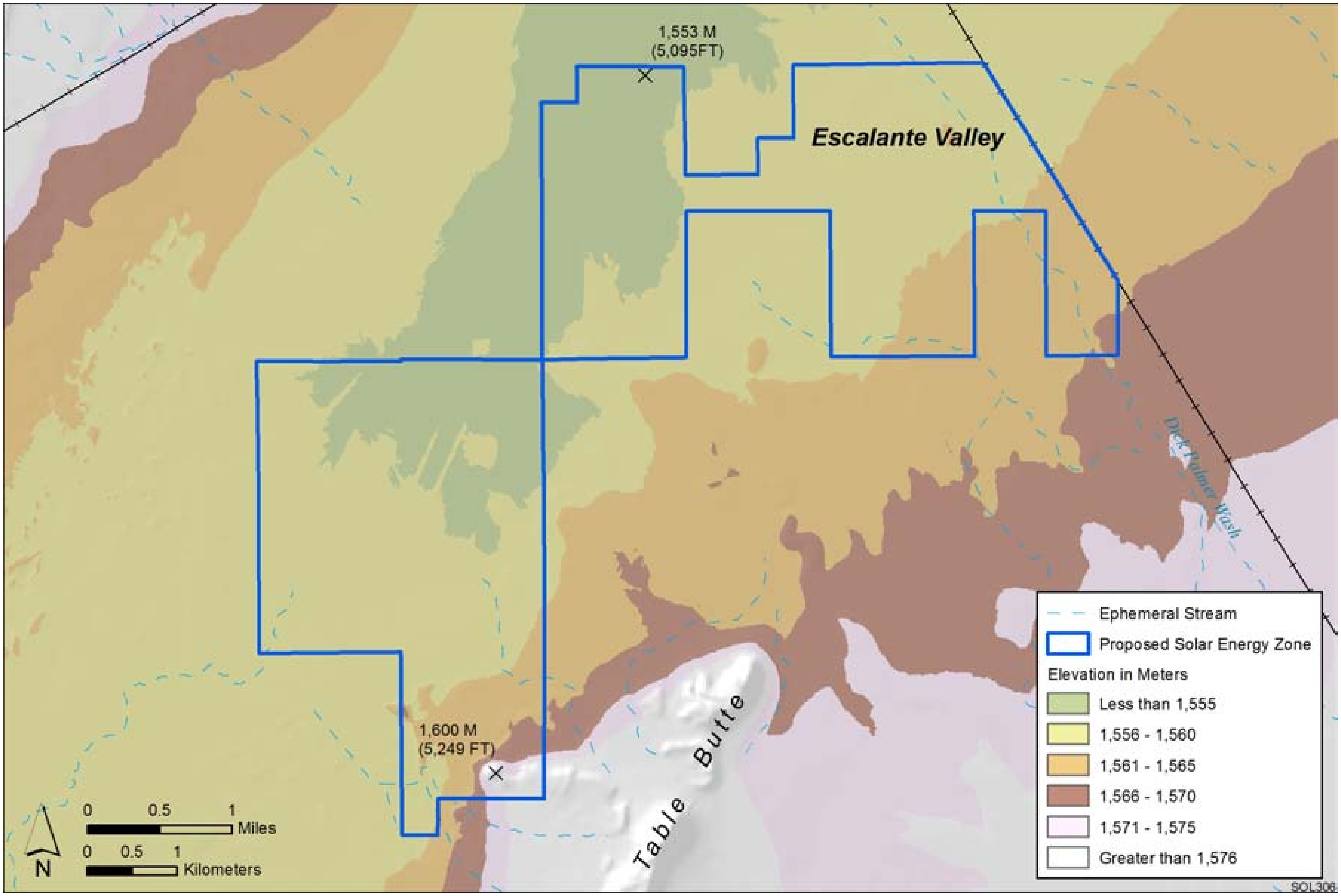

FIGURE 13.1.7.1-3 General Terrain of the Proposed Escalante Valley SEZ

No known Quaternary age faults occur within the proposed Escalante Valley SEZ. The closest Quaternary fault is the south end of the Wah Wah Mountains fault, a north-to-northeast–striking normal fault that lies about 1.7 mi (2.7 km) to the west (Figure 13.1.7.1-4). Highly dissected scarps along this fault suggest multiple faulting events, the most recent less than 130,000 years ago (Black and Hecker 1999a). The Antelope Range fault, which runs along the western front of the Antelope Range, is located about 7 mi (11 km) to the south of the proposed Escalante Valley SEZ. The normal northeast-striking fault is much older and less well understood than the Wah Wah Mountains fault. Movement along this fault dates to the middle to late Pleistocene (between 17,000 and 750,000 years ago) (Hecker 1993; Black and Hecker 1999b).

From June 1, 2000, to May 31, 2010, 55 earthquakes were recorded within a 61-mi (100-km) radius of the proposed Escalante Valley SEZ. The largest earthquake during that period occurred on August 18, 2007. It was located about 10 mi (16 km) to the northeast of the SEZ near Mud Spring Wash and registered a moment magnitude[1] (Mw) of 4.1 (Figure 13.1.7.1-4). During this period, 19 (35%) of the recorded earthquakes within a 61-mi (100-km) radius of the SEZ had magnitudes greater than 3.0; none were greater than 4.1 (USGS 2010b).

Liquefaction. The proposed Escalante Valley SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.08 and 0.09 g. Shaking associated with this level of acceleration is generally perceived as moderate to strong; however, the potential damage to structures is light (USGS 2008). Given the low intensity of ground shaking estimated for the Escalante Valley, the potential for liquefaction in Escalante Valley sediments is also likely to be low. The Utah Geological Survey (UGS) has published liquefaction susceptibility maps for several counties within Utah (mainly those counties encompassing portions of the Great Salt Lake shoreline and other lakes and rivers); however, none have been prepared for Iron County.

Volcanic Hazards. Extensive volcanic activity occurred in southwestern Utah throughout the Tertiary period, shifting in composition from calc-alkaline ash flow tuff eruptions to basalt and rhyolite lava flows about 23 million years ago, when extensional faulting in the eastern Basin and Range province began. Although there are numerous Quaternary age volcanic (basaltic and lesser quantities of rhyolite) vents and flows in the region, there is little evidence of volcanic activity in the past 1,000 years (Anderson and Christenson 1989; Klauk and Gourley 1983; Hecker 1993).

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[1] Moment magnitude (Mw) is used for earthquakes with magnitudes greater than 3.5 and is based on the moment of the earthquake, equal to the rigidity of the earth times the average amount of slip on the fault times the amount of fault area that slipped (USGS 2010c).

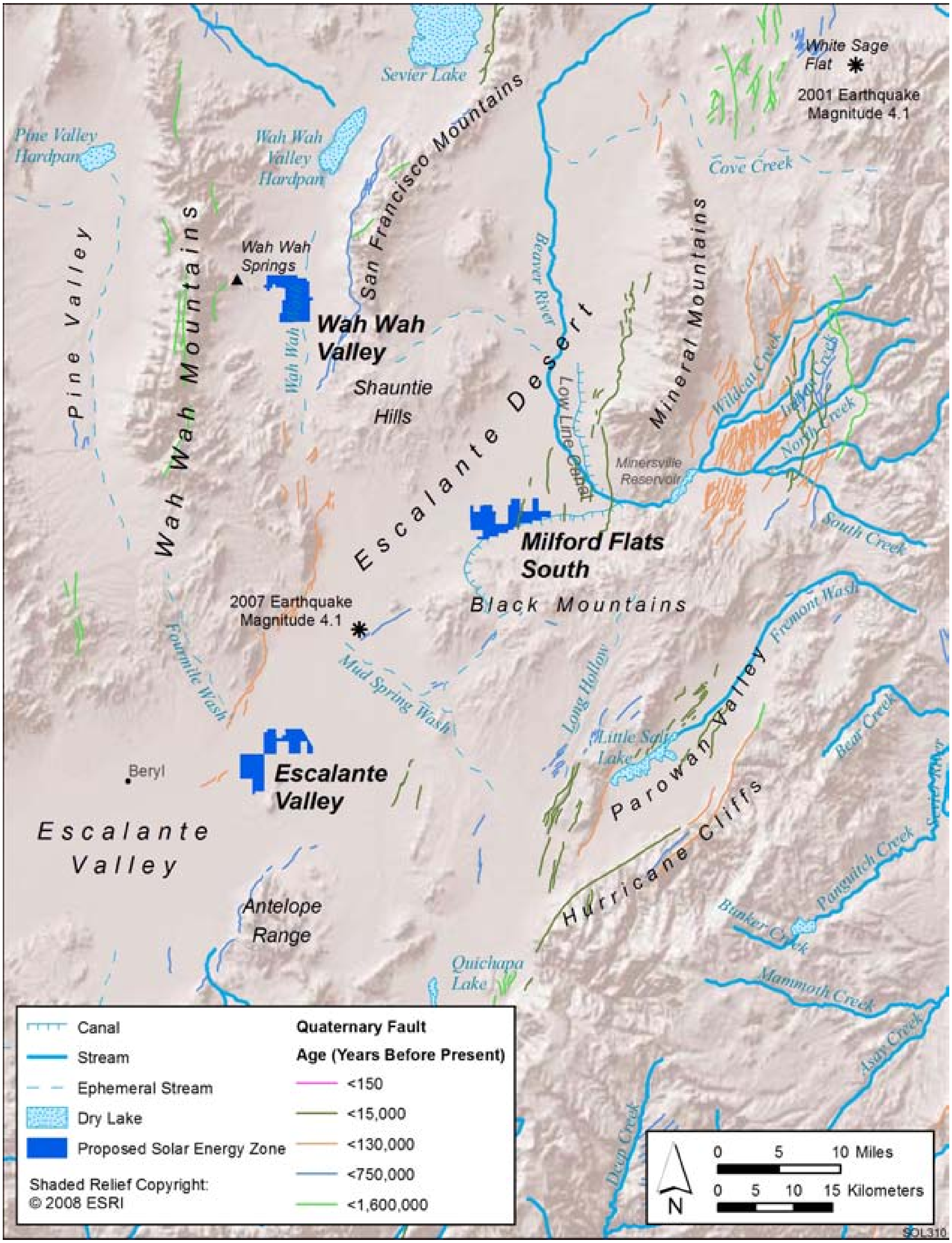

FIGURE 13.1.7.1-4 Quaternary Faults in the Escalante Desert Region (Sources: USGS and UGS 2009; USGS 2010b)

The nearest active volcano is Mount St. Helens in the Cascade Range (Washington), about 750 mi (1,200 km) northwest of Escalante Valley, which has shown some activity as recently as 2008. The nearest volcano that meets the criterion for an unrest episode is the Long Valley Caldera in east-central California, about 290 mi (470 km) to the west, which has experienced recurrent earthquake swarms, changes in thermal springs and gas emissions, and uplift since 1980 (Diefenbach et al. 2009). The Long Valley Caldera is part of the Mono-Inyo Craters volcanic chain that extends from Mammoth Mountain (on the caldera rim) northward about 25 mi (40 km) to Mono Lake. Small to moderate eruptions have occurred at various sites along the volcanic chain in the past 5,000 years at intervals ranging from 250 to 700 years. Windblown ash (tephra) from some of these eruptions is known to have drifted as far east as Nebraska. While the probability of an eruption within the volcanic chain in any given year is small (less than 1%), serious hazards could result from a future eruption. Depending on the location, size, timing (season), and type of eruption, hazards could include mudflows and flooding, pyroclastic flows, small to moderate volumes of tephra, and falling ash (Hill et al. 1998, 2000; Miller 1989).

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 such as Escalante Valley if they are located at the base of steep slopes. The risk of rock falls and slope failures decreases toward the flat valley center.

The UGS has documented earth fissures along the surface due to ground subsidence near Beryl Junction to the south of the proposed Escalante Valley SEZ. These fissures are thought to result from groundwater withdrawal in the area, which has caused compaction in the Escalante Valley aquifer. Lund et al. (2005) observed that between the late 1940s and 2002 water levels in monitoring wells have fallen as much as 105 ft (32 m). The earth fissures tend to occur in areas of high drawdown. Even if stabilized (by increased recharge or decreased pumping), residual compaction may still occur at a reduced rate for several decades (Galloway et al. 1999).

Other Hazards. Other potential hazards at the proposed Escalante Valley 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 varnish (and pavement) on soil surfaces may also increase the likelihood of soil erosion by wind.

Alluvial fan surfaces, such as those found in some areas of Escalante Valley, 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) will depend on the specific morphology of the fan (National Research Council 1996). Section 13.1.9.1.1 provides further discussion of flood risks within the proposed Escalante Valley SEZ.

13.1.7.1.2 Soil Resources

The dominant soil orders in southwestern Utah are Aridisols, Entisols, and Molisols (see Table 4.2.1-1). They are generally very deep, loamy soils that are well drained to somewhat excessively drained. Soils in the regions of the three Utah SEZs were formed on alluvial fans and flats and on lake terraces and lake plains. Parent material consists mainly of alluvium and colluvium (with some eolian materials) derived from mixed igneous and sedimentary rocks and lake sediments (NRCS 2009). Although mechanical and microbiotic crusts are common on Utah soils (Milligan 2009), none have been reported for soils covering the three SEZs, and none were observed in the field.

Soils within the proposed Escalante Valley SEZ are predominantly the silt loams of the Bullion-Antelope Springs complex, the Bullion-Berent complex, the Bullion Series, and the Bullion-Taylorsflat complex, which together make up about 93% of the soil coverage at the site (Figure 13.1.7.1-5). These soils are very deep and well drained, with high surface runoff potential and moderately high permeability (although the smectitic silt loams of the Bullion Series tend to have low permeability). Playa lake sediments occur along the western boundary of the lower portion of the site, covering less than 1% of the SEZ. The natural soil surface is suitable for roads, with a slight to moderate erosion hazard when used as roads or trails (except for the sloping soils of the Saxby Series, which have a severe erosion hazard). The water erosion hazard is severe for most soils. The susceptibility to wind erosion is moderate, with as much as 86 tons (78 metric tons) of soil eroded by wind per acre (4,000 m^2) each year. All the soils within the SEZ have features that are favorable for fugitive dust formation (NRCS 2010). Soil map units are described in Table 13.1.7.1-1. Biological soil crusts and desert pavement have not been documented within the SEZ, but may be present.

None of the soils within the SEZ is rated as hydric.[2] Flooding is not likely for soils at the site (occurring less than once in 500 years). The Escalante sandy loam (covering about 1% of the SEZ) is classified as farmland of statewide importance (NRCS 2010).

Soils in this region are used mainly as rangeland for grazing cattle and sheep, pastureland, and irrigated cropland. The major crops in the region are irrigated alfalfa hay, wheat, barley, potatoes, and corn (USDA 1998).

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

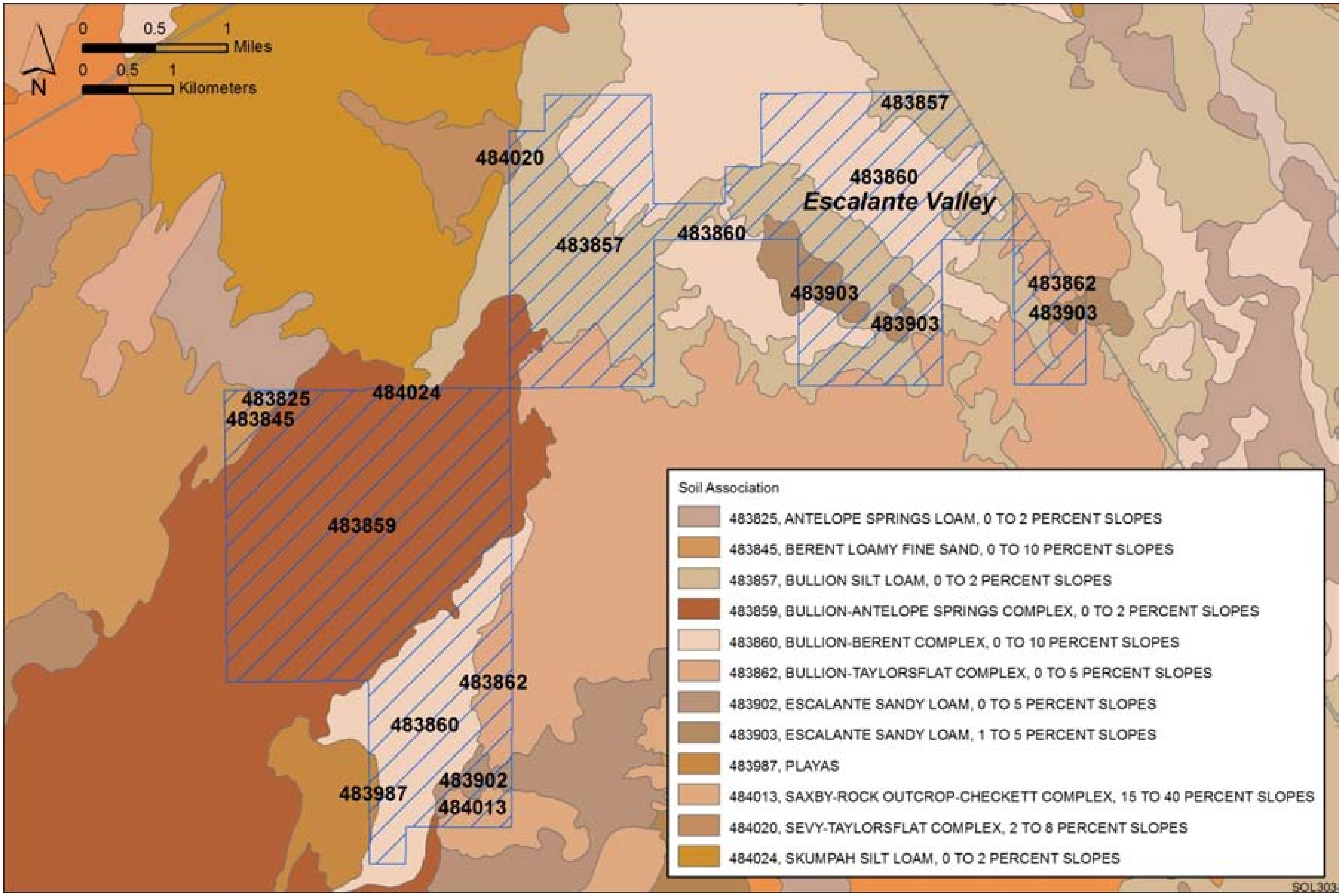

FIGURE 13.1.7.1-5 Soil Map for the Proposed Escalante Valley SEZ (Source: NRCS 2008)

TABLE 13.1.7.1-1 Summary of Soil Map Units within the Proposed Escalante Valley SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area in Acres[c] (% of SEZ)
483859	Bullion-Antelope Springs complex (0 to 2% slopes)	Severe	Moderate (WEG 4)[d]	Level to nearly level soils (silt loams) on alluvial flats, alluvial fans, and fan remnants. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and moderately high permeability. Moderately to strongly saline. Available water capacity is moderate. Severe rutting hazard. Used for rangeland, irrigated pastureland, and urban development (Bullion).	2,191 (33)
483860	Bullion-Berent complex (0 to 10% slopes)	Severe	Moderate (WEG 4)	Level to gently sloping soils (silt loams) on alluvial flats, alluvial fans, and dunes. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and moderately high permeability. Moderately to strongly saline. Available water capacity is moderate. Severe rutting hazard. Used for rangeland and wildlife habitat.	1,814 (28)
483857	Bullion silt loam (0 to 2% slopes)	Severe	Moderate (WEG 4)	Level to nearly level soils on alluvial flats and alluvial fans. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are deep and well drained, with high surface runoff potential (very slow infiltration rate) and moderately high permeability. Moderately to strongly saline. Available water capacity is moderate. Severe rutting hazard. Used for rangeland and urban development.	1,597 (24)
483862	Bullion-Taylorsflat complex (0 to 5% slopes)	Severe	Moderate (WEG 4)	Nearly level soils (silt loams) on alluvial flats, alluvial fans, and fan remnants. Parent material consists of alluvium from igneous and sedimentary rocks and/or lacustrine deposits. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and moderately high permeability. Moderately to strongly saline. Available water capacity is moderate. Severe rutting hazard. Used for rangeland, irrigated cropland, wildlife habitat, and urban development (Bullion).	554 (8)

TABLE 13.1.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area in Acres[c] (% of SEZ)
483903	Escalante sandy loam (1 to 5% slopes)	Moderate	Moderate (WEG 3)	Nearly level soils on alluvial flats and alluvial fan remnants. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with moderate surface runoff potential and high permeability. Available water capacity is moderate. Farmland of statewide importance.[e] Severe rutting hazard. Used for livestock grazing and cultivation.	166 (3)
484013	Saxby-rock outcrop-Checkett complex (15 to 40% slopes)	Slight	Moderate (WEG 6)	Sloping soils (very stony loams) on mountain slopes and alluvial fan remnants. Parent material consists of colluvium from basalt or residuum weathered from basalt. Soils are shallow and well drained, with a high surface runoff potential (very slow infiltration rate) and moderately high permeability. Available water capacity is very low. Moderate rutting hazard. Used mainly for rangeland.	74 (1)
483845	Berent loamy fine sand (0 to 10% slopes)	Moderate	High (WEG 2)	Undulating soils on dunes. Parent material consists of eolian deposits from igneous and sedimentary rocks. Soils are very deep and somewhat excessively drained, with low surface runoff potential (high infiltration rate) and high permeability. Available water capacity is low. Severe rutting hazard. Used for rangeland and wildlife habitat.	69 (1)
483902	Escalante sandy loam (0 to 5% slopes)	Moderate	Moderate (WEG 3)	Nearly level soils on alluvial flats and alluvial fan remnants. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with moderate surface runoff potential and high permeability. Available water capacity is moderate. Farmland of statewide importance.[e] Severe rutting hazard. Used for livestock grazing and cultivation.	68 (1)
483987	Playas	Not rated	Not rated	Level soils in playa depressions. Consist of stratified silty clay loam to silt loam to very fine sand. Soils are very poorly drained with a high surface runoff potential (very slow infiltration rate). Moderately to strongly saline. Severe rutting hazard.	19 (<1)

TABLE 13.1.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area in Acres[c] (% of SEZ)
483825	Antelope Springs loam (0 to 2% slopes)	Moderate	Moderate (WEG 6)	Level to nearly level soils on alluvial flats and alluvial fan remnants. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with high surface runoff potential (slow infiltration rate) and high permeability. Available water capacity is moderate. Severe rutting hazard. Used mainly for rangeland.	16 (<1)
484020	Sevy-Taylorsflat complex (2 to 8% slopes)	Moderate	Moderate (WEG 6)	Nearly level to gently sloping soils (loams) on stream terraces, alluvial flats, and alluvial fan remnants. Parent material consists of alluvium from igneous and sedimentary rock. Soils are very deep and well drained, with moderate surface runoff potential and moderately high permeability. Available water capacity is moderate. Severe rutting hazard. Used for rangeland, irrigated cropland, and wildlife habitat.	14 (<1)
484024	Skumpah silt loam (0 to 2% slopes)	Severe	Moderate (WEG 4)	Level to nearly level soils on alluvial flats. Parent material consists of alluvium from igneous and sedimentary rocks. Soils are very deep and well drained, with high surface runoff potential (very low infiltration rate) and moderately high permeability. Severe rutting hazard. Used for rangeland, irrigated cropland, and pasture.	5 (<1)

[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] Wind erosion potential here is based on the wind erodibility group (WEG) designation: groups 1 and 2, high; groups 3 through 6, moderate; and groups 7 and 8 low (see footnote d for further explanation).

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

Footnotes continued on next page.

TABLE 13.1.7.1-1 (Cont.)

[d] 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: WEG 2, 134 tons per acre per year; WEGs 3 and 4, 86 tons per acre per year; and WEG 6, 48 tons per acre per year.

[e] Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. Farmland of statewide importance includes soils in NRCS's land capability Class II and III that do not meet the criteria for Prime farmland, but may produce high yields of crops when treated and managed according to acceptable farming methods.

Source: NRCS (2010).

13.1.7.2 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.

13.1.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed Escalante Valley 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.

13.1.8 Minerals (Fluids, Solids, and Geothermal Resources)

13.1.8.1 Affected Environment

There are no locatable mining claims within the proposed Escalante Valley SEZ (BLM and USFS 2010a). The land of the SEZ was closed to locatable mineral entry in June 2009, pending the outcome of this solar energy PEIS. There are four active oil and gas leases that cover most of the SEZ, but they are classified as nonproducing (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. There are several areas within about 6 mi (10 km) north and west of the SEZ that were previously leased for geothermal resources but have now been closed (BLM and USFS 2010b). No geothermal development has occurred within or adjacent to the Escalante Valley SEZ.

13.1.8.2 Impacts

The oil and gas leases within the Escalante Valley SEZ are prior existing rights and represent a potential conflict with future solar development. As long as these leases remain in effect, solar development would require the agreement of the oil and gas lessees. Such cooperation might be possible, since oil and gas development generally requires fewer than 5 acres (0.02 km^2) per well, but it would depend on accommodating the oil and gas lease holders' need for continued access to develop, maintain, and service wells.

If the area is identified as a solar energy development zone, it would continue to be closed to all incompatible forms of mineral development. It is assumed that future development of oil and gas resources would continue to be possible, since such development could occur on the existing leases or from directional drilling outside the lease area. Since the SEZ does not contain existing mining claims, it was also assumed that there would be no future loss of locatable mineral production. The production of common minerals, such as sand and gravel and mineral materials used for road construction, might take place in areas not directly developed for solar energy production.

The SEZ has had no history of development of geothermal resources or of leasing interest. For that reason, it is not anticipated that solar development would adversely affect development of geothermal resources.

13.1.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary 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 locatable minerals, and oil and gas resources and geothermal resources.

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13.1.9 Water Resources

13.1.9.1 Affected Environment

The proposed Escalante Valley SEZ is within the Escalante Desert–Sevier Lake subregion of the Great Basin hydrologic region (USGS 2010a). The proposed Escalante Valley SEZ is located in the Beryl-Enterprise area in the southern Escalante Desert Valley. The basin floor of the Beryl-Enterprise area covers an area of approximately 570,000 acres (2,300 km^2). The Escalante Desert Valley is within the Basin and Range physiographic province, which is characterized by intermittent mountain ranges and desert valleys (Robson and Banta 1995). The region consists of semiarid desert valleys where surface waters are typically limited to ephemeral washes and dry lakebeds, and the primary water resource is groundwater. The proposed SEZ is located in the north-central portion of the Beryl-Enterprise area, which is surrounded by a series of low hills to the east and west, the Bull Valley Mountains and the Antelope Range to the south, and the Indian Peak Range and the Wah Wah Mountains to the north (Figure 13.1.9.1-1). The valley opens to the northeast into the Milford area of the Escalante Desert Valley. Surface elevations within the proposed Escalante Valley SEZ range from 5,094 ft (1,553 m) along the northern border of the site to 5,213 ft (1,589 m) at the southeast corner of its lower portion. The highest point in the area is Table Butte, just to the southeast, with a maximum elevation of 5,845 ft (1,782 m). Precipitation in the higher elevations ranges from 8 in./yr to more than 25 in./yr (20 to 64 cm/yr), whereas the average precipitation in the valley is estimated to be 8 in./yr (20 cm/yr) (USDA 2007; WRCC 2010a). The average annual pan evaporation rate is estimated to be 71 in./yr (180 cm/yr) (Cowherd et al. 1988; WRCC 2010b).

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

The proposed Escalante Valley SEZ is located within Utah's Cedar/Beaver River Basin planning area (UBWR 1995). The surface water features near the proposed Escalante Valley SEZ are limited to ephemeral washes and a dry lakebed west of Table Butte in the southwestern portion of the SEZ (Figure 13.1.9.1-1). The Dick Palmer Wash is a named ephemeral wash that flows north from the Antelope Range and through the southeastern portion of the SEZ. Fourmile Wash is an ephemeral wash that drains the Wah Wah Mountains toward the south near the proposed SEZ. Mud Spring Wash drains the Black Mountains, located 9 mi (14 km) east of the SEZ. The only perennial and intermittent streams in the vicinity of the SEZ drain the mountain ranges in the southern part of the basin, near the cities of Enterprise and Newcastle (Mower and Sandberg 1982).

The proposed Escalante Valley SEZ is located in an area that has not been examined for flood risk (Zone D) by FEMA (FEMA 2009). Flooding caused by large rainfall events would be limited to localized ponding and erosion, since there are no permanent surface water features near the proposed SEZ. High-intensity rainstorms in the area have been observed to cause significant flooding and damage in populated areas within the basin (UBWR 1995). According to the NWI, no wetlands have been identified within or near the proposed SEZ (USFWS 2009).

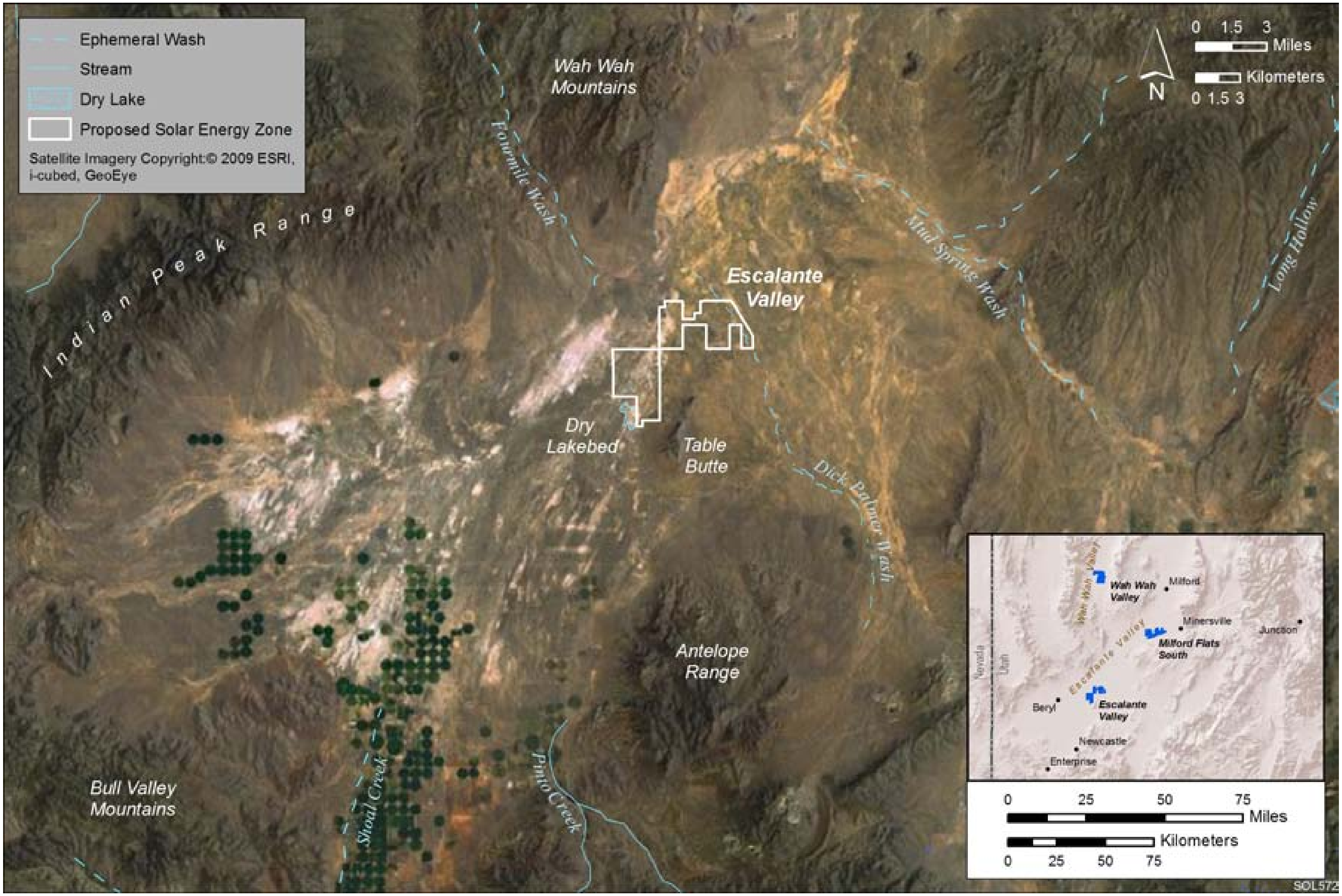

FIGURE 13.1.9.1-1 Surface Water Features near the Proposed Escalante Valley SEZ

There are many springs in the mountains surrounding the SEZ; however, the springs are thought to be fed by precipitation that creates localized perched water tables and not by the basin-fill groundwater reservoir beneath the SEZ (Mower and Sandberg 1982).

13.1.9.1.2 Groundwater

The proposed Escalante Valley SEZ is within the Beryl-Enterprise groundwater basin in the southern Escalante Valley. The basin-fill aquifer in the Beryl-Enterprise basin consists of unconfined Quaternary-age alluvium and lacustrine deposits, primarily of silts and clays, with gravel and sand composing less than 25% of the aquifer material. The mountains surrounding the basin-fill aquifer are composed of consolidated sedimentary and volcanic rocks (Mower and Sandberg 1982). Reported transmissivity values of the basin fill aquifer range between 200 and 120,000 ft^2/day (19 and 11,000 m^2/day) for the basin-fill aquifer, which is approximately 1,000 ft (305 m) thick at the valley center (Mower and Sandberg 1982). Transmissivity values in the vicinity of the proposed SEZ are estimated to be between 10,000 and 25,000 ft^2/day (930 and 8,600 m^2/day). The natural groundwater flow direction is from the southwest to the northeast, with subsurface discharge of an estimated 1,000 ac-ft/yr (1.2 million m^3) occurring through the pass between the Wah Wah Mountains and the Black Mountains (Figure 13.1.7.1-4). Approximately 300 ac-ft/yr (370,000 m^3) is estimated to enter the Beryl-Enterprise basin from the adjacent Cedar Valley basin to the east (Mower and Sandberg 1982). Recharge in the basin takes place primarily at basin margins, where infiltration of precipitation and runoff occurs through course sediments. The base of Table Butte, located just south of the SEZ (Figure 13.1.9.1-1), is also considered an important recharge area within the basin (Thomas and Lowe 2007).

Several studies examining the groundwater resources in the Beryl-Enterprise basin (Klauk and Gourley 1983; Thomas and Lowe 2007; Greer 2008) have used information regarding groundwater processes given by Mower and Sandberg (1982) that examined the groundwater conditions in 1977 by using observations and groundwater simulations. Total groundwater storage in 1977 was estimated to be 72,000,000 ac-ft (89,000 million m^3). In 1977, the majority of the groundwater recharge was estimated to be in the form of surface runoff from higher elevations that occurred along the periphery of the valley, at a total of 31,000 ac-ft (38 million m^3), precipitation on the valley floor was estimated to provide 500 ac-ft (620,000 m^3), subsurface inflow from adjacent basins was estimated to be 320 ac-ft (390,000 m^3), and irrigation return flow was estimated to be 16,300 ac-ft (20 million m^3). In the same study, the majority of the groundwater discharge was through groundwater withdrawals for agriculture, at 81,000 ac-ft (100 million m^3), evapotranspiration accounted for 6,000 ac-ft (7.4 million m^3), and subsurface outflow to the adjacent Milford area groundwater basin was estimated to be 1,000 ac-ft (1.2 million m^3). Based on the work by Mower and Sandberg (1982) and a water balance method, Greer (2008) estimated the annual recharge in the groundwater basin to be 34,000 ac-ft/yr (42 million m^3/yr), including return flow to the aquifer from irrigation. It should be noted that groundwater pumping has exceeded groundwater recharge in the basin every year since 1950 (UBWR 1995).

Groundwater levels dropped as much as 150 ft (46 m) in the Beryl-Enterprise basin between 1948 and 2009 because of excessive groundwater withdrawals in the southwestern portion of the basin (Burden et al. 2009). Two active USGS monitoring wells that are located within 1 mi (1.6 km) of the SEZ indicate a current depth to groundwater of 20 to 25 ft (6 to 8 m) (USGS 2009; well numbers 375245113290001 and 375754113274501). Between 1975 and 2009, groundwater levels in the vicinity of the SEZ were observed to decline 15 ft (4.6 m) (Burden et al. 2009). The depth to groundwater records in these wells and others within the Beryl-Enterprise basin have shown groundwater levels falling at a rate of 0.2 to 1.5 ft/yr (0.06 to 0.5 m/yr) (Burden et al. 2009). Land subsidence in the Beryl-Enterprise basin has resulted in earth fissures and is likely caused by compaction of the unconsolidated aquifer due to dewatering from groundwater withdrawals (Thomas and Lowe 2007). The highest rates of ground subsidence in the Beryl-Enterprise basin have been measured at between 1.2 and 1.6 in./yr (3 and 4 cm/yr) between 1941 and 1998, in an agricultural area located approximately 11 mi (18 km) southwest of the proposed Escalante Valley SEZ (Forster 2006).

The groundwater quality within the proposed Escalante Valley SEZ is generally good, with total dissolved solids (TDS) concentrations ranging between 375 and 750 mg/L (Thomas and Lowe 2007). Over the Beryl-Enterprise basin as a whole, groundwater quality varies, with some wells exceeding the primary maximum contaminant level (MCL) for arsenic (>10 parts per billion [ppb]) and the secondary MCL for sulfate (>250 mg/L) (Burden et al. 2009).

13.1.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals from surface waters and groundwater in Iron County were 308,200 ac-ft/yr (380 million m^3), of which 60% came from surface waters and 40% came from groundwater (Kenny et al. 2009). The largest water use category was for agricultural irrigation, at 294,900 ac-ft/yr (364 million m^3). The remainder was used for domestic (3%) and industrial purposes (<1%) (Kenny et al. 2009). The majority of the agricultural water use within the county occurs in the Beryl-Enterprise region in the southwestern portion of the southern Escalante Desert Valley. In 2008, groundwater withdrawals were approximately 93,000 ac-ft (115 million m^3) within the Beryl-Enterprise basin, and the average groundwater withdrawals between 1997 and 2007 were 85,000 ac-ft/yr (105 million m^3) (Burden et al. 2009).

In Utah, the appropriation doctrine is the basis of water appropriation, which implies that water rights are allocated on a temporal basis (BLM 2001). All waters are the property of the public in the State of Utah and subject to the laws described in *Utah Code*, Title 73, Water and Irrigation (available at http://www.le.state.ut.us/~code/TITLE73/TITLE73.htm). A water right establishes an entity's legal ability to divert surface water or groundwater for beneficial use and contains five key elements: a definition of the beneficial use, a priority date, a defined flow or quantity of water to be diverted, a location of the diversion, and location of the beneficial use. Water rights are administered by the Office of the State Engineer, which was renamed the Utah Division of Water Rights (Utah DWR) in 1963 (Utah DWR 2005).

The Utah DWR manages both surface water and groundwater appropriations (new appropriations and transfer of existing water rights). In many regions of the state, both surface water and groundwater resources are fully appropriated, so new water diversions can only be made through the transfer of existing water rights. The application process for obtaining a water right is the same for surface water and groundwater; however, the criteria used to evaluate new surface water and groundwater diversions are different and can vary by region in the state. Groundwater diversions can also be subject to groundwater management plans that have been established to protect existing water rights and to limit overuse and degradation of water quality in sensitive areas. The Utah DWR assesses a water right application based on its potential for beneficial use and its potential to affect existing water rights or impair water quality (BLM 2001). For water right transfer applications in regions where water resources are limited, the seniority of a transferred water right will determine its ability to not affect more senior water rights in the region and whether it can meet project demands (Utah DWR 2005).

The Beryl-Enterprise basin falls under the jurisdiction of the southwestern regional office of the Utah DWR and is located in Policy Area 71 (Escalante Valley). Surface waters in this Policy Area are fully appropriated, so any new surface water diversions must be transferred from existing surface water rights (transfers between surface water and groundwater diversions are typically not allowed). The proposed Escalante Valley SEZ is located in the Nada-Lund groundwater administration district. No new groundwater diversions are allowed because of declining groundwater elevations, and groundwater right transfers from the adjacent Milford or Beryl–New Castle administration districts are reviewed on a case-by-case basis (Utah DWR 2004).

In 2007, the falling groundwater levels in the basin-fill aquifers throughout the southern Escalante Desert Valley prompted the State Engineer to begin the process of developing a groundwater management plan for the Beryl-Enterprise basin, which includes the area of the proposed SEZ. Statute 73-5-15 of Utah state law describes the initiation and regulation of a groundwater management plan, which in this case was proposed to limit water rights in the region in order to establish a safe yield[3] for the basin. However, in 2008, the Utah State Legislature halted the funding for the development of the groundwater management plan for the Beryl-Enterprise region (Utah DWR 2009). The Utah Legislature passed a bill (S.B. 20) in May 2010 that allows the creation of local districts to develop groundwater management plans under Statute 73-5-15 (Utah State Legislature 2010).

13.1.9.2 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

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[3] Safe yield is the amount of groundwater that can be withdrawn from a groundwater basin over a period of time without exceeding the long-term recharge of the basin or unreasonably affecting the basin's physical and chemical integrity.

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 can also be degraded through the generation of wastewater, chemical spills, increased erosion and sedimentation, and increased salinity (e.g., by the excessive withdrawal from aquifers).

13.1.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy developments, which Section 5.9.1 describes in more detail for the four phases of development; 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 proposed Escalante Valley SEZ could potentially affect natural drainage patterns and natural groundwater recharge and discharge properties. The alteration of natural drainage pathways during construction can lead to impacts related to flooding. Land-disturbance activities should be avoided to the extent possible in the vicinity of the ephemeral stream washes and the dry lake present on the site. Alterations to these systems could enhance erosion processes, disrupt groundwater recharge, and negatively affect plant and animal habitats associated with the ephemeral channels.

13.1.9.2.2 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 Escalante Valley SEZ include the following:

- On the basis of a total area less than 10,000 (40 km^2), it is assumed that one solar project could 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 is 3,000 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 approximately 45% of the total SEZ area during 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 (see Section 5.9.2.1).

Site Characterization

During site characterization, water would be used mainly for controlling fugitive dust and providing 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 water in 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 the proposed Escalante Valley SEZ, the water requirements for construction activities could be met by either trucking water to the sites or by using on-site groundwater resources. Water requirements for dust suppression and potable water supply during construction are shown in Table 13.1.9.2-1 and could be as high as 1,264 ac-ft (1.5 million m^3). The assumptions

TABLE 13.1.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Escalante Valley SEZ[a]

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	811	1,216	1,216	1,216
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	885	1,261	1,235	1,226
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

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

[b] Fugitive dust control estimation assumes a local pan evaporation of 71 in/yr (180 cm/yr) (Cowherd et al. 1988; WRCC 2010a).

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

underlying these estimates for each solar energy technology are described in Appendix M. Groundwater wells would have to yield up to an estimated 765 gal/min (2,900 L/min) to meet the estimated construction water requirements. These yields are similar to average well yields of small- to medium-sized irrigated farms in Utah (USDA 2009b). The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the site characterization phase of a solar development project. In addition, up to 74 ac-ft (91,000 m^3) of sanitary wastewater would be generated and need to be either treated on-site or sent to an off-site facility. If the groundwater supply used for a project does not meet drinking water quality standards, potable water would need to be brought in from off-site.

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 13.1.9.2-2 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 among 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. Assuming that 80% of the SEZ's area would be used for solar energy production, the full build-out capacity would generate 588 to 1,058 MW for the proposed Escalante Valley SEZ. The estimated total water use requirements during operations range from 30 to 301 ac-ft/yr (37,000 to 370,000 m^3/yr) for the PV and dish engine technologies (no cooling required) and from 418 to 15,888 ac-ft/yr (0.5 million to 20 million m^3/yr) for the parabolic trough and power tower technologies (cooling required). Table 13.1.9.2-2 lists the amounts of water needed for mirror/panel washing, potable water supply, and cooling activities for each solar energy technology. Operations would generate up to 15 ac-ft/yr (18,500 m^3/yr) of sanitary wastewater; in addition, for wet-cooled technologies, 167 to 301 ac-ft/yr (210,000 to 370,000 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 parabolic trough and power tower technologies would require an estimated well yield of 259 to 993 gal/min (980 to 3,760 L/min) for dry cooling and 1,830 to 9,850 gal/min (6,910 to 37,300 L/min) for wet cooling. The required well yields for dry cooling are similar to average well yields of small irrigated farms in Utah, while the required well yields for wet cooling range from similar well yields of medium-sized irrigated farms to over three times greater than the average well yields of large irrigated farms in Utah (USDA 2009b). For non-cooled technologies (dish engine and PV), wells would have to yield an

TABLE 13.1.9.2-2 Estimated Water Requirements during Operations at the Proposed Escalante Valley SEZ

	Solar Energy Technology			
Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	1,058	588	588	588
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c, d]	529	294	294	29
Potable supply for workforce (ac-ft/yr)	15	7	7	0.7
Dry cooling (ac-ft/yr)[e]	212–1,058	118–588	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	4,762–15,344	2,646–8,525	NA	NA
Total water use				
Non-cooled technologies (ac-ft/yr)	NA	NA	301	30
Dry-cooled (ac-ft/yr)	756–1,602	418–888	NA	NA
Wet-cooled (ac-ft/yr)	5,306–15,888	2,946–8,825	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	301	167	NA	NA
Sanitary wastewater (ac-ft/yr)	15	7	7	0.7

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

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

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

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

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; these ranges correspond to an assumed 30% and 60% operating time (DOE 2009).

f NA = not applicable.

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

estimated 19 to 187 gal/min (70 to 710 L/min), which is on the order of 2 to 25 times less than the average well yields of small irrigated farms in Utah (USDA 2009b).

The water demands for technologies that require wet cooling are significant in comparison to the overall water balance in the basin-fill aquifer. For the proposed Escalante Valley SEZ, estimated water requirements for wet cooling are equivalent to 3 to 17% of the total groundwater withdrawals for the Beryl-Enterprise basin in 2009 (Burden et al. 2009). Annual recharge in the basin has been estimated to be 34,000 ac-ft/yr (42 million m^3) (Greer 2008). The estimated water requirements for wet cooling are equivalent to 9 to 47% of the estimated annual recharge for the Beryl-Enterprise basin. The water use for wet cooling could exacerbate existing conditions of groundwater overdraft in the Beryl-Enterprise basin. In addition, obtaining water rights within the Beryl-Enterprise basin would be difficult and water rights would have to be transferred from existing uses. Based on the information presented here, wet cooling for the full build-out scenario is not deemed feasible for the Escalante Valley SEZ. To the extent possible, facilities using dry cooling should implement water conservation practices to limit water needs.

The availability of water rights and the impacts associated with groundwater withdrawals 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 would need to be assessed during the site characterization phase and during the development of constructed wells. For the proposed Escalante Valley SEZ, groundwater elevations are currently declining at a rate of 0.3 to 2.5 ft/yr (0.06 to 0.8 m/yr) in the Beryl-Enterprise basin (Burden et al. 2009). The declining groundwater levels have been linked with land subsidence and surface fissures near the Beryl-Enterprise area, approximately 15 mi (24 km) to the southwest of the proposed Escalante Valley SEZ (USDA 2007). With these existing conditions, further groundwater withdrawals for solar energy development at the proposed SEZ could potentially cause further drawdown of groundwater elevations and land subsidence both on-site and more regionally in the Escalante Desert. These indirect impacts can disturb regional groundwater flow patterns and recharge patterns, which have implications for ecological habitats (discussed in Section 13.1.10).

Decommissioning/Reclamation

All surface structures associated with the solar energy development would be dismantled, and the site would be reclaimed to its preconstruction state during decommissioning. Land disturbance and water use activities would be similar to those during the construction phase (see Table 13.1.9.2-1) 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.

13.1.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Escalante Valley SEZ is located 15 mi (24 km) north of State Route 56 and approximately 3 mi (5 km) from existing transmission lines, as described in Section 13.1.1.2. Impacts associated with the construction of roads and transmission lines primarily deal 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 modification and transmission line construction activities (e.g., for soil compaction, dust suppression, and potable supply for workers) 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 programmatic design features described in Appendix A, Section A.2.2 (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 programmatic design features to minimize impacts associated with alterations to natural drainage pathways and hydrologic processes.

13.1.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources associated with developing solar energy in the proposed Escalante Valley SEZ are associated with land disturbance effects on natural hydrology, water use requirements for the various solar energy technologies, and water quality concerns. 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, or 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 alteration of natural drainage pathways during construction can lead to impacts related to flooding. Land-disturbance activities should be avoided to the extent possible in the vicinity of the ephemeral stream washes and the dry lake present on the site. Alterations to these systems could enhance erosion processes, disrupt groundwater recharge, and negatively affect plant and animal habitats associated with the ephemeral channels.

Water in the southern end of Escalante Valley is currently over-appropriated and is closed to new surface water and groundwater appropriations (Utah DWR 2004, 2009). In order to obtain water for solar energy projects in the area, water rights would have to be transferred from existing water rights, most of which are currently used for agriculture (Utah DWR 2004; Kenny et al. 2009).

The groundwater levels in the Escalante Valley have been declining steadily since 1950 (Burden et al. 2009). The average groundwater withdrawals of 85,000 ac-ft/yr (105 million m^3/yr) between 1998 and 2007 are two and a half times larger than the previously estimated basin safe yield of 34,000 ac-ft/yr (42 million m^3/yr) (Burden et al. 2009; Greer 2008). As of 2008, the appropriated water rights were approximately 110,000 ac-ft/yr (136 million m^3/yr), which is over three times the estimated basin safe yield (Utah State Engineer 2008). The large withdrawal-to-recharge ratio has led to significant groundwater level declines in Escalante Valley; in addition, subsidence and land fissures have been linked to declining groundwater levels (Burden et al. 2009; USDA 2007; Utah State Engineer 2008; Forster 2006). Given the information presented here, wet cooling for the full build-out scenario is not deemed feasible for the Escalante Valley SEZ. To the extent possible, facilities using dry cooling should implement water conservation practices to limit water needs.

13.1.9.3 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 coordination 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 on 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 Escalante Valley SEZ are as follows:

- Wet-cooling options would not be feasible; 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 being within a 100-year floodplain;
- Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes and dry lake present on the site;
- Groundwater rights must be obtained from the Utah Division of Water Rights (Utah DWR 2005);
- Groundwater monitoring and production wells should be constructed in accordance with Utah standards (Utah DWR 2008); and
- Stormwater management plans and BMPs should comply with standards developed by the Utah Division of Water Quality (UDWQ 2008); and
- Water for potable uses would have to meet or be treated to meet Utah drinking water standards as defined by Utah Administrative Code Rule R309-200.

13.1.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Escalante Valley SEZ. The affected area considered in this assessment included 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 included the SEZ, a 250-ft (76-m) wide portion of an assumed transmission line corridor, and a 60-ft (18-m) wide portion of an assumed access road corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary, within the 1-mi (1.6-km) wide assumed transmission line corridor, 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 area of direct effect.

Indirect effects considered in the assessment include effects from surface runoff, dust, and accidental spills 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. 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.

13.1.10.1 Affected Environment

Much of the proposed Escalante Valley SEZ is located within the Shadscale-dominated Saline Basins Level IV ecoregion, which primarily supports a sparse saltbush-greasewood shrub community (Woods et al. 2001). This ecoregion includes nearly flat to gently sloping valley bottoms and lower hill slopes. Soils have a high salt and alkali content, and plants are salt and drought tolerant. The dominant shrub species in this ecoregion are shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), greasewood (*Sarcobatus vermiculatus*), and bud sagebrush (*Picrothamnus desertorum*). Perennial grasses are also typically present and include bottlebrush squirreltail (*Elymus elymoides*), indian ricegrass (*Achnatherum hymenoides*), and galleta (*Pleuraphis jamesii*). Much of the western portion of the SEZ lies within the Salt Deserts Level IV ecoregion. This ecoregion is mostly barren and contains playas, salt flats, mud flats, low terraces, and saline lakes. Playas and salt flats are ponded during wet periods and subject to wind erosion when they are dry. Soils are poorly drained, have a high salt and alkali content, and are often salt-crusted. Plants in this ecoregion are generally sparse and widely scattered, if present at all, and include extremely salt-tolerant species such as salicornia (*Salicornia* sp.), saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), iodine bush (*Allenrolfea occidentalis*), and greasewood. Annual precipitation in the vicinity of the SEZ is low, averaging 10 in. (25.4 cm) at Enterprise Beryl Junction (see Section 13.1.13).

The region surrounding the SEZ consists of a mosaic of these ecoregions, as well as the Sagebrush Basins and Slopes Level IV ecoregion, which supports a Great Basin sagebrush community dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and includes perennial bunchgrasses. This ecoregion includes valleys, alluvial fans, bajadas, mountain flanks, and stream terraces. Also present is the Woodland- and Shrub-covered Low Mountains Level IV ecoregion. This ecoregion includes pinyon-juniper woodlands and sagebrush communities, along with mountain brush communities at higher elevations. These ecoregions are all located within the Central Basin and Range Level III ecoregion, which is described in Appendix I.

Land cover types, described and mapped under the Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2005c), were used to evaluate plant communities in and near the SEZ. Each cover type includes a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed Escalante Valley SEZ are shown in Figure 13.1.10.1-1. Table 13.1.10.1-1 provides the surface area of each cover type within the potentially affected area.

Lands within the proposed Escalante Valley SEZ are classified primarily as Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Active and Stabilized Dune, the latter occurring especially in the western portion of the SEZ. Additional cover types within the SEZ are given in Table 13.1.10.1-1. Greasewood and sagebrush were observed to be the dominant species in the low scrub communities observed over much of the SEZ in September 2009, with sagebrush generally the more abundant. Sensitive habitats on the SEZ include sand dune, dry wash, and playa habitats.

The indirect impact area, including the area surrounding the SEZ within 5 mi (8 km), along with the access road and transmission line corridors, includes 18 cover types, which are listed in Table 13.1.10.1-1. The predominant cover types are Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush Shrubland.

There are no National Wetland Inventory (NWI) data for the region that includes the proposed Escalante Valley SEZ (USFWS 2009). Dry washes occur within the SEZ, access road corridor, and transmission line corridor. A dry lakebed intersects the southwestern boundary of the SEZ and an extensive area of playa habitat, including Lund Flats, occurs to the north of the SEZ. Intermittently flooded areas were observed in the SEZ. These dry washes, lakebeds, and intermittently flooded areas typically contain water for short periods during or following precipitation events. One occurrence of Open Water (mostly surrounded by Inter-Mountain Basins Semi-Desert Shrub Steppe) is located in the southwest portion of the SEZ, and two locations of Open Water occur in the eastern portion. These locations are likely small earthen livestock watering areas that have been constructed by building up berms to hold runoff or water pumped into the areas for short periods of time.

Table 13.1.10.1-2 lists the designated noxious weeds of Utah that are recorded as occurring in Iron County (UDA 2008; USDA 2010), which includes the proposed Escalante Valley SEZ, and additional noxious weed species declared by Iron County (UDA 2009). UDA (2008) provides a list of all Utah State designated noxious weeds. Cheatgrass (*Bromus tectorum*) and halogeton (*Halogeton glomeratus*), invasive species known to occur within the SEZ, are not included in Table 13.1.10.1-2.

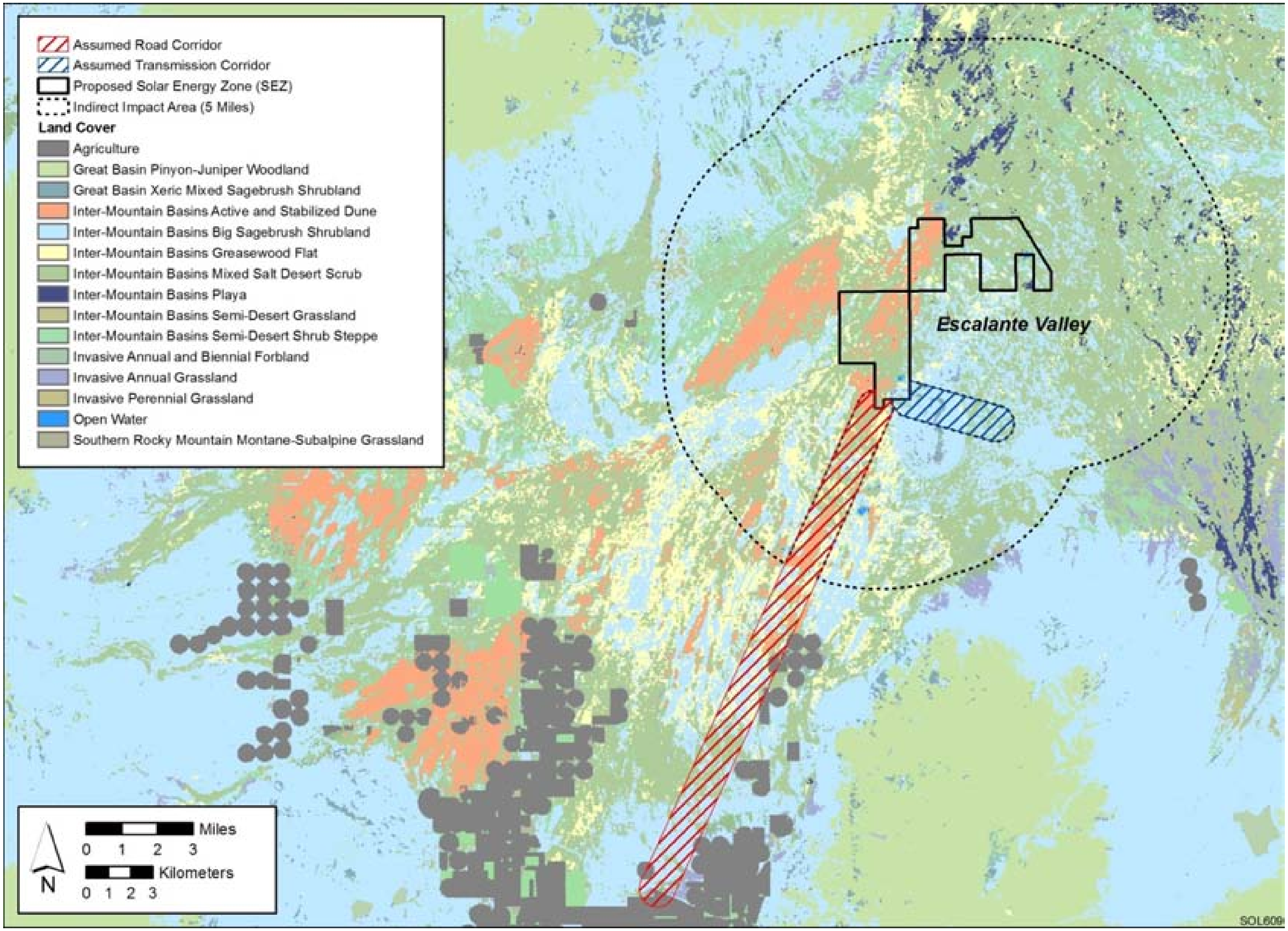

FIGURE 13.1.10.1-1 Land Cover Types within the Proposed Escalante Valley SEZ (Source: USGS 2004)

TABLE 13.1.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Escalante Valley 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]	Assumed Transmission Line (Direct Effects)[e]	Corridors and Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g]
S065 Inter-Mountain Basins Mixed Salt Desert Scrub: Generally consists of open shrublands which include at least one species of *Atriplex* along with other shrubs. Perennial grasses dominate a sparse to moderately dense herbaceous layer.	3,717 acres[h] (1.3%, 2.7%)	33 acres (<0.1%)	23 acres (<0.1%)	48,493 acres (16.8%)	Moderate
S012 Inter-Mountain Basins Active and Stabilized Dune: Includes Dune and sand sheet areas that are unvegetated or sparsely vegetated, with up to 30% plant cover, but generally less than 10%. Plant communities consist of patchy or open grassland, shrubland, or shrub steppe, with species often adapted to the shifting sandy substrate.	1,278 acres (6.5%, 20.4%)	11 acres (0.1 %)	0 acres	4,824 acres (24.4%)	Moderate
S054 Inter-Mountain Basins Big Sagebrush Shrubland: Dominated by basin big sagebrush (*Artemisia tridentata tridentata*), Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), or both. Other shrubs may be present. Perennial herbaceous plants are present but not abundant.	781 acres (0.1%, 0.1%)	40 acres (<0.1%)	64 acres (<0.1%)	32,172 acres (3.0%)	Small
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	339 acres (0.1%, 0.2%)	2 acres (<0.1%)	1 acre (<0.1%)	9,182 acres (3.4%)	Small

TABLE 13.1.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]				
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Corridors and Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g]
S096 Inter-Mountain Basins Greasewood Flat: Dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*) and generally occurring in areas with saline soils, a shallow water table, and intermittent flooding, although remaining dry for most growing seasons. This community type generally occurs near drainages or around playas. These areas may include, or may be co-dominated by, other shrubs, and may include a graminoid herbaceous layer.	318 acres (0.5%, 1.5%)	19 acres (<0.1%)	1.6 acres (<0.1%)	11,637 acres (16.7%)	Small
S090 Inter-Mountain Basins Semi-Desert Grassland: Consists of perennial bunchgrasses as dominants or co-dominants. Scattered shrubs or dwarf shrubs may also be present.	60 acres (0.2%, 0.6%)	1 acre (<0.1%)	<1 acre (<0.1%)	647 acres (1.7%)	Small
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	59 acres (0.3%, 0.7%)	<1 acre (<0.1%)	<1 acre (<0.1%)	2,427 acres (11.4%)	Small
N11 Open Water: Plant or soil cover is generally less than 25%.	22 acres (0.3%, 2.8%)	<1 acre (<0.1%)	0 acres	45 acres (0.6%)	Small
S015 Inter-Mountain Basins Playa: Playa habitats are intermittently flooded and generally barren or sparsely vegetated. Depressions may contain small patches of grass and sparse shrubs may occur around playa margins.	15 acres (0.1%, 0.3%)	<1 acre (<0.1%)	0 acres	2,379 acres (23.7%)	Small

TABLE 13.1.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Corridors and Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g]
S000 Great Basin Xeric Mixed Sagebrush Shrubland: Generally occurs on level plains, slopes, and ridges. The dominant shrub species are black sagebrush (*Artemisia nova*) or, at higher elevations, little sagebrush (*Artemisia arbuscula*), and co-dominants may be Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) or yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Other shrub species may also be present as well as sparse perennial bunchgrasses.	15 acres (<0.1%, <0.1%)	<1 acre (<0.1%)	4 acres (<0.1%)	479 acres (0.3%)	Small
D08 Invasive Annual Grassland: Dominated by non-native annual grass species.	4 acres (<0.1%, <0.1%)	<1 acre (<0.1%)	<1 acre (<0.1%)	863 acres (3.0%)	Small
D06 Invasive Perennial Grassland: Dominated by non-native perennial grasses.	3 acres (<0.1%, 0.1%)	1 acre (<0.1%)	0 acres	311 acres (3.0%)	Small
S024 Rocky Mountain Bigtooth Maple Ravine Woodland: Occurs in ravines, on toeslopes, and benches associated with riparian areas. It may also occur on steep north slopes at higher elevations. The dominant species is bigtooth maple (*Acer grandidentatum*), but gambel oak (*Quercus gambelii*) may be co-dominant in some areas. Other broadleaf trees or conifers may be present.	0 acres	<1 acre (<0.1%)	0 acres	1 acre (1.2 %)	Small
S046 Rocky Mountain Gambel Oak-Mixed Montane Shrubland: Occurs on dry foothills and lower mountain slopes. Gambel oak (*Quercus gambelii*) may be the only dominant species or share dominance with other shrubs.	0 acres	<1 acre (<0.1%)	0 acres	5 acres (<0.1%)	Small

TABLE 13.1.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Assumed Access Road (Direct Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Corridors and Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g]
S040 Great Basin Pinyon-Juniper Woodland: Occurs on low elevation slopes and ridges. Singleleaf pinyon (*Pinus monophylla*), Utah juniper (*Juniperus osteosperma*), or both, are the dominant species, generally associating with curl-leaf mountain mahogany (*Cercocarpus ledifolius*). Understory species include shrubs and grasses.	0 acres	<1 acre (<0.1%)	<1 acre (<0.1%)	170 acres (<0.1%)	Small
N21 Developed, Open Space—Low Intensity: Includes housing, parks, golf courses, and other areas planted in developed settings. Impervious surfaces comprise up to 49% of the total land cover.	0 acres	<1 acre (<0.1%)	0 acres	6 acres (<0.1%)	Small
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	0 acres	4 acres (<0.1%)	0 acres	345 acres (0.2%)	Small
S085 Southern Rocky Mountain Montane-Subalpine Grassland: Typically occurs as a mosaic of two or three plant associations on well-drained soils. The dominant species is usually a bunchgrass.	0 acres	0 acres	0 acres	9 acres (0.1%)	Small

[a] Land cover descriptions are from USGS (2005c). 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.

Footnotes continued on next page.

TABLE 13.1.10.1-1 (Cont.)

[d] For access road development, direct effects were estimated within a 15-mi (24-km) long, 60-ft (18-m) wide road ROW from the SEZ to the nearest state 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] For transmission development, direct effects were estimated within a 3-mi (5-km), 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission 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.

[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 portions of the 1-mi (1.6-km) wide road and transmission corridors where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project developments. The potential degree of indirect effects would decrease with increasing distance away 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.

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

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

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TABLE 13.1.10.1-2 Utah State-Designated Noxious Weeds Known to Occur in Iron County

Common Name	Scientific Name
Bull thistle	*Cirsium vulgare*
Canada thistle	*Cirsium arvense*
Field bindweed	*Convolvulus arvensis*
Hoary cress	*Cardaria* spp.
Musk thistle	*Carduus nutans*
Perennial pepperweed	*Lepidium latifolium*
Puncturevine	*Tribulus terrestris*
Whorled milkweed	*Asclepias verticillata*

Sources: UDA (2008, 2009).

13.1.10.2 Impacts

The construction of solar energy facilities within the proposed Escalante Valley 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. Approximately 80% of the SEZ (5,291 acres [21.4 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 that occur on the SEZ. Therefore, for the purposes of this analysis, all 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 is encountered within the SEZ described in more detail in Section 5.10.1. Any such impacts will be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and from any additional mitigations applied. Section 13.1.10.2.3, below, identifies design features of particular relevance to the proposed Escalante Valley SEZ.

13.1.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected 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 (>1 but <10%) could affect an intermediate proportion of cover type; a large impact could affect greater than 10% of a cover type.

Solar facility construction and operation would primarily affect communities of the Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Active and Stabilized Dune cover types. Additional cover types within the SEZ that would be affected include Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Greasewood Flat, Inter-Mountain Basins Semi-Desert Grassland, Invasive Annual and Biennial Forbland, Open Water, Inter-Mountain Basins Playa, Great Basin Xeric Mixed Sagebrush Shrubland, Invasive Annual Grassland, and Invasive Perennial Grassland. The open water areas are likely artificial impoundments, while Invasive Annual and Biennial Forbland, Invasive Annual Grassland, Invasive Perennial Grassland, and the developed areas likely support few native plant communities. The potential impacts on land cover types resulting from solar energy facilities in the proposed Escalante Valley SEZ are summarized in Table 13.1.10.1-1. Many of these cover types are relatively common in the SEZ region; however, several are relatively uncommon, representing less than 1% of the land area within the SEZ region: Inter-Mountain Basins Semi-Desert Grassland (0.7%), Invasive Annual Grassland (0.6%), Inter-Mountain Basins Active and Stabilized Dune (0.4%), Inter-Mountain Basins Playa (0.2%), Open Water (0.2%), Invasive Perennial Grassland (0.2%), and Invasive Annual and Biennial Forbland (0.4%). In addition, Rocky Mountain Bigtooth Maple Ravine Woodland (<0.1%), and Developed Open Space-Low Intensity (0.6%), would potentially be impacted by the access road ROW. Sand dune, playa, and dry wash communities are important sensitive habitats in the region.

The construction, operation, and decommissioning of solar projects within the SEZ would result in moderate impacts on Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Active and Stabilized Dune. Solar project development within the SEZ would result in small impacts on the remaining cover types in the affected area.

Disturbance of vegetation in dune communities within the SEZ or access road corridor, such as from heavy equipment operation, could result in the loss of substrate stabilization. Re-establishment of dune species could be difficult due to the arid conditions and unstable substrates. Re-establishment of shrub communities in temporarily disturbed areas would likely be very difficult because of the arid conditions 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. Damage to these crusts, 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 disturbed soil areas in 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 indirect impact area identified in Table 13.1.10.1-1.

Communities associated with playa habitats, greasewood flats communities, or other intermittently flooded areas downgradient from solar projects, access road, and transmission line ROWs could be affected by ground-disturbing activities. Site clearing and grading could disrupt surface water, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation, and could potentially alter playa or greasewood flats plant communities and affect community function. Increases in surface runoff from a solar energy project site, access road, or transmission line ROW could also affect the 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. Grading could also affect dry washes within the SEZ, access road corridor, and transmission line corridor. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash or dry lake communities. Vegetation within these communities could be lost to erosion or desiccation. See Section 13.1.9 for further discussion of impacts on washes and dry lakes.

The construction of access roads or transmission lines in ROWs outside of the SEZ could potentially result in direct impacts on wetlands that may occur in or near the ROWs if fill material is placed within wetland areas, or in indirect impacts as described above.

13.1.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

Executive Order (E.O.) 13112, "Invasive Species," 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 (*Federal Register*, Vol. 64, page 61836, Feb. 8, 1999). Potential impacts of noxious weeds and invasive plant species resulting from solar energy facilities are described in Section 5.10.1. Invasive species could be inadvertently brought to a project site by equipment previously used in infested areas, or they may be present on or near a project site. 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 Escalante Valley SEZ and increase the probability that weeds could be transported into areas that were previously relatively weed-free. This could result in reduced restoration success and possible widespread habitat degradation.

Noxious weeds, including cheat grass and halogeton, occur on the SEZ. Additional species designated as noxious weeds for Utah, and those known to occur in Iron County are given in Table 13.1.10.1-2. Past or present land uses, such as grazing or OHV use, may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Small areas of Invasive Annual and Biennial Forbland totaling 59 acres (0.2 km^2) occur within the SEZ, and approximately 2,427 acres (9.8 km^2) occur within 5 mi (8 km) of the SEZ and in the access road and transmission line corridors; 4 acres (0.02 km^2) of Invasive Annual Grassland occur within the SEZ, and approximately 532 acres (2.2 km^2) occur within 5 mi (8 km) of the SEZ and in the access road corridor; 3 acres (0.01 km^2) of Invasive Perennial Grassland occur within the SEZ, and approximately 312 acres (1.3 km^2) occur within 5 mi (8 km) of the SEZ and in the access road corridor. About 9 acres (0.04 km^2) of Developed, Open Space—Low Intensity occur within the access road corridor. Because disturbance may promote the establishment and spread of invasive species, developed areas may provide sources of such species. Disturbance associated with existing roads, transmission lines, and rail 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.

13.1.10.3 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 affected habitats and minimize the potential for the spread of invasive species, such as those occurring in Iron County, that could be introduced as a result of solar energy project activities (see Section 13.1.10.2.2). Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All playa, sand dune and sand transport areas, and dry wash habitats, shall be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area shall be maintained around playas and dry washes to reduce the potential for impacts on these habitats on or near the SEZ.

- Appropriate engineering controls should be used to minimize impacts on dry wash, playa, greasewood flat, and dry lake habitats, including downstream occurrences, that result from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers, best management practices, and engineering controls would be determined through agency consultation.

If these SEZ-specific design features are implemented in addition to programmatic design features, and assuming they are successful, it is anticipated that a high potential for impacts from invasive species and impacts on dry washes, playas, flats, and dry lakes and springs would be reduced to a minimal potential for impact.

13.1.11 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 Escalante Valley SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the Utah Conservation Data Center (UDWR 2009a). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005c, 2007). The amount of aquatic habitat within the SEZ region was determined by estimating the length of linear perennial stream and canal features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ using available GIS surface water datasets.

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, a 250-ft (76-m) wide portion of an assumed 3-mi (5-km) long transmission line corridor, and a 60-ft (18-m) wide portion of an assumed 15-mi (24-km) long access road corridor.

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 transmission and access road corridors where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the areas of direct effect (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or in the transmission line or road construction areas). Since the assumed transmission line location is within the 5-mi (8-km) area of indirect effect for the SEZ, no additional area of indirect effect was considered for the transmission corridor. An additional area of indirect effect was considered for 10 mi (16 km) of the access road corridor that would extend beyond the 5-mi (8-km) area of indirect effect for the SEZ. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. The 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. These areas of direct and indirect effect are defined and the impact assessment approach is described in Appendix M.

Dominant land cover habitat in the affected area is intermountain scrub-shrub, and the primary vegetation community types within the affected area are mixed salt desert scrub and sagebrush (*Artemisia* spp.) (see Section 13.1.10). Ephemeral washes and a dry lakebed in the southwestern portion of the SEZ (Section 13.1.9.1.1). Fourmile Wash occurs in the area of indirect effects as near as 3 mi (5 km) northwest of the SEZ. There are also dry lake playa habitats throughout the area of indirect effects.

13.1.11.1 Amphibians and Reptiles

13.1.11.1.1 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 Escalante Valley SEZ. The list of amphibian and reptile species potentially present in the SEZ area was determined from range maps and habitat information available from the Utah Conservation Data Center (UDWR 2009a). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005c, 2007). See Appendix M for additional information on the approach used.

Eight amphibian species are known to occur in Iron County, within which the proposed Escalante Valley SEZ is located (UDWR 2009a). Based on species distributions within this area and habitat preferences of the amphibian species, only the Great Basin spadefoot (*Spea intermontana*) and the Great Plains toad (*Bufo cognatus*) would be expected to occur within the SEZ (UDWR 2009a; Stebbins 2003).

Thirty reptile species are known to occur within Iron County (UDWR 2009a). About half of these species could occur within the proposed Escalante Valley SEZ (UDWR 2009a; Stebbins 2003). Species expected to be fairly common to abundant within the SEZ include the common sagebrush lizard (*Sceloporus graciosus*), desert horned lizard (*Phrynosoma platyrhinos*), eastern fence lizard (*S. undulatus*), gophersnake (*Pituophis catenifer*), greater short-horned lizard (*Phrynosoma hernandesi*), long-nosed leopard lizard (*Gambelia wislizenii*), nightsnake (*Hypsiglena torquata*), tiger whiptail (*Aspidoscelis tigris*), and wandering gartersnake (*Thamnophis elegans vagrans*, a subspecies of terrestrial gartersnake).

Table 13.1.11.1-1 provides habitat information for representative amphibian and reptile species that could occur within the proposed Escalante Valley SEZ.

13.1.11.1.2 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 13.1.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Escalante Valley 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 13.1.11.1.1 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 impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 13.1.11.1.3).

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 magnitude of impacts on amphibians

TABLE 13.1.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Escalante Valley 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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
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 3,757,000 acres[i] of potentially suitable habitat occurs within the SEZ region.	4,513 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	86,504 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	91 acres of potentially suitable habitat lost 0.002% of available potentially suitable habitat) and 7,897 acres in area of indirect effect	92 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,840 acres in area of indirect effect	Small overall impact. Avoidance of ephemeral washes and the dry lakebed.
Great Plains toad (*Bufo cognatus*)	Prefers desert, grassland, and agricultural habitats. Breeds in shallow temporary pools, quiet areas of streams, marshes, irrigation ditches, and flooded fields. In cold winter months, it burrows underground and becomes inactive. About 481,800 acres of potentially suitable habitat occurs within the SEZ region.	739 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	23,457 acres of potentially suitable habitat (4.9% of available potentially suitable habitat)	33 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) and 2,862 acres in area of indirect effect	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 44 acres in area of indirect effect	Small overall impact. Avoidance of ephemeral washes and the dry lakebed.

TABLE 13.1.11.1-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Lizards						
Common sagebrush lizard (*Sceloporus graciosus*)	Open ground with scattered low bushes. Usually found in sagebrush habitat, but it also occurs in many other types of habitat, including pinyon-juniper areas and open forests. Sometimes abundant in prairie dog colonies. It becomes inactive during the cold winter months, often using stone piles, shrubs, or rodent burrows for cover. About 4,283,300 acres of potentially suitable habitat occurs within the SEZ region.	4,867 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	98,352 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	95 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 8,248 acres in area of indirect effect	92 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,852 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 effect.
Desert horned lizard (*Phrynosoma platyrhinos*)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edges of dunes. Burrows in soil during periods of inactivity. About 2,009,000 acres of potentially suitable habitat occurs in the SEZ region.	5,291 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	117,692 acres of potentially suitable habitat (5.9% of available potentially suitable habitat)	142 acres of potentially suitable habitat lost (0.007% of available potentially suitable habitat) and 12,347 acres in area of indirect effect	93 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 1,878 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 effect.

TABLE 13.1.11.1-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Lizards (Cont.)						
Eastern fence lizard (*Sceloporus undulatus*)	Sunny, rocky habitats of cliffs, talus, old lava flows and cones, canyons, and outcrops. Various vegetation adjacent to or among rocks, including montane forests, woodlands, semidesert shrubland, and various forbs and grasses. About 2,611,600 acres of potentially suitable habitat occurs in the SEZ region.	2,013 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	32,607 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	54 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 4,688 acres in area of indirect effect	2 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 50 acres in area of indirect effect	Small overall impact.
Greater short-horned lizard (*Phrynosoma hernandesi*)	Short-grass prairies, sagebrush, semidesert shrublands, shale barrens, pinyon-juniper and pine-oak woodlands, oak-grass associations, and open conifer forests in mountainous areas. About 3,482,500 acres of potentially suitable habitat occurs in the SEZ region.	841 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	35,324 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	46 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,986 acres in area of indirect effect	64 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,297 acres in area of indirect effect	Small overall impact.

TABLE 13.1.11.1-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Lizards (Cont.)						
Long-nosed leopard lizard (*Gambelia wislizenii*)	Desert and semidesert areas with scattered shrubs). Prefers sandy or gravelly flats and plains. Also prefers areas with abundant rodent burrows that they occupy when inactive. About 1,602,400 acres of potentially suitable habitat occurs in the SEZ region.	4,513 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	86,322 acres of potentially suitable habitat (5.4% of available potentially suitable habitat)	91 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) and 7,891 acres in area of indirect effect	91 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) and 1,835 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 effect.
Tiger whiptail (*Aspidoscelis tigris*)	Primarily occurs in sparsely vegetated desert and shrubland habitats. During cold winter months, it often occupies underground burrows created by rodents or other lizards. About 2,936,000 acres of potentially suitable habitat occurs within the SEZ region.	4,449 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	75,553 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	79 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 6,902 acres in area of indirect effect	30 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 594 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 effect.

TABLE 13.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Within SEZ... Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Snakes						
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 3,802,600 acres of potentially suitable habitat occurs in the SEZ region.	871 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,625 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	50 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 4,345 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,386 acres in area of indirect effect	Small overall impact.
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 2,737,500 acres of potentially suitable habitat occurs within the SEZ region.	5,291 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	70,537 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	72 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 6,239 acres in area of indirect effect	24 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 473 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 effect.

TABLE 13.1.11.1-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Snakes (Cont.)						
Wandering gartersnake (*Thamnophis elegans vagrans*)	Most terrestrial or wetland habitats in the vicinity of any lotic or lentic body of water. However, it also occurs many miles from surface waters. About 1,779,500 acres of potentially suitable habitat occurs within the SEZ region.	2,413 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	52,528 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	68 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 5,923 acres in area of indirect effect	65 acres of potentially suitable habitat lost (0.004% of available potentially suitable 1,301 acres in area of indirect effect	Small overall impact.

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.

c Direct effects within the SEZ would consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 5,291 acres would be developed in the SEZ.

d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide road corridor (less the assumed area of direct effects) that extends beyond the 5-mi (8-km) area adjacent to the SEZ boundary. 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 15-mi (24-km) long, 60-ft (18-m) wide ROW for an assumed new access road from the SEZ to the nearest state highway. Indirect effects were estimated within a 1-mi (1.6-km) wide road corridor to the state highway, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 13.1.11.1-1 (Cont.)

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[f] For transmission development, direct effects were estimated within a 3-mi (5-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission corridor to the existing transmission line, less the assumed area of direct effects.

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

Sources: NatureServe (2010); UDWR (2009a); USGS (2004, 2005c, 2007).

and reptiles summarized in Table 13.1.11.1-1, direct impacts on amphibian and reptile species would be small, as 0.3% or less of potentially suitable habitats identified for the species in the SEZ region would be lost. Larger areas of potentially suitable habitats for most amphibian and reptile species occur within the area of potential indirect effects (e.g., up to 5.9% of available habitat for the desert horned lizard). Other 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 after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are 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 semiarid shrublands.

13.1.11.1.3 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, especially for those species that depend on habitat types that can be avoided (e.g., ephemeral washes and the dry lakebed). Indirect impacts could be reduced to negligible levels by implementing design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While SEZ-specific design features are best established when considering specific project details, the following is one design features that can be identified at this time:

- Avoid the ephemeral washes and dry lakebed in the southwestern portion of the SEZ.

If this SEZ-specific design feature is implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. However, as potentially suitable habitats for a number of the 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.

13.1.11.2 Birds

13.1.11.2.1 Affected Environment

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 Escalante

Valley SEZ. The list of bird species potentially present in the SEZ area was determined from range maps and habitat information available from the Utah Conservation Data Center (UDWR 2009a). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005c, 2007). See Appendix M for additional information on the approach used.

Nearly 270 species of birds are reported from Iron County (Utah Ornithological Society 2007). However, based on habitat preferences for these species, only about 10% of the species would be expected to regularly occur within the proposed Escalante Valley SEZ.

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. Around 80 waterfowl, wading bird, and shorebird species have been reported from Iron County (Utah Ornithological Society 2007). However, within the proposed Escalante Valley SEZ, waterfowl, wading birds, and shorebird species would be mostly absent to uncommon. The perennial streams, canals, lakes, and reservoirs within 50 mi (80 km) of the SEZ would provide more viable habitats 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. Those species that are common or abundant within Iron County and would be expected to occur within the proposed Escalante Valley SEZ include Bewick’s wren (*Thryomanes bewickii*), Brewer’s sparrow (*Spizella breweri*), common raven (*Corvus corax*), gray flycatcher (*Empidonax wrightii*), greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), Le Conte’s thrasher (*Toxostoma leconteii*), loggerhead shrike (*Lanius ludovicianus*), rock wren (*Salpinctes obsoletus*), sage sparrow (*Amphispiza belli*), sage thrasher (*Oreoscoptes montanus*), vesper sparrow (*Pooecetes gramineus*), and western kingbird (*Tyrannus verticalis*) (UDWR 2009a).

Birds of Prey

Section 4.10.2.2.4 provided an overview of the birds of prey (raptors, owls, and vultures) within the six-state solar study area. Twenty-seven bird of prey species have been reported from Iron County (Utah Ornithological Society 2007). Raptor species that could occur within the proposed Escalante Valley SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*, only during winter), Swainson’s hawk (*Buteo swainsoni*), and turkey vulture (*Cathartes aura*) (UDWR 2009a).

Upland Game Birds

Section 4.10.2.2.5 provided 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 Escalante Valley SEZ include the chukar (*Alectoris chukar*), mourning dove (*Zenaida macroura*), and wild turkey (*Meleagris gallopavo*) (UDWR 2009a).

The chukar is an introduced upland game bird. A management plan for the chukar in Utah has been developed (UDWR 2003). Preferred habitat for the chukar is steep, semiarid slopes with rocky outcrops and shrubs with a grass and forb understory. Sources of water are required during hot, dry periods, with most birds found within 0.25 mi (0.4 km) of water during the brooding period (UDWR 2003, 2009a). Grasses and seeds of forbs are the main foods with insects important to young chicks (UDWR 2003). Urbanization and elimination of sagebrush are among the major factors that adversely affect chukar habitat. Population declines periodically occur due to severe winters or droughts (UDWR 2003). The chukar is distributed throughout Utah, with over 20,400,000 acres (82,556 km^2) of potential high and substantial value habitats[4] occurring in the state (UDWR 2003). Figure 13.1.11.2-1 shows the location of the proposed Escalante Valley SEZ relative to substantial chukar habitat. No areas of this habitat type occur within the SEZ. The shortest distance from the SEZ to substantial chukar habitat is 4 mi (6 km).

Two subspecies of wild turkey occur in Utah, the Rio Grande wild turkey (*Meleagris gallopavo intermedia*) and Merriam's wild turkey (*M. g. merriami*). Only the Rio Grande wild turkey has established populations within Iron County (UDWR 2009a). It prefers cottonwood riparian areas of rivers associated with oak-pine and pinyon-juniper forests (UDWR 2009a). Areas of brushy cover are used for nesting. Food items include pine nuts, acorns, grasses, weed seeds, and green vegetation. Insects are also important in the diet of young poults (UDWR 2009a). The shortest distance from the SEZ to crucial wild turkey habitat[5] is 15 mi (25 km). Nearly 1,138,700 acres (4,608 km^2) of crucial wild turkey habitat occurs within the SEZ region.

Table 13.1.11.2-1 provides habitat information for representative bird species that could occur within the proposed Escalante Valley SEZ. Special status bird species are discussed in Section 13.1.12.

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[4] High value habitat is an area that provides for intensive use by a wildlife species. Substantial value habitat is an area used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

[5] Crucial value habitat is essential to the life history requirements of the wildlife species. Degradation or unavailability of crucial habitat will lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

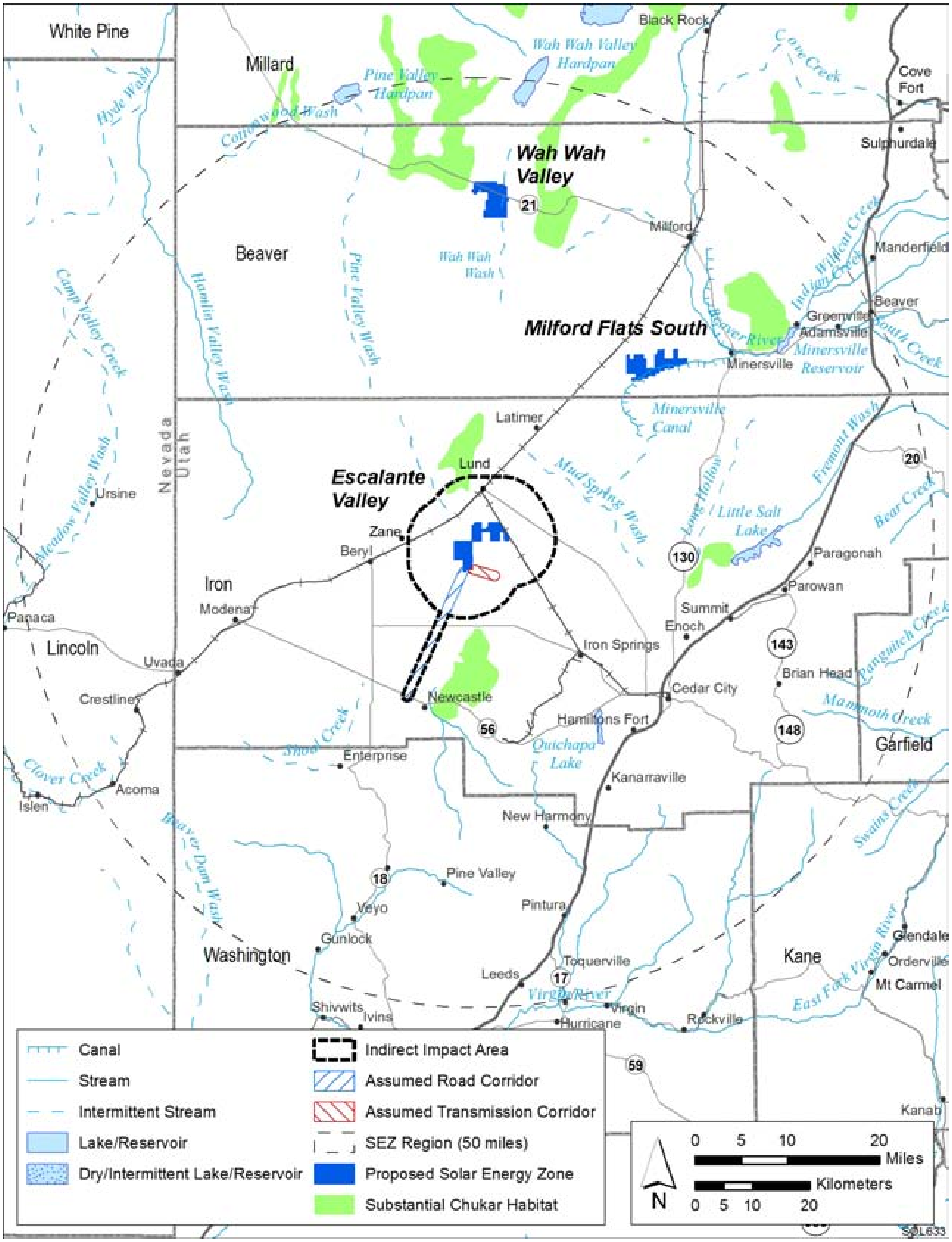

FIGURE 13.1.11.2-1 Location of the Proposed Escalante Valley SEZ Relative to Substantial Chukar Habitat (Source: UDWR 2006)

TABLE 13.1.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Escalante Valley 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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants						
Bewick's wren *(Thryomanes bewickii)*	Generally associated with dense, brushy habitats. Permanent resident of lowland deserts and pinyon-juniper forests of southern Utah. Breeding occurs in brushy areas of open woodlands and other open habitats. Cavity nester with nests constructed in small enclosed areas such as tree cavities, nesting boxes, rock crevices, or the center of a brush pile. About 4,297,900 acres[i] of potentially suitable habitat occurs within the SEZ region.	1,468 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	60,481 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	80 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 6,940 acres in area of indirect effect	71 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,428 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Brewer's sparrow *(Spizella breweri)*	Considered a shrubsteppe obligate. Occupies open desert scrub and cropland habitats. However, may also occur in high desert scrub (greasewood) habitats, particularly where adjacent to shrubsteppe habitats. Nests are usually located in patches of sagebrush that are taller and denser, with more bare	4,912 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	96,568 acres of potentially suitable habitat (4.4% of available potentially suitable habitat)	94 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 8,375 acres in area of indirect effect	92 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,847 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 effect. Some measure of mitigation provided

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TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
Brewer's sparrow *(Spizella breweri) (Cont.)*	ground and less herbaceous cover, than the surrounding habitat. Also breeds in large sagebrush openings in pinyon-juniper or coniferous forest habitats. About 2,199,600 acres of potentially suitable habitat occurs in the SEZ region.					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 human-made structures. Forages in sparse, open terrain. About 4,894,500 acres of potentially suitable habitat occurs in the SEZ region.	5,237 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	111,466 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	130 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,281 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,900 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
Gray flycatcher *(Empidonax wrightii)*	Inhabits woodlands and shrublands occurring predominately in pinyon-juniper, sagebrush, and desert shrublands. Nests are located low in shrubs or small trees, usually 2 to 5 ft (0.6 to 1.5 m) above ground. About 3,790,500 acres of potentially suitable habitat occurs within the SEZ region.	1,135 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	44,583 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	48 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 4,209 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,397 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Greater roadrunner *(Geococcyx californianus)*	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. 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 3,959,300 acres of potentially suitable habitat occurs in the SEZ region.	4,513 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	86,855 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	95 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 8,247 acres in area of indirect effect	91 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,841 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
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 2,294,500 acres of potentially suitable habitat occurs in the SEZ region.	5,245 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	112,459 acres of potentially suitable habitat (4.9% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) and 11,098 acres in area of indirect effect	93 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,879 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Le Conte's thrasher *(Toxostoma leconteii)*	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 352,600 acres of potentially suitable habitat occurs in the SEZ region.	3,717 acres of potentially suitable habitat lost (1.1% of available potentially suitable habitat) during construction and operations	51,387 acres of potentially suitable habitat (14.6% of available potentially suitable habitat)	46 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 4,036 acres in area of indirect effect	23 acres of potentially suitable habitat lost (0.006% of available potentially suitable habitat) and 455 acres in area of indirect effect	Moderate overall impact. Avoid ephemeral washes. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
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 4,507,700 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	110,273 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,106 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Rock wren *(Salpinctes obsoletus)*	Arid and semiarid habitats. Breeds in areas with talus slopes, scrublands, or dry washes. Nests, constructed of plant materials, are located in rock crevices and the nest entrance is paved with small rocks and stones. About 4,681,500 acres of potentially suitable habitat occurs within the SEZ region.	5,245 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	112,304 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	124 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 10,767 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 acres in area of indirect effect	Small overall impact. Avoid ephemeral washes. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
Sage sparrow *(Amphispiza belli)*	Prefers shrubland, grassland, and desert habitats. The nest, constructed of twigs and grasses, is located either low in a shrub or on the ground. About 4,319,500 acres of potentially suitable habitat occurs within the SEZ region.	5,291 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	116,263 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	143 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 12,479 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Neotropical Migrants (Cont.)						
Sage thrasher *(Oreoscoptes montanus)*	It breeds in sagebrush shrublands, other shrublands, and cholla grasslands in the western United States and winters in the southwestern United States and northern Mexico. In Utah, the species nests in greasewood and sagebrush habitats in low-elevation deserts where it constructs a bulky nest in a concealed location, usually in sagebrush or on the ground, using twigs and grasses. About 2,582,000 acres of potentially suitable habitat occurs within the SEZ region.	5,230 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	109,737 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	124 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 10,755 acres in area of indirect effect	93 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,879 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Vesper sparrow *(Pooecetes gramineus)*	Breeds in grasslands, open shrublands mixed with grasslands, and open pinyon-juniper woodlands. Occurs in open riparian and agricultural areas during migration. About 2,087,000 acres of potentially suitable habitat occurs in the SEZ region.	1,261 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	49,163 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	56 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 4,879 acres in area of indirect effect	70 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 1,408 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Western kingbird *(Tyrannus verticalis)*	Occurs in a variety of habitats including riparian forests and woodlands, savannahs, shrublands, agricultural lands, deserts, and urban areas. Nesting occurs in trees, bushes, and other raised areas, such as buildings. It migrates to Central America or the southeastern United States for the winter. About 2,736,200 acres of potentially suitable habitat occurs within the SEZ region.	4,852 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	95,797 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	95 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 8,249 acres in area of indirect effect	92 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 1,846 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 effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
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 4,609,200 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	110,274 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,107 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.
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 4,828,500 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	110,267 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,100 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds of Prey (Cont.)						
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 2,144,600 acres of potentially suitable habitat occurs in the SEZ region.	4,897 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	96,333 acres of potentially suitable habitat (4.5% of available potentially suitable habitat)	100 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 8,712 acres in area of indirect effect	87 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,758 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 effect.
Rough-legged hawk *(Buteo lagopus)*	A winter resident in Utah, where it is usually found in grasslands, fields, marshes, sagebrush flats, and other open habitats. About 1,830,800 acres of potentially suitable habitat occurs within the SEZ region.	1,195 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	45,529 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	54 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 4,687 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,392 acres in area of indirect effect	Small overall impact.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds of Prey (Cont.)						
Swainson's hawk *(Buteo swainsoni)*	Grasslands, agricultural areas, shrublands, and riparian forests. Nests in trees in or near open areas. Migrants often occur in treeless areas. Large flocks often occur in agricultural areas during locust infestations. About 2,444,000 acres of potentially suitable habitat occurs in the SEZ region.	399 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	10,761 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	9 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 822 acres in area of indirect effect	1 acre of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 18 acres in area of indirect effect	Small overall impact.
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 2,456,600 acres of potentially suitable habitat occurs in the SEZ region.	3,717 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	51,909 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	50 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 4,381 acres in area of indirect effect	23 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 461 acres in area of indirect effect	Small overall impact.

TABLE 13.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]				Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	
Upland Game Birds						
Chukar *(Alectoris chukar)*	Steep, semiarid slopes with rocky outcrops and shrubs with a grass and forb understory. Distribution often follows that of cheatgrass. Sources of water are required during hot, dry periods, with most birds found within 0.25 mi (0.4 km) of water during the brooding period. About 4,283,400 acres of potentially suitable habitat occurs in the SEZ region.	4,916 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	97,624 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	97 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 8,447 acres in area of indirect effect	93 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,868 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 effect.
Mourning dove *(Zenaida macrroura)*	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 4,440,300 acres of potentially suitable habitat occurs in the SEZ region.	5,234 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	112,950 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,178 acres in area of indirect effect	90 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,810 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 effect.

TABLE 13.1.11.2-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Upland Game Birds (Cont.)						
Wild turkey *(Meleagris gallopavo)*	The Rio Grande wild turkey prefers cottonwood riparian areas of rivers associated with oak-pine and pinyon-juniper forests, while the Merriam's wild turkey inhabits open stands of ponderosa pine interspersed with aspen, grass meadows, and oaks grading into pinyon pine and juniper. Areas of brushy cover are used for nesting. About 4,193,600 acres of potentially suitable habitat occurs within the SEZ region.	1,210 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	47,749 acres of potentially suitable habitat (1.1% of available potentially suitable habitat)	50 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 4,342 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,398 acres in area of indirect effect	Small overall impact.

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.

c Direct effects within the SEZ would consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 5,291 acres of direct effect within the SEZ was assumed.

d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide road corridor (less the assumed area of direct effects) that extends beyond the 5-mi (8-km) area adjacent to the SEZ boundary. 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.

Footnotes continued on next page.

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TABLE 13.1.11.2-1 (Cont.)

[e] For access road development, direct effects were estimated within a 15-mi (24-km) long, 60-ft (18-m) wide ROW for an assumed new access road from the SEZ to the nearest state highway. Indirect effects were estimated within a 1-mi (1.6-km) wide road corridor to the state highway, less the assumed area of direct effects.

[f] For transmission development, direct effects were estimated within a 3-mi (5-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission corridor to the existing transmission line, less the assumed area of direct effects.

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

Sources: NatureServe (2010); UDWR (2009a); USGS (2004, 2005c, 2007).

13.1.11.2.2 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 13.1.11.2.3, below, identifies design features of particular relevance to the proposed Escalante Valley 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 13.1.11.2.1 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 13.1.11.2.3).

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 13.1.11.2-1 summarizes the magnitude of potential impacts on representative bird species resulting from solar energy development in the proposed Escalante Valley SEZ. Direct impacts on bird species would be small for all but one species (Le Conte's thrasher), as only 0.2% or less of potentially suitable habitats for the bird species would be lost (Table 13.1.11.2-1). Impacts on the Le Conte's thrasher would be moderate, because solar energy development within the SEZ would directly impact 1.1% of potentially suitable habitat for this species (Table 13.1.11.2-1). Larger areas of potentially suitable habitat for bird species occur within the area of potential indirect effects (e.g., up to 14.6% of potentially suitable habitat for the Le Conte's thrasher). Other impacts on birds could result from collision with vehicles and buildings, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (for example, impacts caused by dust generation, erosion, and sedimentation) are expected to be negligible with implementation of programmatic design features.

Decommissioning after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are 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 semiarid shrublands.

13.1.11.2.3 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., ephemeral washes and the dry lakebed). 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 specific project details are considered, the following design features can be identified at this time:

- For solar energy developments 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 UDWR. A permit may be required under the Bald and Golden Eagle Protection Act.

- The steps outlined in the *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin and Muck 1999) should be followed.

- Ephemeral washes and the dry lakebed in the southwestern portion of the SEZ should be avoided.

If these 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 a number 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.

13.1.11.3 Mammals

13.1.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Escalante Valley SEZ. The list of mammal species potentially present in the SEZ area was determined from range maps and habitat information available from the Utah Conservation Data Center (UDWR 2009a). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005c, 2007). See Appendix M for additional information on the approach used. Nearly 80 species of mammals are known to occur within Iron County (UDWR 2009a). Based on species distributions and habitat preferences, fewer than 30 mammal species could occur within the proposed Escalante Valley SEZ (UDWR 2009a). Similar to the overview of mammals provided for the six-state solar energy study area (Section 4.6.2.3), 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 area of the proposed Escalante Valley SEZ include American black bear (*Ursus americanus*, fairly common in Utah), cougar (*Puma concolor*, fairly common in Utah), elk (*Cervis canadensis*, common in the mountainous regions of Utah), mule deer (*Odocoileus hemionus*, common in Utah), and pronghorn (*Antilocapra americana*, common in Utah) (UDWR 2009a).

American Black Bear. The American black bear occurs throughout much of Utah, where it primarily inhabits forested areas (UDWR 2009a). However, no areas of substantial or crucial American black bear habitat occur near the SEZ. The shortest distance from the SEZ to substantial American black bear habitat is 17 mi (27 km), whereas the closest distance to crucial American black bear habitat is 19 mi (31 km).

Cougar. The cougar is fairly common in Utah (UDWR 2009a). A management plan for the cougar has been developed in Utah (UDWR 2009b). Cougar habitat encompasses about 59,325,200 acres (240,080 km^2) in Utah with a statewide cougar population estimate somewhere between about 2,500 and 4,000 (UDWR 2009b). Cougars mostly occur in rough, broken foothills and canyon country, often in association with pinyon-juniper and pine-oak brush areas (CDOW 2009; Pederson undated), avoiding areas of sagebrush and low-growing shrubs or other areas without tall cover (Pederson undated). The proposed Escalante Valley SEZ overlaps the cougar's overall range, but the SEZ does not occur within high-value cougar habitat (UDWR 2009a). Figure 13.1.11.3-1 shows the location of the SEZ relative to areas of the woodland and shrub-covered low mountain Level IV ecoregion. These ecoregion areas would potentially provide suitable cougar habitat. The shortest distance from these areas to the proposed Escalante Valley SEZ is 5 mi (87.7 km). About 1,712,640 acres (6,931 km^2) of the woodland and shrub-covered low mountain Level IV ecoregion occurs within the SEZ region.

Elk. Elk are common in most mountainous regions of Utah. They inhabit mountain meadows and forests during the summer and foothills and valley grasslands during the winter (UDWR 2009a). Elk require an available water source on all seasonal ranges and prefer to be within 0.5 mi (0.8 km) of water. Elk also require cover for escape and protection (UDWR 2010a). Crucial elk habitat is continuously being lost and fragmented within Utah. The statewide management plan for the elk has been updated (UDWR 2010a). The management objective is a statewide population of 80,000 elk. The statewide population estimate in 2009 was nearly 68,000. Within the Pine Valley Big Game Management Unit, which encompasses the area that includes the proposed Escalante Valley SEZ, the population estimate was 50 (UDWR 2010a). Figure 13.1.11.3-2 shows the location of the proposed Escalante Valley SEZ relative to areas of crucial elk habitat. The shortest distance from the SEZ to these areas is 9 mi (14 km). About 1,110,500 acres (4,494 km^2) of crucial elk habitat occur within the SEZ region.

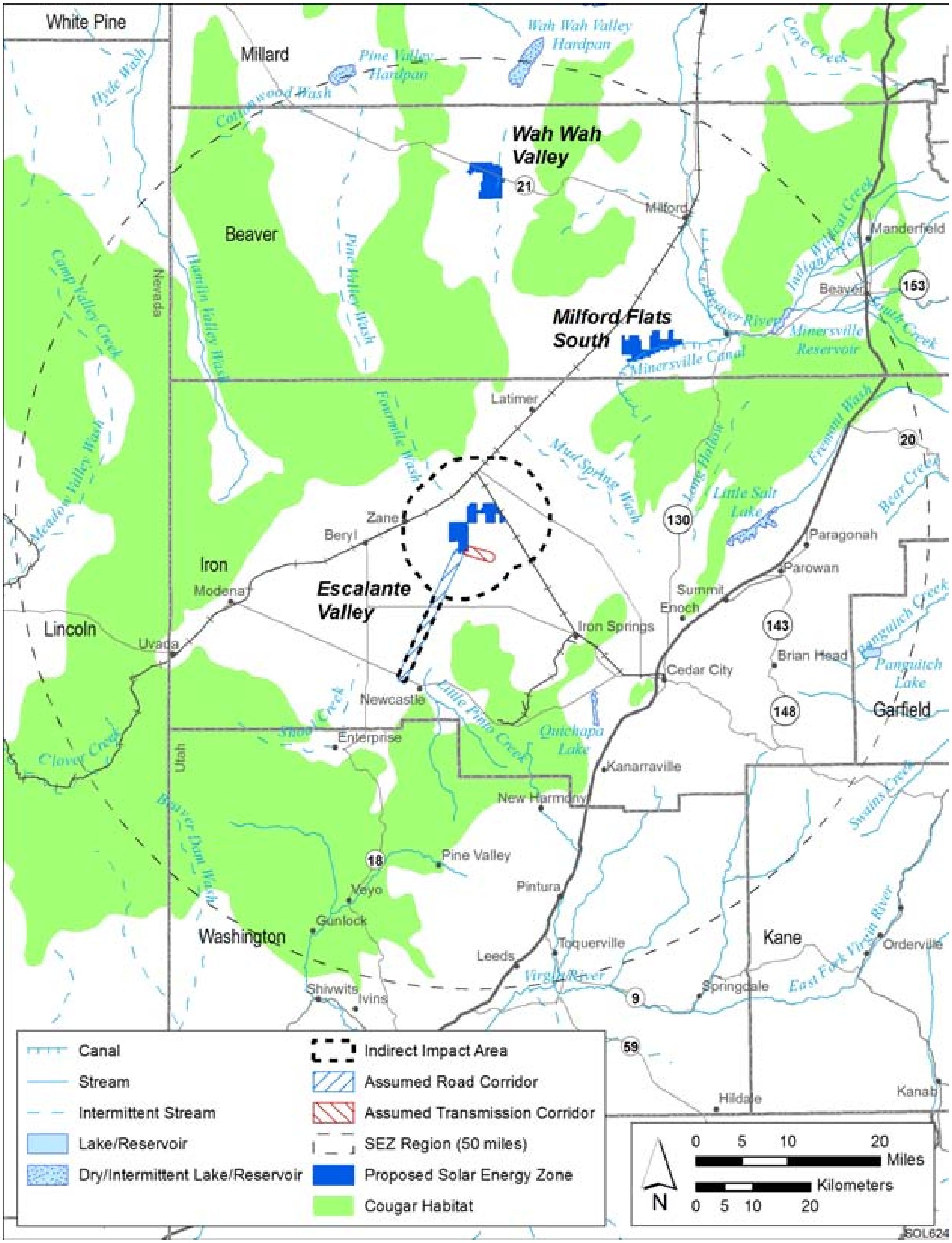

FIGURE 13.1.11.3-1 Location of the Proposed Escalante Valley SEZ Relative to Woodland and Shrub-Covered Low Mountains Level IV Ecoregion Areas (Cougar Habitat) (Source: Woods et al. 2001)

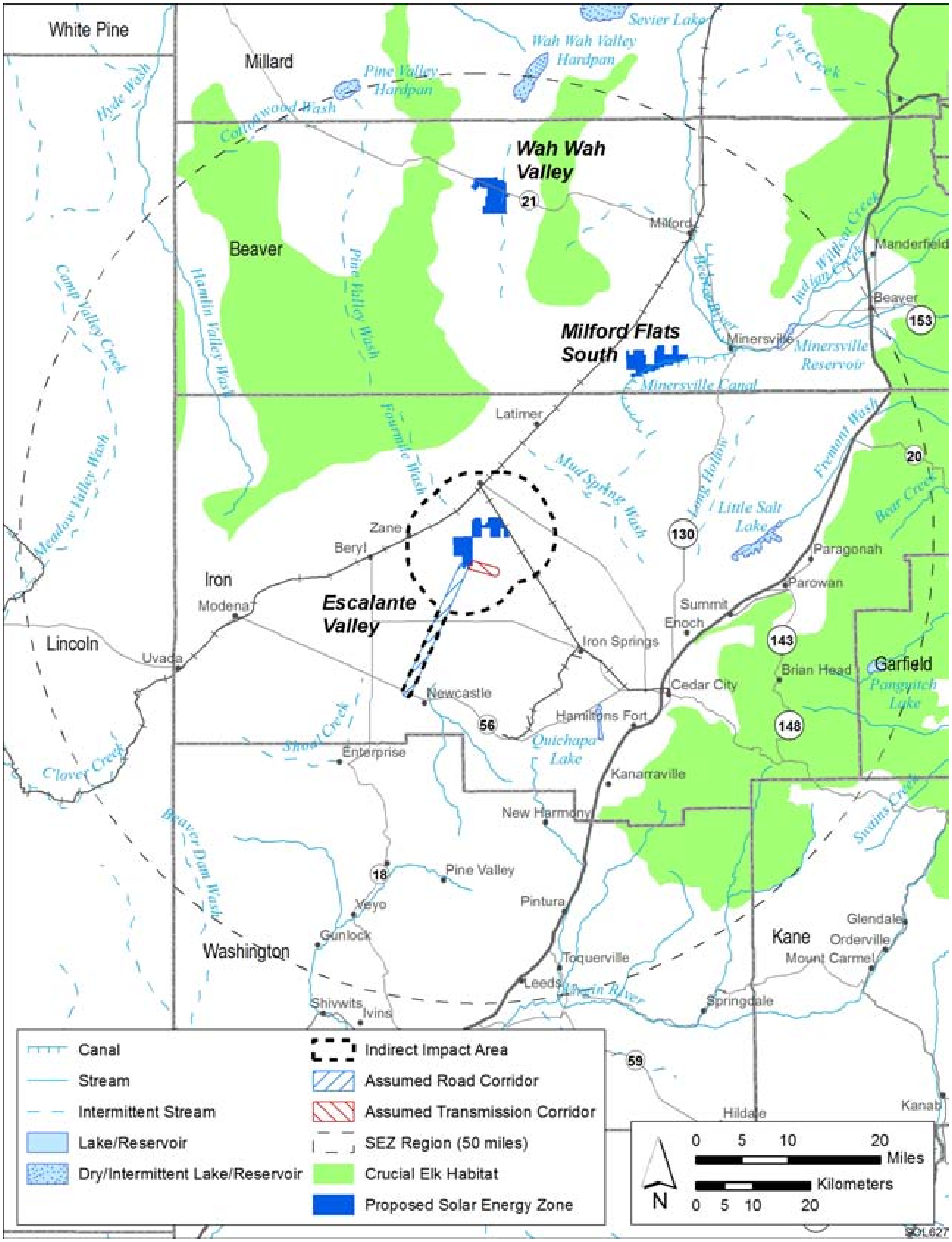

FIGURE 13.1.11.3-2 Location of the Proposed Escalante Valley SEZ Relative to Elk Crucial Habitat Areas (Source: UDWR 2006)

Mule deer. The mule deer is the most important game species in Utah. It is common throughout the state, being least abundant in desert areas (UDWR 2008). A statewide management plan for mule deer has been developed (UDWR 2008). Crucial mule deer habitat is continuously being lost and fragmented within Utah. The statewide population has been declining for over 30 years. The 2003 post-season statewide population estimate was 302,000, much lower than the long-term management objective of 426,000 (UDWR 2008). Figure 13.1.11.3-3 shows the location of the proposed Escalante Valley SEZ relative to areas of crucial mule deer habitat. The shortest distance from the SEZ to these areas is 6 mi (10 km). Over 2,747,600 acres (11,119 km^2) of crucial mule deer habitat occurs within the SEZ region.

Pronghorn. The pronghorn is common in Utah, occurring primarily in shrubsteppe habitat in large expanses of open, low-rolling or flat terrain (UDWR 2009a,c). A statewide management plan for pronghorn has been developed (UDWR 2009c). The statewide population of pronghorn is estimated at 12,000 to 14,000 (UDWR 2009c). Within the Pine Valley Big Game Management Unit, which encompasses the proposed Escalante Valley SEZ, the population estimate is 325 (UDWR 2009c). Figure 13.1.11.3-4 shows that the proposed Escalante Valley SEZ is contained within areas of crucial pronghorn habitat. Over 1,646,560 acres (6,663 km^2) of crucial pronghorn habitat occur within the SEZ region.

Other Mammals

A number of small game and furbearer species occur within Iron County. Species that could occur within the area of the proposed Escalante Valley SEZ include the American badger (*Taxidea taxus*, common in deserts and grasslands), black-tailed jackrabbit (*Lepus californicus*, most abundant rabbit species in Utah), coyote (*Canis latrans*, common), and desert cottontail (*Sylvilagus audubonii*, widely distributed from desert areas to lower slopes of mountains) (UDWR 2009a).

The nongame (small) mammal species include bats, mice, voles, moles, and shrews. Species that could occur within the area of the proposed Escalante Valley SEZ include the desert woodrat (*Neotoma lepida*, common in western Utah), Great Basin pocket mouse (*Perognathus parvus*, common), least chipmunk (*Neotamias minimus*, wide-ranging in many types of habitats), northern grasshopper mouse (*Onychomys leucogaster*, common), sagebrush vole (*Lemmiscus curtatus*, moderately common), and white-tailed antelope squirrel (*Ammospermophilus leucurus*, common) (UDWR 2009a). Bat species that may occur within the area of the SEZ include the Brazilian free-tailed bat (*Tadarida brasiliensis*), little brown myotis (*Myotis lucifugus*), long-legged myotis (*M. volans*), and western pipistrelle (*Parastrellus hesperus*) (UDWR 2009a). However, roost sites for the bat species (e.g., caves, hollow trees, rock crevices, or buildings) would be limited to absent within the SEZ.

Table 13.1.11.3-1 provides habitat information for representative mammal species that could occur within the proposed Escalante Valley SEZ. Special status mammal species are discussed in Section 13.1.12.

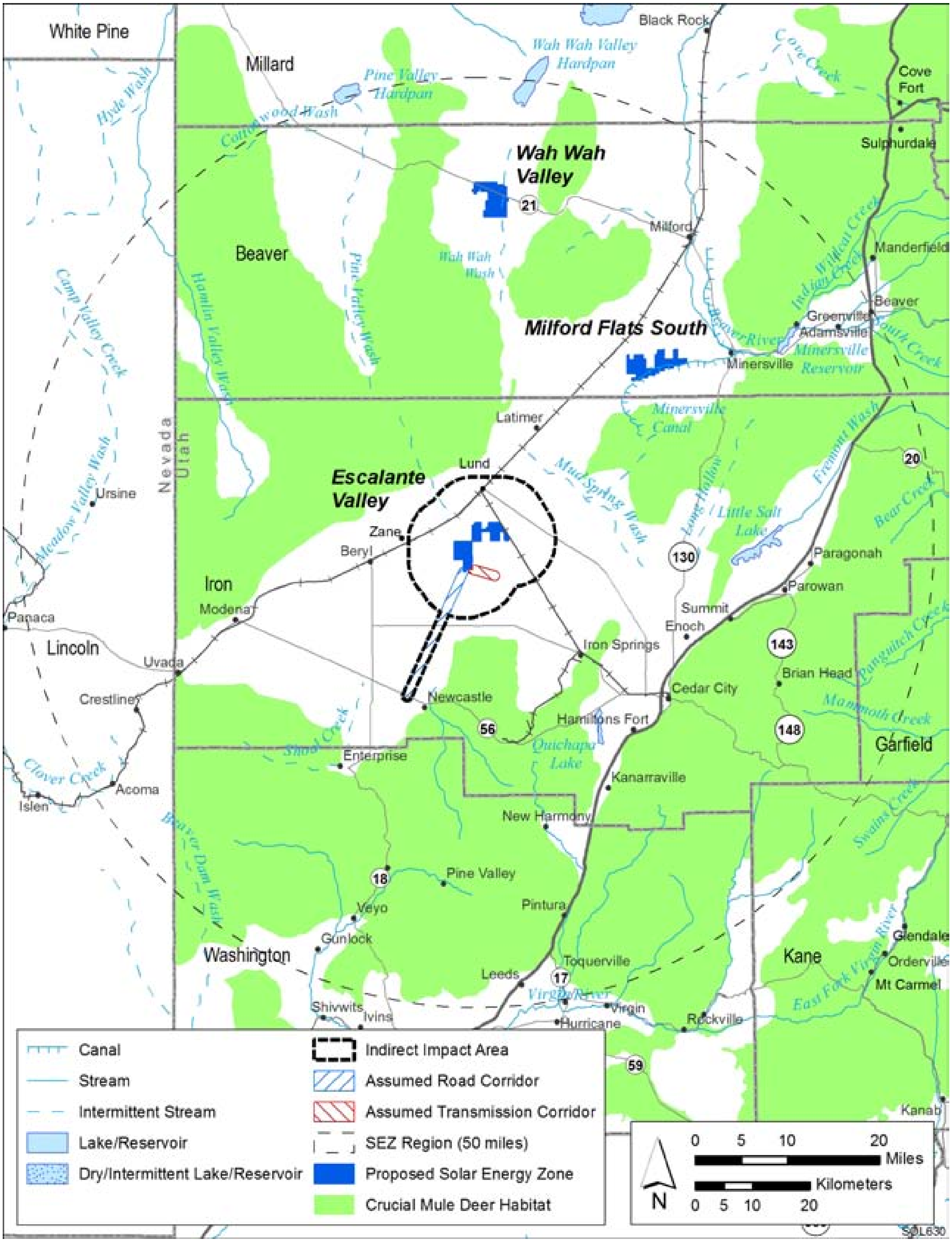

FIGURE 13.1.11.3-3 Location of the Proposed Escalante Valley SEZ Relative to Mule Deer Crucial Habitat Areas (Source: UDWR 2006)

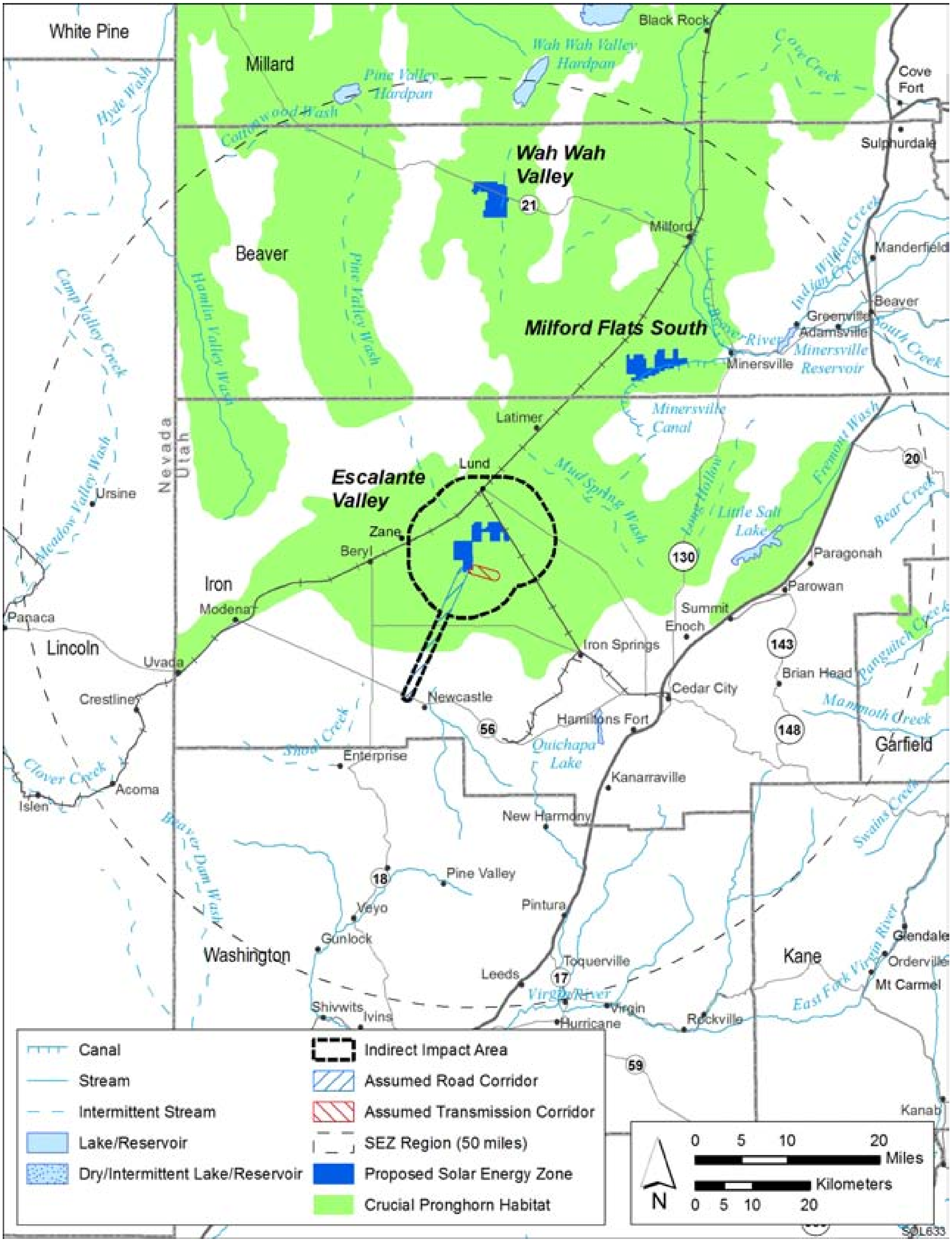

FIGURE 13.1.11.3-4 Location of the Proposed Escalante Valley SEZ Relative to Pronghorn Crucial Habitat Areas (Source: UDWR 2006)

TABLE 13.1.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Escalante Valley 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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Big Game						
American black bear *(Ursus americanus)*	Montane shrublands and forests, and subalpine forests at moderate elevations. About 3,869,500 acres[i] of potentially suitable habitat occurs in the SEZ region.	871 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,285 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	46 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,996 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,386 acres in area of indirect effect	Small overall impact.
Cougar *(Puma concolor)*	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,631,600 acres of potentially suitable habitat occurs in the SEZ region.	4,912 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	96,754 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	96 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 8,375 acres in area of indirect effect	92 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,853 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 effect.

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TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Big Game (Cont.)						
Elk *(Cervis canadensis)*	Semi-open forest, mountain meadows, foothills, plains, valleys, and alpine tundra. Uses open spaces such as alpine pastures, marshy meadows, river flats, brushy clean cuts, forest edges, and semidesert areas. About 2,333,500 acres of potentially suitable habitat occurs in the SEZ region.	796 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat) during construction and operations	34,950 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	44 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 3,862 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 1,379 acres in area of indirect effect	Small overall impact.
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 3,256,800 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	110,097 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 11,106 acres in area of indirect effect	93 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 1,879 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Big Game (Cont.)						
Pronghorn *(Antilocapra americana)*	Grasslands and semidesert shrublands on rolling topography that affords good visibility. Most abundant in shortgrass or midgrass prairies and least common in xeric habitats. About 1,917,800 acres of potentially suitable habitat occurs in the SEZ region.	1,513 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	58,698 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	81 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 7,059 acres in area of indirect effect	71 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 1,423 acres in area of indirect effect	Small overall impact.
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 4,423,100 acres of potentially suitable habitat occurs in the SEZ region.	5,245 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	112,307 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	124 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 10,761 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
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 4,603,900 acres of potentially suitable habitat occurs in the SEZ region.	5,245 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	112,656 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,110 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.
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 5,009,000 acres of potentially suitable habitat occurs in the SEZ region.	5,291 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	122,640 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	150 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 13,031 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,901 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
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 4,475,000 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	110,264 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	128 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 11,106 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.
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 4,459,900 acres of potentially suitable habitat occurs in the SEZ region.	5,215 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	118,404 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	147 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 12,828 acres in area of indirect effect	89 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,795 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Nongame (small) Mammals (Cont.)						
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. At elevations to 8,500 ft (2,591 m). Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,277,900 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	109,910 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	123 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 10,752 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Nongame (small) Mammals (Cont.)						
Great Basin pocket mouse *(Perognathus parvus)*	Prefers arid grassland, sagebrush, and pinyon-juniper habitats with sandy soil. About 4,064,900 acres of potentially suitable habitat occurs within the SEZ region.	5,170 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	109,135 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	122 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 10,622 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,883 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 effect.
Least chipmunk *(Neotamias minimus)*	Low-elevation semidesert shrublands, montane shrublands and woodlands, forest edges, and alpine tundra. About 4,593,200 acres of potentially suitable habitat occurs in the SEZ region.	5,245 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	112,297 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	124 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 10,760 acres in area of indirect effect	94 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,884 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Nongame (small) Mammals (Cont.)						
Little brown myotis *(Myotis lucifugus)*	Various habitats including pinyon-juniper woodlands, montane shrublands, and riparian woodlands. Uses man-made structures for summer roosting, although caves and hollow trees are also utilized. Winter hibernation often occurs in caves or mines. Most foraging activity occurs in woodlands over or near water. About 4,217,600 acres of potentially suitable habitat occurs within the SEZ region.	4,897 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	96,515 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	100 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 8,718 acres in area of indirect effect	88 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,763 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 effect.
Long-legged myotis *(Myotis volans)*	Prefers pine forest, desert, and riparian habitats. Old buildings, rock crevices, and hollow trees are used for daytime roosting and winter hibernation. It forages in open areas, such as forest clearings. About 3,367,300 acres of potentially suitable habitat occurs within the SEZ region.	4,471 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	77,426 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	79 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 6,915 acres in area of indirect effect	25 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat) and 505 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 effect.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Nongame (small) Mammals (Cont.)						
Northern grasshopper mouse *(Onychomys leucogaster)*	Occurs in grasslands, sagebrush deserts, overgrazed pastures, weedy roadside ditches, sand dunes, and other habitats with sandy soil and sparse vegetation. About 3,959,100 acres of potentially suitable habitat occurs within the SEZ region.	2,473 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat) during construction and operations	51,681 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	70 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 6,060 acres in area of indirect effect	69 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 1,398 acres in area of indirect effect	Small overall impact.
Sagebrush vole *(Lemmiscus curtatus)*	Typically associated with semiarid sagebrush and grassland areas. Burrows are often constructed near sagebrush. About 1,232,800 acres of potentially suitable habitat occurs within the SEZ region.	781 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat) during construction and operations	34,357 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	44 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 3,850 acres in area of indirect effect	64 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 1,290 acres in area of indirect effect	Small overall impact.

TABLE 13.1.11.3-1 (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 Road Corridor (Indirect and Direct Effects)[e]	Within Transmission Corridor (Indirect and Direct Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Nongame (small) Mammals (Cont.)						
Western pipistrelle *(Parastrellus esperus)*	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 2,709,700 acres of potentially suitable habitat occurs in the SEZ region.	5,230 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	111,551 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	124 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) and 10,755 acres in area of indirect effect	90 acres of potentially suitable habitat lost (0.003% of available potentially suitable habitat) and 1,788 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 effect.
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 1,361,200 acres of potentially suitable habitat occurs within the SEZ region.	4,146 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	64,596 acres of potentially suitable habitat (4.7% of available potentially suitable habitat)	52 acres of potentially suitable habitat lost (0.004% of available potentially suitable habitat) and 4,522 acres in area of indirect effect	28 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat) and 557 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 effect.

Footnotes on next page.

TABLE 13.1.11.3-1 (Cont.)

[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 5,291 acres of direct effect within the SEZ was assumed.

[c] Direct effects within the SEZ would 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 and within the 1-mi (1.6-km) wide road corridor (less the assumed area of direct effects) that extends beyond the 5-mi (8-km) area adjacent to the SEZ boundary. 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 15-mi (24-km) long, 60-ft (18-m) wide ROW for an assumed new access road from the SEZ to the nearest state highway. Indirect effects were estimated within a 1-mi (1.6-km) wide road corridor to the state highway, less the assumed area of direct effects.

[f] For transmission development, direct effects were estimated within a 3-mi (5-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission corridor to the existing transmission line, less the assumed area of direct effects.

[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. 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 acres to km^2, multiply by 0.004047.

Sources: NatureServe (2010); UDWR (2009a); USGS (2004, 2005c, 2007).

1

13.1.11.3.2 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 13.1.11.3.3, below, identifies design features of particular relevance to mammals for the proposed Escalante Valley 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 13.1.11.3.1 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 13.1.11.3.3).

Table 13.1.11.3-1 summarizes the potential magnitude of impacts on representative mammal species resulting from solar energy development (with the inclusion of design features) in the proposed Escalante Valley SEZ.

American Black Bear

Based on land cover analyses, about 870 acres (3.5 km^2) of potentially suitable American black bear habitat could be directly lost by solar energy development within the proposed Escalante Valley SEZ. This is 0.02% of potentially suitable American black bear habitat within the SEZ region. Based on mapped ranges, the SEZ is 17 mi (27 km) from the closest substantial American black bear habitat and 19 mi (31 km) from the closest crucial American black bear habitat. Thus, solar energy development would not directly impact these American black bear habitats. The access road and transmission line routes would not fragment either category of American black bear habitat. Overall, impacts on American black bear from solar energy development in the SEZ would be small.

Cougar

Based on land cover analyses, about 4,900 acres (19.8 km^2) of potentially suitable cougar habitat could be directly lost by solar energy development within the proposed Escalante Valley SEZ. This is 0.3% of potentially suitable cougar habitat within the SEZ region. Based on mapped ranges, the SEZ is 5 mi (8 km) from the closest preferred habitat for the cougar (i.e., areas contained within the woodland and shrub-covered low mountain Level IV ecoregion; Figure 13.1.11.3-1). Thus, solar energy development would not directly impact preferred cougar habitat. The access road and transmission line routes for the SEZ would not cross through preferred cougar habitat. Overall, impacts on cougar from solar energy development in the SEZ would be small.

Elk

Based on land cover analyses, about 800 acres (3.2 km^2) of potentially suitable elk habitat could be directly lost by solar energy development within the proposed Escalante Valley SEZ. This is 0.03% of potentially suitable elk habitat within the SEZ region. Based on mapped ranges, the SEZ is 9 mi (14 km) from the closest area of crucial elk habitat (Figure 13.1.11.3-2). Thus, solar energy development would not directly or indirectly impact this habitat. The access road and transmission line routes for the SEZ would not cross through crucial elk habitat. Overall, impacts on elk from solar energy development in the SEZ would be small.

Mule Deer

Based on land cover analyses, about 5,200 acres (21 km^2) of potentially suitable mule deer habitat could be directly lost by solar energy development within the proposed Escalante Valley SEZ. This is 0.2% of potentially suitable mule deer habitat within the SEZ region. Based on mapped ranges, the SEZ is 6 mi (10 km) from the closest area of crucial mule deer habitat (Figure 13.1.11.3-3). Thus, solar energy development would not directly or indirectly impact this habitat. The access road and transmission line routes for the SEZ would not cross through crucial mule deer habitat. Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Pronghorn

Based on land cover analyses, about 1,510 acres (6.1 km^2) of potentially suitable pronghorn habitat could be directly lost by solar energy development within the proposed Escalante Valley SEZ. This is 0.1% of potentially suitable pronghorn habitat within the SEZ region. Based on mapped ranges, the SEZ and its access road and transmission line routes would be located within crucial pronghorn habitat (Figure 13.1.11.3-4). This could result in the direct reduction of 5,291 acres (21.5 km^2) of crucial pronghorn habitat within the SEZ, 91 acres (0.37 km^2) for the transmission line, and 109 acres (0.44 km^2) for the access road. Fencing, considered a major problem on pronghorn ranges, would present a barrier or hindrance to pronghorn movement (UDWR 2009c). There are over 1,646,560 acres (6,663 km^2) of crucial pronghorn habitat within the SEZ region. Therefore, the solar energy development would eliminate about 0.3% of crucial pronghorn habitat that occurs within the SEZ region. Overall, impacts on pronghorn from solar energy development in the SEZ would be small.

Other Mammals

Direct impacts on small game, furbearers, and nongame (small) mammal species would be small, as 0.06 to 0.3% of potential habitats identified for these species would be lost (Table 13.1.11.3-1). Larger areas of potentially suitable habitat for these species occur within the area of potential indirect effects (i.e., ranging from 1.3% for the northern grasshopper mouse to 4.7% for the white-tailed antelope squirrel).

Summary

Overall, direct impacts on mammal species would be small for all species, as only 0.3% or less of potentially suitable habitats for the mammal species would be lost (Table 13.1.11.3-1). Larger areas of potentially suitable habitat for mammal species occur within the area of potential indirect effects (e.g., up to 4.7% of potentially suitable habitat for the white-tailed antelope squirrel). Other impacts on mammals could result from collision with vehicles and facilities (e.g., 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. Indirect impacts on areas outside the SEZ (for example, impacts caused by dust generation, erosion, and sedimentation) would be negligible with implementation of programmatic design features.

Decommissioning after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are 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 semiarid shrublands.

13.1.11.3.3 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. While SEZ-specific design features are best established when considering specific project details, design features that can be identified at this time include the following:

- The fencing around the solar energy development should not block the free movement of mammals, particularly big game species; and

- The ephemeral washes and dry lakebed in the southwestern portion of the SEZ should be avoided.

If these SEZ-specific design features are implemented in addition to the 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.

13.1.11.4 Aquatic Biota

13.1.11.4.1 Affected Environment

No natural intermittent or perennial streams, water bodies, seeps, or springs are present on the proposed Escalante Valley SEZ or within the area of the presumed new transmission line corridor and access road. Consequently, no aquatic habitat or aquatic communities are present. The proposed Escalante Valley SEZ contains some small earthen livestock watering areas that have been constructed by building up berms to hold runoff or water pumped into the areas for short periods of time. There is little comprehensive information about the distribution of wetlands within the area and no NW data for the region that include the proposed SEZ (USFWS 2009). However, observations made during September 2009 indicated that wetlands would be unlikely or uncommon.

No perennial streams, water bodies, seeps, or springs have been identified in the area of potential indirect effects. Approximately 3 mi (5 km) of Fourmile Wash is located within the area of indirect effects, which represents approximately 21% of its total 14-mi (23-km) length. Fourmile Wash is an intermittent stream that is usually dry. However, such ephemeral or nonpermanent features, which form during wet periods, may contain invertebrates that are either aquatic opportunists (i.e., species that occupy both temporary and permanent waters) or specialists adapted to living in temporary aquatic environments (Graham 2001). Although most ephemeral pools are populated with widespread species, some can contain species that are endemic to particular geographic regions or even specific pools (Graham 2001). On the basis of information for other ephemeral pools in the American Southwest, ostracods (seed shrimp) and small planktonic crustaceans (e.g., copepods or cladocerans) are expected to be present, and larger branchiopod crustaceans such as fairy shrimp could occur (Graham 2001). Various types of insects that have aquatic larval stages, such as dragonflies and a variety of midges and other flies, may also occur, depending on pool longevity, distance to permanent water features, and the abundance of other invertebrates for prey (Graham 2001). However, site specific surveys would be necessary to characterize aquatic biota, if present.

Outside of the indirect effects area, but within 50 mi (80 km) of the SEZ, are approximately 340 mi (547 km) of perennial stream, 223 mi (359 km) of intermittent stream, and approximately 32 mi (51 km) of canals. Also present within 50 mi (80 km) of the SEZ are approximately 2,354 acres (9.5 km^2) of lake and reservoir habitat. There are approximately 5,575 acres (23 km^2) of dry lake and 1,069 acres (4.3 km^2) of intermittent lake. Pinto Creek, a perennial stream, is located within 2 mi (3 km) of the presumed new access road corridor.

13.1.11.4.2 Impacts

Because surface water habitats are a unique feature in the arid landscape in the vicinity of the proposed Escalante Valley SEZ, the maintenance and protection of such habitats is 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

Section 5.10.2.4 and include (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of water quality.

Disturbance of land areas in order to construct solar energy facilities or new transmission line corridors and access roads could increase the transport of soil from the disturbed area via water and air pathways. However, because there are no intermittent or permanent water bodies, streams, or wetlands present within the boundaries of either the proposed Escalante Valley SEZ or the presumed access road and transmission line corridors, there would be no direct impacts on aquatic habitats or aquatic biota. In addition, given that soils in the area are well drained with moderately high permeability (Section 13.1.7.1.2), and that there are no perennial aquatic habitats within 13 mi (21 km) of the SEZ or within approximately 2 mi (3 km) of the access road corridor, it is unlikely that any surface runoff or airborne dust associated with solar energy development would reach aquatic habitats. Consequently, population- or community-level ecological effects on aquatic habitats would be unlikely. Implementing dust control management practices and maintaining undisturbed (i.e., vegetated) areas around the perimeter of the SEZ would further reduce the potential for long-term sediment deposition into surrounding surface water features.

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 troughs or power towers, 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 habitats on the proposed Escalante Valley 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, which would potentially affect water levels in surface water features outside of the proposed SEZ 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 volume 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. However, because of the relatively large distance of any permanent surface water features from solar development activities (a minimum of approximately 2 mi [3 km]), the potential for introducing contaminants into such water bodies would be small.

13.1.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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 Escalante Valley SEZ. Special status species include the following types of species[6]:

- Species listed as threatened or endangered under the Endangered Species Act (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 Utah[7]; and
- Species that have been ranked as S1 or S2 by the State of Utah or as species of concern by the State of Utah or by the USFWS; hereafter referred to as 'rare' species.

Special status species known to occur within 50 mi (80 km) of the Escalante Valley SEZ center (i.e., the SEZ region) were determined from natural heritage records and other data available through NatureServe Explorer (NatureServe 2010), Utah Division of Wildlife Resources (UDWR) Conservation Data Center (UDWR 2009a) and UDWR Vertebrate Information (UDWR 2003), *Utah Rare Plants Guide* (UNPS 2009), and the Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2004, 2005c, 2007). Information reviewed consisted of county-level occurrences as determined from NatureServe, USGS 7.5-minute quad-level occurrences, 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 Beaver, Garfield, Iron, Kane, Millard, and Washington Counties, Utah, and Lincoln County, Nevada. However, the SEZ and affected area occur only in Iron County, Utah. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

13.1.12.1 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

[6] 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 2008). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

[7] According to Utah Administrative Rule R657-48, as described in the *Utah Sensitive Species List* (UDWR 2010), there are no species that receive a separate regulatory designation from the UDWR or the state of Utah.

Escalante Valley SEZ, the area of direct effects included the SEZ and the areas within the transmission line and road corridors where ground-disturbing activities are assumed to occur (refer to Section 13.1.1.2 for development assumptions). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the portion of the 1-mi (1.6-km) wide transmission line and road corridors where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effects. Indirect effects considered in the assessment included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ, but did not include ground-disturbing activities. 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 indirect effects. The affected area includes both the direct and indirect effects areas.

The primary vegetation community types within the affected area are mixed salt desert scrub and sagebrush (*Artemisia* spp.) (see Section 13.1.10). Potentially unique habitats in the affected area in which special status species may reside include desert dunes, grasslands, woodlands, and playa and wash habitats. The only aquatic or riparian habitats in the affected area occur within and along Fourmile Wash, which occurs in the area of indirect effects as near as 3 mi (5 km) northwest of the SEZ. There are also dry lake playa habitats throughout the area of indirect effects. There are no natural intermittent or perennial surface water bodies on the SEZ; however, there are some man-made earthen livestock-watering areas throughout the SEZ (Section 13.1.9; Figure 13.1.12.1-1).

All special status species that are known to occur within the Escalante Valley 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, 18 could occur in the affected area of 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 13.1.12.1-1. For many of the species listed in the table, 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 more than 20 mi (32 m) from the SEZ.

Based on information provided by the UDWR, quad-level occurrences for five species intersect the Escalante Valley SEZ affected area (Table 13.1.12.1-1): the ferruginous hawk, greater sage-grouse, western burrowing owl, pygmy rabbit, and Utah prairie dog. There are no groundwater-dependent species in the vicinity of the SEZ based on UDWR records, information provided by the USFWS (Stout 2009), and the evaluation of groundwater resources in the Escalante Valley SEZ region (Section 13.1.9).

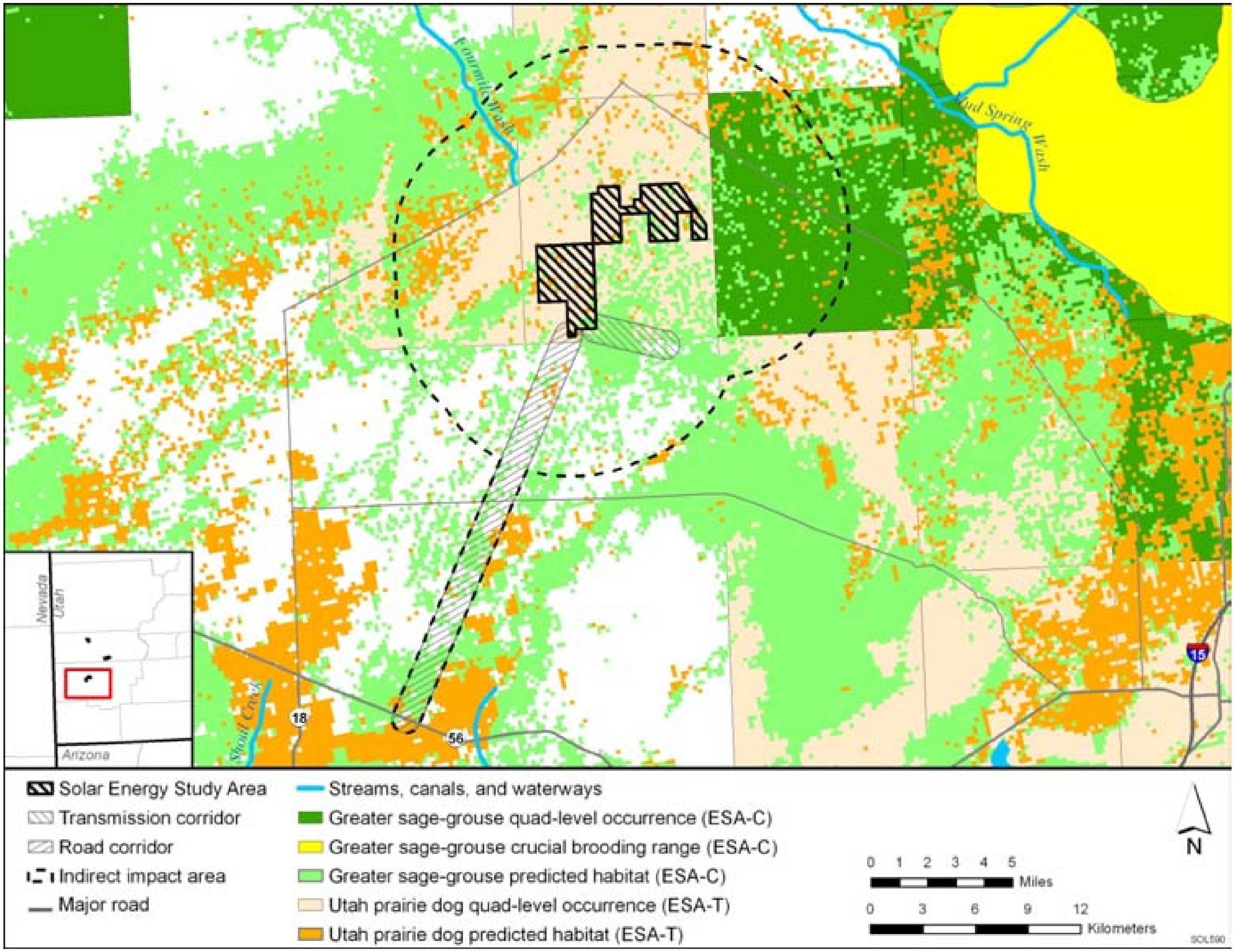

FIGURE 13.1.12.1-1 Known or Potential Occurrences of Species Listed as Endangered, Threatened, or Candidates for Listing under the ESA That May Occur in the Proposed Escalante Valley SEZ Affected Area (Sources: USGS 2007; UDWR 2009a)

TABLE 13.1.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Occur on or in the Affected Area of the Proposed Escalante Valley SEZ

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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Plants								
Compact cat's-eye	*Cryptantha compacta*	BLM-S; FWS-SC; UT-S2	Salt desert shrub and mixed shrub communities at elevations between 5,000 and 8,400 ft.[j] Known from southwestern Millard County and northwestern Beaver County, Utah, and eastern Nevada. Nearest recorded occurrence is 50 mi[k] northwest of the SEZ. About 2,161,906 acres[l] of potentially suitable habitat occurs within the SEZ region.	4,843 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	71 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	88 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	89,274 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of 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 plants.
Jone's globemallow	*Sphaeralcea caespitosa*	BLM-S; FWS-SC; UT-S2	Known from at least four occurrences in western Utah and six occurrences in eastern Nevada on federal and state lands on dolomite calcareous soils in association with mixed shrub, pinyon-juniper, and grassland communities at elevations between 5,000 and 6,500 ft. Nearest recorded occurrence is 38 mi north of the SEZ. About 4,150,988 acres of potentially suitable habitat occurs within the SEZ region.	4,909 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	73 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	89 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,161 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. See compact cat's-eye for a list of potential mitigations applicable to all special status plant species.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Plants (Cont.)								
Long-calyx milkvetch	*Astragalus oophorus lonchocalyx*	BLM-S; FWS-SC; UT-S1	Endemic to the Great Basin in western Utah and eastern Nevada in pinyon-juniper woodlands, sagebrush, and mixed shrub communities at elevations between 5,800 and 7,500 ft. Nearest recorded occurrence are 30 mi west of the SEZ. About 4,065,963 acres of potentially suitable habitat occurs within the SEZ region.	4,843 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	71 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	88 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	89,438 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact. See compact cat's-eye for a list of potential mitigations applicable to all special status plant species.
Money wild buckwheat	*Eriogonum nummulare*	BLM-S	Western Utah and eastern Nevada on gravelly washes, flats, and slopes in saltbush and sagebrush communities and pinyon-juniper woodlands. Nearest recorded occurrence is 30 mi west of the SEZ. About 3,659,646 acres of potentially suitable habitat occurs within the SEZ region.	4,824 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	86 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	89 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,721 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. See compact cat's-eye for a list of potential mitigations applicable to all special status plant species.
Nevada willowherb	*Epilobium nevadense*	BLM-S; FWS-SC; UT-S1	Known from western Utah in Iron, Millard, and Washington Counties, as well as Lincoln County, Nevada, in pinyon-juniper woodlands and oak/mountain mahogany communities, on talus slopes and rocky limestone outcrops. Elevation ranges between 5,000 and 8,800 ft. Nearest recorded occurrence is in the Dixie National Forest, approximately 30 mi southwest of the SEZ. About 2,058,301 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	6 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	175 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodland habitat in the area of direct effects could reduce impacts. See compact cat's-eye for a list of potential mitigations applicable to all special status plant species.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Birds								
Bald Eagle	*Haliaeetus leucocephalus*	BLM-S; UT-SC; UT-S1	Known as a winter resident throughout the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. Wintering areas are associated with open water. May occasionally forage in arid shrubland habitats. Nearest recorded occurrences are from Fourmile and Mud Spring Washes 10 mi north and northeast of the SEZ. About 2,830,633 acres of potentially suitable habitat occurs within the SEZ region.	370 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	6 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	10,565 acres of potentially suitable habitat (0.4% 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.
Ferruginous Hawk[m]	***Buteo regalis***	BLM-S; UT-SC; UT-S2	Known as a winter resident throughout the SEZ region. Grasslands, shrublands, agricultural lands, and the periphery of pinyon-juniper forests throughout the SEZ region. Quad-level occurrences intersect the affected area. About 1,712,600 acres of potentially suitable habitat occurs within the SEZ region.	2,290 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	75 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	67 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	48,774 acres of potentially suitable habitat (2.8% 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.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Birds (Cont.)								
Greater sage-grouse	***Centrocercus urophasianus***	ESA-C; BLM-S; UT-SC; UT-S2	A year-round resident in the SEZ region. Plains, foothills, and mountain valleys dominated by sagebrush throughout the SEZ region. Lek sites are located in relatively open areas surrounded by sagebrush or in areas where sagebrush density is low. Nesting usually occurs on the ground where sagebrush density is higher. Quad-level occurrences intersect the affected area east of the SEZ. Crucial brooding habitat for the species exists within 10 mi east of the SEZ. About 1,591,858 acres of potentially suitable habitat occurs within the SEZ region.	1,038 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	45 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat); 4,123 acres in area of indirect effects	64 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	40,569 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats, especially leks and nesting sites in the areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Mitigation should be developed in consultation with the USFWS and UDWR.
Long-billed curlew	*Numenius americanus*	BLM-S; UT-SC; UT-S2	Summer resident and migrant throughout the SEZ region in short-grass grasslands near standing water. Species is likely to be transient only in the vicinity of the SEZ. Nearest recorded occurrences are from the Beaver River, approximately 30 mi northeast of the SEZ. About 237,630 acres of potentially suitable habitat occurs within the SEZ region.	739 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	6,200 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation needed. Only transient individuals are expected in the affected area.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Birds (Cont.)								
Northern goshawk	*Accipiter gentilis*	BLM-S	A year-round resident in the SEZ region. Mature mountain forest and riparian zone habitats throughout the SEZ region. Nests in trees in mature deciduous, coniferous, and mixed forests. Forages in both heavily forested and relatively open shrubland habitats. Nearest recorded occurrences are approximately 25 mi southeast of the SEZ. About 591,239 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	10 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,109 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of nesting habitats (woodlands) in the area of direct effects or compensatory mitigation of direct effects on occupied nesting habitats could reduce impacts.
Short-eared owl	*Asio flammeus*	BLM-S; UT-SC; UT-S2	A winter resident in the SEZ region. Grasslands, shrublands, and other open habitats throughout the SEZ region. Nearest recorded occurrences are within 10 mi northwest of the SEZ. About 3,990,928 acres of potentially suitable habitat occurs within the SEZ region.	4,963 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	75 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	90,439 acres of potentially suitable habitat (2.3% 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.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Birds (Cont.)								
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; FWS-SC; UT-SC	A year-round resident in the SEZ region. 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 recorded occurrences are about 5 mi from the SEZ. About 2,108,869 acres of potentially suitable habitat occurs within the SEZ region.	6,185 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	85 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	87 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,492 acres of potentially suitable habitat (4.6% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied burrows and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals								
Fringed myotis	*Myotis thysanodes*	BLM-S; FWS-SC; UT-SC	Wide range of habitats including lowland riparian, desert shrub, pinyon-juniper, and sagebrush habitats. Roost sites have been reported in buildings and caves. Nearest recorded occurrences are 30 mi south of the SEZ. About 4,742,697 acres of potentially suitable habitat occurs within the SEZ region.	5,361 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	93 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	86 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	102,839 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Mammals (Cont.)								
Kit fox	*Vulpes macrotis*	BLM-S; UT-SC	Open prairie, plains, and desert habitats where it inhabits burrows and preys on rodents, rabbits, hares, and small birds. Nearest recorded occurrences are approximately 35 mi northwest of the SEZ. About 1,889,326 acres of potentially suitable habitat occurs within the SEZ region.	4,920 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	69 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	87 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,505 acres of potentially suitable habitat (4.8% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Pygmy rabbit	*Brachylagus idahoensis*	BLM-S; UT-SC; UT-S2	Sagebrush-shrubland habitats throughout the SEZ region. Prefers loose soils to dig burrows. Nearest recorded occurrences are about 5 mi from the SEZ. About 1,016,858 acres of potentially suitable habitat occurs within the SEZ region.	683 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	39 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	54 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	29,577 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effects; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Mammals (Cont.)								
Spotted bat	*Euderma maculatum*	BLM-S; FWS-SC; UT-SC; UT-S2	Near forests and shrubland habitats throughout the SEZ region. Uses caves and rock crevices for day roosting and winter hibernation. Nearest recorded occurrences are 25 mi southeast of the SEZ. About 3,580,326 acres of potentially suitable habitat occurs within the SEZ region.	4,949 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	86 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	86 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	90,695 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM-S; FWS-SC; UT-SC	Near forests and shrubland habitats below 9,000 ft elevation throughout the SEZ region. The species may use caves, mines, and buildings for day roosting and winter hibernation. Nearest recorded occurrences are about 10 mi north of the SEZ. About 3,197,836 acres of potentially suitable habitat occurs within the SEZ region.	5,489 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	46 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	23 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	66,834 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 13.1.12.1-1 (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]	Transmission Line (Direct Effects)[f]	Outside SEZ (Indirect Effects)[g]	Overall Potential Impact Magnitude[h] and Species-Specific Mitigation[i]
Mammals (Cont.)								
Utah prairie dog	*Cynomys parvidens*	ESA-T; UT-S1	Endemic to southwestern Utah in grasslands in level mountain valleys and areas with deep, well-drained soils. Colonies reside in underground burrow systems, which are dynamic in size and location. Nearest recorded occurrences are about 5 mi north of the SEZ. Potentially suitable habitat occurs along Fourmile Wash about 3 mi north of the SEZ. About 573,137 acres of potentially suitable habitat occurs within the SEZ region.	398 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	8 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	0 acres	10,750 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Conservation measures should be developed in consultation with the USFWS and the UDWR.

a BLM-S = listed as a sensitive species by the BLM; ESA-C = candidate for listing under the ESA; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern; UT-S1 = ranked as S1 in the state of Utah; UT-S2 = ranked as S2 in the state of Utah; UT-SC = Utah 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.

Footnotes continued on next page.

TABLE 13.1.12.1-1 (Cont.)

[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 15-mi (24-km) long, 60-ft (18-m) wide road ROW from the SEZ to the nearest state 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.

[f] For transmission development, direct effects were estimated within a 3-mi (5-km) long, 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

[g] 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 access road and transmission corridors 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.

[h] 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.

[i] 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.

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

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

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

[m] Species in bold text have been recorded or have designated critical habitat in the affected area.

13.1.12.1.1 Species Listed under the ESA That Could Occur in the Affected Area

In its scoping comments on the proposed Escalante Valley SEZ (Stout 2009), the USFWS expressed concern for impacts of project development on the Utah prairie dog, a species listed as threatened under the ESA. This species has the potential to occur within the SEZ on the basis of observed occurrences near the SEZ and the presence of potentially suitable habitat in the SEZ (Figure 13.1.12.1-1; Table 13.1.12.1-1). Appendix J provides basic information on life history, habitat needs, and threats to populations of this species. No other species that is currently listed under the ESA, proposed for listing, under review for listing, or a candidate for listing is present within the Escalante Valley SEZ affected area.

The Utah prairie dog occurs in grasslands, level mountain valleys and areas with deep well-drained soils with low growing vegetation that allows for good visibility. It is one of three prairie dog species in the state of Utah and the only prairie dog species to occur in the SEZ region (UDWR 2009a). In its scoping comments on the Escalante Valley SEZ, the USFWS indicated that suitable habitat for the species may occur on the SEZ. Potential habitat for the Utah prairie dog within the SEZ region is described by SWReGAP as year-round known or probable habitat.

Quad-level occurrences for this species intersect the SEZ and other portions of the affected area. SWReGAP predicts the presence of potentially suitable habitat for the species on the SEZ and throughout the area of indirect effects (Figure 13.1.12.1-1; Table 13.1.12.1-1). Data provided by the Utah prairie dog colony tracking database[8] also indicates the presence of active Utah prairie dog colonies within the area of indirect effects outside of the SEZ. Critical habitat for this species has not been designated.

13.1.12.1.2 Species That Are Candidates for Listing under the ESA

The greater sage-grouse is the only species that is a candidate for listing as threatened or endangered under the ESA that may occur in the affected area of the proposed Escalante Valley SEZ. This species is known to occur in plains, foothills, and mountain valleys dominated by sagebrush. In its scoping comments on the SEZ (Stout 2009), the USFWS indicated that suitable sage-grouse habitat occurs throughout the Escalante Valley SEZ region. Potential habitat for the greater sage-grouse within the SEZ region is described by SWReGAP as year-round known or probable habitat. The UDWR has also identified crucial brooding habitat for this species within 10 mi (16 km) east of the SEZ (Figure 13.1.12.1-1).

Quad-level occurrences for this species intersect the SEZ affected area. SWReGAP predicts the presence of potentially suitable habitat for the species on the SEZ and throughout the area of indirect effects (Figure 13.1.12.1-1; Table 13.1.12.1-1).

[8] The Utah prairie dog colony tracking database contains sensitive data provided by the UDWR, for official use only. These data were used for the analyses in this PEIS, but the distributions were not displayed on figures in this PEIS.

13.1.12.1.3 BLM-Designated Sensitive Species

There are 17 BLM-designated sensitive species that may occur in the affected area of the Escalante Valley SEZ (Table 13.1.12.1-1). These BLM-designated sensitive species include the following: (1) plants—compact cat's-eye, Jone's globemallow, long-calyx milkvetch, money wild buckwheat, and Nevada willowherb; (2) birds—bald eagle, ferruginous hawk, greater sage-grouse, long-billed curlew, northern goshawk, short-eared owl, and western burrowing owl; and (3) mammals—fringed myotis, kit fox, pygmy rabbit, spotted bat, and Townsend's big-eared bat. Quad-level occurrences intersect the SEZ affected area for the following BLM-designated species: ferruginous hawk, western burrowing owl, and pygmy rabbit. Habitats in which these 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 13.1.12.1-1. One species (greater sage-grouse) was discussed in Section 13.1.12.1.1 because of its status under the ESA. All other BLM-designated 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.

Compact Cat's-Eye

The compact cat's eye is a perennial herb endemic to southwestern Utah and eastern Nevada. It occurs in scattered locations throughout the Escalante Valley SEZ region. Suitable habitat includes salt desert shrub-scrub. Populations are known to occur about 50 mi (80 km) northwest of the SEZ. Potentially suitable habitat for the species may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Jone's Globemallow

The Jone's globemallow is a perennial herb endemic to southwestern Utah and eastern Nevada. It inhabits mixed shrublands, pinyon-juniper woodlands, and grassland communities. Populations are known to occur about 38 mi (61 km) north of the SEZ. Potentially suitable habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Long-Calyx Milkvetch

The long-calyx milkvetch is a perennial herb endemic to the Great Basin from southwestern Utah and eastern Nevada. It inhabits mixed shrublands, pinyon-juniper woodlands, and grassland communities. Populations are known to occur about 30 mi (48 km) west of the SEZ. Potentially suitable habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Money Wild Buckwheat

The money wild buckwheat is a perennial shrub from the southwestern United States. It inhabits saltbush, sagebrush, and pinyon-juniper woodland communities on gravelly substrates. Populations are known to occur about 30 mi (48 km) west of the SEZ. Potentially suitable habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Nevada Willowherb

The Nevada willowherb is a perennial herb endemic to the Great Basin from southwestern Utah and southeastern Nevada. It inhabits pinyon-juniper and oak-mahogany woodland communities on talus slopes and rocky outcrops. Populations are known to occur within the Dixie National Forest, approximately 30 mi (48 km) southwest of the SEZ. Potentially suitable habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Bald Eagle

The bald eagle is known to occur in the SEZ region, primarily associated with larger waterbodies. The species has been recorded in the vicinity of the Fourmile and Mud Spring Washes, approximately 10 mi (16 km) north and northeast of the SEZ. According to the SWReGAP habitat suitability model, only potentially suitable nonbreeding winter habitat occurs in the SEZ affected area. Suitable nesting habitat does not occur in the affected area, but shrubland habitats suitable for foraging may occur on the SEZ and throughout the affected area (Table 13.1.12.1-1).

Ferruginous Hawk

The ferruginous hawk is known to occur in the SEZ region where it forages in shrubland habitats. Quad-level occurrences for this species intersect the Escalante Valley SEZ affected area. According to the SWReGAP habitat suitability model, only potentially suitable nonbreeding winter habitat occurs in the SEZ affected area. Suitable nesting habitat does not occur in the affected area, but shrubland habitats suitable for foraging may occur on the SEZ and throughout the affected area (Table 13.1.12.1-1).

Long-Billed Curlew

The long-billed curlew is known to occur in the SEZ region as a summer resident and migrant in short-grass grasslands near standing water. The species has been recorded near the Beaver River, approximately 30 mi (48 km) northeast of the SEZ. According to the SWReGAP habitat suitability model, only potentially suitable nonbreeding migratory habitat is expected to occur in the SEZ affected area. Suitable nesting habitat does not occur in the affected area, but the species may be observed as a transient in grassland habitats throughout the affected area (Table 13.1.12.1-1).

Northern Goshawk

The northern goshawk is known to occur in the SEZ region where it forages in montane forests and valley shrubland habitats. Populations are known to occur approximately 25 mi (40 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, year-round breeding and nonbreeding potential habitat does not occur on the SEZ or within the access road corridor; however, potentially suitable habitat may occur in the transmission corridor and within the area of indirect effects (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, approximately 6 acres (<0.1 km^2) of pinyon-juniper woodland habitat that may be potentially suitable nesting habitat occurs in the transmission corridor. Approximately 164 acres (0.7 km^2) of this habitat occurs in the area if indirect effects.

Short-Eared Owl

The short-eared owl is known to occur in the SEZ region where it forages in grasslands, shrublands, and other open habitats. The species has been recorded within 10 mi (16 km) northeast of the SEZ. According to the SWReGAP habitat suitability model, only potentially suitable nonbreeding winter habitat is expected to occur in the affected area. Suitable nesting habitat is not expected to occur in the affected area, but grassland and shrubland habitats suitable for foraging may occur throughout the affected area (Table 13.1.12.1-1).

Western Burrowing Owl

The western burrowing owl is known to occur in the SEZ region where it forages in grasslands, shrublands, and open disturbed areas. This species typically nests in burrows constructed by mammals such as prairie dogs. Quad-level occurrences for this species intersect the Escalante Valley SEZ affected area. According to the SWReGAP habitat suitability model, only potentially suitable summer breeding habitat is expected to occur in the SEZ affected area (Table 13.1.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but grassland and shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

Fringed Myotis

The fringed myotis is known to occur in the SEZ region in a variety of habitats including riparian, shrubland, sagebrush, and pinyon-juniper woodlands. The species roosts in buildings and caves. Populations are known to occur from the Dixie National Forest, approximately 30 mi (48 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat may be present within the affected area (Table 13.1.12.1-1).

On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

Kit Fox

The kit fox is widely distributed throughout western North America. Within the SEZ region, this species is known to occur in open grassland and shrubland habitats where it inhabits burrows; it has been recorded about 35 mi (56 km) northwest of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round shrubland habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Pygmy Rabbit

The pygmy rabbit is widely distributed throughout the Great Basin and intermotane regions of western North America. This species is known to occur in western Utah where it prefers areas with tall dense sagebrush and loose soils. Quad-level occurrences for this species intersect the SEZ and other portions of the affected area. According to the SWReGAP habitat suitability model, potentially suitable year-round sagebrush-shrubland habitat may occur on the SEZ and in other portions of the affected area (Table 13.1.12.1-1).

Spotted Bat

The spotted bat is known to occur in the SEZ region where it inhabits forest and shrubland habitats and roosts in caves and rock crevices. The species has been recorded about 25 mi (50 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat may be present within the affected area (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is known to occur in the SEZ region where it inhabits forest and shrubland habitats and roosts in caves, mines, and buildings. The species has been recorded about 10 mi (16 km) north of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat may be present within the affected area (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects.

13.1.12.1.4 State-Listed Species

According to Utah Administrative Rule R657-48, as described in the *Utah Sensitive Species List* (UDWR 2010b), there are no species that receive a separate regulatory designation from the UDWR or the state of Utah.

13.1.12.1.5 Rare Species

There are 16 species that have a state status of S1 or S2 in Utah or that are considered species of concern by the State of Utah or the USFWS may occur in the affected area of the Escalante Valley SEZ (Table 13.1.12.1-1). All these species have been previously discussed as ESA-listed (Section 13.1.12.1.1), ESA candidates (Section 13.1.12.1.2), or BLM-designated sensitive (Section 13.1.12.1.3).

13.1.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Escalante Valley SEZ is discussed 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 on special status species is based on available information on the presence of species in the affected area, as presented in Section 13.1.12.1 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 13.1.12.3).

Solar energy development within the Escalante Valley SEZ could affect a variety of habitats (see Sections 13.1.9 and 13.1.10). Based on UDWR records, occurrences for the following five special status species intersect the Escalante Valley SEZ affected area: ferruginous hawk, greater sage-grouse, western burrowing owl, pygmy rabbit, and Utah prairie dog. Suitable habitat for each of these species may occur in the affected area. Other special status species may occur on the SEZ or within the affected area based upon the presence of potentially suitable habitat. As discussed in Section 13.1.12.1, 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 on some special status species.

Potential direct and indirect impacts on special status species within the SEZ and in the area of indirect effects outside the SEZ are presented in Table 13.1.12.1-1. 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 13.1.1.2, a 15-mi (24-km) long road corridor and a 3-mi (5-km) long transmission corridor are assumed to be needed to serve solar facilities within this SEZ.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ and assumed access road and transmission corridors where ground-disturbing activities are expected to occur. Indirect impacts could result from 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 development 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 on 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., pinyon-juniper woodlands). Indirect impacts on special status species could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.

13.1.12.2.1 Impacts on Species Listed under the ESA

The Utah prairie dog is the only species listed under the ESA that has the potential to occur in the affected area of the proposed Escalante Valley SEZ and is the only ESA-listed species that the USFWS identified as potentially affected by solar energy development on the SEZ (Stout 2009). Quad-level occurrences for this species intersect the SEZ, and potentially suitable shrubland habitat occurs throughout the affected area (Figure 13.1.12.1-1). Furthermore, information provided by the Utah prairie dog colony tracking database indicates the presence of Utah prairie dog colonies in the area of indirect effects outside of the SEZ. According to SWReGAP, about 398 acres (0.1 km^2) of potentially suitable habitat on the SEZ and 8 acres (<0.1 km^2) of potentially suitable habitat in the road corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat of the Utah prairie dog in the SEZ region. About 11,440 acres (46 m^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 SEZ region (Table 13.1.12.1-1).

The overall impact on the Utah prairie dog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents <1% of potentially suitable habitat in the SEZ region.

The implementation of programmatic design features and complete avoidance of known occupied habitats could reduce impacts to negligible levels. Additional measures may be taken by buffering the locations of known prairie dog colony locations and avoiding or minimizing disturbance to those areas, as recommended by the USFWS (Stout 2009). Formal consultation with the USFWS under Section 7 of the ESA is required for any federal action that may adversely affect an ESA-listed species. Therefore, prior to development, consultation with the USFWS would be necessary to discuss potential impacts on the Utah prairie dog, develop an approved pre-disturbance survey protocol, develop site-specific mitigation, authorize incidental take statements, and develop a Utah prairie dog translocation and monitoring program (if necessary).

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 Utah prairie dog populations. Compensation can be accomplished by improving the carrying capacity for the Utah prairie dog on the acquired lands. As for other mitigation actions, consultations with the USFWS and the UDWR would be necessary to determine the appropriate mitigation ratio to acquire, enhance, and preserve these lands.

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

The greater sage-grouse is the only species that is a candidate for listing under the ESA that could occur in the affected area of the proposed Escalante Valley SEZ. Quad-level occurrences for this species intersect the affected area and potentially suitable sagebrush habitat occurs throughout the affected area (Figure 13.1.12.1-1). In its scoping comments on the SEZ, the USFWS identified a potential impact on greater sage-grouse habitat resulting from solar energy development on the SEZ (Stout 2009). According to SWReGAP, about 1,038 acres (4 km^2) of potentially suitable habitat on the SEZ, 45 acres (0.2 km^2) of potentially suitable habitat in the road corridor, and 64 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat for the greater sage-grouse in the SEZ region. About 46,000 acres (186 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 2.9% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the greater sage-grouse from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley 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 alone may not be sufficient to reduce impacts to negligible levels because potentially suitable sagebrush habitats are widespread throughout the area of direct effects.

Efforts to mitigate the impacts of solar energy development in the Escalante Valley SEZ on the greater sage-grouse should be developed in consultation with the USFWS and the UDWR following the *Strategic Plan for Management of Sage Grouse* (UDWR 2009d) and *Guidelines to Manage Sage Grouse Populations and Their Habitats* (Connelly et al. 2000). Impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the areas of direct effects, especially leks and nest sites. If avoidance is not a feasible option, 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. Any mitigation plans should be developed in coordination with the USFWS and the UDWR.

13.1.12.2.3 Impacts on BLM-Designated Sensitive Species

Of the 17 BLM-designated sensitive species that could occur in the affected area of the proposed Escalante Valley SEZ, one species, greater sage-grouse, was discussed in Section 13.1.12.2.2 because of its status under the ESA. Impacts on all other BLM-designated sensitive species that have potentially suitable habitat within the SEZ, road corridor, or transmission corridor (i.e., the area of direct effects) are discussed below.

Compact Cat's-Eye

The compact cat's-eye is not known to occur in the affected area of the Escalante Valley SEZ; however, approximately 4,843 acres (20 km^2) of potentially suitable habitat on the SEZ, 71 acres (<0.1 km^2) in the road corridor, and 88 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.2% of available suitable habitat in the SEZ region. About 97,000 acres (393 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 4.5% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the compact cat's-eye from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features may be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats to mitigate impacts on the compact cat's-eye is not feasible because potentially suitable shrubland habitats are widespread throughout the area of direct effects. For this species and other special status plants, 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 is not a feasible option, plants could be translocated from areas 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 uses one or more of these options could be designed to completely offset the impacts of development.

Jone's Globemallow

The Jone's globemallow is not known to occur in the affected area of the Escalante Valley SEZ; however, approximately 4,909 acres (20 km^2) of potentially suitable habitat on the SEZ, 73 acres (<0.1 km^2) in the road corridor, and 89 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 99,000 acres (400 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 2.4% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the Jone's globemallow from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features may be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats to mitigate impacts on the Jone's globemallow is not feasible because these habitats (shrublands) are widespread throughout the area of direct effects. However, impacts could be reduced to negligible levels with the implementation of programmatic design features and the mitigation options described previously for the compact cat's-eye. The need for mitigation should first be determined by conducting preconstruction surveys for the species and its habitat in the area of direct effects.

Long-Calyx Milkvetch

The long-calyx milkvetch is not known to occur in the affected area of the Escalante Valley SEZ; however, approximately 4,843 acres (20 km^2) of potentially suitable habitat on the SEZ, 71 acres (<0.1 km^2) in the road corridor, and 88 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 97,000 acres (393 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 2.4% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

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

Avoidance of all potentially suitable habitats to mitigate impacts on the long-calyx milkvetch is not feasible because these habitats (sagebrush and shrublands) are widespread throughout the area of direct effects. However, impacts could be reduced to negligible levels with the implementation of programmatic design features and the mitigation options described previously for the compact cat's-eye. The need for mitigation should first be determined by conducting preconstruction surveys for the species and its habitat in the area of direct effects.

Money Wild Buckwheat

The money wild buckwheat is not known to occur in the affected area of the Escalante Valley SEZ; however, approximately 4,824 acres (20 km^2) of potentially suitable habitat on the SEZ, 86 acres (<0.1 km^2) in the road corridor, and 89 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 101,000 acres (409 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 2.8% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the money wild buckwheat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley 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 may be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats to mitigate impacts on the money wild buckwheat is not feasible because these habitats (sagebrush and shrublands) are widespread throughout the area of direct effects. However, impacts could be reduced to negligible levels with the implementation of programmatic design features and the mitigation options described previously for the compact cat's-eye. The need for mitigation should first be determined by conducting preconstruction surveys for the species and its habitat in the area of direct effects.

Nevada Willowherb

The Nevada willowherb is not known to occur in the affected area of the Escalante Valley SEZ, and potentially suitable pinyon-juniper and oak/mahogany forest habitats do not occur on the SEZ. However, approximately 1 acre (<0.1 km^2) of potentially suitable habitat in the road corridor and 6 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents <0.1% of available suitable habitat in the SEZ region. About 175 acres (1 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents <0.1% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

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

Nevada willowherb habitat (pinyon-juniper and oak/mahogany forests) occupies a limited portion of the area of direct effects and could be completely avoided during solar development and protected from indirect effects. In conjunction with the implementation of programmatic design features, avoiding or minimizing disturbance to occupied habitats and forested areas, and the mitigation measures described previously for the compact cat's-eye could further reduce impacts on this species. The need for mitigation should first be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

Bald Eagle

The bald eagle is a winter resident within the proposed Escalante Valley SEZ region. Approximately 370 acres (2 km^2) of potentially suitable foraging habitat on the SEZ, 6 acres (<0.1 km^2) in the road corridor, and 5 acres (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about <0.1% of available suitable habitat in the SEZ region. About 11,200 acres (45 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 0.4% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features are expected to reduce indirect impacts to negligible levels. Avoidance of direct impacts on all potentially suitable foraging habitat is not a feasible way to mitigate impacts on the bald eagle because potentially suitable shrubland is widespread throughout the area of direct effects and readily available in other portions of the affected area.

Ferruginous Hawk

The ferruginous hawk is a winter resident within the proposed Escalante Valley SEZ region. Approximately 2,290 acres (9 km^2) of potentially suitable foraging habitat on the SEZ, 75 acres (0.3 km^2) in the road corridor, and 67 acres (0.3 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 57,000 acres (231 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 3.3% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features are expected to reduce indirect impacts to negligible levels. Avoidance of direct impacts on all potentially suitable foraging habitat is not a feasible way to mitigate impacts on the ferruginous hawk because potentially suitable shrubland is widespread throughout the area of direct effects and readily available in other portions of the affected area.

Long-Billed Curlew

The long-billed curlew is a summer resident and migrant within the proposed Escalante Valley SEZ region. Individuals may occur as migratory transients in grassland and wetland habitats (playas) in the affected area. Approximately 739 acres (3 km^2) of potentially suitable foraging habitat on the SEZ, 12 acres (<0.1 km^2) in the road corridor, and 1 acre (<0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.3% of available suitable habitat in the SEZ region. About 7,300 acres (30 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 3.1% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the long-billed curlew from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features may be sufficient to reduce indirect impacts on this species to negligible levels; however, no species-specific mitigation of direct effects is warranted because the species occurs only as a transient in the affected area and the affected area represents a very small proportion of potentially suitable foraging habitat in the SEZ region.

Northern Goshawk

The northern goshawk is considered to be a year-round resident within the proposed Escalante Valley SEZ region in montane forests and shrubland habitats. According to the SWReGAP habitat suitability model, potentially suitable habitat does not exist on the SEZ or within the road corridor. However, approximately 10 acres (<0.1 km^2) of potentially suitable habitat in the transmission corridor could be directly affected (Table 13.1.12.1-1). This direct effects area represents about <0.1% of available suitable habitat in the SEZ region.

About 1,300 acres (5 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 0.2% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1). Most of this area could serve as foraging habitat (i.e., shrublands); however mature forest habitats suitable for nesting may also occur in the transmission corridor and in portions of the area of indirect effects. On the basis of an evaluation of SWReGAP land cover types, approximately 6 acres (<0.1 km^2) of pinyon-juniper woodland habitat that may be potentially suitable nesting habitat occurs in the transmission corridor. Approximately 164 acres (0.7 km^2) of this habitat occurs in the area if indirect effects.

The overall impact on the northern goshawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley 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 on this species to negligible levels.

Avoidance of direct impacts on all foraging habitat (shrublands) is not feasible because suitable foraging habitat (shrublands) is widespread in the area of direct effect and may be readily available in other portions of the affected area. However, avoiding or minimizing disturbance of all potential nesting habitat (woodlands) or occupied nests within the transmission corridor is feasible, and could reduce impacts. If avoiding or minimizing disturbance of all suitable nesting habitat or occupied habitat is not feasible, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. 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 within the area of direct effects.

Short-Eared Owl

The short-eared owl is considered to be a winter resident within the proposed Escalante Valley SEZ region in open grasslands and shrublands. Approximately 4,963 acres (20 km^2) of potentially suitable foraging habitat on the SEZ, 75 acres (0.3 km^2) in the road corridor, and 83 acres (0.3 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 99,000 acres (400 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.5% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the short-eared owl from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features are expected to reduce indirect impacts to negligible levels. Avoidance of direct impacts on all potentially suitable foraging habitat is not a feasible way to mitigate impacts on the short-eared owl because potentially suitable shrubland is widespread throughout the area of direct effects and readily available in other portions of the affected area.

Western Burrowing Owl

The western burrowing owl is considered to be a summer resident within the proposed Escalante Valley SEZ region where it is known to forage in grasslands and shrublands. Within the SEZ region, the species nests in burrows constructed by mammals such as prairie dogs. Approximately 6,185 acres (25 km^2) of potentially suitable habitat on the SEZ, 85 acres (0.3 km^2) in the road corridor, and 87 acres (0.4 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.3% of available suitable habitat in the SEZ region. About 107,000 acres (433 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 5.1% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1). Most of this area could serve as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting on the SEZ and in the area of indirect effects 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 Escalante Valley SEZ is considered small because the amount of potentially suitable habitat 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 is not feasible to mitigate impacts on the western burrowing owl because potentially suitable shrubland habitats are widespread throughout the area of direct effect and may be readily available in other portions of the SEZ region. However, impacts on the western burrowing owl could be reduced by avoiding or minimizing disturbance to occupied burrows and habitat in the area of direct effects. If avoiding or minimizing disturbance of all occupied habitat are not feasible options, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. 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 within the area of direct effects.

Fringed Myotis

The fringed myotis is considered to be a year-round resident within the proposed Escalante Valley SEZ region where it is known to forage in riparian, shrubland, and forested habitats. Approximately 5,361 acres (22 km^2) of potentially suitable foraging habitat on the SEZ, 93 acres (0.4 km^2) in the road corridor, and 86 acres (0.3 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable foraging habitat in the SEZ region. About 113,000 acres (457 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.4% of the available suitable foraging habitat in the SEZ region (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

The overall impact on the fringed myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat 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 foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Kit Fox

The kit fox is considered to be a year-round resident within the proposed Escalante Valley SEZ region in grassland and shrubland habitats. Approximately 4,920 acres (20 km^2) of potentially suitable habitat on the SEZ, 69 acres (0.3 km^2) in the road corridor, and 87 acres (0.4 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.3% of available suitable habitat in the SEZ region. About 99,000 acres (400 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 5.3% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the kit fox from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region.

The avoidance of all potentially suitable habitats is not feasible to mitigate impacts on the kit fox because potentially suitable shrubland habitats are widespread throughout the area of direct effects. In conjunction with the implementation of programmatic design features, pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effects could reduce impacts. If avoidance or minimization is not a feasible option, a translocation and compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Consultation with the appropriate federal and state agencies should be required for the development of any translocation and compensatory mitigation plans. 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 uses one or both of these options could be designed to completely offset the impacts of development.

Pygmy Rabbit

The pygmy rabbit is considered to be a year-round resident within the proposed Escalante Valley SEZ region in sagebrush habitats. Approximately 683 acres (3 km^2) of potentially suitable habitat on the SEZ, 39 acres (0.2 km^2) in the road corridor, and 54 acres (0.2 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat in the SEZ region. About 34,000 acres (138 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 3.4% of the available suitable habitat in the SEZ region (Table 13.1.12.1-1).

The overall impact on the pygmy rabbit from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region.

The avoidance of all potentially suitable habitats is not feasible to mitigate impacts on the pygmy rabbit because potentially suitable sagebrush habitats are widespread throughout the area of direct effects. In conjunction with the implementation of programmatic design features, pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effects could reduce impacts. If avoidance or minimization is not a feasible option, a translocation and compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Consultation with the appropriate federal and state agencies should be required for the development of any translocation and compensatory mitigation plans. 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 uses one or both of these options could be designed to completely offset the impacts of development.

Spotted Bat

The spotted bat is considered to be a year-round resident within the proposed Escalante Valley SEZ region where it is known to forage in shrubland and forested habitats. Approximately 4,949 acres (20 km^2) of potentially suitable foraging habitat on the SEZ, 86 acres (0.3 km^2) in the road corridor, and 86 acres (0.3 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.1% of available suitable foraging habitat in the SEZ region. About 100,000 acres (405 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.8% of the available suitable foraging habitat in the SEZ region (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

The overall impact on the spotted bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat 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 foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is considered to be a year-round resident within the proposed Escalante Valley SEZ region where it is known to forage in shrubland and forested habitats. Approximately 5,489 acres (22 km^2) of potentially suitable foraging habitat on the SEZ, 46 acres (0.2 km^2) in the road corridor, and 23 acres (0.1 km^2) in the transmission corridor could be directly affected by construction and operations (Table 13.1.12.1-1). This direct effects area represents about 0.2% of available suitable foraging habitat in the SEZ region. About 71,500 acres (289 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.2% of the available suitable foraging habitat in the SEZ region (Table 13.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

The overall impact on the Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Escalante Valley SEZ is considered small because the amount of potentially suitable habitat 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 foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

13.1.12.2.4 Impacts on State-Listed Species

According to Utah Administrative Rule R657-48, as described in the *Utah Sensitive Species List* (UDWR 2010b), there are no species that receive a separate regulatory designation from the UDWR or the State of Utah.

13.1.12.2.5 Impacts on Rare Species

There are 16 species with a state status of S1 or S2 in Utah or species of concern by the State of Utah or the USFWS that may occur in the affected area of the Escalante Valley SEZ. Impacts have been previously discussed for all of these species, which are also ESA-listed (Section 13.1.12.2.1), ESA candidates (Section 13.1.12.2.2), or BLM-designated sensitive (Section 13.1.12.2.3).

13.1.12.3 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 to determine the presence and abundance of all special status species, including those identified in Table 13.1.12.1-1; disturbance to occupied habitats for these species should be avoided or impacts on occupied habitats should be minimized to the extent practicable. If avoiding or minimizing impacts on 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.

- Avoiding or minimizing disturbance of pinyon-juniper and oak/mahogany woodlands in the area of direct effects could reduce impacts on the Nevada willowherb and nesting habitat of the northern goshawk.

- Consultation with the USFWS and the UDWR should be conducted to address the potential for impacts on the Utah prairie dog a species listed as threatened under the ESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements.

- Coordination with the USFWS and the UDWR should be conducted to address the potential for impacts on the greater sage-grouse, a candidate species for listing under the ESA. Coordination would identify an appropriate pre-disturbance survey protocol, avoidance measures, and any potential compensatory mitigation actions.

- 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 the UDWR.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on the special status and rare species would be reduced. Depending on the effectiveness of an overall mitigation strategy, residual impacts on some species could be minor because of the relative abundance of suitable habitats in the SEZ region.

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13.1.13 Air Quality and Climate

13.1.13.1 Affected Environment

13.1.13.1.1 Climate

The proposed Escalante Valley SEZ is located in southwestern Utah, near the central portion of Iron County. The SEZ is at an elevation of about 5,110 ft (1,558 m) and thus experiences lower air temperatures than lower elevations of comparable latitude. Pacific storms along with prevailing westerly winds lose moisture as they ascend the Cascade and Sierra Nevada Ranges. Therefore, air masses reaching Utah are relatively dry, resulting in light precipitation over the state (NCDC 2009a). Subzero temperatures and prolonged cold spells during the winter months are rare over most parts of the state, because mountain ranges to the east and north block Arctic air masses. Utah experiences relatively strong insolation (solar radiation) during the day and rapid nocturnal cooling because of its relatively thin atmosphere, resulting in wide ranges in daily temperature. In general, the climate around the proposed SEZ is temperate and dry (NCDC 1989). Meteorological data collected at the Milford Municipal Airport and Enterprise Beryl Junction, which are located about 38 mi (61 km) northeast of and about 12 mi (19 km) southwest of the Escalante Valley SEZ, respectively, are summarized below.

A wind rose from the Milford Municipal Airport in Milford[9] for the 5-year period 2004 to 2008 and taken at a level of 33 ft (10 m) is presented in Figure 13.1.13.1-1 (NCDC 2009b). During this period, the annual average wind speed at the airport was about 10.5 mph (4.7 m/s), with a prevailing wind direction from the south–southwest (about 22.4% of the time) and secondarily from the south (about 15.9% of the time), parallel to nearby mountain ranges. About half of the time winds blew from these directions, ranging from south to southwest inclusive. Winds blew predominantly from the south–southwest every month throughout the year, except in March from the north. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (almost 9% of the time). Average wind speeds were relatively uniform by season with the highest in fall at 11.1 mph (5.0 m/s); lower in spring and winter at 10.4 mph (4.6 m/s); and lowest in summer at 10.1 mph (4.5 m/s).

For the 1940 to 2008 period, the annual average temperature at Enterprise Beryl Junction was 47.9°F (8.8°C) (WRCC 2009). January was the coldest month, with an average minimum temperature of 12.8°F (–10.7°C), and July was the warmest month, with an average maximum of 90.7°F (32.6°C). In summer, daytime maximum temperatures were frequently above 90°F

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[9] Surface wind data from the Milford Municipal Airport were selected as representative of the proposed Escalante Valley SEZ, although the Cedar City Municipal Airport is closer to the Escalante Valley SEZ (about 22 mi [35 km]) than the Milford Municipal Airport (about 38 mi [61 km]). The Escalante Valley SEZ and the Milford Municipal Airport are situated in the valley floor, but the Cedar City Municipal Airport is situated in the foothills of the mountains and surrounded by nearby hills and mountains. The general wind pattern at the Cedar City Municipal Airport is similar to that at the Milford Municipal Airport but more affected by nearby topographic features, with lower wind speeds (6.7 mph [3.0 m/s]) and higher calm winds of almost 25%.

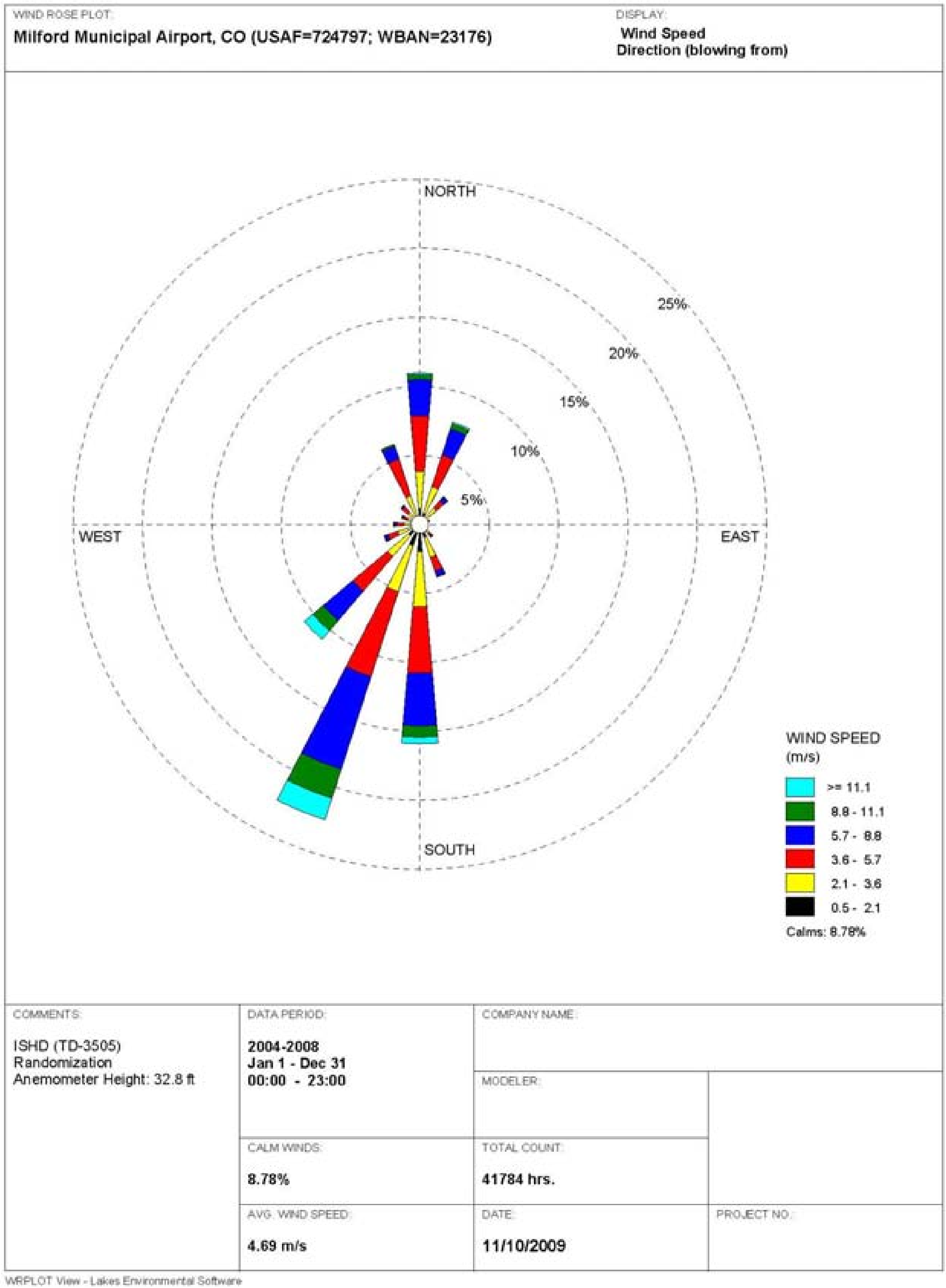

FIGURE 13.1.13.1-1 Wind Rose at 33-ft (10-m) Height at Milford Municipal Airport, Milford, Utah, 2004 to 2008 (Source: NCDC 2009b)

(32.2°F) and minimums were in the 40s. On most days of colder months (November through March), the minimum temperatures recorded were below freezing (≤32°F [0°C]); subzero temperatures also occurred about 5 and 3 days in January and December, respectively. During the same period, the highest temperature, 104°F (40.0°C), was reached in July 1960, and the lowest, –34°F (–36.7°C), in December 1990. Each year, about 43 days had a maximum temperature of ≥90°F (32.2°C), while about 204 days had minimum temperatures at or below freezing.

For the 1940 to 2008 period, annual precipitation at Enterprise Beryl Junction averaged about 10.0 in. (25.4 cm) (WRCC 2009). There is an average of 57 days annually with measurable precipitation (0.01 in. [0.025 cm] or higher). Precipitation is rather evenly distributed by season. During the summer months, low-pressure storm systems in the area are rare, and precipitation during this period occurs as showers and thundershowers in widely varying amounts (NCDC 1989). Snow is usually light and powdery with below-average moisture content, starting as early as September and continuing as late as May. Most of the snow falls from November through March. The annual average snowfall at Enterprise Beryl Junction is about 28.4 in. (72.1 cm) (WRCC 2009).

Because the area surrounding the proposed SEZ is so far from major water bodies (e.g., about 390 mi [630 km] to the Pacific Ocean) and because surrounding mountain ranges block air masses, severe weather events, such as thunderstorms and tornadoes, are rare.

Cities situated in the foothills of mountain ranges along I-15 in eastern Iron County occasionally experienced flash floods from summer thunderstorms, some of which caused property and crop damage. Since 1994, 21 floods (mostly flash floods) with peaks in July and August were reported in Iron County (NCDC 2010); these did cause some property and crop damage.

In Iron County, 12 hail events that caused minor property damage have been reported since 1970. Hail measuring 1.75 in. (4.4 cm) in diameter was reported in 1981. In Iron County, one high-wind event was reported in 1994 (NCDC 2010). Since 1963, 12 thunderstorm wind events up to a maximum wind speed of 75 mph (33 m/s) occurred, mostly during the summer months, but caused minimal damage (NCDC 2010).

During a fall 2009 site visit, windblown dusts were observed in Iron County. However, no dust storms were reported in Iron County (NCDC 2010). The ground surface of the SEZ is covered predominantly with silt loams, which have relatively moderate dust storm potential. Occasional dust storms can deteriorate air quality and visibility and have adverse respiratory health effects. High winds in combination with dry soil conditions result in blowing dust in Utah (UDEQ 2009), typically during the spring through fall months.

Complex terrain typically disrupts the mesocyclones associated with tornado-producing thunderstorms, and thus tornadoes in Iron County, which encompasses the proposed Escalante Valley SEZ, occur infrequently. In the period from 1950 to July 2010, a total of four tornadoes (0.1 per year each) were reported in Iron County (NCDC 2010). However, all tornadoes occurring in Iron County were relatively weak (i.e., one was F [uncategorized[10]], two were F0, and one was F1 on the Fujita tornado scale). None of these tornadoes caused deaths, injuries, or property damage or occurred in the area near the Escalante Valley SEZ.

13.1.13.1.2 Existing Air Emissions

Iron County, which encompasses the proposed Escalante Valley SEZ, has only a few industrial emission sources, and the amount of their emissions is relatively low. Mobile source emissions, primarily from I-15, account for substantial portions of total NO_x and CO emissions in Iron County. Data for 2002 on annual emissions of criteria pollutants and VOCs in Iron County are presented in Table 13.1.13.1-1 (WRAP 2009). Emission data are classified into six source categories: point, area (including fugitive dust), onroad mobile, nonroad mobile, biogenic, and fire (e.g., wildfires, prescribed fires, agricultural fires, structural fires). In Iron County, area sources were the major contributors to SO_2, PM_{10}, and $PM_{2.5}$—about 66%, 75%, and 38%, respectively, of total county emissions. Onroad sources were major contributors to NO_x and CO emissions (56% and 67%, respectively). Biogenic sources (e.g., naturally occurring emissions from vegetation, including trees, plants, and crops) accounted for most of the VOC emissions (about 95%) and were a secondary contributor to CO emissions (about 19%). Nonroad sources were secondary contributors to SO_2 and NO_x (about 22% and 31%, respectively, of total county emissions), while point sources were minor sources of criteria pollutants and VOCs. Fire emissions were secondary contributors to PM_{10} and $PM_{2.5}$ emissions (about 14% and 38%, respectively), but their $PM_{2.5}$ contributions were comparable to primary contributors (area sources) in Iron County.

TABLE 13.1.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Iron County, Utah, Encompassing the Proposed Escalante Valley SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)
SO_2	592
NO_x	4,791
CO	38,810
VOCs	61,890
PM_{10}	1,690
$PM_{2.5}$	539

[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 VOCs = volatile organic compounds.

Source: WRAP (2009).

Information on GHG emissions was not available at the county level in Utah. In 2005, the state of Utah produced about 69 MMt of *gross*[11] carbon dioxide equivalent (CO_2e) emissions[12] (Roe et al. 2007). Gross GHG emissions in Utah

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

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

[12] 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.

increased by about 40% from 1990 to 2005, which was more than twice as fast as the national rate (about 16%). In 2005, electricity production (37.2%) was the primary contributor to gross GHG emission sources in Utah, followed by transportation (24.6%). Fossil fuel use (in the residential, commercial, and nonfossil industrial sectors) accounted for about 17.7% of total state emissions, while fossil fuel production and agriculture accounted for about 6% each. Utah's *net* CO_2e emissions were about 31 MMt, considering carbon sinks from forestry activities and agricultural soils throughout the state. The EPA (2009a) also estimated that in 2005, CO_2 emissions from fossil fuel combustion were 66 MMt, which is comparable to the state's estimate. The electric power generation (53%) and transportation (25%) sectors accounted for more than three-fourths of the CO_2 emission total, and the residential, commercial, and industrial (RCI) sectors accounted for the remainder.

13.1.13.1.3 Air Quality

The State of Utah has adopted National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: SO_2, NO_2, CO, O_3, particulate matter (PM_{10} and $PM_{2.5}$), and Pb (EPA 2010; Prey 2009). The NAAQS for criteria pollutants are presented in Table 13.1.13.1-2.

Iron County, which encompasses the proposed Escalante Valley SEZ, is located administratively within the Four Corners Interstate Air Quality Control Region (AQCR) (Title 40, Part 81, Section 121 of the *Code of Federal Regulations* [40 CFR 81.121]), along with southwestern Colorado, northwestern New Mexico, and southern and east central Utah. Currently, Iron County is designated as being in unclassifiable/attainment for all criteria pollutants (40 CFR 81.345).

Because of low population density, little industrial activity (except for agricultural and hog production activities), and low traffic volumes (except on I-15) in Iron County, anthropogenic emissions are small, and thus ambient air quality is relatively good. The primary air quality concern for the lower elevations in Iron County (e.g., around the Escalante Valley SEZ) is soil erosion (NRCS 2005). High winds, coupled with soils that are susceptible to wind erosion, cause dust storms that can damage human health, livestock, and crops and degrade the environmental stability of the area. Many farming and ranching operations have to deepen wells and increase pump capacities to obtain access to available well waters. Larger engines and motors to drive the higher capacity pumps have increased energy consumption and associated air emissions.

No measurement data are available for criteria pollutants in Iron County (EPA 2009b). Background concentrations of SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$ representative of Iron County have been developed by the Utah Division of Air Quality for air-quality-modeling purposes and are presented in Table 13.1.13.1-2 (Prey 2009). Ambient air quality in Iron County is relatively good, considering that background levels representative of Iron County were lower than their respective standards (up to 55%), except O_3. The background O_3 concentration presented in the table, taken at Zion National Park (NP) from 2004 to 2008, exceeds the NAAQS. Albeit in a remote area, both local and distant point and mobile emission sources, including power plants, refineries, and lime kilns, would affect air quality at Zion NP.

TABLE 13.1.13.1-2 NAAQS and Background Concentration Levels Representative of the Proposed Escalante Valley SEZ

			Background Concentration Level[c,d]	
Pollutant[a]	Averaging Time	NAAQS[b]	Concentration	Measurement Location, Year
SO_2	1-hour	0.075 ppm[e]	NA[f]	NA
	3-hour	0.5 ppm	0.008 ppm (1.6%)	Estimate
	24-hour	0.14 ppm	0.004 ppm (2.9%)	Estimate
	Annual	0.03 ppm	0.002 ppm (6.7%)	Estimate
NO_2	1-hour	0.100 ppm[g]	NA	NA
	Annual	0.053 ppm	0.005 ppm (9.4%)	Estimate
CO	1-hour	35 ppm	1 ppm (2.9%)	Estimate
	8-hour	9 ppm	1 ppm (11%)	Estimate
O_3	1-hour	0.12 ppm[h]	NA	NA
	8-hour	0.075 ppm	0.091 ppm (121%)	Zion National Park, Washington County, 2005; highest of fourth-highest daily maximum during 2004 to 2008
PM_{10}	24-hour	150 μg/m^3	83 μg/m^3 (55%)	Graymont Lime Kiln, about 17 mi north–northeast of Black Rock in Millard County
	Annual	50 μg/m^3 [i]	21.8 μg/m^3 (44%)	
$PM_{2.5}$	24-hour	35 μg/m^3	18 μg/m^3 (51%)	St. George, Washington County, 2005
	Annual	15.0 μg/m^3	8 μg/m^3 (53%)	Estimate, 2006
Pb	Calendar quarter	1.5 μg/m^3	0.08 μg/m^3 (5.3%)	Magna, Salt Lake County, 2005
	Rolling 3-month	0.15 μg/m^3 [j]	NA	NA

[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; and SO_2 = sulfur dioxide.

[b] The State of Utah has adopted NAAQS for all criteria pollutants.

[c] Background concentrations for SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$ are developed for the Iron County by Utah Division of Air Quality for NAAQS and/or PSD modeling purposes.

[d] Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO_2, 1-hour NO_2, and rolling 3-month Pb to NAAQS was not made because no measurement data based on new NAAQS are available. Although not representative of Iron County, the highest monitored value of Pb in Utah is presented to show that Pb is not an issue in the state of Utah.

[e] Effective August 23, 2010.

[f] NA = not applicable or not available.

[g] Effective April 12, 2010.

Footnotes continued on next page.

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

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

[j] Effective January 12, 2009.

Sources: EPA (2009b, 2010); Prey (2009).

The Prevention of Significant Deterioration (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, the 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 proposed Escalante Valley SEZ, only one of which is situated within 62 mi (100 km), Zion NP (40 CFR 81.430), about 30 mi (48 km) south–southeast of the SEZ. This Class I area is not located directly downwind of prevailing winds at the SEZ (Figure 13.1.13.1-1). The next nearest Class I areas are located beyond 62 mi (100 km): Bryce Canyon NP, about 66 mi (106 km) east–southeast of the Escalante Valley SEZ; Grand Canyon NP in Arizona, 105 mi (169 km) south; and Capital Reef NP, 112 mi (180 km) east.

13.1.13.2 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 heat transfer fluids [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–fired 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 Escalante Valley 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 13.1.13.3 below identifies SEZ-specific design features of particular relevance to the Escalante Valley SEZ.

13.1.13.2.1 Construction

The Escalante Valley 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 that experiences windblown dust problems. Fugitive dusts, which are released near ground level, typically have more localized impacts than similar emissions from an elevated stack, which has 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.[13,14] For the Escalante Valley SEZ, the modeling was conducted based on the following assumptions and input:

- Emissions were uniformly distributed over the 3,000 acres (12.1 km^2) and in the western portion of the SEZ, close to the nearest residence and nearby communities;

- Surface hourly meteorological data came from the Milford Municipal Airport, and upper air sounding data came from Salt Lake City for the 2004 to 2008 period;

- A receptor grid was regularly spaced over a modeling domain of 62 mi × 62 mi (100 km × 100 km) centered on the proposed SEZ; and

- There were additional discrete receptors at the SEZ boundaries and at the nearest Class I area—Zion NP—about 30 mi (48 km) south-southeast of the SEZ.

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[13] 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.

[14] In Utah, construction lasting less than 180 days might be considered temporary and not require modeling (Maung 2009). For a longer development time, modeling would be required if PM_{10} emissions exceeded 5 tons/yr. However, for a staged development in which different areas were being developed at different times, the decision to require modeling would depend upon the details of the development plan. In all situations, the state must be informed of development plans and must be presented with a written fugitive dust control plan.

Results

The modeling results for both PM_{10} and $PM_{2.5}$ concentration increments and total concentrations (modeled plus background concentrations) that would result from construction-related fugitive emissions are summarized in Table 13.1.13.2-1. Maximum 24-hour PM_{10} concentration increment modeled to occur at the site boundaries would be an estimated 622 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. The total 24-hour PM_{10} concentration (increment plus background) of 705 μg/m^3 would further exceed this standard level at the SEZ boundary. However, high PM_{10} concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Predicted maximum 24-hour PM_{10} concentration increments would be about 114 μg/m^3 at the nearest residence (about 1.1 mi [1.8 km] northwest of the SEZ), about 85 μg/m^3 at Lund, about 10 μg/m^3 at Newcastle, about 6 μg/m^3 at Beryl, and less than 5 μg/m^3 at more distant communities. Annual modeled PM_{10} concentration increment and total concentration at the SEZ boundary are 113 μg/m^3 and 135 μg/m^3, respectively. The total concentration is higher than the standard level of 50 μg/m^3, which was revoked by EPA in 2006. Annual PM_{10} increments would be much lower at the mentioned towns, about 7 μg/m^3 at the nearest residence, about 4.5 μg/m^3 at Lund, and less than 0.5 μg/m^3 at other communities. Total 24-hour $PM_{2.5}$ concentrations would be about 60 μg/m^3 at the SEZ boundary, which is higher than the standard

TABLE 13.1.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Escalante Valley SEZ

			Concentration (μg/m^3)				Percentage of NAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background[c]	Total	NAAQS	Increment	Total
PM_{10}	24 hour	H6H	622	83	705	150	414	470
	Annual[d]	NA[e]	113	21.8	135	50	226	269
$PM_{2.5}$	24 hour	H8H	42.4	18	60.4	35	121	172
	Annual	NA[e]	11.3	8	19.3	15.0	75	129

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-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

c See Table 13.1.13.1-2 (Source: Prey [2009]).

d Effective December 18, 2006, the EPA revoked the annual PM10 standard of 50 μg/m^3, but annual PM10 concentrations are presented for comparison purposes.

e NA = not applicable.

level of 35 μg/m^3; modeled concentrations are more than twice the background concentrations in this total. The total annual average $PM_{2.5}$ concentration would be 19.3 μg/m^3, which is above the standard level of 15.0 μg/m^3. At the nearest residence, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about 5.4 and 0.7 μg/m^3, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the nearest Class I Area, Zion NP, would be about 5.3 and 0.1 μg/m^3, or 67% and 2.6% of the allowable PSD increments for Class I area, respectively.

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 residences and cities would be 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 (Zion NP). Construction activities are not subject to the PSD program, and the comparison provides only a screen to gauge 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 could cause impacts on air quality related values (AQRVs) (e.g., visibility and acid deposition) at the nearest federal Class I area, Zion NP, which is not located directly downwind of prevailing winds. SO_x emissions from engine exhaust would be very low, because programmatic design features would require that ultra-low-sulfur fuel with a sulfur content of 15 ppm be used. 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.

Transmission lines within a designated ROW would be constructed to connect to the nearest regional grid. A regional 138-kV transmission line is located about 3 mi (5 km) south of the Escalante Valley SEZ; thus construction of a transmission line over this relatively short distance would be needed if that line were used to connect to the regional grid. Also, it is likely that the 138-kV line would need to be upgraded to handle the output of a full-size solar project. Activities would result in fugitive dust emissions from soil disturbance and engine exhaust emissions from heavy equipment and vehicles as at other construction sites. Because of the short distance of 3 mi (5 km) to the regional grid, transmission line construction from the Escalante Valley SEZ could be performed in a short time period (a few months, at most). The construction site along the transmission line ROW would move continuously; thus no particular area would be exposed to air emissions for a prolonged period, and potential air quality impacts on nearby residences, if any, would be minor and temporary in nature.

13.1.13.2.2 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).

The type of emission sources caused by and offset by operation of a solar facility are discussed in Section M.13.4 of Appendix M.

Estimates of potential air emissions displaced by the solar project development at the Escalante Valley SEZ are presented in Table 13.1.13.2-2. Total power generation capacity ranging from 588 to 1,058 MW is estimated for the Escalante Valley SEZ for various solar

TABLE 13.1.13.2-2 Annual Emissions from Combustion-Related Power Generation Displaced by Full Solar Development of the Proposed Escalante Valley SEZ

Area Size (acres)	Capacity (MW)[a]	Power Generation (GWh/yr)[b]	Emission Rates (tons/yr; 10^3 tons/yr for CO_2)[c]			
			SO_2	NO_x	Hg	CO_2
6,614	588–1,058	1,030–1,854	1,025–1,845	1,960–3,528	0.004–0.007	1,111–2,000
Percentage of total emissions from electric power systems in Utah[d]			2.8–5.0%	2.8–5.0%	2.8–5.0%	2.8–5.0%
Percentage of total emissions from all source categories in Utah[e]			1.9–3.4%	0.80–1.5%	NA[f]	1.5–2.8%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.41–0.74%	0.53–0.95%	0.14–0.25%	0.42–0.76%
Percentage of total emissions from all source categories in the six-state study area[e]			0.22–0.39%	0.07-0.13%	NA	0.13–0.24%

[a] It is assumed that the SEZ would eventually have development on 80% of the lands and that 5 acres (0.020 km^2) per MW (for parabolic trough technology) to 9 acres (0.04 km^2) per MW (power tower, dish engine, and PV technologies) of land would be required.

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

[c] Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 1.99, 3.81, 7.8×10^{-6}, and 2,158 lb/MWh, respectively, were used for the state of Utah.

[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] NA = not estimated.

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

technologies (see Section 13.1.1.2). 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 Escalante Valley SEZ were fully developed, it is expected that emissions avoided would be substantial. Development of solar power in the SEZ would result in avoided air emissions ranging from 2.8% to 5.0% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Utah (EPA 2009d). Avoided emissions would be up to 1.0% 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 3.4% of SO_2, 1.5% of NO_x, and 2.8% of CO_2 emissions in the state of Utah (EPA 2009a; WRAP 2009). These emissions would be up to 0.4% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for about 97.5% of the total electric power generation in Utah, most of which is from coal combustion (more than 94%). Thus, solar facilities to be built in the Escalante Valley SEZ could displace relatively more fossil fuel emissions than those built in other states that rely less on fossil fuel–generated power.

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 higher voltage lines during rain or very humid conditions. Since the proposed SEZ in Utah 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, considering the infrequent occurrences and small amount of emissions from corona discharges.

13.1.13.2.3 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 also would be implemented during the decommissioning phase (Section 5.11.3).

13.1.13.3 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 Escalante Valley SEZ (such 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.

13.1.14 Visual Resources

13.1.14.1 Affected Environment

The proposed Escalante Valley SEZ in Utah is located within the Basin and Range ecoregion (Woods et al. 2001). Regional topography is characterized by linear, generally north and south trending, semiarid desert valleys at approximately 5,000-ft (1,524-m) elevation and intermittent mountain ranges up to approximately 10,000 ft (3,048 m) in elevation. No large water bodies or large urban areas are located near the SEZ, and few major roads cross the area. The region is sparsely inhabited, remote, and rural in character. As shown in Figure 13.1.14.1-1, the proposed Escalante Valley SEZ (6,614 acres [27 km^2]) is located in the south-central portion of the Escalante Desert, a large, southwest–northeast trending valley. The site is approximately 5 mi (8 km) southeast of the Wah Wah Mountains and 7 mi (11 km) north of the Antelope Range. Within the SEZ, elevation ranges from about 5,093 ft (1,552 m) along the central northern boundary to 5,184 ft (1,580 m) in the southeast corner of the western portion of the SEZ.

The SEZ is within a flat treeless plain, with the strong horizon line being the dominant visual feature. Vegetation is primarily low shrubs (generally less than 3 ft [0.9 m] high, but in some parts of the SEZ generally less than 1 ft [0.3 m] high), with some areas of bare, generally tan soil and gravel. An area of low dunes is located in the far southwestern portion of the SEZ, with slightly more relief and large expanses of sand, and with sparse shrubs and grasses on low ridges. During a September 2009 site visit, the vegetation within the SEZ presented a range of greens, light browns, blue-grays, and gray bare wood, with banding and other variation sufficient to add slight visual interest. Bands or patches of light tan bare soil are interspersed with the vegetation in some areas. Some or all of the vegetation might be snow-covered in winter, which might significantly affect the visual qualities of the area by changing the color contrasts associated with the vegetation. This, in turn, could change the contrasts associated with the introduction of solar facilities into the landscape. No permanent water features are present within the SEZ. This landscape type is common within the region. Panoramic views of the SEZ are shown in Figures 13.1.14.1-2, 13.1.14.1-3, and 13.1.14.1-4.

No paved roads pass through or near the SEZ, but a number of unpaved roads cross the SEZ. No electric transmission lines are located within the SEZ. Other than normally dry livestock ponds, cattle trails, and wire fences, there is little evidence of cultural modifications that affect the scenic quality of the SEZ. In general, the SEZ is natural appearing.

Off-site views include distant mountains to the north, east, and west. The Shauntie Hills, approximately 4 mi (6.4 km) northwest of the SEZ, add somewhat to the scenic quality of views from the SEZ. However, to the east and west, the other mountains are at a sufficient distance that they do not substantially add to the scenic quality of the SEZ. Table Butte is located about 0.5 mi (0.8 km) from the southeast corner of the southernmost portion of the SEZ. Table Butte dominates views in that direction from the southern portion of the SEZ, adding significantly to the scenic quality of nearby portions of the SEZ. In addition, the southeastern portion of the SEZ

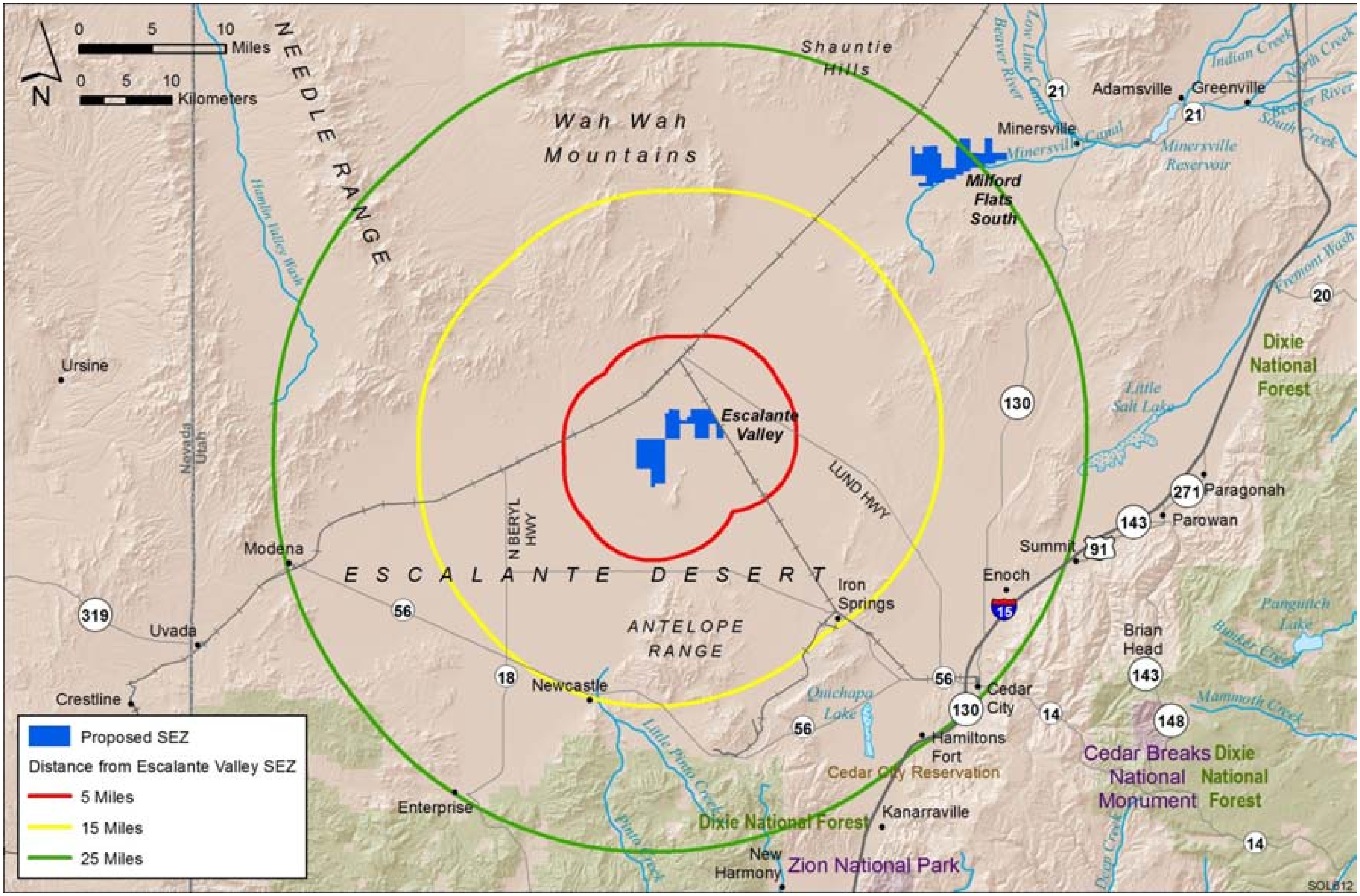

FIGURE 13.1.14.1-1 Proposed Escalante Valley SEZ and Surrounding Lands

FIGURE 13.1.14.1-2 Approximately 180° Panoramic View of the Proposed Escalante Valley SEZ, Including Table Butte at Far Left (southwest) and Black Mountains at Right (northeast)

FIGURE 13.1.14.1-3 Approximately 90° Panoramic View of the Proposed Escalante Valley SEZ, Looking South from Central Portion of the Proposed SEZ, with Table Butte at Center

FIGURE 13.1.14.1-4 Approximately 120° Panoramic View of the Proposed Escalante Valley SEZ, North from Southern Boundary of the Proposed SEZ

also has greater visual interest because of the relief and color variety from the dune landscape. As a result, the far southeastern portion of the SEZ has the highest relative scenic value within the SEZ.

Few off-site cultural disturbances are visible from the SEZ; however, the Union Pacific (UP) Railroad is visible about 2 mi (3.2 km) northwest of the SEZ, and a spur from that line passes just northeast of the far northeastern corner of the SEZ on a slightly raised embankment, making it visible from nearby locations. Transmission lines and a few low structures are visible in the far distance from the eastern portion of the SEZ. The nearest transmission line is 3 mi (4.8 km) away.

Access to the Escalante Valley SEZ is on dirt roads, from Lund Highway northeast of the SEZ, or Beryl Milford Road northwest of the SEZ. The nearest major road is State Route 56, located about 15 mi (24 km) south of the SEZ.

Current land uses within the SEZ include grazing, general outdoor recreation, backcountry and OHV driving, and hunting for both small and big game. The land is used primarily by local residents, but at low usage levels. Because the SEZ location is remote with few people living nearby, few visitors, and poor road access, the number of viewers is relatively low.

The BLM conducted a visual resource inventory (VRI) for the SEZ and surrounding lands in 2009 to 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 key observation points. Based on these three factors, BLM-administered lands are placed into one of four Visual Resource Inventory 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 5.7 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The VRI values for the SEZ and most of its immediate surroundings are VRI Class IV, indicating low relative visual values. A very small portion of the SEZ and the area immediately east of the southernmost section of the SEZ, which includes Table Butte, is VRI Class III, indicating moderate relative visual values. The Table Butte VRI Class III determination was due primarily to its prominence as a local landmark, and its interesting form.

The inventory indicates generally low scenic quality for the SEZ and its immediate surroundings, excluding Table Butte, based primarily on the lack of topographic relief and water features, the presence of cultural disturbances, and the relative commonness of the landscape type within the region. The SEZ also received relatively low scores for variety in vegetation types and color. A positive visual attribute noted in the inventory was the attractive off-site views; however, this positive attribute was insufficient to raise the scenic quality to the "moderate" level. The VRI noted relatively low levels of use and public interest. middleground

Lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain 38,155 acres (154.41 km^2) of VRI Class II areas, primarily east and southeast of the SEZ in the Antelope Range and Three Peaks areas in lands near the Old Spanish National Historic Trail, but also north and northwest of the SEZ; 58,988 acres (237.03 km^2) of Class III areas, primarily south and east of the SEZ in lands near the Old Spanish National Historic Trail, but also west of the SEZ; and 682,898 acres (2763.59 km^2) of VRI Class IV areas, concentrated primarily in the Escalante Desert and nearby mountain ranges north of the SEZ. The VRI map for the SEZ and surrounding lands is shown in Figure 13.1.14.1-5.

The Cedar Beaver Garfield Antimony Final Resource Management Plan/Final Environmental Impact Statement (BLM 1984b) indicates that the entire SEZ is managed as visual resource management (VRM) Class IV, which permits major modification of the existing character of the landscape. The VRM map for the Escalante Valley SEZ and surrounding lands is shown in Figure 13.1.14.1-6. More information about the BLM VRM program is available in Section 5.7 and in *Visual Resource Management*, BLM Manual Handbook 8400 (BLM 1984a).

13.1.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Escalante Valley 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, as are potential SEZ-specific design features.

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

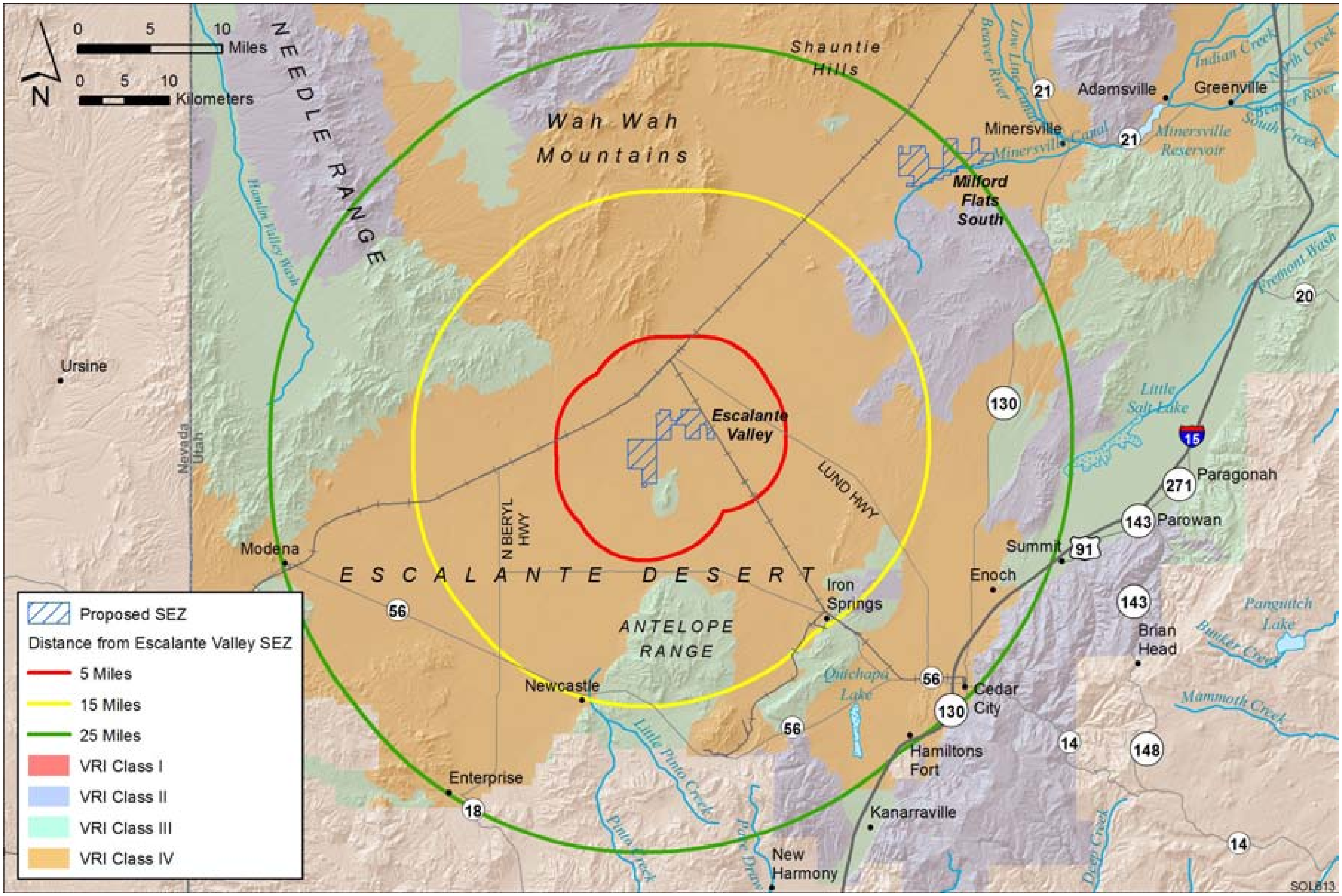

FIGURE 13.1.14.1-5 Visual Resource Inventory Values for the Proposed Escalante Valley SEZ and Surrounding Lands

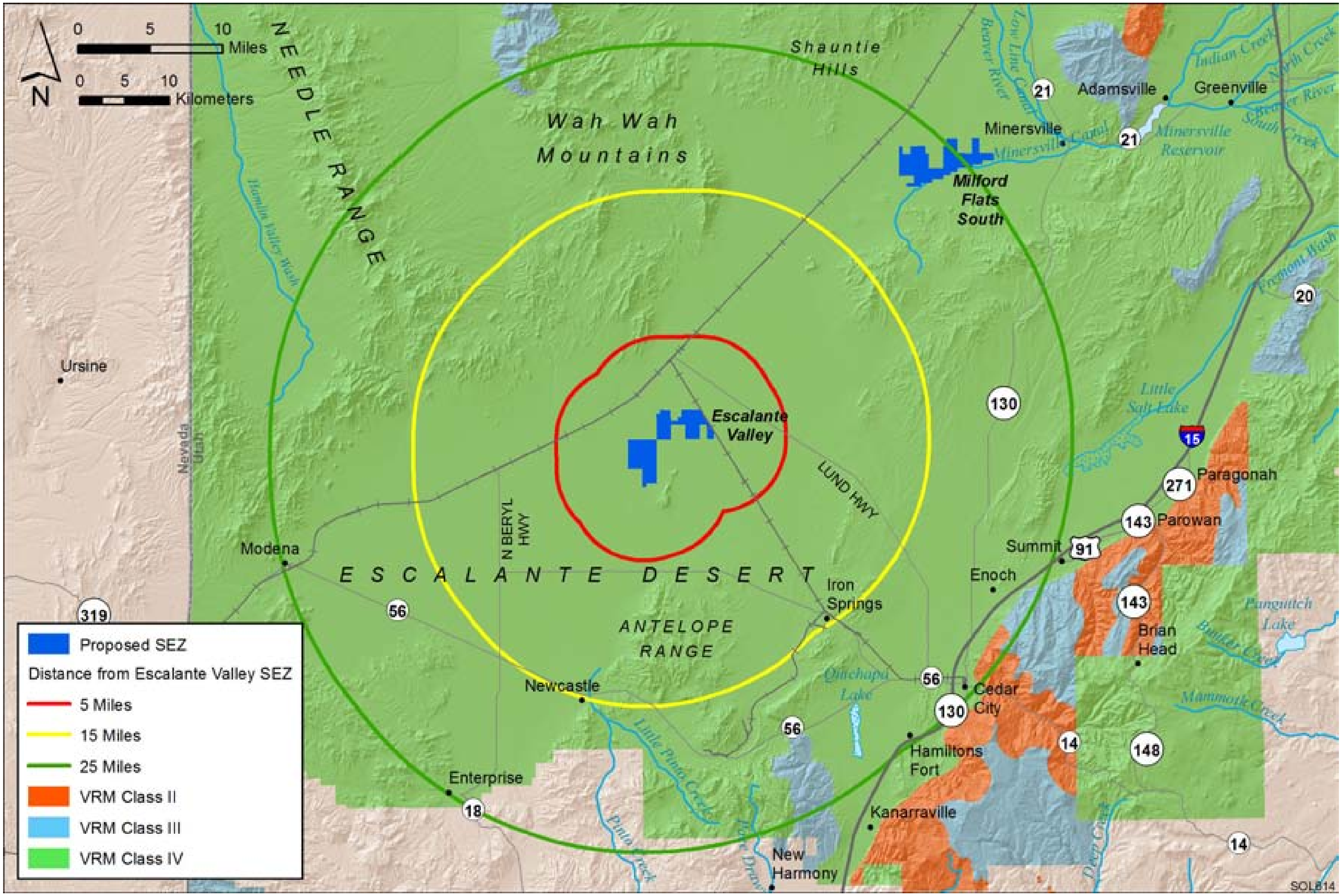

FIGURE 13.1.14.1-6 Visual Resource Management Classes for the Proposed Escalante Valley SEZ and Surrounding Lands

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 of this PEIS.

13.1.14.2.1 Impacts on the Proposed Escalante Valley 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 modifications of the existing character of the landscape and would likely dominate the nearby views. 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 6.5 of the PEIS.

The changes described above would be expected to be consistent with BLM VRM objectives for VRM Class IV, as seen from nearby KOPs. 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.

13.1.14.2.2 Impacts on Lands Surrounding the Proposed Escalante Valley SEZ

Impacts on Selected Sensitive Visual Resource Areas

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 could have views of solar facilities in at least some portion of the SEZ (see Appendix M for information on assumptions and limitations of the methods used). Four viewshed analyses were conducted, each for 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 available in Appendix N.

Figure 13.1.14.2-1 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 the occurrence of 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, and dark purple, and at least the upper portions of power tower receivers could be visible from the additional areas shaded in medium brown.

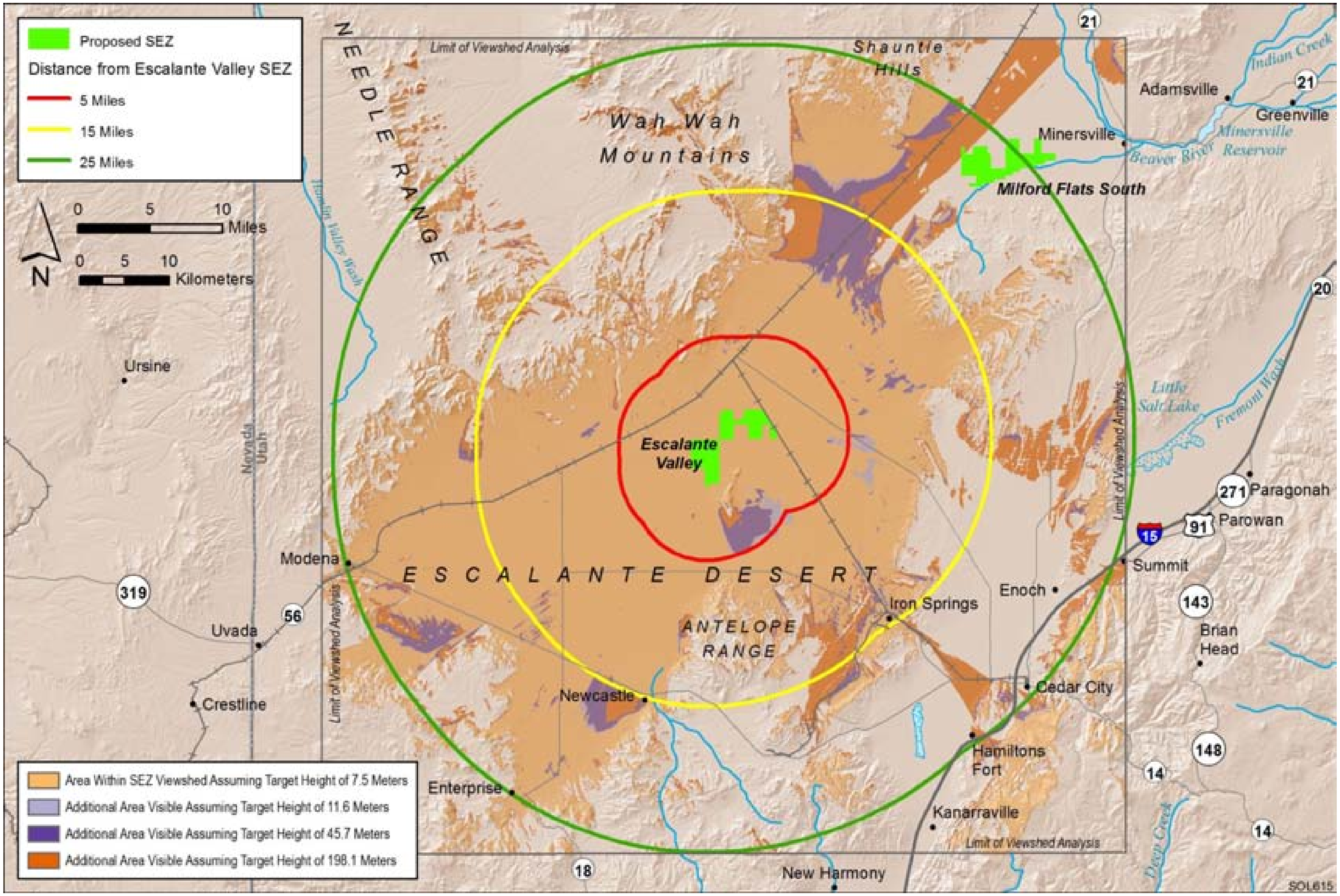

FIGURE 13.1.14.2-1 Viewshed Analyses for the Proposed Escalante Valley SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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 transmission towers and short solar power towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of these facilities would fall between that for tall power towers and PV and parabolic trough arrays.

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

Figure 13.1.14.2-2 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. The figure illustrates which of these sensitive visual resource areas could 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.

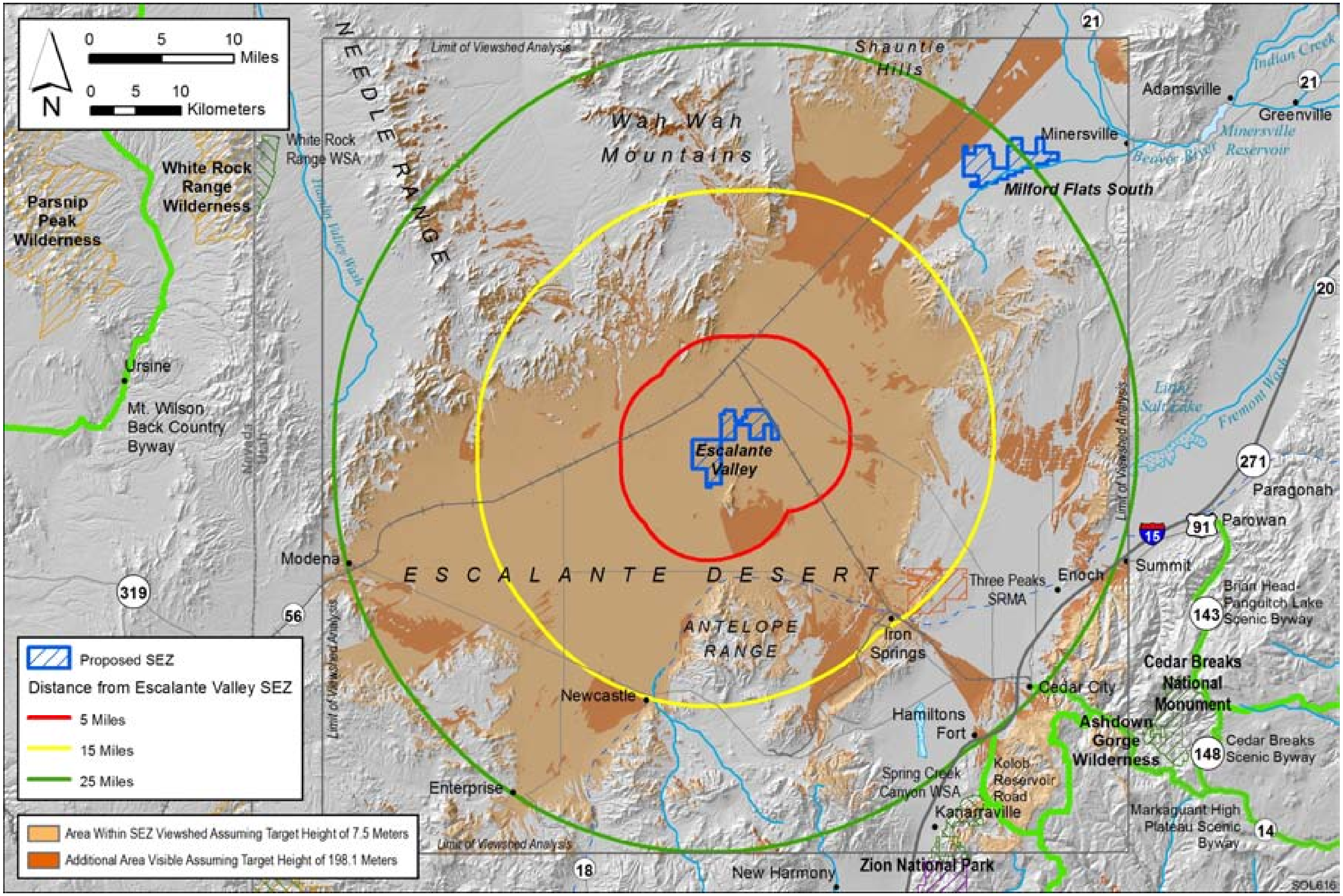

FIGURE 13.1.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650 ft (198.1 m) and 24.6 ft (7.5 m) Viewsheds for the Proposed Escalante Valley SEZ

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Escalante Valley SEZ are discussed below. The results of this analysis are also summarized in Table 13.1.14.2-1. Further discussion of impacts on these areas is provided in Sections 13.1.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and 13.1.17 (Cultural Resources).

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the seen landscape, 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 Historic Trail

- *Old Spanish*—The Old Spanish National Historic Trail is a congressionally designated, multistate historic trail that passes within 6.4 mi (10.3 km) of the SEZ at the point of closest approach on the south side of the SEZ. Approximately 30 mi (48 km) of the trail are within the 650-ft (198.1-m) viewshed of the SEZ.

TABLE 13.1.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Escalante Valley SEZ, Assuming a Viewshed Analysis Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[a]		
			Visible between	
Feature Type	Feature Name and Total Acreage	Visible within 5 mi	5 and 15 mi	15 and 25 mi
National Historic Trail	Old Spanish	0	22 mi	8 mi
SRMA	Three Peaks (6,631 acres)	0	1,672 acres (25%)[b]	164 acres (3%)[b]

[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 area for areal features.

As shown in Figure 13.1.14.2-2, within 25 mi (40 km) of the SEZ, following the trail from the east, the trail extends southwest and enters the viewshed just east of Iron Springs, where the trail turns northwest to pass north of the Antelope Range, drawing closer to the SEZ. At the 6.6-mi (10.6-km) point of closest approach, the trail then turns to the southwest toward Newcastle and passes out of the 25-mi (40-km) viewshed as it descends into Mountain Meadow.

For trail users traveling westward, the upper portions of sufficiently tall power towers might become visible in the vicinity of Iron Springs, assuming no screening by nearby vegetation or structures. The trail is elevated approximately 200 ft (61 m) above the SEZ, and at a distance of approximately 14 mi (23 km), the angle of view would be very low. If power towers were visible within the SEZ, they would appear as points of light on the northwest horizon, and if they were sufficiently tall to require hazard navigation lighting, they could potentially be visible at night as well. Views of some of the southwestern portion of the SEZ would be blocked by Table Butte.

Figure 13.1.14.2-3 is a Google Earth visualization that depicts a view of the Escalante Valley SEZ (highlighted in orange) as seen from a point on the Old Spanish Trail in the Three Peaks area at the north end of the Antelope Range, about 10 mi (16 km) from the closest visible portion of the SEZ and about 700 ft (213 m) higher in elevation than the southern portion of the SEZ. The visualization includes simplified wireframe models of a hypothetical solar power tower facility. The models were placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver towers depicted in the visualization are properly scaled

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 the 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.

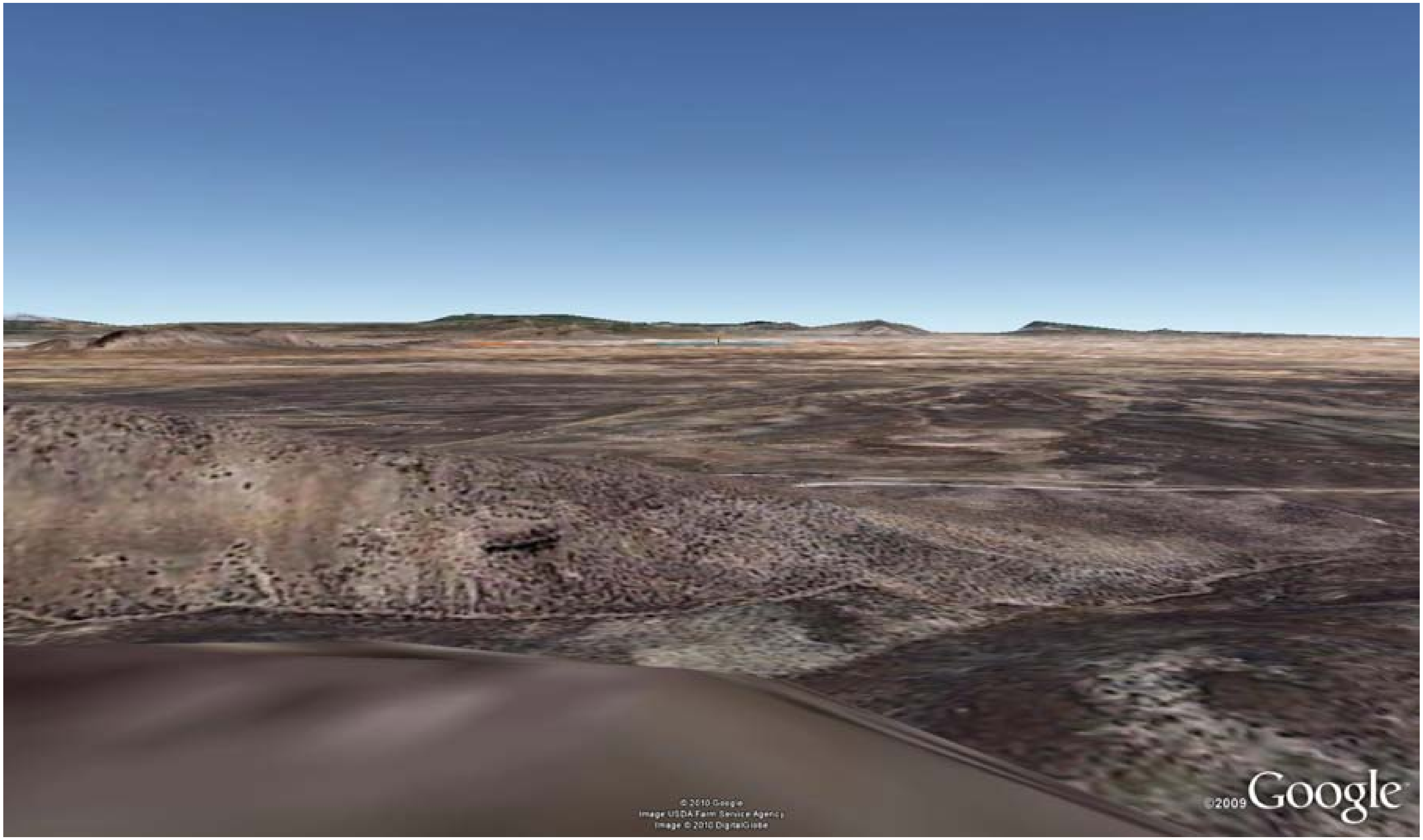

FIGURE 13.1.14.2-3 Google Earth Visualization of the Proposed Escalante Valley SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on Old Spanish Trail at North End of Antelope Range

models of a 459-ft (139.9-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, each representing approximately 100 MW of electric generating capacity. Two models were placed in the SEZ for this and other visualizations shown in this section of the PEIS. In the visualization, the SEZ area is depicted in orange, the heliostat fields in blue.

The visualization suggests that a substantial portion of the SEZ would be screened from view by Table Butte, but the visible portion of the SEZ would occupy a small portion of the field of view from this point on the Old Spanish Trail, essentially appearing as a thin horizontal band in the distance.

Solar arrays within the visible portion of 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 line of the horizon, which would tend to reduce visual contrast. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

Operating power towers within the SEZ could be visible as points of light on the northeast horizon, against the backdrop of the Escalante Desert floor or the Wah Wah Mountains north of the SEZ. If sufficiently tall, the power towers could have red or white flashing hazard navigation lights that would likely be visible from this viewpoint at night, given the dark night skies in the vicinity of the SEZ. Other lighting associated with solar facilities in the SEZ could potentially be visible as well, at least for facilities in the closest portions of the SEZ.

Visual contrasts associated with solar energy development within the SEZ would depend solar facility type, size, and location within the SEZ, and other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected.

Figure 13.1.14.2-4 is a Google Earth view of the Escalante Valley SEZ as seen from a location on the Old Spanish Trail near the point of closest approach of the trail to the SEZ (6.4 mi [10.3 km]), about 300 ft (91 m) higher in elevation than the southern boundary of the SEZ. West-bound trail users would see the SEZ to the right as they traveled down the trail.

From this viewpoint, much of the SEZ is screened from view by Table Butte, but portions of the SEZ are visible both east and west of Table Butte. Although closer than the viewpoint in Figure 13.1.14.2-3, this viewpoint is lower in elevation, so the overall appearance of the SEZ is similar, although more of the SEZ is visible. The SEZ and solar arrays within the SEZ would appear as a thin band at the base of the Wah Wah Mountains. Solar arrays within the visible portion of the SEZ would be seen edge-on, reducing their apparent size, concealing their strong regular geometry, and causing them to

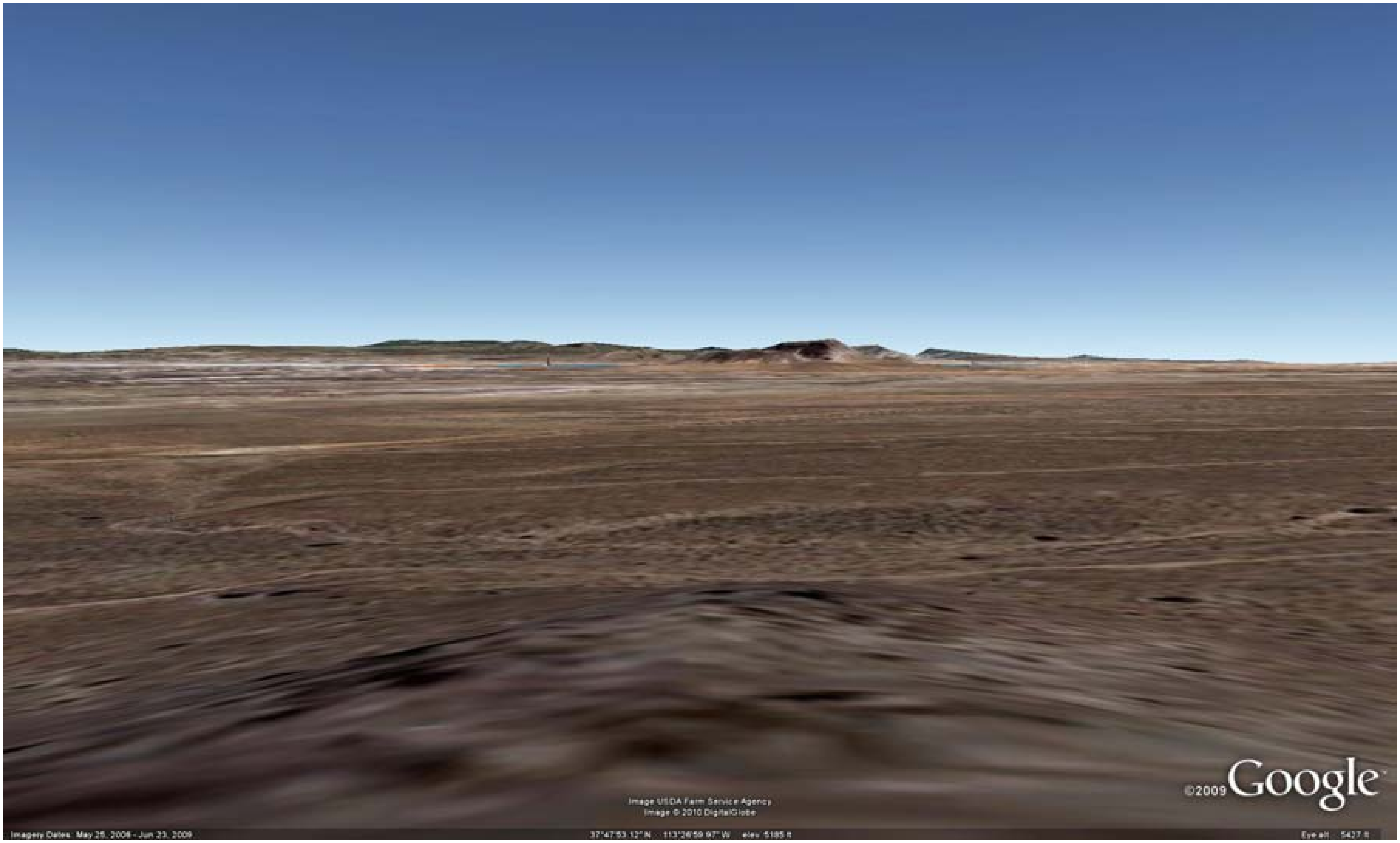

FIGURE 13.1.14.2-4 Google Earth Visualization of the Proposed Escalante Valley SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on Old Spanish Trail near Point of Closest Approach to the SEZ

appear to repeat the line of the horizon, which would tend to reduce visual contrast.

Plumes (if present) and taller ancillary facilities, such as buildings, transmission structures, and cooling towers, 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 possible, but their extent would depend on the materials and surface treatments utilized in the facilities.

Operating power towers within the SEZ could be visible as bright points of light on the northeast horizon against the backdrop of the Escalante Desert floor or the Wah Wah Mountains north of the SEZ. If sufficiently tall, the power towers could have red or white flashing hazard navigation lights that would likely be visible from this viewpoint at night, and could be conspicuous, given the dark night skies in the vicinity of the SEZ. Other lighting associated with solar facilities in the SEZ could be visible as well. Visual contrasts associated with solar energy development within the SEZ would depend on solar facility type, size, and location within the SEZ, and other visibility factors. Under the 80% development scenario analyzed in the PEIS, weak levels of visual contrast would be expected.

As westbound trail users passed the point of closest approach, the trail would already be turning away from the SEZ toward the southwest, and as trail users continued westward on the trail, the SEZ would be behind them, with impacts diminishing from the levels described above as the users continued westward.

East-bound trail users would enter the 25-mi (40-km) viewshed just north of Mountain Meadow in Holt Canyon and about 1,000 ft (300 m) higher in elevation than the SEZ. However, at 25 mi (40 km), while operating, power tower receivers within the SEZ could be visible as distant points of light on the northeastern horizon, the SEZ would occupy a very small portion of the field of view, and most solar facilities would be unlikely to be distinguishable from the background. Almost immediately, the trail drops in elevation substantially, to about 400 ft (120 m) above the SEZ, lowering the angle of view and, except for a few small areas, eliminating visibility of the SEZ for the next few miles.

At about 21 mi (34 km) from the SEZ, the trail re-enters the SEZ viewshed. At this far distance and low viewing angle, solar collector/reflector arrays would be seen edge-on, if at all. Operating power towers within the SEZ might be visible as distant points of light on the northern horizon, but visual contrasts from solar facilities within the SEZ would be weak. As east-bound trail users traveled farther northeast on the trail, contrast levels would increase gradually but only slightly, because even as distance to the SEZ decreased, the angle of view would decrease, as the trail eventually drops to only about 200 ft (60 m) in elevation above the SEZ. The SEZ and solar arrays within the SEZ would be visible down the trail, but at a very low viewing angle and occupying a very small portion of the field of view, in part because Table Butte would screen portions of the SEZ.

In general, at no point would visual contrasts from solar facilities within the SEZ be expected to create more than weak visual contrasts as viewed from the trail, although near the point of closest approach power tower receivers within the SEZ might appear as bright points of light low in the field of view.

Special Recreation Management Areas

- *Three Peaks*—The Three Peaks Special Recreation Management Area is a BLM-designated SRMA 13 mi (21 km) southeast of the SEZ at the point of closest approach. The SRMA was designated to manage diverse recreational uses and to protect natural resources from being damaged from recreational use (BLM 2005). The SRMA provides front-country experiences. Activities occurring in the SRMA include horseback riding, OHV riding, mountain biking, camping, and radio-controlled model airplane flying (BLM 2006).

  The Escalante Valley SEZ is visible from higher elevations in the SRMA, particularly the northwest slopes of the Three Peaks. The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 1,836 acres (7.4 km^2), or 28% of the total SRMA acreage. The area of the SRMA within the 24.6-ft (7.5 m) viewshed of the SEZ includes 1,199 acres (4.9 km^2), or 18% of the total SRMA acreage. As shown in Figure 13.1.14.2-2, the visible area extends from the point of closest approach to almost 2 mi (3 km) into the SRMA, about (15 mi [24 km] from the SEZ).

  Figure 13.1.14.2-5 is a Google Earth visualization of the SEZ as seen from the southwestern-most peak of the Three Peaks in the southwestern portion of the SRMA, approximately 16 mi (26 km) from the far southeastern portion of the SEZ. Because of the long distance to the SEZ, the angle of view is very low. The SEZ and solar arrays within the SEZ would appear as a thin band at the base of the distant Wah Wah Mountains, with Table Butte screening the farthest southwest portions of the SEZ. Solar arrays within the SEZ that were visible from the SRMA would be seen edge-on, reducing their apparent size, concealing their strong regular geometry, and causing them to appear to repeat the line of the horizon, which would tend to reduce visual contrast. Operating power towers within the SEZ could be visible as distant points of light on the northwest horizon, against the backdrop of the Escalante Desert valley floor. If sufficiently tall, the power towers could have red or white flashing hazard navigation lights that would likely be visible from this viewpoint at night, given the dark night skies in the vicinity of the SEZ.

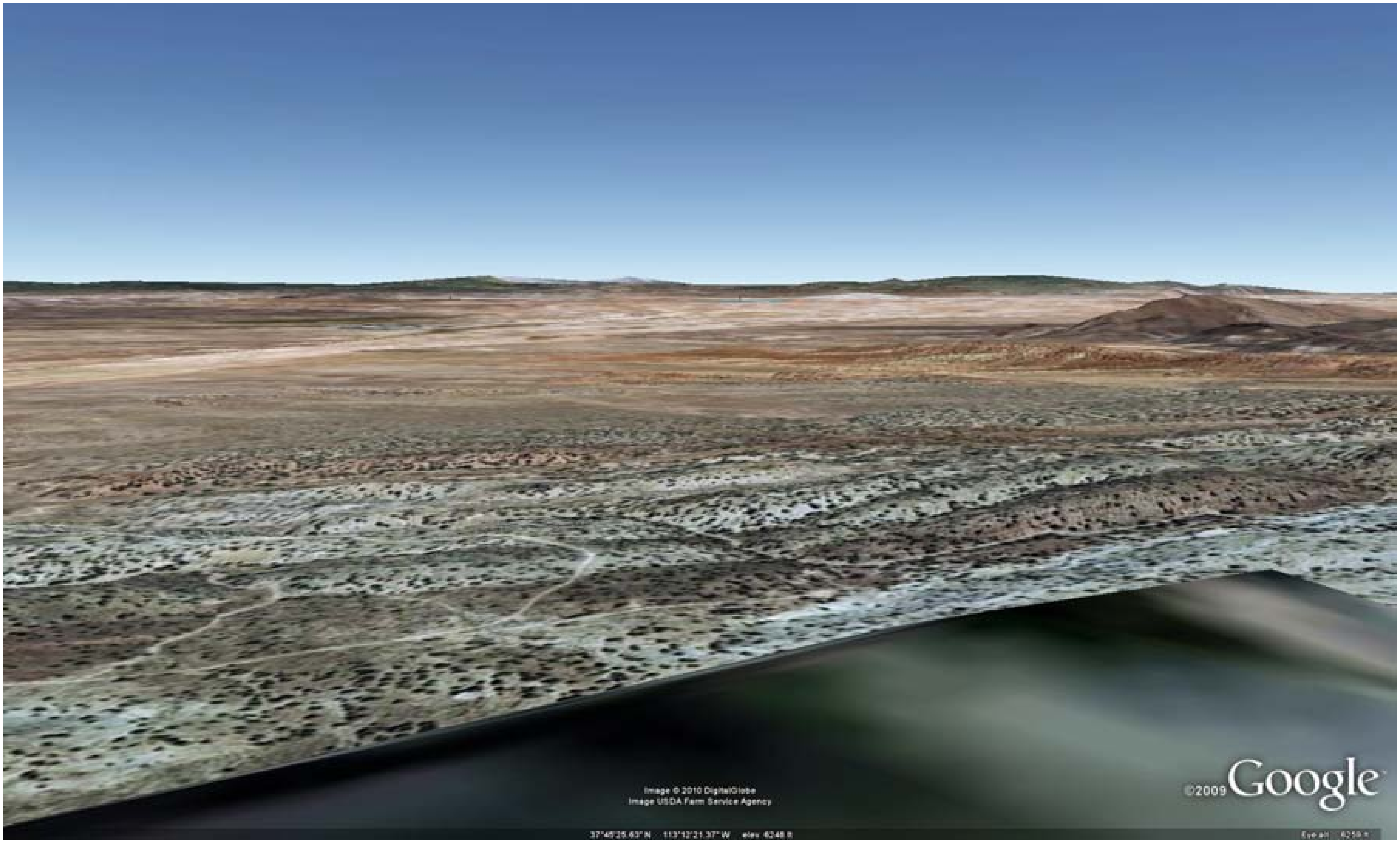

FIGURE 13.1.14.2-5 Google Earth Visualization of the Proposed Escalante Valley SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint in Three Peaks SRMA

> Visual contrasts associated with solar energy development within the SEZ would depend on viewer location within the SRMA; solar facility type, size, and location within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected. The highest contrast levels would be expected for the peaks and northwest slopes of the Three Peaks, with lower contrasts expected for lower elevations.

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 nonfederal sensitive visual resources, as well as communities close enough to the proposed project to be affected by visual impacts. Selected nonfederal 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 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 locations of which cannot be determined until a specific solar energy project is proposed. Currently, there are no suitable transmission lines within the proposed SEZ; thus construction and operation of a transmission line both inside and outside the proposed SEZ would be required. 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 5.12.1.5. A detailed site-specific NEPA analysis based on more precise knowledge of facility location and characteristics would be required to determine visibility and associated impacts precisely for any future solar projects.

Impacts on Selected Other Lands and Resources

Communities of Modena, Enterprise, and Newcastle. The viewshed analyses indicate visibility of the SEZ from the communities of Modena (about 25 mi [40 km] west-southwest of the SEZ), Enterprise (about 25 mi [40 km] south-southwest), and Newcastle (about 15 mi [24 km] south). All three communities are between 200 and 350 ft (60 to 110 m) higher in elevation than the closest boundary of the SEZ.

Screening by small undulations in topography, vegetation, buildings, or other structures would likely restrict or eliminate visibility of the SEZ and associated solar facilities within these communities, but a detailed future site-specific NEPA analysis would be required to determine visibility precisely.

Because of the very long distance from both Modena and Enterprise to the SEZ, and the very low elevation difference between these communities and the SEZ, the angle of view to the

SEZ is quite low, and where screening from nearby vegetation or structures was absent, the SEZ would occupy a very small portion of the field of view from these communities. Power tower receivers within the SEZ might be visible as faint lights on the horizon, and at night, if power towers were tall enough to require hazard navigation lighting, that towers could have flashing red or white lights that could potentially be visible from these communities. Other solar facilities are unlikely to be visible at all. Thus, visual impacts on these communities from solar development within the SEZ would be expected to be minimal.

The SEZ would occupy a slightly larger portion of the field of view from Newcastle, at 15 mi (24 km) from the SEZ; however, Table Butte would screen the far eastern portion of the SEZ from view. The angle of view is so low that any solar collector/reflector arrays and other low-height facilities within the SEZ either would be seen on edge, which would reduce their visibility and visual contrast, or might not be visible at all. Power tower receivers within the SEZ might be visible as lights on the horizon. Visual impacts on Newcastle from solar development within the SEZ would be expected to be minimal.

In addition to the impacts described above, 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, including Lund Highway, which would be subject to major visual contrast from solar development within the SEZ, Beryl Road, and Antelope Road.

13.1.14.2.3 Summary of Visual Resource Impacts for the Proposed Escalante Valley SEZ

Under the 80% development scenario analyzed in this PEIS, there could be multiple solar facilities within the Escalante Valley SEZ, a variety of technologies employed, and a range of supporting facilities that would contribute to visual impacts, such as transmission towers and lines, substations, power block components, and roads. The resulting visually complex landscape would be essentially industrial in appearance and would contrast strongly with the surrounding mostly natural-appearing landscape. Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed would result from solar energy development under the 80% development scenario analyzed in this PEIS, because of major modification of the character of the existing landscape. Additional impacts would result from construction and operation of transmission lines and access roads within the SEZ.

The SEZ is in an area of low scenic quality. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as anyassociated access roads and transmission lines) as they travel area roads.

Utility-scale solar energy development within the proposed Escalante Valley SEZ is unlikely to cause even moderate visual impacts on highly sensitive visual resource areas, the closest of which is more than 6 mi (10 km) from the SEZ. The closest community (Newcastle) is about 15 mi (24 km) from the SEZ and is likely to experience minimal visual impacts from solar development within the SEZ. The communities of Modena and Enterprise are also located within the 25-mi (40-km) viewshed of the SEZ. Visual impacts on these communities would be expected to be minimal.

13.1.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified to protect visual resources for the proposed Escalante Valley SEZ. As noted in Section 5.12, the presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into non-industrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. Implementation of the programmatic design features that are presented 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 typical 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.

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13.1.15 Acoustic Environment

13.1.15.1 Affected Environment

The proposed Escalante Valley SEZ is located in southwestern Utah, around the central portion of Iron County. The State of Utah has no applicable quantitative noise-level regulations, but Iron County, which includes the proposed Escalante Valley SEZ, has quantitative noise limits applicable to solar power plants. No solar power plant should exceed 65 dBA as measured at the property line, or 50 dBA as measured at the nearest neighboring inhabitable building (Iron County 2009).

The nearest major road in the vicinity of the proposed Escalante Valley SEZ is State Route 56, located about 14 mi (23 km) to the south. Two county roads, Lund Highway and Beryl Milford Road, northeast and northwest, respectively, are located within 2 mi (3 km) of the SEZ. The UP Railroad runs along the Beryl Milford Road, from which a railroad branches out at Lund, passes through eastern edge of the SEZ, and connects to Cedar City. The nearest airport is privately owned Sun Valley Estates Airport, which is about 1.3 mi (2.1 km) northwest of the SEZ, and the next nearest one is Beryl Junction Airport, about 15 mi (24 km) southwest of the SEZ. Nearby regional airports include Cedar City Airport and Milford Airport, which are located about 22 mi (35 km) southeast of and 38 mi (61 km) northeast of the SEZ, respectively. Large-scale irrigated agricultural lands are situated more than 6 mi (10 km) southwest, while hog production facilities are about 9 mi (15 km) north–northeast. No sensitive receptors (e.g., residences, hospitals, schools, or nursing homes) exist around the SEZ. The closest residences to the boundary of the SEZ are about 1.1 mi (1.8 km) to the northwest. Several small communities are nearby: Lund is about 3.5 mi (5.6 km) to the north and Beryl about 9 mi (14.5 km) to the west. No population centers with schools exist within a 15-mi (24-km) radius of the SEZ. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, and agricultural activities. Other noise sources are associated with current land use around the SEZ, including grazing, outdoor recreation, back-country and OHV use, and hunting. The proposed Escalante Valley SEZ is in a remote and undeveloped area, the overall character of which is rural. To date, no environmental noise survey has been conducted around the proposed SEZ. On the basis of the population density, the day-night average sound level (L_{dn}) is estimated to be 32 dBA for Iron County, a low-end level typical of a rural area in the range of 33 to 47 dBA L_{dn}[15] (Eldred 1982; Miller 2002).

13.1.15.2 Impacts

Potential noise impacts associated with solar projects in the Escalante Valley 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

[15] Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, the nighttime level is 10 dBA lower than the daytime level, and it 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.

(within 1.1 mi [1.8 km]) would be anticipated, albeit of short duration. During the operations phase, potential impacts on the nearest 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 Escalante Valley 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 13.1.15.3 below). This section primarily addresses potential noise impacts on humans, although potential impacts on wildlife at nearby sensitive areas are discussed. Additional discussion on potential noise impacts on wildlife is presented in Section 5.10.2.

13.1.15.2.1 Construction

The proposed Escalante Valley 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) to 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 50 dBA at a distance of 0.5 mi (0.8 km) from the power block area. This noise level is the same as the Iron County regulation of 50 dBA for a solar facility. 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 Iron County regulation levels would occur at distances somewhat shorter than 0.5 mi (0.8 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 at 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 northwestern SEZ boundary, estimated noise levels would be about 42 dBA at the nearest residences, which is below the Iron County regulation of 50 dBA for a solar facility and comparable to the typical daytime mean rural background level of 40 dBA. In addition, an estimated 42 dBA L_{dn}[16] at these residences is well below the EPA guideline of 55 dBA L_{dn} for residential areas.

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

There are no specially designated areas within 5 mi (8 km) of the Escalante Valley SEZ, which is the farthest distance at which noise, other than extremely loud noise, would be discernable. Thus, no noise impact analysis at nearby specially designated areas was conducted.

Depending on the soil conditions, pile driving might be required for installation of solar dish engines. However, the pile drivers used would be relatively small and quiet, such as vibratory or sonic drivers, rather than the impulsive impact pile drivers frequently used at large-scale construction sites. Potential impacts on the nearest residences would be anticipated to be minor, considering the distance to the nearest residences (about 1.1 mi [1.8 km] from the northwestern 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 would cause some unavoidable but localized short-term noise impacts on neighboring communities, particularly for activities occurring near the northwestern SEZ boundary, 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 located in close proximity. Therefore, no adverse vibration impacts are anticipated from construction activities, including from pile driving for dish engines.

It is assumed that a transmission line would be constructed to connect to the nearest regional grid. A 138-kV transmission line is located about 3 mi (5 km) south of the Escalante Valley SEZ; thus construction of a transmission line over this relatively short distance would be needed if that line were used to connect to the regional grid. Also, it is likely that the 138-kV line would need to be upgraded to handle the output of a full-size solar project. Such construction could be performed over a short time period (a few months, at most). Construction sites along the transmission line ROWs would move continuously, and thus no particular area would be exposed to noise for a prolonged period. Therefore, potential impacts on nearby residences along the transmission line ROW, if any, would be minor and temporary.

13.1.15.2.2 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).

With respect to 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 a facility located near the northwestern SEZ boundary, the predicted noise level would be about 40 dBA at the nearest residences about 1.1 mi (1.8 km) from the SEZ boundary, which is lower than the Iron County regulation of 50 dBA and the same as the typical daytime mean rural background level of 40 dBA. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[17]), 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 not be exceeded outside of the proposed SEZ boundary. At the nearest residences, about 42 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 the 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 Escalante Valley 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[18] 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 the lowest. To estimate the day–night average sound 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 sound 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 1.1 mi [1.8 km] from the northwestern SEZ boundary) would be 50 dBA, which is equivalent to the Iron County regulation but is much higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 52 dBA L_{dn}, which is lower than the EPA guideline of 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours,

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[17] Maximum possible operating hours at the summer solstice, but limited to 7 to 8 hours at the winter solstice.

[18] A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

and no credit was given to other attenuation mechanisms, so it is likely that sound levels would be lower than 52 dBA L_{dn} at the nearest residences, even if TES were used at a solar facility. In consequence, operating parabolic trough or power tower facilities using TES and located near the northwestern SEZ boundary could result in adverse noise impacts at the nearest residences, depending on background noise levels and meteorological conditions. 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 Escalante Valley SEZ, on the basis of the assumption of dish engine facilities of up to 588-MW total capacity (covering 80% of the total area, or 5,291 acres [21.4 km^2]), up to 23,515 25-kW dish engines could be employed. Also, for a large dish engine facility, several hundred 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 tens of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, for example, about 49 dBA at 1.0 mi (1.6 km) and 44 dBA at 2 mi (3 km) from the boundary of the squarely shaped dish engine solar field; both of these are lower than the Iron County regulation of 50 dBA for a solar facility but higher than the typical daytime mean rural background level of 40 dBA. Noise levels would be higher than the Iron County regulation up to 0.8 mi (1.3 km) from a dish engine facility. However, the 50-dBA level would occur at a somewhat shorter distance than the aforementioned 0.8-mi (1.3-km) distance, 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 over 80% of the Escalante Valley SEZ at intervals of 98 ft (30 m). Under this assumption, the estimated noise level at the nearest residences, about 1.1 mi (1.8 km) from the SEZ boundary, would be about 45 dBA, which is lower than the Iron County regulation of 50 dBA for a solar facility but higher than the typical daytime mean rural background level of 40 dBA. On the basis of a 12-hr daytime operation, the estimated 44 dBA L_{dn} at these residences is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, depending on background noise levels and meteorological conditions, noise from dish engines could have adverse impacts on the nearest residences. Thus, 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 Escalante Valley SEZ to experience physical damage. Therefore, during operation of any solar facility potential vibration impacts on surrounding communities and vibration-sensitive structures would be minimal.

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 1.6-mi (2.6-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and 1.1 mi [1.8 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the nearest residences would be minimal.

For impacts from transmission line corona discharge noise during rainfall events (discussed in 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. Corona noise includes high-frequency components, considered to be more annoying than low-frequency environmental noise. However, corona noise would not likely cause impacts, unless a residence was located close to it (e.g., within 500 ft [152 m] of a 230-kV transmission line). The proposed Escalante Valley SEZ is located in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts on nearby residences from corona noise along transmission lines within the SEZ would be negligible.

13.1.15.2.3 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 in nature. 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 minimal.

13.1.15.3 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 northwest 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 Escalante Valley 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 eastern or southwestern area of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.

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13.1.16 Paleontological Resources

13.1.16.1 Affected Environment

The proposed Escalante Valley SEZ is covered predominantly by Quaternary aged deposits of varying types. The western half is mostly composed of Quaternary landslide deposits (classified as Ql on geological maps). The total acreage of the landslide deposits within the SEZ is 3,549 acres (14.4 km^2), or 54% of the SEZ. The eastern half is mostly composed of Quaternary alluvium (classified as Qa). The total acreage of alluvium within the SEZ is 2,447 acres (9.9 km^2), or 37% of the SEZ. Peripheral sections of the southwest portion of the SEZ are composed of Quaternary eolian deposits (classified as Qe). The total acreage of eolian deposits within the SEZ is 617 acres (2.5 km^2), or 9% of the SEZ. All these Quaternary deposits are classified as Potential Fossil Yield Classification (PFYC) Class 2 on the basis of the PFYC map from the Utah State Office (Murphey and Daitch 2007). Class 2 indicates that the potential for the occurrence of significant fossil material is low (see Section 4.14 for a discussion of the PFYC system).

13.1.16.2 Impacts

Few, if any, impacts on significant paleontological resources are likely to occur in the proposed Escalante Valley SEZ. Vertebrate paleontological resources have been found in ancient lacustrine deposits associated with Lake Bonneville, particularly in caves (Madsen 2000). Therefore, a more detailed look at the geological deposits of the SEZ is needed to determine whether a paleontological survey is warranted. If the geological deposits are determined to be as described above and remain classified as PFYC Class 2, further assessment of paleontological resources is not likely to be necessary. Important resources could exist; if identified, they would need to be managed on a case-by-case basis. Section 5.14 discusses the types of impacts that could occur on any significant paleontological resources found to be present within the Escalante Valley SEZ. Impacts will be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2.

Indirect impacts on paleontological resources, such as looting or vandalism, are not likely for a PFYC Class 2 area. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

The nearest State or U.S. Route is 15 mi (24 km) from the SEZ (State Route 56), so a new road is anticipated to be needed to access the Escalante Valley SEZ, resulting in approximately 109 acres (0.44 km^2) of disturbance to PFYC Class 2 deposits. Approximately 3 mi (5 km) of transmission line is anticipated be needed to connect to the nearest existing line, resulting in approximately 91 acres (0.37 km^2) of disturbance also in areas classified as PFYC Class 2. Few, if any, impacts on paleontological resources are anticipated in areas of PFYC Class 2 deposits related to these additional ROWs. However, similar to the SEZ footprint, important resources could exist, and if identified, they would need to be managed on a case-by-case basis. 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 were to occur.

13.1.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, as described in Appendix A, Section A.2.2. If the geological deposits are determined to be as described above and remain classified PFYC Class 2, SEZ-specific design features for mitigating impacts on paleontological resources within the proposed Escalante Valley SEZ and associated ROWs are not likely to be necessary.

13.1.17 Cultural Resources

13.1.17.1 Affected Environment

13.1.17.1.1 Prehistory

The proposed Escalante Valley SEZ is located in the Escalante Desert of southwest Utah. The earliest known occupation of southwest Utah is from the Paleoindian Era, dating from about 12,000 to 9,000 years before present (B.P.). The archaeological data suggest that Paleoindian groups were mobile hunter-gatherers moving seasonally to exploit available natural resources. Although these groups initially hunted large animals (megafauna), such as mammoth and mastodon, they adapted to hunting bison and smaller game animals and continued their reliance on wild plant foods as the megafauna became extinct. Sites dating to the Paleoindian Era are typically represented by isolated surface finds of single projectile points. Very limited amounts of Paleoindian material have been found on BLM-administered lands within the Cedar City Field Office, but much of what has been found comes from the dune areas of the Escalante Valley.

About 9,000 years ago, the Archaic Era began, as evidenced by changing subsistence patterns and associated tool production. The projectile points associated with Archaic peoples are stemmed or notched varieties rather than the large, lanceolate points of the Paleoindian Era, indicating a reliance on smaller game. Early, Middle, and Late Archaic (9,000 to 2,000 years B.P.) sites have been found in the vicinity of the Escalante Desert. Large and deeply stratified Early Archaic sites (9,000 to 5,500 B.P.) are best known from cave sites near lakes, but small, seasonal sites indicating mobile foraging strategy are common. During the Middle Archaic (5,500 to 3,500 years B.P.), use areas are similar to the Early Archaic, but site frequency increases in upland areas. Relatively few sites dating to the Late Archaic period (3,500 to 2,000 years B.P.) have been recorded; what is known, however, indicates increased use of upland areas and abandonment of lowland areas (Backer et al. 2001).

The period between A.D. 1 and 1300 is known as the Formative Era, when there was a transition toward the use of domesticated crops, such as maize, beans, and squash and widespread use of the bow and arrow (Backer et al. 2001). The Fremont culture is located in most of Utah, north of the Colorado, Escalante, and Virgin Rivers between A.D. 400 and 1300. The Fremont culture is well known for its distinctive rock art using trapezoidal figures. South of the Fremont area pueblo-style cultures (Virgin Anasazi) based on horticulture occur along the Virgin and Muddy Rivers—ceramic parallels with the Kayenta Anasazi suggest dates of A.D. 400 to 1150. By 1300 both the Fremont and Virgin Anasazi cultures disappeared and were replaced by mobile Shoshonean and Paiute groups, who practiced a more Archaic lifestyle until European contact. Reasons for this disappearance are unknown, but the popular theories are climate change, invasion by an outside group, or overuse of the environment resulting in widespread erosion and a lowering of the water table (Hauck 1977; Stegner and Kelly 2008). Several Fremont sites have been recorded northeast of the Escalante Valley SEZ in the higher elevations (Dalley 2009).

13.1.17.1.2 Ethnohistory

Late Prehistoric and Protohistoric sites date from A.D. 1100 to the early 19th century. Inhabitants of the Escalante Valley during this time would primarily include the Numic-speaking Southern Paiute. The Southern Paiute were mobile groups usually based near permanent water sources suitable for floodplain or irrigation horticulture; they moved seasonally to take advantage of a wide variety of plant and animal resources produced by variations in altitude and topography. Small bands, often no larger than a nuclear family, followed a pattern of gathering and hunting resources that were in season (Stoffle and Dobyns 1983). As part of a seasonal round, these groups came together for communal hunts or to gather pine nuts. Winter and farming villages were located near permanent water and included storage features for seeds and roots. Plant resources tended to predominate. Basketry, sickles, seed beaters, nets, and weirs were common food procurement tools along with bows and arrows, clubs, and traps (Kelly and Fowler 1986). Characteristic brownware ceramics in the archaeological record have been suggested as the best indicator of occupation by Numic groups. Other Native American groups that may have visited or passed through the area during this time are the Ute and Shoshone, also Numic speakers. The Ute were known to conduct raids on the Southern Paiute and participate in slave trading. The following text discusses each of these Native American groups.

Southern Paiute

The proposed Escalante Valley SEZ lies within the area recognized by contemporary Southern Paiutes as part of their traditional homeland (Stoffle and Dobyns 1983; Stoffle et al. 1997). The Southern Paiute appear to have moved into southern Nevada and southwestern Utah about A.D. 1150 (Euler 1964). Early ethnographies based on remnant groups that had survived a 75% reduction in population resulting from the spread of European diseases, Ute slave raids, and displacement from high-quality resource areas, reported small, struggling nomadic bands (Kelly and Fowler 1986). More recent evidence suggests that before the arrival of Euro-American colonists, the Southern Paiute may have been organized on a tribal level under the ritual leadership of High Chiefs and bound together by a network of trails used by specialist runners (Stoffle and Dobyns 1983). The Southern Paiute occupied territory that stretched from the high Colorado Plateaus west and southwest following the bend in the Colorado River through canyon country and the Basin and Range geologic province into the Mojave Desert. This territory encompassed several different shifts in vegetation and corresponding differences in subsistence practices. The proposed Escalante Valley SEZ falls within *Yanawant*, the traditional eastern subdivision of the Southern Paiute (Stoffle et al. 1997). Situated in the Escalante Desert, it is located in a little-used no-man's-land surrounded by the Cedar, Beaver, and Panguitch groups (Kelly 1934). When first described by ethnographers, these groups did not maintain any overall tribal organization; territories were self-sufficient economically; and the only known organizations were kin-based bands, often no larger than that of a nuclear family (Kelly and Fowler 1986).

The Southern Paiute practiced a mixed subsistence economy, gathering wild plant resources, hunting, and fishing. They also maintained some floodplain and irrigated agricultural fields and husbanded wild plants through transplanting, pruning, burning, and irrigation (Stoffle and Dobyns 1983). The diet of the Southern Paiute was varied, but the harsh climate of the area at times made subsistence precarious for these people. They were experts in uses of botanicals, knowledge that was maintained primarily by the women, and this knowledge of seasonal plant exploitation meant that at times the agricultural fields would have been little maintained while groups were away from their base camp gathering resources (Stoffle et al. 1999). The Southern Paiute maintained seasonal housing that corresponded to their seasonal exploitation of resources. In the summer, they lived under trees with brush bedding, using shades and windbreaks occasionally. After the fall harvest, they resided in conical or subconical shaped houses or in caves. It was not until the late nineteenth century that teepees and sweathouses were adopted from the Utes (Kelly and Fowler 1986). The Southern Paiute were a non-warlike group, and consequently they were often the target of raids by their more aggressive neighbors. Despite the Ute aggression, the Southern Paiute were on friendly terms with most of the other groups north of the Colorado River and would visit, trade, hunt, or gather in each other's territory and occasionally intermarry.

Basketry was one of the most characteristic crafts practiced by the Southern Paiute. Conical burden baskets, fan-shaped trays for winnowing and parching (drying), seed beaters, and water jugs were made from local plants. Pottery, usually unfired, was also made for daily use. The annual cycle of seasonal plant exploitation required great mobility on the part of the Southern Paiute, and consequently they often used the lighter weight baskets for carrying their belongings.

The arrival of Europeans in the New World had serious consequences for the Southern Paiute. Even before direct contact occurred, the spread of European diseases and the slave trade implemented by Utes and Navajo on horseback for the Spanish colonial markets in New Mexico, Sonora, and California resulted in significant depopulation. The Southern Paiutes retreated from areas where there was an increased presence of Euro-American travelers, such as along the Old Spanish Trail. They were further displaced by Euro-American settlers in Utah and Nevada, who sought the same limited water supplies used by the Southern Paiute. Dependency on wild plant resources likely increased during this time, as the Southern Paiute would have been forced to withdraw into more remote areas away from the intruding Euro-Americans (Kelly and Fowler 1986). As Euro-American settlements grew, the Southern Paiute were drawn into the new economy, often serving as transient wage labor. Settlements or colonies of laborers grew up around settlements, farms, and mines, often including individuals from across the Southern Paiute homeland.

In 1865, an initial attempt to settle the Southern Paiutes in northeastern Utah with their traditional enemies, the Utes, failed. The Moapa Reservation, established in eastern Nevada in 1875, was more successful. In the first decades of the twentieth century, small reservations were created in southern Utah for the Shivwits, Indian Peak, Koosharem, and Kanosh Bands, and in northern Arizona for the Kaibab. Colonies at Las Vegas and Pahrump, Nevada, along with Cedar City, Utah, each acquired a small land base. Where feasible, the Southern Paiute farmed or ranched on these reservations, but mostly they served as wage laborers, travelling great distances. The various bands retained social and ceremonial ties with one another. In 1954, the four Utah reservations were terminated by the Federal Government and their lands distributed among tribal members, resulting in the loss of much of the land. The Southern Paiute successfully filed claims with the Indian Claims Commission in the same decade. In 1980, the Paiute Indian Tribe of Utah was created from the terminated Utah bands and the Cedar City colony and restored to federal trust status (Stoffle and Dobyns 1983; Kelly and Fowler 1986).

Western Shoshone

The Western Shoshone are ethnically similar Central Numic speakers who traditionally occupied the northwestern flank of Southern Paiute territory—stretching from eastern California through central Nevada into northwestern Utah and southern Idaho. Those in western Utah in the Salt Lake and Tooele Valleys are usually termed Goshutes (Thomas et al. 1986). Moving primarily in small groups, depending on the abundance of resources available, they pursued a mobile subsistence strategy following a seasonal round gathering a wide variety of plant resources (Stoffle et al. 1990) supplemented by hunting. Pine nuts, available in the mountains of eastern Nevada and western Utah, were a storable staple. Pronghorn antelope and bighorn sheep were among the large game animals they hunted, but smaller game, including rodents, birds, and, where available, fish, provided more protein. Groups, often identified by their home territory, varied in size and composition with the seasons. The largest groups gathered for the pine nut harvest, which may have included a rabbit or antelope drive as well. Winter villages, consisting of conical structures overlaid with juniper bark, were usually close to stores of pine nuts. Those groups closest to the Utah SEZs were the Snake Valley Shoshone and the Cedar Valley Goshutes. They interacted peacefully with the Southern Paiutes, with whom they were on good terms (Thomas et al. 1986).

Their first recorded contact with Euro-Americans was the trapper Jedediah Smith in 1827. The Western Shoshone were heavily affected by the Mormon migration to the Valley of the Great Salt Lake beginning in 1847 and the onslaught of prospectors seeking gold and other mineral wealth in California and Nevada beginning in 1849. The Shoshone were occasionally hostile to miners and those traveling trails to the west, and attempts were made to negotiate treaties and set up reservations beginning in 1860 (Rusco 1992). Never actually surrendering their lands (the Western Shoshone were not willing to give up their mobile lifestyle), the Treaty of Ruby Valley, in eastern Nevada, and the Treaty of Tooele Valley, in western Utah, were signed in 1863. Reserves or “farms” were set aside for the Western Shoshone beginning in the late 1850s; however, it wasn’t until after 1900 that federal lands were set aside for Western Shoshone “colonies.” Those closest to the Utah SEZs are the Ely, Nevada, Colony and the Goshute Reservation in Ibapah, Utah (Thomas et al. 1986).

Ute

Like the Southern Paiutes, the Utes speak a dialect of Southern Numic. The two groups can understand each other’s speech, and the Beaver and Cedar groups of the Southern Paiute adopted many cultural traits from the Utes to the extent that they were considered Utes by some other Southern Paiute groups. The northeastern neighbors of the Southern Paiute, the Ute ranged from the Oquirrh Mountains in the west to the Front Range in Colorado in the east. The range of the Pahvant Band, centered on Sevier Lake and the Sevier River, overlapped with that of Southern Paiute groups (Callaway et al. 1986).

Western Ute bands, concentrated along the Wasatch Front, shared many traits with the Southern Paiutes and Western Shoshone, both in subsistence base and dwelling style. Unlike the Eastern Utes, Western Utes lived in conical winter houses and used nets in their jackrabbit drives. They were gatherers of roots, nuts, lilies, berries, and a variety of seed plants and consumed crickets, grasshoppers, and locusts as well as jackrabbits, cottontails, mountain sheep, deer, and fish. Like their Great Basin neighbors, they lived in highly mobile bands whose membership was fluid, and like their western neighbors, as long as they remained without horses they were subject to slaving raids by the Eastern Utes (Callaway et al. 1986).

Unlike their eastern counterparts, Western Utes did not encounter Euro-Americans in their homelands until the mid-1700s. As with their Southern Paiute neighbors, the Pahvant band suffered from the introduction of European diseases and the influx of Mormon settlers and prospectors. By 1870 their population was decimated. The first Ute reservation was established in 1868 in northeastern Utah. Many Utes were forced to move to the Uintah Reservation, but small groups in the west refused to leave and eventually found a home on the reservations of the Paiute Indian Tribe of Utah (Callaway et al. 1986; Simmons 2000).

13.1.17.1.3 History

The earliest documented European presence in the Escalante Desert was the Dominguez-Escalante Expedition, which began in July 1776.[19] Two Catholic priests, Fathers Francisco Atanasio Dominguez and Silvestre Velez de Escalante, were looking for a route from the Spanish capital city of Santa Fe to the Spanish settlement of Monterey on the California coast. A specific location of potential interest near the proposed SEZs in Utah is Thermo Hot Springs, where the Dominguez-Escalante group cast lots to determine whether they would continue forward or head back to Santa Fe. They were short on supplies, and it had started snowing, so they decided to return to Santa Fe. The group traveled for more than 6 months on a 2,000-mi (2,320-km) circle through the previously unexplored interior of the Great Basin. Although they did not complete their intended goal, the maps and journals describing their travels and encounters would prove very valuable to later expeditions, such as to Spanish/New Mexican traders and Anglo-American fur trappers traveling the Old Spanish Trail in the 1820s and 1830s (BLM 1976).

The Old Spanish Trail was an evolving trail system generally established in the early nineteenth century, but tended to follow established paths used by earlier explorers, like Dominguez and Escalante, and Native Americans. The trail is not a direct route due to a desire to avoid hostile Indian Tribes, as well as the Grand Canyon. Several forks and cutoffs were established as more and more travelers made use of the trail system. The 2,700-mi (4,345-km) trail network crosses through six states with various paths between Santa Fe and Los Angeles.

[19] Although it was technically illegal, traders from New Spain (New Mexico) would travel north to acquire Native American slaves for New Mexican settlers from at least the mid-1700s.

It was used primarily between 1829 and 1848 by New Mexican traders exchanging textiles for horses. The portion of the trail of interest in the Escalante Desert is the Northern Route, which passes through what today are the Utah towns of Parowan and Iron Springs. The trail cuts through the Escalante Desert and passes relatively close to the proposed Escalante Valley SEZ (NPS 2000).

With the ratification of the Treaty of Guadalupe Hidalgo in 1848, closing out the Mexican-American War, the area came under American control. In 1847, the first American settlers arrived in the Great Basin, among them Mormon immigrants under the leadership of Brigham Young, who settled in the Valley of the Great Salt Lake. They sought to bring the entire Great Basin under their control, establishing an independent State of Deseret. From its center in Salt Lake City, the church sent out colonizers to establish agricultural communities in surrounding valleys and missions to acquire natural resources such as minerals and timber. Relying on irrigation to support their farms, the Mormons often settled in the same places as the Fremont and Virgin Anasazi centuries before. The result was a scattering of planned agricultural communities from northern Arizona to southern Idaho and parts of Wyoming, Nevada, and southern California. Much of this area was included in the Utah Territory established by Congress in 1850 (Arrington 1958). Utah did not achieve statehood until 1896.

In 1851, as a result of scouting efforts by Jefferson Hunt, a senior Mormon officer of the Mormon Battalion, several Mormon settlements like Cedar City and Parowan arose in what is today known as Iron County, Utah. Iron County is aptly named for its iron ore deposits. Parowan was a halfway point between the Salt Lake Valley and southern California. Its intended purpose was as an agricultural community to support the Mormon's iron mission. It was in close proximity to Cedar City, where Mormon scouts had found a rich iron ore deposit (200 million tons of 52% iron) near many cedar trees, which were an excellent source of fuel. Committees of iron missionaries laid out the town, constructed a fort, roads, bridges, and canals, and planted crops. Unfortunately, after 10 years of hard labor trying to make the iron mission a success, the "small, volunteer, cooperative industry was simply unable to cope with the problems associated with developing a major resource" (Arrington 1958).

One of the most important events in Utah (and in U.S.) history during the nineteenth century was the completion of the transcontinental railroad at Promontory Summit, Utah, in 1869. The subsequent construction of connecting railroads through most other parts of the territory was equally significant for the development of the region. Union Pacific (UP) was the first railroad company to build in Utah and connect to the Central Pacific line at Promontory in 1869. Within 20 years, it became the largest railroad company in the territory. The movement of goods and people became relatively easy through much of the territory. More goods meant more money and more banks. The Church of Jesus Christ of the Latter-day Saints was in favor of the railroad expansion, because it allowed more of its members to travel safely to new Zion at low cost. The railroads were essential to the prosperity of the mining industry, and the mining industry was instrumental in population growth. Between 1890 and 1920, mining companies were heavily recruiting immigrant workers (European, Japanese, Mexican, and Chinese), who were migrating into the United States at that time, to satisfy their labor needs. The railroads changed not only the economy of Utah but also the settlement patterns. Stockyards, lumberyards, and distribution centers were established along the lines. Commercial corridors followed the tracks, and workers lived near where they worked. Social differences were accentuated on the basis of which side of the tracks one lived (University of Utah 2009b). UP Railroad lines pass through or near the proposed Escalante Valley SEZ. One of the station stops for the Los Angeles to Salt Lake City line was located in Lund, Utah, less than 4 mi (6.4 km) from the north boundary of the SEZ. In the early 1920s, a branch line was constructed from Lund to Cedar City to encourage travel to the nearby national parks; this branch line marks the northeast edge of the SEZ.

13.1.17.1.4 Traditional Cultural Properties

The Southern Paiute see themselves as persisting in a cultural landscape composed of many culturally significant places bound together into the land called *Puaxant Tuvip* (sacred land or power land), created by a supernatural being who established a birthright relationship between them and the land upon which they were created. Significant sites, such as the mountain *Nuvagntu* (Mount Charleston in southwestern Nevada), have meaning for all Southern Paiutes (Stoffle et al. 1997). Traditional cultural properties of significance to the Southern Paiute could be present in the valleys. Government-to-government consultation is ongoing with these Native American Tribes, so that their concerns, including any potential impacts on traditional cultural properties, can be adequately addressed (see also Section 13.1.18 on Native American concerns and Chapter 14 and Appendix K for a summary of government-to-government consultation for this PEIS). Identification of traditional cultural properties may be considered sensitive and therefore may not be fully described or disclosed in this PEIS.

To date, no traditional cultural properties have been identified within the proposed Escalante Valley SEZ, nor have concerns been raised for traditional cultural properties or sacred areas located in the vicinity of the SEZ. However, in the past the Southern Paiutes have identified mountain springs, clay and rock sources, burial sites, rock art, trails, shrines, ceremonial areas, and former habitation sites as sites of cultural importance (Stoffle and Dobyns 1983) (see also Section 13.1.18).

13.1.17.1.5 Cultural Surveys and Known Archaeological and Historic Resources

Eight linear archaeological surveys (mostly seismic lines) go through the proposed Escalante Valley SEZ, but they do not cover much area in terms of acreage (Dalley 2009). Two block sample surveys for the Intermountain Power Project were conducted on the western border of the SEZ. Five sites have been recorded as a result of these 10 surveys in the southern and western half of the SEZ; no sites have been recorded in the northern and eastern half (Dalley 2009). Of the five sites, two are minor lithic scatters that are not eligible for the *National Register of Historic Places* (NRHP); two are NRHP-eligible prehistoric sites in dune areas (one contains a base of a Paleoindian point and the other includes some ceramic sherds); and the fifth site is a lithic scatter with no diagnostic artifacts—its eligibility status is unclear from the report but is likely not eligible. Two additional sites within the SEZ are noted on the Utah Division of State History GIS database, but details regarding these sites are unknown at this time (Utah SHPO 2009). Four additional sites were recorded from these surveys in areas just outside of the SEZ boundary—two of unknown type and eligibility status, a minor ineligible lithic scatter, and a hearth and burned rock scatter with one mano and a few flakes—its eligibility status is unclear (Dalley 2009; Utah SHPO 2009).

Approximately 60 sites have been recorded within 5 mi (8 km) of the SEZ; one-third of these sites were recorded north of the SEZ in blowout areas in the dunes for a geothermal leasing project, and the others are mostly northwest of the main UP Railroad line or south of the SEZ. No historic structures were observed within the proposed SEZ.

The SEZ has the potential to contain significant cultural resources, in addition to the two previously recorded NRHP-eligible sites. Several chert flakes were found in the dune area in the southwestern portion of the SEZ during a preliminary site visit; additional artifacts are likely to be encountered in the area. Of all of the Utah SEZs, the dune areas in the Escalante Valley SEZ have the highest potential to contain sites.

The Dominguez-Escalante Trail is reported to have come very close to the SEZ, likely to the west. On the basis of preliminary maps, the Old Spanish Trail is located about 6 mi (10 km) from the southern boundary of the SEZ; the mapped location is considered approximate. The UP Railroad passes to the northwest of the SEZ with a rail stop in Lund; the branch line to Cedar City cuts through the northeast corner of the SEZ.

National Register of Historic Places

Within Iron County, 19 properties are listed in the NRHP. Most of these properties are houses or are related to town (post offices, meeting halls, schools) and industrial (railroad depots, mining sites) development. Other property types include cabins, farmsteads, and archaeological sites. A historic district is also included, located in Cedar City. None of these properties is located within or adjacent to the SEZ or within 5 mi (8 km) of the SEZ; the closest NRHP-listed property is Old Irontown, just under 20 mi (32 km) from the SEZ to the south. Two of the sites in Iron County listed on the NRHP are located on BLM-administered lands—Parowan Gap and Gold Spring Historic Site. Parowan Gap is a Fremont rock art site of importance to the Paiute Indians and is located approximately 20 mi (6 km) east of the Escalante Valley SEZ. The Gold Spring Historic Site is a mining town located west of Escalante Valley near the Nevada border.

13.1.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Escalante Valley SEZ; however, further investigation is needed at the project-specific level. A cultural resource survey of the entire area of potential effects, 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 Escalante Valley SEZ has a high potential for containing prehistoric sites in the dune area on the west side of the SEZ; it also has some potential for containing historic sites.

Section 5.15 discusses the types of impacts that could occur on any significant cultural resources found to be present within the Escalante Valley SEZ. Impacts will 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.

The Dominguez-Escalante Trail is reported to have come very close to the SEZ, likely to the west, but since there is relatively little potential for finding traces of the single pack trail itself, the potential for adverse effects on the trail is very low. The nearest well-documented site related to the Dominguez-Escalante Trail is the Thermo Hot Springs (the BLM has a Thermo Hot Springs and Casting of the Lots Wayside just outside of Lund, a few miles north of the SEZ); this site would not be affected by solar development within the SEZ. The Old Spanish Trail is located approximately 6 mi (10 km) from the southern boundary of the SEZ and would not be affected physically by solar development within the SEZ. However, the trail could be affected from a visual standpoint, although Table Butte would screen, or block, the view of the solar development from the trail in the southwestern portion of the SEZ (see Section 13.1.14.2.2). The largest potential for adverse impacts on significant cultural resources is in the dune area of the SEZ. Dunes and blowout areas tend to have higher archaeological site densities (Dalley 2009). At least two of the five prehistoric sites previously recorded in this portion of the Escalante Valley SEZ have been determined eligible for the NRHP. If solar development were to take place in this portion of the SEZ, direct impacts on these sites, as described in Section 5.15, could occur and additional resources could be found in the area.

Indirect impacts on cultural resources resulting from erosion outside of the SEZ boundary (including along ROWs) are unlikely assuming programmatic design features to reduce water runoff and sedimentation are implemented (as described in Appendix A, Section A.2.2). If indirect impacts are likely to occur on the setting of historic properties, then these should be examined and mitigated in an appropriate manner at the project-specific level.

The nearest state or U.S. route is 15 mi (24 km) from the SEZ (State Route 56), so a new road is anticipated to be needed to access the Escalante Valley SEZ, resulting in approximately 109 acres (0.44 km^2) of disturbance. The area nearest to State Route 56, the southwest corner of the SEZ, is the area of highest potential for containing archaeological sites; direct impacts on cultural resources from road construction are possible in this area. The access road could also parallel the Old Spanish Trail as it turns south along the west side of Antelope Range at a distance of less than 6 mi (10 km); no direct impacts as a result of road construction are anticipated on the trail as long as the road is located sufficiently west of the base of the Antelope Range. Approximately 3 mi (5 km) of transmission line is anticipated to be needed to connect to the nearest existing line, resulting in approximately 91 acres (0.37 km^2) of disturbance. The nearest line is also closest to the southwest portion of the SEZ but to the east, away from the dry lake and dune area, so the potential is somewhat reduced for direct impacts resulting from construction. Impacts on cultural resources are possible in areas related to these associated ROWs, because new areas of potential cultural significance could be directly affected by construction or opened to increased access due to road and transmission ROW construction and use. Indirect impacts are also possible from unauthorized surface collection depending on the proximity of the ROW to potential archaeological sites. 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 were to occur. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur with the ROWs, as with the SEZ footprint.

13.1.17.3 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, are provided in Appendix A, Section A.2.2.

SEZ-specific design features would be determined in consultation with the Utah SHPO and affected Tribes. Consultation efforts should include discussions on significant archaeological sites and traditional cultural properties and on sacred sites and trails.

One design feature that can be identified at this time is the following:

- Avoidance of significant resources clustered in specific areas, such as those in the vicinity of the dunes, is recommended.

13.1.18 Native American Concerns

Native Americans 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. Specifically for the proposed Escalante Valley SEZ, Section 13.1.17 discusses archaeological sites, structures, landscapes, and traditional cultural properties; Section 13.1.8 discusses mineral resources; Section 13.1.9.1.3 discusses water rights and water use; Section 13.1.10 discusses plant species; Section 13.1.11 discusses wildlife species, including wildlife migration patterns; Section 13.1.13 discusses air quality; Section 13.1.14 discusses visual resources; Sections 13.1.19 and 13.1.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21. This section focuses on concerns that are specific to Native Americans and to which Native Americans bring a distinct perspective.

13.1.18.1 Affected Environment

The three Utah SEZs are clustered in the valleys and deserts of west-central Utah. They fall within a Tribal traditional use area generally attributed to the Southern Paiute, most of which has been so recognized by the courts (Royster 2008), but are close to the traditional ranges of the Western Shoshone and the Utes with whom the Southern Paiute interacted. It is likely that members of all three Tribes were present from time to time in this area. All federally recognized Tribes with Southern Paiute roots or possible associations with the Utah SEZs have been contacted and provided an opportunity to comment or consult regarding this PEIS. They are listed in Table 13.1.18.1-1. A listing of all federally recognized Tribes contacted for this PEIS is found in Appendix K.

13.1.18.1.1 Territorial Boundaries

Southern Paiutes

The traditional territory of the Southern Paiute stretches from close to the Mojave River in California to Moencopi Wash in Arizona, and from the Colorado River as far north as Sevier Lake in Utah. It generally follows the right bank of the Colorado, including its tributary streams and canyons in southern Nevada and Utah. The Southern Paiutes refer to this as *Puaxant Tuvip*, sacred land or power land. According to Southern Paiute tradition, this is the land where they were created and which they have a divine birthright to manage and protect. In the past, the Southern Paiutes have occupied all of *Puaxant Tuvip*. While Southern Paiute groups tend to be more concerned with lands close to where they now live, some places, such as *Nuvangantu* (Mount Charleston, Nevada) are clearly recognized as important for all. In their view, all the Southern Paiutes have a right to understand the impacts of any project being undertaken within *Puaxant Tuvip*, and to participate in identifying, evaluating, and making recommendations about potential impacts (Stoffle et al. 1997; Stoffle and Dobyns 1983).

TABLE 13.1.18.1-1 Federally Recognized Tribes with Traditional Ties to the Utah SEZs

Tribe	Location	State
Chemehuevi Indian Tribe	Havasu Lake	California
Colorado River Indian Tribes	Parker	Arizona
Confederated Tribes of the Goshute Reservation	Ibapah	Utah
Ely Shoshone Tribe	Ely	Nevada
Hopi Tribe	Kykotsmovi	Arizona
Kaibab Paiute Tribe	Fredonia	Arizona
Las Vegas Paiute Tribe	Las Vegas	Nevada
Moapa Band of Paiutes	Moapa	Nevada
Pahrump Paiute Tribe	Pahrump	Nevada
Paiute Indian Tribe of Utah	Cedar City	Utah
Cedar Band	Cedar City	Utah
Indian Peak Band	Cedar City	Utah
Kanosh Band	Kanosh	Utah
Koosharem Band	Cedar City	Utah
Shivwits Band	Ivins	Utah
San Juan Southern Paiute Tribe	Tuba City	Arizona
Skull Valley Band of Goshute Indians	Grantsville	Utah
Ute Indian Tribe	Fort Duchesne	Utah
Ute Mountain Ute Tribe	Towaoc	Colorado

The three Utah SEZs are located in the northern part of Southern Paiute territory, in an area assigned by ethnographers to groups, or economic clusters, they designated Cedar and Beaver (Kelly 1934). Unlike most other Southern Paiute groups, these bands were not tied to a tributary of the Colorado River but were more closely linked to the internal drainage of the Sevier River. Stable dwelling sites were located along the river. The flat, largely waterless, valley bottoms where the SEZs are located would have seen more transitory use, mostly as a route of travel between resources clustered in the mountains (Kelly and Fowler 1986).

On the edge of *Puaxant Tuvip,* they acquired many attributes of their northern neighbors, the Utes, and were on friendly terms with the Western Shoshone. From a traditional Southern Paiute perspective, these groups were part of the eastern subtribe or *Yanawant* (Stoffle et al. 1997). Their descendants are found mainly in the Indian Peak and Cedar Bands of the Paiute Indian Tribe of Utah, and the Moapa Reservation in Nevada (Stoffle and Dobyns 1983). A summary of the history of the Southern Paiute is found in Section 13.1.17.1.2.

Western Shoshone

The Western Shoshone, although mainly ranging to the northwest of the SEZs, as friends of the Southern Paiute are likely to have been familiar with border regions and may have been present in the SEZs. Their traditional subsistence base was similar, although for the most part lacking in horticulture (Callaway et al. 1986). They share many concerns with the Southern

Paiute. All federally recognized Western Shoshone Tribes, including the Goshutes, have been contacted. Those with the closest ties to the Utah SEZs are the Ely Shoshone Tribe, the Confederated Tribes of the Goshute Reservation, and the Skull Valley Goshute Tribe.

Ute

The home territory of the Pahvant Band of the western Utes was located in the Sevier River drainage and around Sevier Lake. Their territory overlapped that of the Beaver Southern Paiute group, with whom they shared a language and many other cultural traits. Pahvant Ute descendants are to be found on the Ute Reservation at Fort Duchesne, Utah, and scattered among the reservations of the Paiute Indian Tribe of Utah (Thomas et al. 1986; Simmons 2000).

The proposed Escalante Valley SEZ yielded more evidence of Native American use than the other two Utah SEZs (see Section 13.1.17.1.5). This suggests that in the past it was the source of plant, animal, or mineral resources important to Native Americans and that those resources are likely to still exist there.

13.1.18.1.2 Plant Resources

The vegetation present at the proposed Escalante Valley SEZ is described in Section 13.1.10. The cover types present in the SEZ are from the Inter-Mountain Basins series. They are mostly Mixed Salt Desert and Active and Stabilized Dune. There are smaller areas of Greasewood Flat and Big Sagebrush. Greasewood and sagebrush are dominant species. Native Americans made use of these plants for medicinal purposes, and greasewood seeds were harvested for food. As shown in Table 13.1.18.1-2, very few of the many other plant species traditionally used by Native Americans for food (Stoffle et al. 1999; Stoffle and Dobyns 1983) are likely to be present in the SEZ.

13.1.18.1.3 Other Resources

Wildlife likely to be found in the proposed Escalante Valley SEZ is described in Section 13.1.11. Because of the general aridity of the SEZ, few game species traditionally important to Native Americans are found within the SEZ, although archaeological resources found in the dune areas suggest that some species were exploited there in the past. The most important are the black-tailed jackrabbit (*Lepus californicus*) and the pronghorn antelope (*Antilocapra Americana*) (Stoffle and Dobyns 1983; Kelly and Fowler 1986). Of the large game species, mule deer (*Odocoileus hemionus*) occur in the surrounding mountains but are less common on the desert floor. Smaller game important to Native Americans found in the SEZ include cottontails (*Sylvilagus audubonii*), chipmunks (*Neotamias minimus*), and wood rats (*Neotoma lepida*).

Other animals traditionally important to the Southern Paiute include lizards, seven species of which are likely to occur in the SEZ, and the golden eagle (*Aquila chrysaetos*).

TABLE 13.1.18.1-2 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Escalante Valley SEZ

Common Name	Scientific Name	Status
Food		
Chokecherry	*Prunus virginiana*	Possible
Dropseed	*Sporobolus* spp.	Possible
Greasewood	*Sarcobatus vermiculatus*	Observed
Indian ricegrass	*Achnatherum hymenoides*	Possible
Juniper	*Juniperus* sp.	Possible
Muhly	*Muhlenbergis* sp.	Possible
Saltbush	*Atriplex* spp.	Possible
Saltgrass	*Distichlis spicata*	Possible
Wolfberry	*Lycium andersonii*	Possible
Medicine		
Greasewood	*Sarcobatus vermiculatus*	Observed
Mormon tea	*Ephedra nevadensis*	Possible
Sagebrush	*Artemisia* spp.	Observed
Rabbitbrush	*Ericameria nauseosa*	Possible

Sources: Field visit and USGS (2005a).

The SEZ falls within the range of the wide-ranging eagle. Animal species important to Native Americans that are likely to be present in the proposed SEZ are listed in Table 13.1.18.2-1.

Other natural resources traditionally important to the Southern Paiute include clay for pottery, salt, and naturally occurring mineral pigments for the decoration and protection of the skin (Stoffle and Dobyns 1983). There are some clay deposits in the playa soils along the southwestern edge of the SEZ (see Section 13.1.7).

13.1.18.2 Impacts

In the past, Southern Paiutes and the Western Shoshone have expressed concern over project impacts on a variety of resources. They tend to take a holistic view of their traditional homeland. For them, both cultural and natural features are inextricably bound together. Effects on one part have ripple effects on the whole. Western distinctions between the sacred and the secular have no meaning in their traditional worldview (Stoffle and Dobyns 1983). While no comments specific to the proposed Escalante Valley SEZ have been received from Native American Tribes to date, the Paiute Indian Tribe of Utah and the Skull Valley Band of Goshute Indians have asked to be kept informed of project developments. During energy development projects in adjacent areas, the Southern Paiute have expressed concern over adverse effects on a wide range or resources. Geophysical features and physical cultural remains are listed in Section 13.1.17.1.4. However, these places are often seen as important because they are the

TABLE 13.1.18.2-1 Animal Species Used by Native Americans as Food Whose Range Includes the Proposed Escalante Valley SEZ

Common Name	Scientific Name	Status
Mammals		
Black-tailed jackrabbit	*Lepus californicus*.	All year
Chipmunks	Various species	All year
Coyote	*Canis latrans*	All year
Desert cottontail	*Sylvilagus audubonii*	All year
Desert woodrat	*Neotoma lepida*	All year
Great Basin pocket mouse	*Perognathus parvus*	All year
Kangaroo rat	*Dipodomys ordii*	All year
Kit fox	*Vulpes macotis*	All year
Mule deer	*Odocoileus hemionus*	All year
Mountain cottontail	*Sylvilagus nuttallii*	All year
Mountain lion	*Puma concolor*	All year
Pocket gophers	*Thomomys* spp.	All year
Pronghorn	*Antilocarpa americana*	All year
Porcupine	*Erethizon dorsatum*	All year
White-tailed antelope squirrel	*Ammospermophilus leucurus*	All year
Birds		
Burrowing owl	*Athene cunicularia*	Summer
Common raven	*Corvus corax*	All year
Ferruginous hawk	*Buteo regalis*	Winter
Golden eagle	*Aquila chrysaetos*	All year
Great horned owl	*Bubo virginianus*	All year
Greater roadrunner	*Geococcyx californianus*	All year
Horned lark	*Eremophila alpestris*	All year
Mourning dove	*Zenaida macroura*	All year
Northern mockingbird	*Mimus polyglottos*	All year
Piñon jay	*Gymnorhinus cyanocephalus*	All year
Prairie falcon	*Falco mexicanus*	All year
Red-tailed hawk	*Buteo jamaicensis*	All year
Rough-legged hawk	*Buteo lagopus*	Winter
Sage grouse	*Centrocercus urophasians*	All year
Western meadow lark	*Sturnella neglecta*	All year
Reptiles		
Horned lizard	*Phrynosoma platyrhinos*	All year
Large lizards	Various species	All year
Western rattlesnake	*Crotalis viridis*	All year

Sources: USGS (2005b); Fowler (1986).

location of or have ready access to a range of plant, animal, and mineral resources (Stoffle et al. 1997). Resources mentioned as important include food plants; medicinal plants; plants used in basketry; plants used in construction; large game animals; small game animals; birds; and sources of clay, salt, and pigments (Stoffle and Dobyns 1983). Those likely to be found within the proposed Escalante Valley SEZ are discussed in Section 3.1.18.1.2. Traditional plant knowledge is found most abundantly in Tribal elders, especially female elders (Stoffle et al. 1999).

The Escalante Desert appears to have been a no-man's-land, for the most part rarely used by the surrounding Native American groups. While it includes some plant species traditionally important to Native Americans, they appear to be relatively scant. The most important traditionally collected resource is likely to be the black-tailed jackrabbit. Development of utility-scale solar energy facilities in the proposed SEZ would result in the loss of some plants traditionally important to Native Americans and some habitat for traditionally important animal species. As discussed in Section 13.1.10, the impact on plant resources is expected to be small to moderate. For the most part, the vegetation communities that would be impacted are widely distributed. As discussed in Section 13.1.11, the impact of the loss of animal habitat is expected to be small since it is likewise widely distributed outside the SEZ.

As consultation with the Tribes continues and project-specific analyses are undertaken, it is possible that Native American concerns will be expressed over potential visual, acoustic, and other effects of solar energy development within the SEZ on specific resources and any culturally important landscape.

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.

13.1.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to address 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 13.1.18.1-1.

Mitigation of impacts on archaeological sites and traditional cultural properties is discussed in Section 13.1.17.3, in addition to design features for historic properties discussed in Section A.2.2 in Appendix A.

13.1.19 Socioeconomics

13.1.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the proposed Escalante Valley SEZ. The ROI is a two-county area consisting of Iron County and Washington County in Utah. 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 the proposed SEZ facility is expected to take place.

13.1.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 79,939 (Table 13.1.19.1-1). Over the period 1999 to 2008, the annual average employment growth rate was slightly higher in Washington County (4.8%) than in Iron County (3.4%). At 4.4%, growth rates in the ROI as a whole were higher than the average rate for Utah (2.1%).

In 2006, the service sector provided the highest percentage (34.2%) of employment in the ROI, followed by the wholesale and retail trade at 23.2% (Table 13.1.19.1-2). Smaller employment shares were held by transportation and public utilities. Within the ROI, the distribution of employment across sectors varied compared with the ROI as a whole, with a higher percentage of employment in transportation and public utilities in Washington County (20.6%), and a higher percentage in agriculture (7.0%), construction (13.8%), and manufacturing (13.1%) in Iron County.

TABLE 13.1.19.1-1 Employment in the ROI Surrounding the Proposed Escalante Valley SEZ

SEZ and Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Iron County	14,571	20,300	3.4
Washington County	37,351	59,639	4.8
ROI	51,922	79,939	4.4
Utah	1,080,441	1,336,556	2.1

Sources: U.S. Department of Labor (2009a,b).

TABLE 13.1.19.1-2 Employment, by Sector, in 2006,[a] in the ROI Surrounding the Proposed Escalante Valley SEZ

	Iron County		Washington County		ROI	
Industry	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	934	7.0	381	0.9	1,315	2.3
Mining	10	0.1	60	0.1	70	0.1
Construction	1,829	13.8	3,202	7.2	5,031	8.7
Manufacturing	1,732	13.1	1,344	3.0	3,076	5.3
Transportation and public utilities	363	2.7	9,146	20.6	9,509	16.5
Wholesale and retail trade	2,650	20.0	10,720	24.1	13,370	23.2
Finance, insurance, and real estate	646	4.9	3,678	8.3	4,324	7.5
Services	5,068	38.2	14,689	33.0	19,757	34.2
Other	10	0.1	10	0.0	20	0.0
Total	13,250		44,495		57,745	

[a] Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009a).

13.1.19.1.2 ROI Unemployment

Unemployment rates have been similar in both counties in the ROI. Over the period 1999 to 2008, the average rate in both Iron County and Washington County was 4.1%, the same as the rate for Utah as a whole (Table 13.1.19.1-3). Unemployment rates for the first five months of 2009 contrast somewhat with rates for 2008 as a whole; in Washington County, the unemployment rate increased to 7.1%, while rates reached 6.4% in Iron County. The average rates for the ROI (6.9%) and Utah (5.2%) were also higher during this period than the corresponding average rates for 2008.

13.1.19.1.3 ROI Urban Population

The population of the ROI in 2006 to 2008 was 92% urban, with a group of cities and towns centered around St. George, in the south-central portion of Washington County and centered on Cedar City, in the southwestern part of Iron County.

The largest urban area in Washington County, St. George, had an estimated 2008 population of 71,702; other cities in the county include Washington (17,452), Hurricane (13,149), Ivins (7,729), Santa Clara (6,767), and La Verkin (4,448) (Table 13.1.19.1-4). In addition, there are nine other cities and towns in the county with a 2008 population ranging from 192 to 1,952 persons. Most of these urban areas are about 50 mi (80 km) from the site of the proposed SEZ. Population growth rates among these urban areas have varied over the period

TABLE 13.1.19.1-3 Unemployment Rate (%) in the ROI Surrounding the Proposed Escalante Valley SEZ

Location	1999–2008 (average)	2008	2009[a]
Iron County	4.1	4.2	6.4
Washington County	4.1	4.6	7.1
ROI	4.1	4.5	6.9
Utah	4.1	3.4	5.2

[a] Rates for 2009 are the average for January through May.

Sources: U.S. Department of Labor (2009a–c).

2000 to 2008. Washington grew at an annual rate of 9.9% during this period, with higher-than-average growth also experienced in Ivins (7.1%), Hurricane (6.0%), and Toquerville (5.1%). Rockville (0.7%), Apple Valley (0.6%), Hilldale (0.4%), and New Harmony (0.1%) all experienced lower growth rates between 2000 and 2008.

In Iron County, in addition to Cedar City (28,439), there are two cities, Enoch (5,076) and Parowan (2,606), with a 2008 population of more than 2,000 people. Population growth between 2000 and 2008 has been relatively high in Enoch (4.9%), with annual growth rates of 4.2% in Cedar City and less than 1% elsewhere in the county.

13.1.19.1.4 ROI Urban Income

Median household incomes varied considerably across cities and towns in the ROI. One city in Washington County, Santa Clara ($67,942), had median incomes in 1999 that were higher than the average for the state ($58,873), while median incomes were below the state average elsewhere in the ROI (Table 13.1.19.1-4). The cities of Hurricane ($42,314), Hilldale ($42,010), Parowan ($41,749), and Cedar City ($41,719) had relatively low median incomes in 1999.

Data on median household incomes for the period 2006 to 2008 were available for only two cities in the ROI. The median income growth rate for the period 1999 and 2006 to 2008 for St. George was 0.1%, while median incomes in Cedar City declined slightly (–0.1%). The average median household income growth rate for the state as a whole over this period was –0.5%.

TABLE 13.1.19.1-4 ROI Urban Population and Income for the Proposed Escalante Valley SEZ

City	Population			Median Household Income ($ 2008)		
	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
St. George	49,663	71,702	4.7	47,001	47,308	0.1
Cedar City	20,527	28,439	4.2	41,719	41,318	–0.1
Washington	8,816	17,452	9.9	45,502	NA[b]	NA
Hurricane	8,250	13,149	6.0	42,314	NA	NA
Ivins	4,450	7,729	7.1	53,171	NA	NA
Santa Clara	4,630	6,767	4.9	67,942	NA	NA
Enoch	3,467	5,076	4.9	48,112	NA	NA
La Verkin	3,392	4,448	3.4	46,285	NA	NA
Parowan	2,565	2,606	0.2	41,749	NA	NA
Hilldale	1,895	1,952	0.4	42,010	NA	NA
Enterprise	1,285	1,617	2.9	45,957	NA	NA
Toquerville	910	1,351	5.1	43,824	NA	NA
Leeds	547	756	4.1	53,110	NA	NA
Springdale	457	573	2.9	53,570	NA	NA
Virgin	394	551	4.3	47,578	NA	NA
Paragonah	470	477	0.2	43,721	NA	NA
Apple Valley	440	460	0.6	NA	NA	NA
Kannaraville	311	314	0.1	44,258	NA	NA
Rockville	247	261	0.7	48,819	NA	NA
New Harmony	190	192	0.1	44,526	NA	NA
Brian Head	118	126	0.8	56,732	NA	NA

[a] Data are averages for the period 2006 to 2008.

[b] NA = data not available.

Source: U.S. Bureau of the Census (2009b-d).

13.1.19.1.5 ROI Population

Table 13.1.19.1-5 presents recent and projected populations in the ROI surrounding the proposed SEZ and for the state as a whole for the period 2000 to 2008. Population in the ROI stood at 179,872 in 2008, having grown at an average annual rate of 4.7% since 2000. The growth rate for the ROI was higher than the rate for Utah (2.5%) over the same period.

Each county in the ROI has experienced growth in population since 2000. Washington County recorded a population growth rate of 5.2% between 2000 and 2008, while Iron County grew by 3.4% over the same period. The ROI population is expected to increase to 328,894 by 2021 and to 351,677 by 2023.

TABLE 13.1.19.1-5 Population in the ROI Surrounding the Proposed Escalante Valley SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Iron County	33,779	44,194	3.4	66,796	69,173
Washington County	90,354	135,678	5.2	262,099	282,504
ROI	124,133	179,872	4.7	328,894	351,677
Utah	2,233,169	2,727,343	2.5	3,546,228	3,666,248

Sources: U.S. Bureau of the Census (2009e,f); Governor's Office of Planning and Budget (2009).

13.1.19.1.6 ROI Income

Personal income in the ROI stood at $4.3 billion in 2007 and has grown at an annual average rate of 4.7% over the period 1998 to 2007 (Table 13.1.19.1-6). ROI personal income per capita increased slightly over the same period, at a rate of 0.5%, from $23,081 to $24,290. Per capita incomes were slightly higher in Washington County ($25,064) in 2007 than in Iron County ($21,922). Personal income growth rates were higher in Washington County (5.1%), and lower in Iron County (3.5%), than for the state as a whole (2.9%). Personal income per capita was higher in Utah ($30,927) in 2007 than in the ROI as a whole.

Median household income in the ROI in 2006 to 2008 varied between $42,687 in Iron County and $49,747 in Washington County (U.S. Bureau of the Census 2009d).

13.1.19.1.7 ROI Housing

In 2007, nearly 70,000 housing units were located in the two counties, with almost 75% of these located in Washington County (Table 13.1.19.1-7). Owner-occupied units compose approximately 74% of the occupied units in the two counties, with rental housing making up 26% of the total. Vacancy rates in 2007 were higher in Iron County (23.46%) than in Washington County (17.1%). With an overall vacancy rate of 18.7% in the ROI, there were 9,530 vacant housing units in the ROI in 2007, of which 4,075 (2,540 in Washington County, and 1,643 in Iron County) are estimated to be rental units that would be available to construction workers. There were 6,348 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 4.9% over the period 2000 to 2007, with 19,888 new units added to the existing housing stock in the ROI (Table 13.1.19.1-7).

TABLE 13.1.19.1-6 Personal Income in the ROI Surrounding the Proposed Escalante Valley SEZ

Location	1998	2007	Annual Average Growth Rate, 1998–2007 (%)
Iron County			
Total income[a]	0.7	0.9	3.5
Per-capita income	21,352	21,922	0.3
Washington County			
Total income[a]	2.0	3.3	5.1
Per-capita income	23,726	25,064	0.6
ROI			
Total income[a]	2.7	4.3	4.7
Per-capita income	23,081	24,290	0.5
Utah			
Total income[a]	61.9	82.4	2.9
Per-capita income	28,567	30,927	0.8

[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).

The median value of owner-occupied housing in the ROI in 2006 to 2008 varied between $217,700 in Iron County and $250,800 in Washington County (U.S. Bureau of the Census 2009g).

13.1.19.1.8 ROI Local Government Organizations

Table 13.1.19.1-8 lists the various local and county government organizations in the ROI. In addition, there is one Tribal government located in the ROI, with members of other Tribal groups located in the ROI, but whose Tribal governments are located in adjacent states.

13.1.19.1.9 ROI Community and Social Services

This section describes educational, health-care, law enforcement, and firefighting resources in the ROI for the proposed Escalante Valley SEZ.

TABLE 13.1.19.1-7 Housing Characteristics in the ROI Surrounding the Proposed Escalante Valley SEZ

Parameter	2000	2007[a]
Iron County		
Owner-occupied	7,040	8,387
Rental	3,587	5,387
Vacant units	2,991	4,202
Seasonal and recreational use	1,986	NA[a]
Total units	13,618	17,976
Washington County		
Owner-occupied	22,128	30,795
Rental	7,811	12,326
Vacant units	6,539	8,887
Seasonal and recreational use	4,362	NA
Total units	36,478	52,008
ROI		
Owner-occupied	29,168	39,182
Rental	11,398	17,713
Vacant units	9,530	13,089
Seasonal and recreational use	6,348	NA
Total units	50,096	69,984

[a] NA = data not available.

Sources: U.S. Bureau of the Census (2009h-j).

Schools

In 2007, there were a total of 64 public and private elementary, middle, and high schools in the three-county ROI (NCES 2009). Table 13.1.19.1-9 provides summary statistics for enrollment, 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 Washington County schools (22.1) is slightly higher than that for schools in Iron County (21.2), while the level of service is slightly higher in Iron County (9.3).

Health Care

With a much larger number of physicians (277), the number of doctors per 1,000 population in Washington County (2.1) is also higher than in Iron County (1.3) (Table 13.1.19.1-10). The smaller number of health-care professionals in Iron County may mean that residents of these counties have poorer access to specialized health care; a substantial number of county residents might also travel to Washington County for their medical care.

TABLE 13.1.19.1-8 ROI Local Government Organizations and Social Institutions in the Proposed Escalante Valley SEZ

Governments	
City	
Brian Head	Paragonah
Cedar City	Parowan
Enoch	Rockville
Enterprise	Santa Clara
Hilldale	Springdale
Hurricane	St. George
Ivins	Toquerville
La Verkin	Virgin
Leeds	Washington
County	
Iron County	Washington County
Tribal	
Paiute Indian Tribe of Utah	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

TABLE 13.1.19.1-9 School District Data in 2007 for the ROI Surrounding the Proposed Escalante Valley SEZ

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Iron County	8,522	402	21.2	9.3
Washington County	24,357	1,103	22.1	8.3
ROI	32,879	1,505	21.9	8.6

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI. Iron County has 31 officers and would provide law enforcement services to the SEZ (Table 13.1.19.1-11), while Washington County has 45 officers. There are currently 8 professional firefighters in Iron County, and 10 in Washington County (Table 13.1.19.1-11). Levels of service in police protection are similar in both Iron County and Washington County.

TABLE 13.1.19.1-10 Physicians in 2007 in the ROI Surrounding the Proposed Escalante Valley SEZ

Location	Number of Primary Care Physicians	Level of Service[a]
Iron County	55	1.3
Washington County	277	2.1
ROI	332	1.9

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

TABLE 13.1.19.1-11 Public Safety Employment in the ROI Surrounding the Proposed Escalante Valley SEZ

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service[b]
Iron County	31	0.7	8	0.2
Washington County	45	0.3	10	0.1
ROI	76	0.4	18	0.1

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: Fire Departments Network (2009); U.S. Department of Justice (2008).

13.1.19.1.10 ROI Social Structure and Social Change

Community social structures and other forms of social organization within the ROI are related to various factors, including historical development, major economic activities and sources of employment, income levels, race and ethnicity, and forms of local political organization. Although an analysis of the character of community social structures is beyond the scope of the current programmatic analysis, project-level NEPA analyses would include a description of ROI social structures, contributing factors, their uniqueness, and consequently, the susceptibility of local communities to various forms of social disruption and 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,

TABLE 13.1.19.1-12 County and ROI Crime Rates for the Proposed Escalante Valley SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
Iron County	56	1.2	1,085	23.7	1,141	24.9
Washington County	270	1.8	3,197	21.6	3,467	23.4
ROI	326	1.7	4,282	22.1	4,608	23.8

[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).

TABLE 13.1.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Escalante Valley SEZ ROI[a]

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health[b]	Divorce[c]
Utah Southwest Region (includes Iron County and Washington County)	5.6	2.5	11.3	–[d]
Utah				4.3

[a] Data for alcoholism and drug use represent 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 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 2007.

[d] A dash indicates not applicable.

Sources: SAMHSA (2009); CDC (2009).

social conflict, divorce, and delinquency would increase and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Data on violent crime and property crime rates and on alcoholism and illicit drug use, mental health, and divorce, which might be used as indicators of social change, are presented in Tables 13.1.19.1-12 and 13.1.19.1-13, respectively.

There is some variation in the level of crime across the ROI, with slightly higher rates of violent crime in Washington County (1.8 per 1,000 population) than in Iron County (1.2), and slightly higher rates of property crime in Iron County (23.7) than in Washington County (21.6) (Table 13.1.19.1-12). The overall crime rate in the ROI was 23.8 offenses per 1,000 population.

Other measures of social change—alcoholism, illicit drug use, and mental health—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 ROI is located (Table 13.1.19.1-13).

13.1.19.1.11 ROI Recreation

There are various areas in the vicinity of the proposed SEZ that are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These activities are discussed in Section 13.1.5.

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 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, with some activity occurring 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, 9,219 people were employed in the ROI in the various sectors identified as recreation, constituting 11.3% of total ROI employment (Table 13.1.19.1-14). Recreation spending also produced almost $163.3 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

13.1.19.2 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.

TABLE 13.1.19.1-14 Recreation Sector Activity in the Proposed Escalante Valley SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	565	11.3
Automotive rental	66	1.8
Eating and drinking places	6,318	99.9
Hotels and lodging places	1,340	31.0
Museums and historic sites	30	0.9
Recreational vehicle parks and campsites	87	1.3
Scenic tours	118	5.2
Sporting goods retailers	695	11.9
Total ROI	9,219	163.3

Source: MIG, Inc. (2010).

13.1.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed 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 circulate 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, which would affect population, rental housing, health service employment, and public safety employment. Socioeconomic impacts common to all utility-scale solar energy developments are discussed in detail in Section 5.17.1. These impacts will be minimized through the implementation of programmatic design features described in 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 development 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 developments 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, with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency, and 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 0.4% in county population during construction of the trough technology, with smaller increases for the power tower, dish engine, and PV technologies, and during the operation of each technology. While it is possible that some construction and operations workers will choose to locate in communities closer to the SEZ, the lack of available housing in smaller rural communities in the ROI to accommodate all in-migrating workers and families, and the insufficient range of housing choices to suit all solar occupations, make it likely that many workers will commute to the SEZ from larger communities elsewhere in the ROI, thus reducing the potential impact of solar development 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 development 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 138 jobs and $0.6 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed Escalante Valley SEZ could result in a decline in the amount of land available for livestock grazing, resulting in total (direct plus indirect) impacts of the loss of three jobs 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 $147 annually on land dedicated to solar development in the SEZ.

Transmission Line Impacts

The impacts of transmission line construction could include the addition of 15 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 13.1.19.2-1). Construction activities in the peak year would constitute less than 1% of total ROI employment. A transmission line would also produce $0.6 million in ROI income. Direct sales taxes and direct income taxes would be less than $0.1 million in the peak year.

Given the likelihood of local worker availability in the required occupational categories, construction of a transmission line would mean that some in-migration of workers and their families from outside the ROI would be required, with 11 persons in-migrating into the Escalante

TABLE 13.1.19.2-1 ROI Socioeconomic Impacts of a 230-kV Transmission Line at the Proposed Escalante Valley SEZ[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	6	<1
Total	15	<1
Income[b]		
Total	0.6	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	11	0
Vacant housing[c] (no.)	6	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 new transmission line for the Escalante Valley 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.

Valley ROI during the peak construction year. 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 six rental units expected to be occupied in the Escalante Valley ROI. This occupancy rate would represent less than 1% of the vacant rental units expected to be available in the ROI in the peak year.

No new community service employment would be required in order to meet existing levels of service in the three ROIs.

Total operations employment impacts in the ROI (including direct and indirect impacts) of a transmission line would be less than one job during the first year of operation (Table 13.1.19.2-1) and would 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.

Operation of a transmission line 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.

Access Road Impacts

The impacts of construction of an access road connecting the Escalante Valley SEZ could include the addition of 346 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 13.1.19.2-2). Construction activities in the peak year would constitute less than 1% of total ROI employment. Access road construction would also produce $10.0 million in ROI income. Direct income taxes and direct sales taxes would be $0.3 million and $0.2 million, respectively, in the peak year.

Given the likelihood of local worker availability in the required occupational categories, construction of an access road would mean that some in-migration of workers and their families from outside the ROI would be required, with 138 persons in-migrating into the Escalante Valley ROI during the peak construction year. 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 access road construction on the number of vacant rental housing units is not expected to be large, with 69 rental units expected to be occupied in the Escalante Valley ROI. This occupancy rate would represent less than 1% of the vacant rental units expected to be available in the ROI in the peak year.

In addition to the potential impact on housing markets, in-migration would 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,

TABLE 13.1.19.2-2 ROI Socioeconomic Impacts of an Access Road Connecting to the Proposed Escalante Valley SEZ[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	177	<1
Total	346	<1
Income[b]		
Total	10.0	<0.1
Direct state taxes[b]		
Sales	0.3	<0.1
Income	0.2	<0.1
In-migrants (no.)	138	0
Vacant housing[c] (no.)	69	0
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts assume 15 mi (24 km) of new access road for the Escalante Valley 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.

one new teacher would be required in the ROI. The increase would represent less than 0.1% of total ROI employment expected in this occupation.

Total operations (maintenance) employment impacts in the ROI (including direct and indirect impacts) of an access road would be less than one job during the first year of operation (Table 13.1.19.2-1) and would produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million in the first year, and direct income taxes, less than $0.1 million.

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.

13.1.19.2.2 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 are provided 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, with one solar project assumed to be constructed within a given year, and assumed to disturb up to 3,000 acres (12 km^2) of land. To capture a range of possible impacts, solar facility size was assessed according to the 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. For operations impacts, a representative first year of operations was assumed to be 2023 for trough and power tower and 2022 for the minimum facility size for dish engine and PV, and 2023 was assumed 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 3,518 jobs (Table 13.1.19.2-3). Construction activities would constitute 2.4% of total ROI employment. A solar facility would also produce $177.6 million in income. Direct sales taxes would be $3.5 million, and direct income taxes $6.1 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 1,325 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 would not be expected to be large, with 663 rental units expected to be occupied in the ROI. This occupancy rate would represent 9.2% of the vacant rental units expected to be available in the ROI.

TABLE 13.1.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Escalante Valley SEZ with Trough Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,682	232
Total	3,518	380
Income[b]		
Total	177.6	11.6
Direct state taxes[b]		
Sales	3.5	0.1
Income	6.1	0.4
BLM payments ($ million 2008)		
Rental	NA[c]	0.4
Capacity[d]	NA	7.0
In-migrants (no.)	1,325	76
Vacant housing[e] (no.)	663	68
Local community service employment		
Teachers (no.)	11	1
Physicians (no.)	3	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 600 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 1,058 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c NA = not applicable.

d 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 2010b), 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.

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 employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 11 new teachers, 3 physicians, and 1 public safety employee (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 0.4% 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 380 jobs (Table 13.1.19.2-3). Such a solar facility would also produce $11.6 million in income. Direct sales taxes would be $0.1 million, and direct income taxes, $0.4 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $7.0 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 76 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 would not be expected to be large, with 68 owner-occupied units expected to be occupied in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (health, education, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the provision of these services in the ROI. Accordingly, one new teacher would be required 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 1,394 jobs (Table 13.1.19.2-4). Construction activities would constitute 1.0% of total ROI employment. Such a solar facility would also produce $70.7 million in income. Direct sales taxes would be $1.0 million, with direct income taxes of $2.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 528 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

TABLE 13.1.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Escalante Valley SEZ with Power Tower Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	670	120
Total	1,394	167
Income[b]		
Total	70.7	5.0
Direct state taxes[b]		
Sales	1.0	<0.1
Income	2.4	0.2
BLM payments ($ million 2008)		
Rental	NA[c]	0.4
Capacity[d]	NA	7.0
In-migrants (no.)	528	39
Vacant housing[e] (no.)	264	35
Local community service employment		
Teachers (no.)	5	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 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 588 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c NA = not applicable.

d 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 2010b), 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.

e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

construction on the number of vacant rental housing units would not be expected to be large, with 264 rental units expected to be occupied in the ROI. This occupancy rate would represent 3.6% of the vacant rental units expected to be available in the ROI.

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, five new teachers and one physician would be required in the ROI. These increases would represent 0.2% 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 167 jobs (Table 13.1.19.2-4). Such a solar facility would also produce $5.0 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $7.0 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 39 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 would not be expected to be large, with 35 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 567 jobs (Table 13.1.19.2-5). Construction activities would constitute 0.4% of total ROI employment. Such a solar facility would also produce $28.7 million in income. Direct sales taxes would be $0.4 million, and direct income taxes, $1.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 215 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 would not be expected to be large, with 107 rental units expected to be occupied in the ROI. This occupancy rate would represent 1.5% of the vacant rental units expected to be available in the ROI.

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 would be required in the ROI. This increase would represent 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 163 jobs (Table 13.1.19.2-5). Such a solar facility would also produce $4.9 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $3.9 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 38 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 would not be expected to be large, with 34 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 264 jobs (Table 13.1.19.2-6). Construction activities would constitute 0.2 % of total ROI employment. Such a solar development would also produce $13.4 million in income. Direct sales taxes would be $0.2 million, and direct income taxes, $0.5 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 100 persons in-migrating into the ROI. Although in-migration may potentially affect local

TABLE 13.1.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Escalante Valley SEZ with Dish Engine Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	272	116
Total	567	163
Income[b]		
Total	28.7	4.9
Direct state taxes[b]		
Sales	0.4	<0.1
Income	1.0	0.2
BLM payments ($ million 2008)		
Rental	NA[c]	0.4
Capacity[d]	NA	3.9
In-migrants (no.)	215	38
Vacant housing[e] (no.)	107	34
Local community service employment		
Teachers (no.)	2	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 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 588 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] 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 2010b), 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.

[e] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

TABLE 13.1.19.2-6 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Escalante Valley SEZ with PV Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	127	12
Total	264	16
Income[b]		
Total	13.4	0.5
Direct state taxes[b]		
Sales	0.2	<0.1
Income	0.5	<0.1
BLM payments ($ million 2008)		
Rental	NA[c]	0.4
Capacity[d]	NA	3.1
In-migrants (no.)	100	4
Vacant housing[e] (no.)	50	3
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 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 588 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] 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 2010b), assuming full build-out of the site.

[e] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

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 would not be expected to be large, with 50 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.7% of the vacant rental units expected to be available in the ROI.

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 PV technologies would be 16 jobs (Table 13.1.19.2-6). Such a solar facility would also produce $0.5 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $3.1 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with four 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 would not be expected to be large, with three 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.

13.1.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Escalante Valley 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.

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13.1.20 Environmental Justice

13.1.20.1 Affected Environment

E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (*Federal Register*, Vol. 59, page 7629, Feb. 11, 1994), formally requires federal agencies to incorporate environmental justice as part of their missions. 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 *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) the issue of whether the impacts from construction and operation would produce impacts that are high and adverse is assessed; and (3) if impacts are high and adverse, a determination is made as to whether the impacts would 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 and environmental impacts 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 locations of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the proposed SEZs in Utah and an associated 50-mi (80-km) radius around the facility boundary. The geographic distribution of minority and low-income groups 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 origins may choose up to six racial groups on 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 Council on Environmental Quality (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 another appropriate unit of geographic analysis.

This 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 it is in the state (the reference geographic unit).

- **Low-Income.** Individuals who 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 below the age of 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 13.1.20.1-1 show the minority and low-income composition of the total population located in the proposed Escalante Valley SEZ on the basis of 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 also identifying themselves as being part of one or more of the population groups listed in the table.

A small number of minority and low-income individuals are located in the 50-mi (80-km) radius around the boundary of the SEZ. When census data are averaged across all the block groups within the 50-mi (80-km) radius, within the Nevada portion, 11.8% of the population is classified as minority and, within the Utah portion, 8.3% of the population is classified as minority. Because the minority population within the 50-mi (80-km) radius does not exceed 50% of the total population in either portion of the 50-mi (80-km) radius, and because the minority population does not exceed the state average by 20 percentage points in either portion of the 50-mi (80-km) radius, in aggregate, there are no minority populations in these states on the basis of 2000 Census data and CEQ guidelines. In addition, there are no minority populations within individual census block groups in this area based on CEQ guidelines.

When census data are averaged across all the block groups within the 50-mi (80-km) radius, within the Nevada portion, 15.3% of the population is classified as low-income and, within the Utah portion, 14.0% of the population is classified as low-income. Because the number of low-income individuals does not exceed the state average by 20 percentage points or more, and because it does not exceed 50% of the total population in either state, there are no

TABLE 13.1.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Escalante Valley SEZ

Parameter	Nevada	Utah
Total population	3,069	80,187
White, non-Hispanic	2,708	73,497
Hispanic or Latino	178	3,520
Non-Hispanic or Latino minorities	183	3,170
One race	134	2,257
Black or African American	70	190
American Indian or Alaskan Native	51	1,385
Asian	11	409
Native Hawaiian or other Pacific Islander	1	197
Some other race	1	76
Two or more races	49	913
Total minority	361	6,690
Total low-income	470	11,220
Percentage minority	11.8	8.3
Percentage low-income	15.3	14.0
State percentage minority	34.8	14.7
State percentage low-income	10.5	9.4

Source: U.S. Bureau of the Census (2009k,l).

low-income populations within the 50-mi (80-km) radius of the proposed Escalante Valley SEZ according to 2000 Census data and CEQ guidelines.

Figure 13.1.20.1-1 shows the locations of the 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 low-income populations in specific census block groups within this area as shown in Figure 13.1.20.1-1. Low-income populations are located in two block groups in Iron County. One block group in Cedar City has more than 50% of the total population below the poverty line, while one block group to the west of Cedar City, including the towns of Newcastle and Modena, has a low-income population that is more than 20 percentage points higher than the state average. There are no minority populations that exceed 50% of the total population in the block group, and the number of minority individuals does not exceed the state average by 20 percentage points or more at the individual block group level.

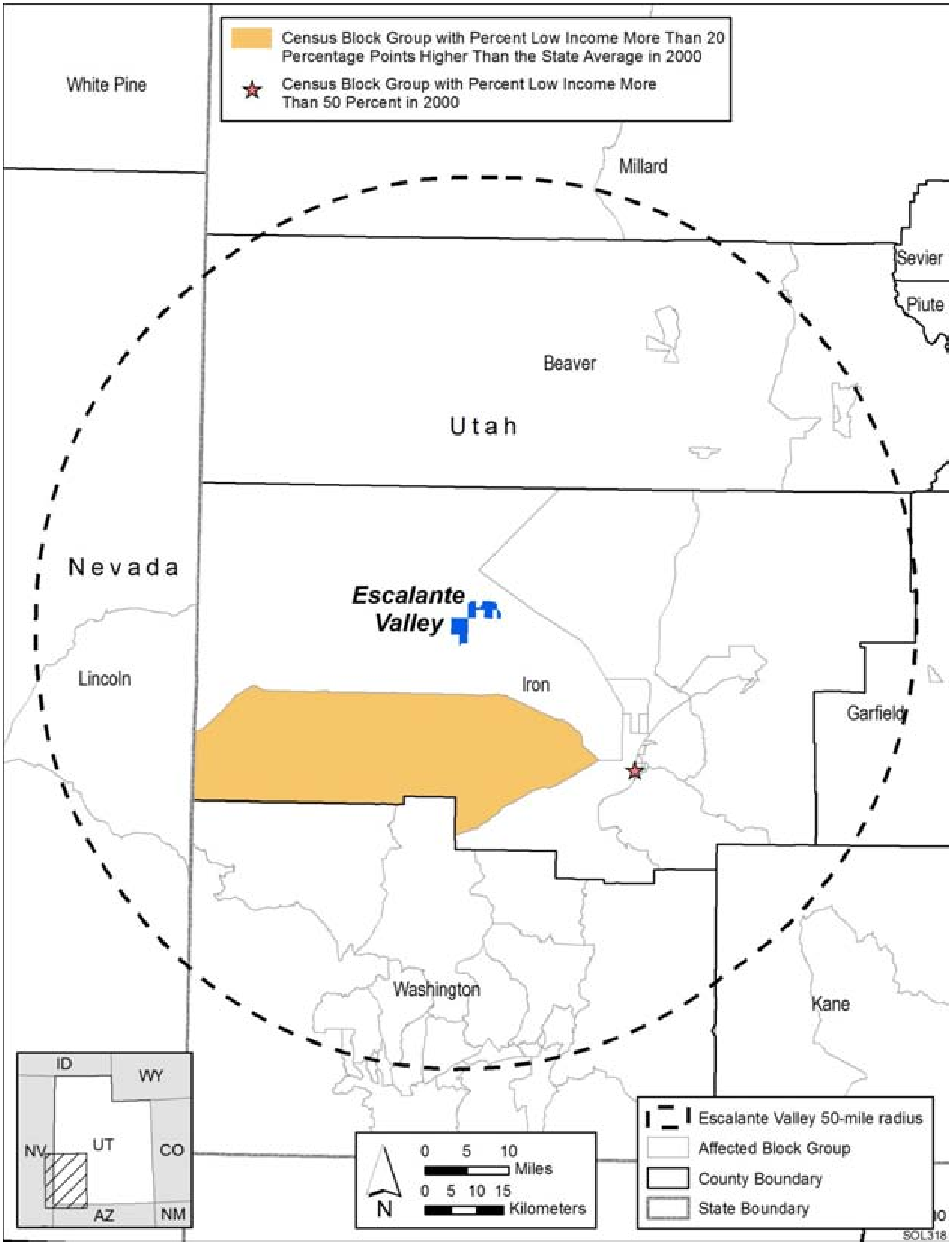

FIGURE 13.1.20.1-1 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Escalante Valley SEZ (Source: U.S. Bureau of the Census 2009f)

13.1.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy facilities are described in detail in Section 5.18. These impacts would be minimized through the implementation of the 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 facilities within the proposed SEZ include noise and dust during construction; noise and electromagnetic field (EMF) effects associated with operations; 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 as areas of concern that might potentially affect minority and low-income populations.

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar facilities involving each of the four technologies. Although impacts are likely to be small, and therefore unlikely to produce disproportionate impacts, there are low-income 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 no minority populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would be no impacts on minority populations.

13.1.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed Escalante Valley 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.

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13.1.21 Transportation

The proposed Escalante Valley SEZ is accessible by road and by rail. In addition to three small airports, one major railroad and two secondary roads serve the immediate area. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

13.1.21.1 Affected Environment

Beryl Milford Road passes by the proposed Escalante Valley SEZ to the northwest, and Lund Highway passes by to the northeast, as shown in Figure 13.1.21.1-1. Both roads are secondary paved roads. Beryl Milford Road connects with North Beryl Highway in Beryl, approximately 8 mi (13 km) west of the SEZ. North Beryl Highway travels 13 mi (21 km) south to its junction with State Route 56 at Beryl Junction. Lund Highway travels approximately 30 mi (48 km) southeast from Lund to its junction with State Route 56, approximately 1.5 mi east of I-15 and Cedar City. The SEZ area has not been designated for vehicle travel in a BLM land use plan but will be considered in the upcoming revision of the land use plans in the Cedar City Field Office.

Current access to the SEZ from Beryl Milford Road would be on Cow Trail or on 7200 E Road, both unimproved dirt roads, which provide access to the western and central sections of the SEZ, respectively. Access to the eastern portion of the SEZ from Lund Highway would be on 15200 N, another unimproved dirt road. There have been no reports on annual average traffic (AADT) volumes for the roads in the immediate vicinity, but the AADT volume for I-15 is about 21,000 vehicles as it passes through Cedar City, which is about 30 mi (48 km) to the southeast of the SEZ (UDOT 2009). Table 13.1.21.1-1 shows the AADT on major roads near the proposed Escalante Valley SEZ in 2008. AADT volumes on State Route 56 average about 11,000 vehicles at the turnoff for Lund Highway, 3,000 vehicles at the turnoff for Iron Springs about 2.5 mi (4.0 km) west of Lund Highway, and 1,500 vehicles at the junction with North Beryl Highway, an additional 27 mi (43 km) to the west. AADT volumes drop below 1,000 vehicles within a few miles of Cedar City on the secondary roads and highways that emanate from the city in the direction of the proposed Escalante Valley SEZ.

The UP Railroad serves the area. The main line connecting Las Vegas and Salt Lake City runs just to the northwest of the proposed Escalante Valley SEZ. The railroad has a rail stop in Lund, about 4 mi (6 km) directly north of the proposed Escalante Valley SEZ, where Beryl Milford Road and Lund Highway meet. A rail spur breaks away from the main line at Lund, passing to the southeast on its way to Cedar City. This spur passes through the northeastern edge of the SEZ.

The nearest public airport is the Cedar City Regional Airport, about 27 mi (43 km) southeast of the SEZ. The airport has two runways, one in good condition with a length of 4,822 ft (1,470 m), and the other in fair condition with a length of 8,653 ft (2,637 m)

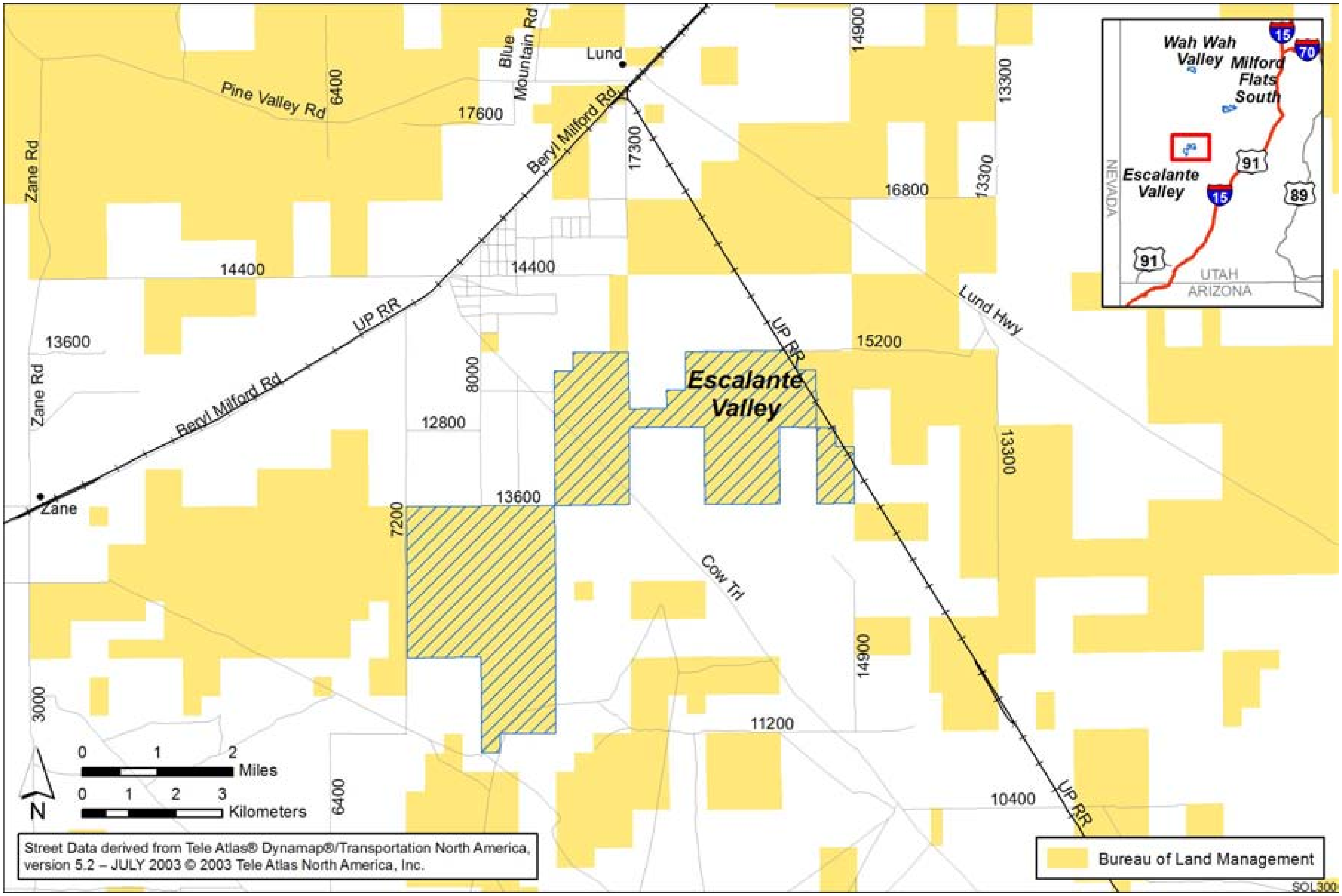

FIGURE 13.1.21.1-1 Local Transportation Network Serving the Proposed Escalante Valley SEZ

TABLE 13.1.21.1-1 AADT on Major Roads near the Proposed Escalante Valley SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
I-15	North–south	Junction with State Route 130 north of Cedar City	18,255
		Intersection with State Route 56 in Cedar City	25,140
State Route 130	North–south	Between Minersville and Cedar City	900

Source: UDOT (2009).

(FAA 2009). The airport is served by one regional carrier, Skywest Airlines, with scheduled service between Cedar City and Salt Lake City (Cedar City 2009). In 2008, approximately 7,800 passengers departed from Cedar City and 1,900 passengers arrived at Cedar City. About 133,000 lb (60,300 kg) of freight departed and 159,000 lb (72,100 kg) arrived at the airport in 2008 (BTS 2008).

The other public airports in the area are in Milford and Beaver, about 40 mi (64 km) and 55 mi (8 km) to the north-northeast and northeast, respectively. The Milford Municipal Airport has a 5,000-ft (1,524-m) asphalt runway that is in good condition and equipped with landing lights (FAA 2009). There is no control tower, but the airport is staffed during daylight hours. An average of approximately 125 aircraft operations (takeoffs/landings) occur on a weekly basis (Milford 2009). The Beaver Municipal Airport has two runways—a 4,984-ft (1,519-m) asphalt runway in fair condition with landing lights and a 2,150-ft (655-m) dirt runway in fair condition without landing lights (FAA 2009). This latter airport is unattended (Beaver 2009).

13.1.21.2 Impacts

As discussed in Section 5.19, 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). The volume of traffic on regional corridors would be more than double the current values in most cases. As discussed above, Beryl Milford Road and Lund Highway provide regional traffic corridors for the proposed Escalante Valley SEZ. Local road improvements would be necessary on any portion(s) of Beryl Milford Road and Lund Highway that might be developed so as not to overwhelm the local access roads near any site access point(s). Potential existing site access roads would require improvements, including asphalt pavement.

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 re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

13.1.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the proposed Escalante Valley 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.

13.1.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Escalante Valley SEZ in Iron County in southwestern Utah. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental effects 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 largest nearby town is Cedar City, located about 30 mi (48 km) southeast of the SEZ. Lund is located about 4 mi (6 km) to the north, and Zane is about 5 mi (8 km) to the west. The surrounding land is rural. Both state and private lands are nearby. Farther away, are two sections of the Dixie National Forest—one about 20 mi (32 km) to the south and one about 30 mi (48 km) to the southwest. Tribal lands—Cedar City Reservation—are about 25 mi (40 km) to the southeast, and Zion NP is about 30 mi (48 km) to the southeast. In addition, the proposed Escalante Valley SEZ is located close to both the proposed Milford Flats South SEZ and the proposed Wah Wah Valley SEZ, and in some areas, impacts from the three SEZs overlap.

The geographic extent of the cumulative impacts analysis for potentially affected resources near the Escalante Valley SEZ is identified in Section 13.1.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 13.1.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 13.1.22.3. Cumulative impacts for each resource area are discussed in Section 13.1.22.4.

13.1.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 13.1.22.1-1 presents the geographic extent of the cumulative impacts analysis for potentially affected resources near the Escalante Valley SEZ. These geographic areas define the boundaries encompassing potentially affected resources. Their extent varies on the basis of 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). Lands around the SEZ are State or privately owned, administered by the USFS, or administered by the BLM. The BLM administers approximately 56% of the lands within a 50-mi (80-km) radius of the SEZ.

13.1.22.2 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:

TABLE 13.1.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Escalante Valley SEZ

Resource Area	Geographic Extent
Lands and Realty	Southern Escalante Desert Valley
Specially Designated Areas and Lands with Wilderness Characteristics	Southern Escalante Desert Valley
Rangeland Resources	Southern Escalante Desert Valley
Recreation	Southern Escalante Desert Valley
Military and Civilian Aviation	Southern Escalante Desert Valley
Soil Resources	Areas within and adjacent to the Escalante Valley SEZ
Minerals	Southern Escalante Desert Valley
Water Resources	
Surface Water	Fourmile Wash, Mud Spring Wash, Dick Palmer Wash
Groundwater	Beryl-Enterprise basin
Vegetation, Wildlife and Aquatic Biota, Special Status Species	Known or potential occurrences within a 50-mi (80-km) radius of the Escalante Valley SEZ
Air Quality and Climate	Southern Escalante Desert Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Escalante Valley SEZ
Acoustic Environment (noise)	Areas adjacent to the Escalante Valley SEZ
Paleontological Resources	Areas within and adjacent to the Escalante Valley SEZ
Cultural Resources	Areas within and adjacent to the Escalante Valley SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Escalante Valley SEZ for other properties, such as historic trails and traditional cultural properties
Native American Concerns	Escalante Desert Valley; viewshed within a 25-mi (40-km) radius of the Escalante Valley SEZ
Socioeconomics	Iron County and Washington County
Environmental Justice	Iron County and Washington County
Transportation	Local Roads (e.g., Lund Highway) and I-15

- Proposals for which NEPA documents are in preparation or finalized;
- Proposals in a detailed design phase;
- Proposals listed in formal Notices of Intent (NOIs) published in the Federal Register or state publications;
- Proposals for which enabling legislation 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 impacts 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 under the proposed action (Section 13.1.22.2.1), and (2) other ongoing and reasonably foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 13.1.22.2.2). Together, these actions have the potential to affect human and environmental receptors within the geographic range of potential impacts over the next 20 years.

13.1.22.2.1 Energy Production and Distribution

Recent developments in the state of Utah have emphasized more future reliance on renewable sources for energy production. In 2008, Utah enacted the Energy Resource and Carbon Emission Reduction Initiative (Senate Bill 202), which established a voluntary renewable portfolio goal (RPG) of 20% by 2025. This bill is similar to those in states that have adopted Renewable Portfolio Standards (RPSs); however, this bill requires that utilities pursue renewable energy only to the extent that it is “cost-effective” to do so. The voluntary renewable goals are being addressed by companies that intend to be energy producers, possibly resulting in several projects being sited in the same geographic areas of southwestern Utah during the same time frame.

Reasonably foreseeable future actions related to energy development and distribution in the vicinity of the proposed Escalante Valley SEZ are identified in Table 13.1.22.2-1 and described in the following sections. Renewable energy projects identified include wind and geothermal projects, but no foreseeable solar energy projects have been identified. Other energy-related projects include transmission lines and oil and gas leasing. The following is a summary of planned renewable energy and transmission distribution projects.

TABLE 13.1.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Escalante Valley SEZ

Description	Status	Resources Affected	Primary Impact Location
Renewable Energy Development			
Milford Wind (UTU 82972)	Ongoing	Land use, ecological resources, visual	About 50 mi (80 km) northeast of Escalante Valley SEZ (Beaver County)
Milford Wind Phase II (UTU 83073)	Under way	Land use, ecological resources, visual	About 50 mi (80 km) northeast of Escalante Valley SEZ (Beaver and Millard Counties)
Milford Wind Phases III-IV (UTU 8307301)	Planned	Land use, ecological resources, visual	About 50 mi (80 km) northeast of Escalante Valley SEZ (Beaver County)
Geothermal Energy Project UTU 66583O	Authorized	Land use, terrestrial habitats, visual	About 45 mi (72 km) northeast of Escalante Valley SEZ (Beaver County)
Geothermal Energy Project UTU 66583X	Authorized	Land use, terrestrial habitats, visual	About 45 mi (72 km) northeast of Escalante Valley SEZ (Beaver County)
Transmission and Distribution Systems			
Sigurd to Red Butte No. 2 345-kV Transmission Line Project	Planned	Land use, ecological resources, visual	East of Milford Flats South and Escalante Valley SEZs
Three Peaks 138-kV Transmission Line Project	Planned	Land use, ecological resources, visual	Southeast of Escalante Valley SEZ
Energy Gateway South 500-kV AC Transmission Line Project	Planned	Land use, ecological resources, visual	About 5 mi (8 km) southeast of Escalante Valley SEZ and 3 mi (5 km) west of Milford Flats South SEZ
TransWest Express 600-kV DC Transmission Line Project	Planned	Land use, ecological resources, visual	About 5 mi (8 km) southeast of Escalante Valley SEZ and 3 mi (5 km) west of Milford Flats South SEZ
UNEV Liquid Fuel Pipeline (UTU-79766)	FEIS April 2010	Disturbed areas, terrestrial habitats along pipeline ROW	About 5 mi (8 km) southeast of Escalante Valley SEZ and 3 mi (5 km) west of Milford Flats South SEZ
Oil and Gas Leasing			
Oil and gas leasing	Planned	Land use, ecological resources, visual	Eastern portions of Iron and Beaver counties.

Solar Energy Development

There are no existing solar energy projects in the Escalante Valley SEZ. A search of the BLM database of ROW grant applications did not identify any new solar projects in the vicinity of the SEZ.

Wind Energy Development

The Milford Wind Corridor Project, Phases I–V, which are either planned, under way, or ongoing, are currently the only reasonably foreseeable wind energy development within a 50-mi (80-km) radius of the proposed Escalante Valley SEZ. This development is administered under three BLM ROW applications, as listed in Table 13.1.22.2-1. The footprints of these and numerous other renewable energy ROW applications in various stages of authorization are shown in Figure 13.1.22.2-1. The identified reasonably foreseeable energy development and distribution projects are discussed in the following subsections, followed by a brief discussion of pending wind applications, also shown in Figure 13.1.22.2-1, which are considered to represent potential, if not foreseeable, projects at this time.

- *Milford Wind Phase I (UTU 82972).* Phase I of the Milford Wind Corridor Project, a 203.5-MW facility, began operations in October 2009. At least four more phases will follow. The facility is located about 10 mi (16 km) northeast of Milford, east of State Route 287, and on 25,00 acres (103 km^2) covering land in both Beaver and Millard Counties. The facility has 97 wind turbines, including 58 Clipper Liberty 2.5-MW wind turbines and 39 GE 1.5-MW wind turbines. Power from this facility is being purchased by the Southern California Public Power Authority. The project also includes a new transmission line connecting the facility to the existing Intermountain Power Project substation near Delta, Utah. The Milford Wind Corridor Project is the first wind energy facility permitted under the BLM Wind Energy PEIS for western states (First Wind 2009).

- *Milford Wind Phases II, III, IV, and V.* Four additional phases of the Milford Wind Corridor Project, adjacent to Milford Wind Phase I, are in development. Construction of Milford Wind Phase II (UTU 83073) is under way. Each of the four projects will be a 200-MW wind energy facility (First Wind 2009).

Pending Wind ROW Applications on BLM-Administered Lands. Applications for right-of-way grants that have been submitted to the BLM include three pending authorization for wind site testing, eight authorized for wind testing, and three pending authorization for development of wind facilities that would be located within 50 mi (80 km) of the SEZ as of May 14, 2010 (BLM and USFS 2010b). Table 13.1.22.2-2 lists these applications and Figure 13.1.22.2-1 shows their locations.

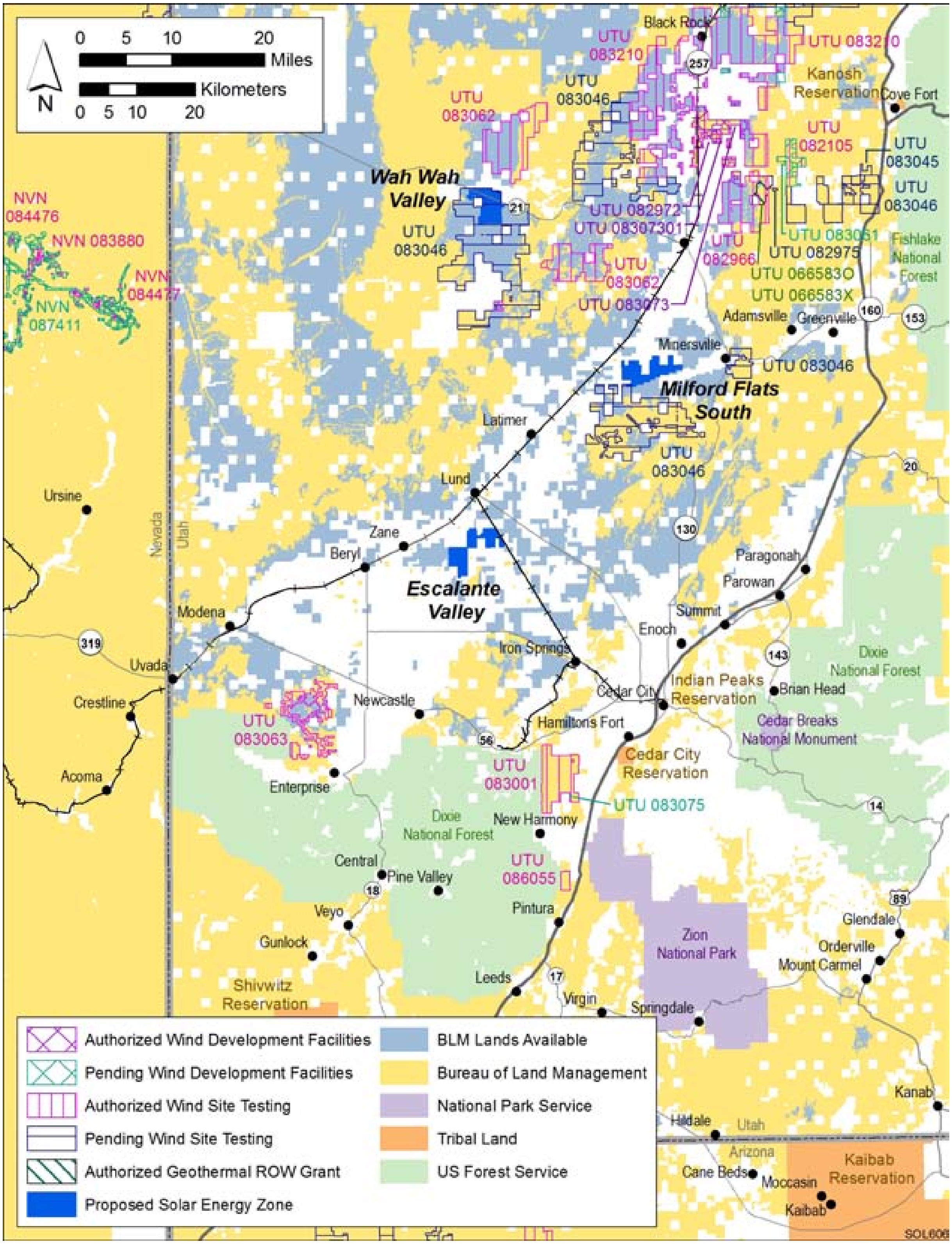

FIGURE 13.1.22.2-1 Locations of Renewable Energy Proposals within a 50-mi (80-km) Radius of the Proposed Escalante Valley SEZ

TABLE 13.1.22.2-2 Pending Wind Energy Project Applications on BLM-Administered Land within 50 mi (80 km) of the Escalante Valley SEZ[a]

Serial No.	Technology	Status (NOI date)	Field Office
Pending Wind Site Testing			
UTU 082975	Wind	Pending	Cedar City
UTU 083046	Wind	Pending	Cedar City
UTU 085819	Wind	Pending	Cedar City
Authorized Wind Site Testing			
UTU 082105	Wind	Site testing	Cedar City
UTU 082966	Wind	Site testing	Cedar City, Fillmore
UTU 083001	Wind	Site testing	Cedar City, St. George
UTU 083062	Wind	Site testing	Cedar City, Fillmore
UTU 083063	Wind	Site testing	Cedar City
UTU 083210	Wind	Site testing	Cedar City, Fillmore
UTU 086055	Wind	Pending	Cedar City
NVN 084477	Wind	Site testing	Ely
Pending Wind Development Facilities			
UTU 083061	Wind	Pending	Cedar City
UTU 083075	Wind	Pending	Cedar City
NVN 087411	Wind	Pending	Cedar City

[a] Pending wind applications information downloaded from GeoCommunicator (BLM and USFS 2010b).

The likelihood of any of the pending wind ROW application projects actually being developed is uncertain, but it is generally assumed that applications authorized for wind testing are closer to fruition. However, wind testing alone is not considered a sufficient basis to classify these as reasonably foreseeable projects. The pending applications are listed in Table 13.1.22.2-2 for completeness and as an indication of the level of interest in development of wind energy in the region. Some number of these applications would be expected to result in actual projects. Thus, the cumulative impacts of these potential projects are analyzed in their aggregate effects.

Wind testing will involve some relatively minor activities that could have some environmental effects, mainly the erection of meteorological towers and monitoring of wind conditions. These towers may or may not employ guy wires and may be 200 ft (60 m) high.

Geothermal Energy Development

Two applications for the development of geothermal energy facilities within 50 mi (80 km) of the proposed SEZ have geothermal agreements authorized by the BLM, as listed in Table 13.1.22.2-1 and shown in Figure 13.1.22.2-1. The two applications are located in close proximity to each other, about 45 mi (72 km) northeast of the SEZ and about 10 mi (16 km) northeast of Milford. These projects are considered only minimally reasonably foreseeable because applications have received only authorized geothermal agreements (BLM and USFS 2010b), and there is a good likelihood that they might not actually be built.

Transmission and Distribution Systems

Existing and proposed electric transmission lines are considered in the cumulative impact analysis related to solar energy project development in the proposed Utah SEZs. Several transmission line projects and a petroleum pipeline project occur or are planned within the geographic extent of effects for the proposed Escalante Valley SEZ.

- *Sigurd to Red Butte No. 2, 345-kV Transmission Line.* Rocky Mountain Power submitted a preliminary ROW application form to the BLM (i.e., Form 299) along with a Plan of Development for the project in December 2008. The project would traverse public lands administered by the BLM and the USFS and private lands over a distance of 150 to 160 mi (241 to 258 km) from the Sigurd Substation in Sevier County near Richfield, Utah, to the Red Butte Substation in southwestern Utah near the town of Central in Washington County. Transmission towers would be steel H-frame design spaced about 1,000 to 1,200 ft (305 to 366 m) apart. The transmission line would need to be operating by 2012 to meet the expected energy demands of southwestern Utah because of population growth in the St. George area and surrounding communities. The proposed route and alternative segments under consideration by Rocky Mountain Power would pass about 10 to 15 mi (16 to 24 km) east of the Milford Flats South and Escalante Valley SEZs (BLM 2009a).

- *Three Peaks 138-kV Transmission Line Project*. PacifiCorp requested BLM approval to construct a 6.35-mi (10.2-km), single-circuit 138-kV line that would extend eastward in Iron County from a facility owned by Western Electrochemical Company to the proposed Three Peaks Substation. The transmission line would cross BLM-administered land in the vicinity of the Escalante Valley SEZ, some private land, and land controlled by the Utah School and Institutional Trust Lands Administration. An estimated 63 wood poles would be needed for the line, which would parallel and join the existing Sigurd to Red Butte No.1 345-kV transmission line.

- *Energy Gateway South 500-kV AC Line.* PacifiCorp, as part of its Energy Gateway Transmission Expansion Project, is planning to build a high-voltage transmission line, known as the Gateway South segment, from the Aeolus substation in southeastern Wyoming into the new Clover substation near Mona, Utah. An additional segment would continue from the new Clover substation to the existing Crystal substation north of Las Vegas. The larger Gateway Transmission Expansion Project would provide a broad regional expansion of transmission capacity in the West, in part to connect new renewable energy sources to load centers. The Gateway South portion is in the early planning, siting, and permitting stages. Rights of way and an EIS are expected to be completed by 2015, while PacifiCorp projects an in-service date of 2017 to 2019 (PacifiCorp 2010).

- *TransWest Express 600-kV DC Line.* The TransWest Express, LLC, is proposing a 600-kV DC transmission line that would deliver 3,000 MW of wind energy from Wyoming to the desert southwest by way of Las Vegas. The proposed route would cover 725 mi (1160 km) and pass through southwestern Utah, about 20 mi (32 km) northwest of Cedar City in the vicinity of the three proposed Utah SEZs and within or adjacent to federally designated or proposed utility corridors, or parallel to existing transmission lines or pipelines. The project is in the planning, permitting, and design stages. Project proponents entered the project into the Western Electricity Coordinating Council's rating process for grid integration in January 2008 jointly with PacifiCorp's Gateway South project and anticipate a path rating by 2011. An EIS to be prepared by BLM and the Western Area Power Administration is expected to be completed by 2013 and the line is expected to be in service in 2015 (TransWest 2010).

- *UNEV Pipeline Project.* Holly Energy Partners proposes to construct and operate a 399-mi (640-km) long, 12-in (0.3-m) wide petroleum products (gasoline and diesel fuel) pipeline that will originate at the Holly Corporation's Woods Cross, Utah, refinery near Salt Lake City and terminate near the Apex Industrial Park northeast of Las Vegas, Nevada. The pipeline would run along the same route as the proposed TransWest Express transmission line described above, passing about 20 mi (32 km) northwest of Cedar City, Utah, and would include a lateral pipeline from the main line to a pressure reduction station at a terminal about 10 mi (16 km) northwest of Cedar City. Access roads would be built to all aboveground infrastructures. BLM issued a Final EIS for the project in April 2010 (BLM 2010c).

Oil and Gas Leasing. The BLM Cedar City Field Office prepared an environmental assessment (EA) in August 2008 (EA UT-040-08-036) that addressed the impacts of ongoing and new oil and gas leases in the eastern portions of Beaver and Iron Counties. The geographical area covered in the analysis extended from about 10 mi (16 km) north of Milford, south and east to New Harmony, 10 mi (16 km) south of Cedar City. A smaller area east of I-15, east and northeast of Cedar City, was also evaluated. A total of 960,000 acres (3,885 km^2) of federal mineral lands was considered in the EA. Of this total, about half has been leased (374,000 acres [1,514 km^2]) or has been issued a lease but awaits protest resolution (108,000 acres [437.1 km^2]). Of the remaining land (478,000 acres [1,934 km^2]), almost one-fourth (121,000 acres [490 km^2]) is being considered for development by industry. The intent of the proposed action is for the BLM to protect environmental resources in future leased areas by imposing additional resource protective measures.

13.1.22.2.2 Other Actions

Grazing Allotments

Grazing is a common use of the lands in the vicinity of the proposed Escalante Valley SEZ. The management authority for grazing allotments on these lands rests with the BLM's Cedar City Field Office. Some of the allotments currently in effect or under review by the BLM in the area include Adams Well, Lowe Jones, Neck of the Desert, Norte Well, Willow Spring, Lone Pine Spring, Matheson, Wood West, Bennion Spring, Jackson Wash, Bergstrom, Horse Hollow, Long Hollow Cattle, Parowan Gap, and Lund (BLM 2009a). While many factors could influence the level of authorized use, including livestock market conditions, natural drought cycles, increasing nonagricultural land development, and long-term climate change, it is anticipated that the current level of use will continue in the near term. A long-term reduction in federal authorized grazing use would affect the value of the private grazing lands.

Other Projects

Many projects requesting ROW grant approvals on BLM and USFS lands are under review or have received recent BLM approval for locations in Beaver, Iron, and Millard Counties. These projects include initiatives such as minerals mining, communication tower construction or modification, habitat improvement, and vegetation removal for fire control. The following is a summary of larger projects in the vicinity of the three proposed SEZs in Utah (because of the close proximity of the three proposed SEZs in Utah and overlapping geographic extent of boundaries for various resource areas, the projects described in this section apply to all three SEZs in Utah). Following these summaries, a list of other identified projects is provided in Table 13.1.22.2-3. The list was derived from the BLM web site for the State of Utah on projects recently approved or under review for ROW permits (BLM 2009a).

- *Blawn Mountain Stewardship.* The BLM implemented a project in January 2009 to improve wildlife habitat in the south end of the Wah Wah Mountains located about 33 mi (53 km) southwest of Milford. The largest part of the project area is dominated by pinyon-juniper stands, where understory species are in decline. The objectives are to improve forage for wild horses and provide good deer habitat. An estimated 1,065 acres (4.3 km^2) was to be improved by cutting, lopping, and scattering juniper while retaining most of the pinyon pine. Riparian habitat improvement includes removing the danger of crown fire in ponderosa pine, which can threaten survival of pinyon pine, and improving habitat around springs and where perennial water occurs. The desired condition is to have a patchy density of shrublands, forbs, and grasses to support wildlife. The project also is planning to thin up to 3,180 acres (13 km^2) of pinyon-juniper stands that surround the Blawn Mountain Chainings. All other actions would be to improve the overall forest health and suitability for wildlife.

TABLE 13.1.22.2-3 Other Projects in the Vicinity of the Proposed SEZs in Utah

Project Name	Description	Status	County	Location
AirCell, LLC, Communication Site	Communication tower	Approved Nov. 2009	Beaver	Frisco Peak, San Francisco Mountains.
Utah Alunite, LLC, Potassium Prospecting Permit Applications	Request to conduct prospect mining for potassium minerals	Applications received Sept. 2009; scoping Dec. 2008	Iron	Vicinity of Bible, Typhoid, and Mountain Springs.
Utah Copper Company Hidden Treasure Mine	Amendment to change some mine facilities, haul road change, and perimeter disturbances on BLM and private lands	Approved Jan. 2009	Beaver	5 to 10 mi (8 to 16 km) northwest of Milford, south end of Rocky Range and Beaver Lake Mountains.
Copper Ranch Knoll Exploration Plan of Operation	Authorization requested to initiate a copper reserve delineation project on the Marguerite No. 15 and Jewel Mine patented claims	EA completed Jan. 2009, signed Jan. 28, 2009	Beaver	About 7 mi (11.3 km) northwest of Milford on and around Copper Ranch Knoll, about halfway between west side of Rocky Range and the southeast edge of Beaver Lake Mountains.
Clark Livestock Pipeline ROW Renewal	Renewal of permit to transport water to livestock along 17,253-ft (5,259-m) long ROW across about 3,950 acres (16 km^2) of BLM lands	Approved Aug. 7, 2008	Iron	Iron Springs/Big Hollow Wash about 10 mi (16.1 km) northwest of Cedar City, Utah.
Highway 56 Fuels Reduction	Decrease fire hazard by removal of up to 1,000 acres (4 km^2) of standing pinyon-juniper; project would involve controlled burning, seeding, controlled grazing	Categorical Exclusion prepared in 2008	Iron	Adjacent to residential and outlying properties near Newcastle in southwestern Iron County.
Bible Spring Complex Wild Horse Gather and Removal	Removal of about 380 wild horses through capture; information gained used to update HMA Plans	EA approved June 30, 2009	Beaver, Iron	Wah Wah and Peak Mountain Ranges.
Kern River Gas Transportation Co. Apex Expansion Temporary Use Permit	Request to conduct four geotechnical borings for a proposed compressor site; borings to be conducted early June 2009	No information found	Beaver	Northwest of Minersville.

TABLE 13.1.22.2-3 (Cont.)

Project Name	Description	Status	County	Location
Sunrise Exploration Project	Exploration to evaluate grade, depth, and thickness of in-place copper to allow delineation of mineable reserves; 100 to 200 rotary drill holes would occur over about 160 acres (0.67 km^2)	Finding of No Significant Impact (FONSI) and Decision Record approved Sept. 24, 2009	Beaver	Located about 4 mi (6.4 km) northwest of the City of Milford at the southern extent of the Rocky Range.
Mineral Mountain Communication Site	Upgrade requested for existing communication site; upgrades expand existing site from 45 ft × 35 ft (14 m × 11 m) to 80 ft × 35 ft (24 m × 11 m); internal building modifications; new 70-ft (21-m) tall steel lattice tower	Application to the BLM received in June 2009; EA checklist received in Sept. 2009	Beaver	Township 26S, Range 8W, Section 30.
Enel's Proposed Cove Fort Wind Testing ROW	Three-year ROW requested to erect one met tower; about 2.4 acres (0.01 km^2) total disturbance to erect 197-ft (60-m) high tower, anchors and guy wires	Application received in July 2009, currently under review by the BLM	Beaver, Millard	West of I-15 near Cove Fort, Utah, in an area known as Cinder Crater.
Hamlin Valley Habitat Improvement	Improve vegetation conditions in Hamlin Valley Project Area; goals include habitat improvements in sagebrush-steppe, pinyon-juniper woodlands, and riparian areas; techniques include harrowing of sagebrush and seeding, thinning of pinyon juniper	EA started in Nov. 2005	Beaver, Iron	Project involves parts of Modena, Spanish George, Rosebud, Butcher, Stateline, Indian Peak, Atchison, South Pine Valley, North Pine Valley, and Indian Peak Grazing Allotments.

- *Paradise Mountain Stewardship.* The BLM initiated a NEPA review in January 2009 on 8,850 acres (36 km^2) of montane vegetation in the Paradise Mountains near the Utah–Nevada border to evaluate the impacts of vegetation removal and selective thinning to improve wildlife habitat and reduce fire hazards in the areas. The project objectives are to improve forest health; improve wildlife habitat; improve and maintain shrub, grass, and forb habitats in meadow and riparian areas; and decrease the probability of crown fires, which would eliminate individual stands. The Paradise Mountains are located 10 mi (16 km) northwest of the town of Modena, about 50 mi (80 km) southwest of the Wah Wah Valley SEZ and 20 mi (32 km) west of the Escalante Valley SEZ.

- *Lake Powell Pipeline.* Washington, Kane, and Iron Counties are pursuing the construction of a pipeline that would run from Lake Powell, near Glen Canyon Dam, through Kane County, to Sand Hollow Reservoir, which is located approximately 10 mi (16 km) east of St. George. The pipeline would then run parallel to I-15 into Iron County. The pipeline would be 158 mi (254 km) long and bring 70,000 ac-ft (86 million m^3) of water to Washington County, 10,000 ac-ft (12 million m^3) to Kane County, and 20,000 ac-ft (25 million m^3) to Iron County. The NEPA review could be completed by 2012 based on the results of technical studies currently under way. Construction of the pipeline may begin as soon as 2015 and is estimated to take only 3 years. The pipeline would be located about 15 to 20 mi (24 to 32 km) southeast of the Escalante Valley SEZ (Utah Foundation 2008).

- *Clark, Lincoln, and White Pine Counties Groundwater Development Project.* The Southern Nevada Water Authority (SNWA) proposes to construct a groundwater development project that will be capable of transporting as much as 200,000 ac-ft/yr (247 million m^3/yr) of groundwater, including 11,584 ac-ft/yr (14 million m^3/yr) of water rights in the Dry Lake Valley groundwater basin. The proposed facilities include production wells, water pipelines, pumping stations, water treatment, power, and other appurtenant facilities. The project would draw groundwater from the Snake Valley aquifer in western Millard County and the adjacent Spring Valley aquifer in Nevada, as well as the Cave Valley and Dry Lake Valley basins to the southwest. A DEIS is expected in 2010 (SNWA 2010).

13.1.22.3 General Trends

General trends of population growth, energy demand, water availability, and climate change are similar for all three SEZs in Utah and are presented together in this section. Table 13.1.22.3-1 lists the relevant impacting factors for the trends.

13.1.22.3.1 Population Growth

Over the period 2000 to 2008, the population grew by 5.7% annually in the ROI for the Escalante Valley SEZ (see Section 13.1.19.1.4). The annual population growth rates for the Milford Flats and Wah Wah Valley proposed SEZs in the same period were 3.7 and 3.2%, respectively. The growth rate for the state of Utah as a whole was 2.5%. Within each ROI, each county experienced growth in population since 2000, ranging from 1.4% in Millard County to 6.4% for Washington County. County populations are expected to continue to increase over the period 2010 to 2023 (Governor's Office of Planning and Budget 2009). Most of the population growth in the Escalante SEZ ROI over this period will be in Cedar City.

TABLE 13.1.22.3-1 General Trends Relevant to the Proposed SEZs in Utah

General Trend	Impacting Factors
Population growth	Urbanization Increased use of roads and traffic Land use modification Employment Education and training Increased resource use (e.g., water and energy) Tax revenue
Energy demand	Increased resource use Energy development (including alternative energy sources) Energy transmission and distribution
Water availability	Drought conditions and water loss Conservation practices Changes in water distribution
Climate change	Water cycle changes Increased wildland fires Habitat changes Changes in farming production and costs

13.1.22.3.2 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 the three-SEZ area in Utah (by as much as 19% 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 improvements in energy efficiency and the high cost of oil 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, with the fastest growth 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).

13.1.22.3.3 Water Availability

As described in Section 13.1.9.1.2, the proposed Escalante SEZ is located within the Escalante Valley groundwater basin, which is also referred to as the Beryl-Enterprise basin. Groundwater extraction in the Beryl-Enterprise area located 40 mi (64.4 km) west of Cedar City averaged 80,000 ac-ft/yr (98.7 million m^3/yr) during the period 1989 to 1998 based on well pumping data (Utah Division of Water Resources 2001). In comparison, the Cedar Valley and

Parowan Valley groundwater areas had withdrawal rates of 33,000 and 29,000 ac-ft/yr (40.7 million and 35.8 million m^3/yr), respectively, during this period. The groundwater withdrawal rate of 80,000 ac-ft/yr (98.7 million m^3/yr) in the Beryl-Enterprise area caused a lowering of the groundwater table by 1.2 ft (0.4 m) per year during this 11-year period. Recent information reported by the USGS showed a continued increase in annual rate of groundwater withdrawal in the Beryl-Enterprise area to about 93,000 ac-ft/yr (114.7 million m^3/yr) in 2008, which was an increase of 1,000 ac-ft (1.2 million m^3) from 2007, and 8,000 ac-ft (9.9 million m^3) above the average annual withdrawal from 1998 to 2007 of 85,000 ac-ft/yr (105 million m^3). This increase was mostly the result of increased withdrawals for irrigation (Burden et al. 2009). Groundwater use in the Milford area of the Escalante Valley basin also has increased in recent years. The total of estimated withdrawals in the Milford area in 2008 was about 51,000 ac-ft (62.9 million m^3), which is 2,000 ac-ft (2.5 million m^3) more than was reported for 2007 and 6,000 ac-ft (7.4 million m^3) more than the average annual withdrawal for 1998 to 2007. The increase was due mainly to increased industrial water use. The Utah DWR reports that 4,009 water rights have been approved in the Milford area of the Escalante Valley. Almost all of the area is closed to new water appropriations (Utah DWR 2004).

In 2008, water usage of the total groundwater withdrawals in the Beryl-Enterprise basin was primarily for agriculture (97%) (Burden et al. 2009). This is slightly higher than the average agricultural water usage (96%) for Iron County in 2005, with the remaining water being used for domestic (3%) and industrial (1%) purposes (Kenny et al. 2009). The majority of the agricultural water use occurs in the Beryl-Enterprise region in the southwestern portion of the southern Escalante Desert Valley.

Pumping has resulted in ground surface subsidence in some areas of western Iron County, Utah. Groundwater levels dropped as much as 150 ft (46 m) in the Beryl-Enterprise region between 1948 and 2009 because of excessive groundwater withdrawals in the southwestern portion of the southern Escalante Desert Valley. Monitoring wells located within 1 mi (1.6 km) of the proposed Escalante Valley SEZ indicate a current depth to groundwater of 20 to 25 ft (6 to 8 m), while groundwater levels in these wells have been falling at a rate of 0.2 to 1.5 ft/yr (0.06 to 0.5 m/yr) (Burden et al. 2009). Land subsidence likely caused by groundwater withdrawals and overdrafts in the Beryl-Enterprise basin has resulted in earth fissures (Thomas and Lowe 2007).

To meet future increases in water demand, Washington, Iron, and Kane Counties in southwestern Utah are studying the feasibility of an agreement to obtain water from Lake Powell on the Lower Colorado River via a pipeline. Despite water conservation efforts, this area of Utah may begin to experience water shortfalls by 2012. Washington, Kane, and Iron Counties are pursuing the construction of a pipeline that would run from Lake Powell, near Glen Canyon Dam, through Kane County, to Sand Hollow Reservoir, which is located approximately 10 mi (16.1 km) east of St. George. The pipeline would then run parallel to I-15 into Iron County. The pipeline would be 158 mi (254 km) long and bring 70,000 ac-ft (86.3 million m^3) of water to Washington County, 10,000 ac-ft (12.3 million m^3) to Kane County, and 20,000 ac-ft (24.7 million m^3) to Iron County. It would tap into Utah's unused portion of the Upper Colorado River, which was defined as belonging to Utah in the 1922 Colorado River Compact. The pipeline would cross both private and BLM-administered lands in Iron County and would be about 15 to 20 mi (24 to 32 km) southeast of the Escalante Valley SEZ. Construction could begin in 2015 and be completed in 3 years (Utah Foundation 2008).

13.1.22.3.4 Climate Change

A study of climate change and its effects on Utah was conducted by the Governor's Blue Ribbon Advisory Council on Climate Change (BRAC 2007). The report, generated by scientists from the three major universities in Utah, summarizes present scientific understanding of climate change and its potential impacts on Utah and the western United States. Excerpts of researchers' findings and conclusions from the report follow:

- *Temperature Change.* In Utah, the average temperature during the past decade was higher than observed during any comparable period of the past century and roughly 2°F (1°C) higher than the 100-year average. Precipitation in Utah during the twentieth century was unusually high; droughts during other centuries have been more severe, prolonged, and widespread. Declines in low-elevation mountain snowpack have been observed over the past several decades in the Pacific Northwest and California. However, clear trends in snowpack levels in Utah's mountains from temperature increases cannot be developed at this time based on recent historic data. Climate models suggest that the average earth's surface temperature will increase between 3 and 7°F (2 and 4°C). GHG emissions at current rates will continue to exacerbate climate change and associated impacts. For Utah, the projected change in annual mean temperature under the 2.5 times increase in CO_2 concentrations by the end of this century is about 8°F (5°C), which is comparable to the present difference in annual mean temperature between Park City (44°F [24°C]) and Salt Lake City (52°F [29°C]).

- *Impacts of Climate Change in Utah*. Utah is projected to warm more than the average for the entire globe and more than coastal regions of the contiguous United States. The expected consequences of this warming are fewer frost days, longer growing seasons, and more heat waves. Agricultural impacts anticipated include (1) an increase in crop productivity, assuming that water use for irrigation remains relatively constant and more precipitation falls as rain than as snow; (2) grazing use decreases on nonirrigated lands because there is less forage for livestock; and (3) changes in insect and other animal populations which, in turn, affect pollination and crop damage.

Snowpack, water supply, and drought potential are predicted to be affected by GHG emissions holding at current levels or increasing. Year-to-year variations in snowfall will continue to dominate mountain snowpack, streamflow, and water supply during the next couple of decades. As temperature increases, it is likely that a greater fraction of precipitation will fall as rain rather than as snow, and the length of the snow accumulation season will decrease. Projected trends likely to occur in the twenty-first century are as follows:

- A reduction in natural snowpack and snowfall in the early and late winter for the winter recreation industry, particularly in low- to mid-elevation mountain areas (trends in high-elevation areas are unclear);

- An earlier and less intense average spring runoff for reservoir recharge;

- Increased demand for agricultural and residential irrigation due to more rapid drying of soils; and

- Warming of lakes and rivers with associated changes on aquatic life, including increased algal abundance and upstream shifts of fish.

Increasing temperatures will cause soils to dry more rapidly and likely increase soil vulnerability to wind erosion. Increased dust transport during high wind events would likely occur, particularly from salt flats and dry lakebeds such as Sevier Lake. Dust deposited on mountain snowpack would also accelerate spring snowmelt.

Forests, desert communities, and wildlife will likely be affected by increasing temperatures and associated climate change. Drier conditions would result in changes in plant distribution, quality of wildlife habitat, and increased potential for and intensity of wildfires. Plant distribution may change such that species occupy higher elevations.

The three proposed SEZs in Utah are in dry areas that experience drought conditions that will become worse with temperature increases and climate-induced changes on rainfall amounts and patterns. Groundwater availability for agriculture and livestock grazing on BLM-administered and private lands in southwestern Utah will likely be adversely affected by climate change.

13.1.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Escalante Valley SEZ on the basis of the following assumptions: (1) because of the relatively small size of the proposed SEZ (less than 10,000 acres [41 km^2]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 5,291 acres (21 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1 km^2) monthly on the basis of construction schedules planned in current applications. In addition, it is assumed that a 3-m (5-km) long transmission line would be constructed from the proposed SEZ to the nearest available transmission line. The new transmission line would disturb an additional 91 acres (0.37 km^2) (Table 13.1.1.2-1). Regarding site access, it may be necessary to construct a new access road to the proposed SEZ to support construction and operation of solar facilities in the SEZ. If an access road were constructed to State Route 56, which is approximately 15 mi (24 km) from the SEZ, it would disturb an area of about 109 acres (0.44 km^2) of land. In addition, some improvement of county roads might be required.

Cumulative impacts in each resource area 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 are discussed below. At this stage of development, because of the uncertainties of the future projects in terms of location within the proposed SEZ, size, number, 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 areas.

13.1.22.4.1 Lands and Realty

The area covered by the proposed Escalante Valley SEZ is largely undeveloped and rural. In general, the areas surrounding the SEZ are rural in nature. Numerous dirt/ranch roads provide access throughout the SEZ.

Development of the SEZ for utility-scale solar energy production would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Access to such areas by both the general public and much wildlife would be eliminated. Traditional uses of public lands would no longer be allowed. Utility-scale solar energy development would be a new and discordant land use to the area. It also is possible that similar development of state and private lands located adjacent to the SEZ would be induced by development on public lands and might include additional industrial or support facilities and activities.

In addition, numerous wind energy projects are proposed within a 50-mi (80-km) radius of the Escalante Valley SEZ. As shown in Table 13.1.22.2-2 and Figure 13.1.22.2-1, in addition to the ongoing Milford Wind Corridor project, there are three pending authorization for wind site testing, eight authorized for wind testing, and three pending authorization for development of wind facilities within this distance. The majority of these wind applications lie 40 to 50 mi (60 to 80 km) to the northeast of the SEZ; no wind applications lie within 10 mi (16 km). Two authorized geothermal leases are located about 50 mi (80 km) to the northeast, while there are currently no solar applications within 50 mi (80 km) of the SEZ (Figure 13.1.22.2-1). The Milford Flats South SEZ is located about 20 mi (32 km) northeast and the Wah Wah SEZ is located about 33 mi (53 km) north of the Escalante Valley SEZ.

In combination with ongoing and foreseeable actions within the geographic extent of effects, nominally 50 mi (80 km), the cumulative effects on land use of development of utility-scale solar projects on public lands on the Escalante Valley SEZ would be small to moderate. Most other actions outside of the proposed SEZ are wind energy projects located 30 to 50 mi (48 to 80 km) away, which would allow many current land uses to continue, including farming. However, the number and size of such projects could result in cumulative effects, especially if the SEZ is fully developed, or all three Utah SEZs are fully developed, with solar projects.

13.1.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are no specially designated areas within the proposed Escalante Valley SEZ. No specially designated areas exist within 5 mi (8 km) of the SEZ either. Portions of the historic route of the Old Spanish Trail pass about 6 mi (10 km) south of the SEZ. Other than some potential to contribute cumulatively to visual impacts from the Old Spanish Trail, no cumulative impacts would be expected on specially designated areas from the construction of utility-scale solar energy facilities within the SEZ. The actual nature of cumulative visual impacts on the users of the Old Spanish Trail would depend on the specific solar technologies employed in the SEZ and the locations selected within the SEZ. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the SEZ.

13.1.22.4.3 Rangeland Resources

Currently, there is one grazing allotment in the proposed Escalante Valley SEZ. If utility-scale solar facilities were constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. Depending on the number and size of potential projects, the impact on the ranger(s) who currently utilize the same lands could be significant. If water rights supporting agricultural use are purchased to support solar development, some areas that are currently farmed by using that water would be converted to dry land uses. The effects of other renewable energy projects within the geographic extent of effects, including the Milford Wind project and two authorized geothermal applications within 50 mi (80 km) of the SEZ, would result in at most small cumulative impacts due to the distance to the locations of the proposed projects and the low impacts of wind facilities on grazing. Additional pending or authorized wind applications fall within this distance, but none would be closer than about 20 mi (32 km) to the SEZ.

Because the proposed SEZ is more than 6 mi (10 km) from any wild horse and burro HMA managed by the BLM and more than 24 mi (39 km) from any wild horse and burro territory administered by the USFS, solar energy development within the SEZ would not contribute to cumulative impacts on wild horses and burros managed by the BLM or the USFS.

13.1.22.4.4 Recreation

Limited outdoor recreation (e.g., backcountry driving, OHV use, and hunting for both small and big game) occurs on or in the immediate vicinity of the SEZ. Construction of utility-scale solar projects on the SEZ would preclude recreational use of the affected lands for the duration of the projects. However, improvements to or additional access roads could increase the amount of recreational use in unaffected areas of the SEZ or in the immediate vicinity. There would be a potential for visual impacts on recreational users of the Old Spanish Trail in the area (Section 13.1.22.3.2). Since the area of the proposed SEZ has low current recreation use and the surrounding area holds similar or better opportunities for recreation, while major foreseeable actions, mainly wind projects, lie 15 mi (24 km) or more away, cumulative impacts on recreation within the geographic extent of effects would be small.

13.1.22.4.5 Military and Civilian Aviation

The proposed Escalante Valley SEZ is located more than 100 mi (161 km) away from any military installation. The closest civilian municipal aviation facility is the Cedar City Regional Airport, located about 30 mi (48 km) east-southeast of the SEZ. Recent information from the DoD indicates that there are no concerns about solar development in the SEZ. Considering the distance to other ongoing and reasonably foreseeable future actions discussed in Section 13.1.22.2, the cumulative impacts from the solar energy development in the proposed SEZ on military and civilian aviation would be small.

13.1.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including any associated transmission line connections and new roads, would contribute to the soil loss due to wind erosion. Road use during construction, operations, and decommissioning of the solar facilities, would further contribute to soil loss. Design features would be employed to minimize erosion and loss. Residual soil losses with mitigations in place would be in addition to losses from construction of other renewable energy facilities, recreational uses, and agricultural. Overall the cumulative impacts on soil resources would be small, however, due to the generally low level of foreseeable development within the geographic extent of effects.

Landscaping of solar energy facility areas could alter drainage patterns and lead to increased siltation of surface water streambeds, in addition to that caused by other development activities and agriculture. However, with the programmatic design features in place, cumulative impacts would be small.

13.1.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

As discussed in Section 13.1.8, there are currently oil and gas leases that cover the entire SEZ; however, there are no producing oil and gas facilities. There are no mining claims or proposals for geothermal energy development in the SEZ. If the proposed SEZ were approved for solar energy development, conflicts would have to be resolved with existing oil and gas lease holders. Development of both solar resources and oil and gas resources in the SEZ would be possible utilizing directional drilling techniques for oil and gas. Because of the generally low mineral productivity of the proposed SEZ and surrounding area and the expected low impact on mineral accessibility of other foreseeable actions within the geographic extent of effects, mainly wind facilities, cumulative impacts on mineral resources would be small.

13.1.22.4.8 Water Resources

The water requirements for various technologies if they were to be employed on the proposed SEZ to develop utility-scale solar energy facilities are described in Section 13.1.9.2.

If the SEZ were to be fully developed over 80% of its available land area, the amount of water needed during the peak construction year for all evaluated solar technologies would be 885 to 1,261 ac-ft (1.1 million to 1.6 million m^3). During operations, the amount of water needed for all evaluated solar technologies would range from 30 to 15,888 ac-ft/yr (36,000 to 20 million m^3). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. As discussed in Section 13.1.22.2.3, the amount of groundwater extracted in the Beryl-Enterprise in the vicinity of the proposed Escalante Valley SEZ averaged 85,000 ac-ft/yr (105 million m^3/yr) during the period 1998 to 2007. Therefore, the additional water needed for solar facilities in the SEZ during operations would constitute from a relatively small (0.03%) to a relative large (18%) increment (the ratio of the annual water requirement to the annual amount withdrawn in Beryl-Enterprise) depending on the solar technology used (PV technology at the low end and the wet-cooled parabolic technology at the high end). However, as discussed in Section 13.1.9.1.3, since the water resources in the area are fully appropriated, any new uses would simply replace any existing use and no net increase or decrease would occur in the total amount of water used. Small cumulative effects on groundwater supplies might result from withdrawals from solar projects in the SEZ combined with withdrawals from the Southern Nevada Water Authority's proposed Clark, Lincoln, and White Pine Counties (Nevada) Groundwater Development Project, which would draw water from the Snake Valley and Spring Valley aquifers located about 40 mi (64 km) north and west of the Escalante SEZ. The proposed Lake Powell Pipeline project could supply a portion of current demands or offset future demands on groundwater in the region.

Sanitary wastewater would range from 9 to 74 ac-ft (11,000 to 91,000 m^3) during the peak construction year and would range from less than 1 to 15 ac-ft/yr (up to 18,000 m^3/yr) during operations of utility-scale solar energy facilities. Such volumes would not strain available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that use conventional wet-cooling systems, there would also be from 167 to 301 ac-ft/yr (200,000 to 370,000 m^3) 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.

13.1.22.4.9 Vegetation

The proposed Escalante Valley SEZ is located mostly within the Shadscale-dominated Saline Basins ecoregion, which primarily supports a sparse saltbush-greasewood shrub community. Because of the long history of livestock grazing, the plant communities in the area have likely been affected by grazing. 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. Facility construction would primarily affect Semi-Desert Shrub Steppe, Mixed Salt Desert Scrub, or Big Sagebrush Shrubland, which are relatively common in the Escalante Desert Valley area. There are no known wetlands within the proposed SEZ; however, any wetland or riparian habitats outside of the SEZ that are supported by groundwater discharge could be affected by hydrologic changes resulting from groundwater withdrawal or other project activities. 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, agriculture, recreation, and transportation. The cumulative dust loading could result in reduced productivity or changes in plant community composition. Programmatic and SEZ-specific design features would be used to reduce the impacts on plant communities from solar energy projects. Other ongoing and reasonably foreseeable future actions would affect the same plant species affected by development within the SEZ. However, cumulative effects would be small due to the abundance of the affected species; the distance to other major actions, mainly wind energy facilities; and the relatively low impact of these actions on vegetation.

13.1.22.4.10 Wildlife and Aquatic Biota

Wildlife species that can potentially be affected by the development of utility-scale solar energy facilities in the proposed SEZ include amphibians, reptiles, birds, mammals, and aquatic species. The construction of utility-scale solar energy projects in the SEZ and any associated transmission line connections 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, and wildlife injury or mortality. In general, impacted species with broad distributions and a variety of habitats would be less affected than species with a narrowly defined habitat within a limited area. Design features may include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats (e.g., areas of crucial habitat for pronghorn).

Other ongoing and reasonably foreseeable future actions within 50 mi (80 km) of the proposed SEZ are dominated by wind energy projects (Section 13.1.22.2). The majority of these projects lie 20 to 50 mi (30 to 80 km) to the northeast (Figure 13.1.22.2-1). The Milford Flats South and Wah Wah Valley SEZs are also located within this distance. Since many of the wildlife species present within the proposed SEZ that could be affected by other actions have extensive available habitat within the affected counties (e.g., mule deer and pronghorn) and most of the major actions, wind facilities, would be at some distance from the proposed SEZ and would have low to moderate impacts on most species, cumulative impacts on wildlife within the geographic extent of effects would be small to moderate.

Surface water within the proposed Escalante Valley SEZ is typically limited to intermittent washes and dry lakebeds that contain water only for short periods during or following precipitation events, and no perennial surface water bodies, seeps, or springs are present within its boundaries. Similarly, wetlands are uncommon on the proposed SEZ (Section 13.1.11.1). In addition, there are no perennial streams in close proximity to the proposed SEZ. Thus, potential 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 would be minimal. Further, other major foreseeable actions within the geographic extent of effects, proposed wind facilities, would be more than 15 mi (30 km) away and would not use groundwater for operations. Thus cumulative impacts on aquatic species would be small. Design features, such as settling basins, silt fences, or directing water draining from the developed areas away from specific drainages, would limit cumulative impacts on aquatic biota and habitats.

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

As many as 18 special status species could occur within the proposed Escalante Valley SEZ based on suitable habitat, while 5 of these species have been recorded within the SEZ: ferruginous hawk, greater sage-grouse, western burrowing owl, pygmy rabbit, and Utah prairie dog. Numerous additional species listed as threatened or endangered by the states of Utah and Nevada or listed as a sensitive species by the BLM (see Section 13.1.12.1) are known to occur within 50 mi (80 km) of the proposed SEZ. Potential design features that could be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy projects in the SEZs and related developments (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, agriculture, and recreational activities in the area, while foreseeable actions are dominated by proposed wind projects 20 to 50 mi (32 to 80 km) to the northeast. Many of the special status species present on the SEZ are also likely to be present at the locations of proposed wind projects where the same habitats exit. Wind projects, however, would be generally less disruptive to habitats than would solar projects. Thus, depending on where other projects are actually built, small cumulative impacts on protected species could occur within the geographic extent of effects. Projects would employ programmatic and SEZ-specific design features to limit such effects.

13.1.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuel–generated energy, the site preparation and construction activities associated with solar energy facilities would produce some emissions, mainly particulate matter (fugitive dust) and engine exhaust emissions from vehicles and construction equipment. When these emissions are combined with those from other projects near solar energy facilities or when they are added to natural dust generated by winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, particulate matter (dust) concentration at or near the SEZ boundaries could at times exceed state or federal ambient air quality standards. Generation of dust from construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency or road paving or treatment.

Because the area proposed for the SEZ is rural and undeveloped land, there are no significant industrial sources of air emissions in the area. The only type of air pollutant of concern is dust generated by winds. Other ongoing and reasonably foreseeable future activities in the general vicinity of the SEZ are described in Section 13.1.22.2. Because the other major actions that could produce fugitive dust emissions are located more than 15 mi (24 km) from the proposed SEZ, cumulative air quality effects due to dust emissions during any overlapping construction periods would be small.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and air quality–related 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 13.1.13, 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 relative large. For example, if the Escalante SEZ were fully developed (80% of its acreage) with solar facilities, the quantity of pollutants avoided could be as large as 5% of all emissions from the current electric power systems in Utah.

13.1.22.4.13 Visual Resources

The proposed Escalante Valley SEZ is within a relatively flat, treeless valley floor. The SEZ is visible from upper elevations of the Wah Wah Mountains to the northeast and the Antelope Range to the south. The area is sparsely inhabited, remote, and rural in character. Other than a few dirt roads and some livestock management-related modifications such as wire fences, normally dry livestock ponds, and cattle trails, there is little evidence of cultural modifications that detract from the area's natural scenic quality. Given the natural state of the SEZ, construction of utility-scale solar facilities on the SEZ would significantly alter the natural scenic quality of the area. If other reasonably foreseeable activities as described in Section 13.1.22.2 take place, they would cumulatively affect the visual resources in the area. Additional impacts would occur as a result of the construction, operation, and decommissioning/reclamation of related facilities, such as access roads and electric transmission line connections.

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, including portions of the Old Spanish Trail, would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy developments within the SEZ.

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 the Sigurd to Red Butte, Energy Gateway South, TransWest Express, and Three Peaks transmission line projects. In addition, the Milford Wind project and two authorized geothermal applications lie within 50 mi (80 km), while three applications pending authorization for wind site testing, eight authorized for wind testing, and three pending authorization for development of wind facilities on public lands also lie within 50 mi (80 km) of the SEZ, most located 20 to 50 mi (30 to 80 km) to the northeast (Figure 13.1.22.2-1). The Milford Flats South and Wah Wah Valley SEZs are also located within 50 mi (80 km) of the Escalante SEZ. While proposed and potential facilities would lie some distance from the SEZ and their contribution to cumulative impacts in the area would depend on the number of projects that are actually built, it may be concluded that the general visual character of the landscape within this distance could be altered by the presence of solar facilities and windmills from what is currently rural desert. Because of the topography of the region, solar facilities within the SEZ and wind facilities located in basin flats would be visible at great distances from surrounding mountains. It is possible that two or more facilities might be viewable from a single location, but facilities would be widely separated under current proposals. Also, facilities would be located near major roads, and thus would be viewable by motorists, who would also be viewing transmission line corridors, towns, and other infrastructure, as well as the road system itself.

In addition, as additional facilities are added, several projects might become visible in succession, as viewers move through the landscape, as by driving on local roads. In general, the new facilities would not be expected to be consistent in terms of their 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 all of the above, the overall cumulative visual impacts within the geographic extent of effects from solar, wind, and other developments could be in the range of small to moderate.

13.1.22.4.14 Acoustic Environment

The areas around the proposed Escalante valley SEZ are relatively quiet. The existing noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, and agricultural activities. Other noise sources associated with current land use around the SEZ include outdoor recreation, backcountry and OHV driving, and hunting. The construction of solar energy facilities could increase the noise levels periodically for up to three years, but there would be little noise 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 future activities in the general vicinity of the SEZs are described in Section 13.1.22.2. Because proposed projects are far from the SEZ, the area is sparsely populated, and noise seldom exerts its influence over several miles. Cumulative noise effects during the construction or operation of solar facilities are unlikely.

13.1.22.4.15 Paleontological Resources

The proposed Escalante Valley SEZ has low potential for the occurrence of significant fossil material (Section 13.1.16). While impacts on significant paleontological resources are unlikely to occur in the SEZ, specific sites selected for future projects would be investigated to determine whether a paleontological survey is needed. Any paleontological resources encountered would be mitigated to the extent possible as determined through consultation with the BLM. A similar process would be employed at other facilities constructed in the area. No significant cumulative impacts on paleontological resources are expected.

13.1.22.4.16 Cultural Resources

The Escalante Desert is rich in cultural history with settlements dating as far back as 12,000 years. The area covered by the proposed Escalante Valley SEZ has the potential to contain significant cultural resources. Although surveys of small portions of the SEZ have been conducted and five sites have been recorded in the Escalante Valley SEZ, the acreage of the areas surveyed is small compared with the total acreage in the SEZ. Two of the five sites recorded in the dune area of the Escalante Valley SEZ are eligible for listing in the NRHP. In addition, several historic properties are found near the SEZ (see Section 13.1.17.1). It is possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, such as the several authorized and pending wind applications on public lands, could contribute cumulatively to cultural resource impacts occurring in the region. However, only four wind applications—two pending wind site testing and two authorized for wind site testing—lie within the 25-mi (40-km) geographic extent of effects, while no foreseeable wind projects have been identified within this distance. The proposed Milford Flats South SEZ also lies about 25 mi (40 km) to the northeast, but currently has no solar applications pending. Potential future wind projects would cover large areas but would result in a relatively low level of actual land disturbance. In addition, the specific sites selected for future projects would be surveyed, and historic properties would be avoided or mitigated to the extent possible. Through ongoing consultation with the Utah SHPO and appropriate Native American governments, it is likely that many adverse effects on significant resources in the region could be mitigated to some degree. In addition, given what is currently known archaeologically about the valley floors in this area of Utah, it is unlikely that sites recorded in the SEZ would be of such significance that, if properly mitigated, development would cumulatively cause an irretrievable loss of information about a significant resource type.

13.1.22.4.17 Native American Concerns

Government-to-government consultation is under way with Native American governments with possible traditional ties to the Escalante Desert. All federally recognized Tribes with Southern Paiute roots or possible associations with the Utah SEZs have been contacted and provided an opportunity to comment or consult regarding this PEIS. To date, no specific concerns regarding the proposed Escalante Valley SEZ have been raised to the BLM. It is, however, possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, including wind energy facilities and other renewable energy projects outside of the SEZ, could contribute cumulatively to visual and acoustic impacts on their traditional landscape and the destruction of other resources in the valley important to Native Americans. Continued discussions with the area Tribes through government-to-government consultation is necessary to effectively consider and address the Tribes' concerns tied to solar energy development in the Escalante Desert.

13.1.22.4.18 Socioeconomics

Solar energy development projects in the proposed Escalante Valley SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZs 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 developments in the area, including other renewable energy development. The number of workers involved in the construction of solar projects in the peak construction year could range from about 130 to 1,700 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 300 (solar PV) to as high as 3,900 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar, wind, or geothermal 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-or-more year solar development period.

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. The number of workers needed at the solar facilities would be in the range of 12 to 230, with approximately 16 to 380 total jobs created in the region (Section 13.1.19.2.2). 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.

13.1.22.4.19 Environmental Justice

Low-income populations have been identified within 50 mi (80 km) of the proposed SEZ in both Utah and Nevada; no minority populations are present. Any impacts from solar development could have cumulative impacts on low-income populations in combination with other development in the area. Such impacts could be both positive, such as from increased economic activity, and negative, such as visual impacts, noise, and exposure to fugitive dust. 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 major foreseeable actions are widely separated and would not likely combine with effects from the SEZ on low-income populations. If needed, mitigation measures can be employed to reduce the impacts on the population in the vicinity of the SEZ, including the low-income populations. Thus, it is not expected that the proposed Escalante Valley SEZ would contribute to cumulative impacts on low-income populations.

13.1.22.4.20 Transportation

Major roads that run close to the proposed Escalante Valley SEZ are Beryl Milford Road and Lund Highway. The AADT on the roads near the SEZ is currently relatively low, less than 1,000. During construction of utility-scale solar energy facilities, there could be up to 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT on these roads by 2,000 vehicles. This increase in highway traffic from construction workers could have moderate cumulative impacts in combination with existing traffic levels and increases from construction traffic from other major future actions, should construction schedules overlap. Local road improvements may be necessary so as not to overwhelm the local roads near site access points. 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 of future actions would be relatively small because of the low number of workers needed to operate the solar and wind facilities and would have little contribution to cumulative impacts.

13.1.23 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.

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.

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, R.E., and G.E. Christenson, 1989, *Quaternary Faults, Folds, and Selected Volcanic Features in the Cedar City 1° × 2° Quadrangle, Utah*, Utah Geological and Mineral Survey, Miscellaneous Publication 89-6.

Arrington, L.J., 1958, *Great Basin Kingdom: The Economic History of the Latter-Day Saints 1830–1900*, Harvard University Press, Cambridge, Mass.

Backer, A., et al., 2001, *Cultural Resource Inventory and Reevaluation for the 2003 Kern River Expansion Project: Beaver, Iron, Juab, Millard, Morgan, Salt Lake, Summit, Utah, and Washington Counties, Utah*, prepared by Alpine Archaeological Consultants, Inc., Montrose, Colo., for Williams Gas Pipeline, Houston, Tex., Sept.

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.

Beaver, 2009, *Beaver Municipal Airport*. Available at http://www.beaverutah.net/airport.htm. Accessed Nov. 12, 2009.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

Black, B.D., and S. Hecker, 1999a, “Fault Number 2485, Wah Wah Mountains (South End near Lund) Fault (Class A),” in *Quaternary Fault and Fold Database of the United States*, U.S. Geological Survey. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Dec. 1, 2009.

Black, B.D., and S. Hecker, 1999b, “Fault Number 2517, Antelope Range Fault (Class A),” in *Quaternary Fault and Fold Database of the United States*, U.S. Geological Survey. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Dec. 1, 2009.

BLM (Bureau of Land Management), 1976, *Dominguez-Escalante Expedition: Exploring the Interior West*, brochure prepared by the BLM for wayside exhibits in Arizona, Colorado, New Mexico, and Utah, Washington, D.C.

BLM, 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program*, Colorado State Office, Denver, Colo., Jan.

BLM, 1984a, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1984b, *Final Resource Management Plan and Environmental Impact Statement for the Cedar/Beaver/Garfield/Antimony Planning Area*, Cedar City District, Utah, Oct.

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 Impact Statement*, Colorado State Office, White River Resource Area, Craig District, Colo., June.

BLM, 2001, *Utah Water Rights Fact Sheet*. Available at http://www.blm.gov/nstc/WaterLaws/pdf/Utah.pdf.

BLM, 2005, *Greater Three Peaks Special Recreation Management Area Designation and Recreation Management Plan, Land Use Plan Amendment, Land Exchanges, and R&PP Amendment*, Environmental Assessment UT-040-03-17, U.S. Department of the Interior, Cedar City, Utah, April. Available at http://governor.utah.gov/rdcc/Y2005/05-5088.pdf. Accessed May 12, 2010.

BLM, 2006, *2006 Accomplishment Report: An Annual Accomplishment Report by the Recreation and Visitor Services Advisory Team (RVSAT)*. Available at http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/caso/publications.Par.8147.File.dat/2006RecreationVisitorServices.pdf. Accessed May 12, 2010.

BLM, 2008, *Special Status Species Management*, BLM Manual 6840, Release 6-125, U.S. Department of the Interior, Dec. 12.

BLM, 2009a, *Rangeland Administration System*, last updated Aug. 24, 2009. Available at http://www.blm.gov/ras/index.htm. Accessed Nov. 24, 2009.

BLM, 2009b, *Herd Management Areas Utah*, Washington, D.C. Available at http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/wild_horses_and_burros/tatistics_and_maps/new_hma_state_maps.Par.73653.File.dat/HMA_Utah.pdf. Accessed Oct. 20, 2009.

BLM, 2010a, *Draft Visual Resource Inventory*, prepared by Otak, Inc., for the U.S. Department of Interior BLM, Cedar City Field Office, Cedar City, Utah, March.

BLM, 2010b, *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, 2010c, *Proposed Pony Express RMP Amendment and Final EIS for the UNEV Pipeline*, April. Available at http://www.blm.gov/pgdata/etc/medialib/blm/ut/lands_and_minerals/lands/major_projects/unev_pipeline.Par.73184.File.dat/01_UNEV%20FEIS%20Front%20Matter_FINAL%20508%20&%20BM.pdf.

BLM and USFS (Bureau of Land Management and U.S. Forest Service), 2010a, *Geocommunicator: PLSS.* Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed April 29, 2010.

BLM and USFS, 2010b, *GeoCommunicator: Energy Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 10, 2010.

BRAC (Blue Ribbon Advisory Council on Climate Change), 2007, *Report to Governor Jon M. Huntsman, Jr.*, Final BRAC Report, Utah Department of Environmental Quality, Oct. 3. Available at http://www.deq.utah.gov/BRAC_Climate/final_report.htm. Accessed Dec. 3, 2009.

BTS (Bureau of Transportation Statistics), 2008, *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 June 23, 2009.

Burden, C.B., et al., 2009, *Ground-Water Conditions in Utah Spring 2009*, U.S. Geological Survey, Cooperative Investigations Report No. 50. Available at http://ut.water.usgs.gov/publications/GW2009.pdf. Accessed Dec. 8, 2009.

Callaway, D., et al., 1986, "Ute," pp. 336–367 in *Handbook of North American Indians*, *Vol. 11*, *Great Basin*, W. D'Azevedo (editor), Smithsonian Institution, Washington, D.C.

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.

CDOW (Colorado Division of Wildlife), 2009, *Natural Diversity Information Source, Wildlife Species Page,* Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

Cedar City, 2009, *Cedar City, Utah, Airport*. Available at http://ut-cedarcity.civicplus.com/index.aspx?NID=76. Accessed Aug. 13, 2009.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec. 28. Available at http://www.whitehouse.gov/CEQ.

Christenson, G.E. (editor), 1995, *The September 2, 1992 ML 5.8 St. George Earthquake, Washington County, Utah*, Utah Geological Survey Circular 88.

Connelly, J.W., et al., 2000, "Guidelines to Manage Sage Grouse Populations and Their Habitats," *Wildlife Society Bulletin* 28(4):967–985.

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.

Dalley, G., 2009, personal communication from Dalley (Bureau of Land Management, Cedar City Field Office, Cedar City, Utah) to B. Verhaaren (Argonne National Laboratory, Argonne, Ill.), May 26.

Diefenbach, A.K., et al., 2009, *Chronology and References of Volcanic Eruptions and Selected Unrest in the United States, 1980–2008*, U.S. Geological Survey Open File Report 2009-1118.

DOE (U.S. Department of Energy), 2009, *Report to Congress, Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation*, Jan. 13.

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, 2009a, *Energy CO_2 Emissions by State*, last updated June 12, 2009. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html. Accessed Sept. 11, 2009.

EPA, 2009b, *AirData: Access to Air Pollution Data.* Available at http://www.epa.gov/oar/data. Accessed Nov. 18, 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*, last updated Oct. 16, 2008. Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html. Accessed Jan. 12, 2009.

EPA, 2010, *National Ambient Air Quality Standards (NAAQS)*, last updated June 3, 2010. Available at http://www.epa.gov/air/criteria.html. Accessed June 4, 2010.

Euler, R., 1964, "Southern Paiute Archaeology," *American Antiquity* 29(3):379–381.

FAA (Federal Aviation Administration), 2009, *Airport Data (5010) & Contact Information, Information Current as of 07/02/2009*. Available at http://www.faa.gov/airports/airport_safety/airportdata_5010. Accessed Aug. 13, 2009.

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.

Fire Departments Network, 2009, *Fire Departments by State*. Available at http://www.firedepartments.net.

First Wind, 2009, *Milford Wind Corridor Project Is Completed; Largest Wind Facility in Utah and One of the Largest in the West*, press release, Nov. 10. Available at http://www.firstwind.com/aboutFirstWind/news.cfm?ID=db580938%2Da4e6%2D4521%2Da81a%2Dff33cd51251b. Accessed Nov. 13, 2009.

Forster, R.R., 2006, *Land Subsidence in Southwest Utah from 1993 to 1998 Measured with Interferometric Synthetic Aperture Radar (InSAR)*, Utah Geological Survey Miscellaneous Publication 06-5, ISBN 1-55791-754-X.

Fowler, C.S., 1986, "Subsistence," pp. 64–97 in *Handbook of North American Indians, Vol. 11, Great Basin*, W.L. D'Azevedo (editor), Smithsonian Institution, Washington, D.C.

Galloway, D., et al., 1999, *Land Subsidence in the United States*, U.S. Geological Survey Circular 1182.

Gerston, R.C., and R.B. Smith, 1979, *Interpretation of a Seismic Refraction Profile across the Roosevelt Hot Springs, Utah and Vicinity*, U.S. Department of Energy, Report No. ADO/78-1701.a.3.

Giffen, R., 2009, "Rangeland Management Web Mail," personal communication from Giffen (U.S. Forest Service, Rangelands Management, Washington, D.C.) to W. Vinikour (Argonne National Laboratory, Argonne, Ill.), Sept. 22.

Governor's Office of Planning and Budget, 2009, *Demographic and Economic Projections.* Available at http://www.governor.utah.gov/dea/projections.html. Accessed Dec. 3, 2009.

Graham, T.B., 2001, *Survey of Ephemeral Pool Invertebrates at Wupatki NM: An Evaluation of the Significance of Constructed Impoundments as Habitat*, WUPA-310, final report for Wupatki National Monument and Southwest Parks and Monuments Association, Sept.

Greer, J., 2008, *Safe Yield Estimate for the Beryl-Enterprise Area*, White Paper, Utah Division of Water Resources, Salt Lake City, Utah.

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.

Hauck, F.R., 1977, *Cultural Resource Evaluation in South Central Utah*, Cultural Resource Series No. 4, Bureau of Land Management.

Hecker, S., 1993, *Quaternary Tectonics of Utah with Emphasis on Earthquake-Hazard Characterization*, Utah Geological Survey Bulletin 127.

Hill, D.P., et al., 1998, *Future Eruptions in California's Long Valley Area—What's Likely?*, U.S. Geological Survey Fact Sheet 073-97, Nov.

Hill, D.P., et al., 2000, *Living with a Restless Caldera—Long Valley California*, U.S. Geological Survey Fact Sheet 108-96, Version 2.1, May.

Hintze, L., 1980, *Geologic Map of Utah (Scale 1:500,000)*, Utah Geological and Mineral Survey.

Iron County, 2009, "Solar Power Plant," Chapter 17.33 in *Title 17 Zoning*. Available at http://planning.utah.gov/Library/Index_files/PDFs/Iron17.33.pdf. Accessed Nov. 3, 2009.

Kelly, I.T., 1934, "Southern Paiute Bands," *American Anthropologist* 36(4):548–560.

Kelly, I., and C. Fowler, 1986, "Southern Paiute," pp. 368–397 in *Handbook of North American Indians*, *Vol. 11*, *Great Basin*, W. D'Azevedo (editor), Smithsonian Institution, Washington, D.C.

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.

Klauk, R.H., and C. Gourley, 1983, *Geothermal Assessment of a Portion of the Escalante Valley, Utah*, Utah Geological and Mineral Survey, Special Study 63, Dec.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

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.

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, original file updated in December 2007. Available at http://pubs.usgs.gov/of/2005/1305/index.htm.

Lund, W.R., et al., 2005, *The Origin and Extent of Earth Fissures in Escalante Valley, Southern Escalante Desert, Iron County, Utah*, Utah Geological Survey, Special Study 115.

Lund, W.R., et al., 2007, *Paleoseismic Investigation and Long-Term Slip History of the Hurricane Fault in Southwestern Utah*, Utah Geological Survey, Special Study 119.

Madsen, D.B., 2000, *Late Quaternary Paleoecology in the Bonneville Basin*, Utah Geological Survey Bulletin 130.

Mason, J., 1998, "Ground Water Hydrology and Simulated Effects of Development in the Milford Area, an Arid Basin in Southwestern Utah," in *Regional Aquifer-System Analysis—Great Basin: Nevada and Utah*, U.S. Geological Survey Professional Paper 1409-G.

Maung, M., 2009, personal communication from Maung (Utah Department of Environmental Quality, Division of Air Quality, Salt Lake City, Utah) to A. Smith (Argonne National Laboratory, Argonne, Ill.), Nov. 18.

MIG, Inc. (Minnesota IMPLAN Group), 2010, *State Data Files*, Stillwater, Minn.

Milford, 2009, *Airport, City of Milford, Utah*. Available at http://www.milfordut.com/departments.airport.html. Accessed Nov. 12, 2009.

Miller, C.D., 1989, *Potential Hazards from Future Volcanic Eruptions in California*, U.S. Geological Survey Bulletin 1847.

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.

Milligan, M., 2009, *What Are Those Crunchy Crusts Found on Some Utah Soils?*, Utah Geological Survey. Available at http://ugs.utah.gov/surveynotes/gladasked/gladcrusts.htm. Accessed Dec. 1, 2009.

Mower, R.W., and G.W. Sandberg, 1982, *Hydrology of the Beryl-Enterprise, Escalante Desert, Utah, with Emphasis on Ground Water*, U.S. Geological Survey, Open File Report 81-533.

Murphey, P.C., and D. Daitch, 2007, "Figure D4, Utah-PFYC," in *Paleontological Overview of Oil Shale and Tar Sands Areas in Colorado, Utah, and Wyoming*, prepared for U.S Department of the Interior, Bureau of Land Management, Dec.

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 Academy 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), 1989, *1988 Local Climatological Data Annual Summary with Comparative Data, Milford, Utah*, National Oceanic and Atmospheric Administration. Available at http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html. Accessed Nov. 9, 2009.

NCDC, 2009a, *Climates of the States (CLIM60): Climate of Utah*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed Nov. 9, 2009.

NCDC, 2009b, *Integrated Surface Data (ISD), DS3505 Format*, database, Asheville, N.C. Available at ftp://ftp3.ncdc.noaa.gov/pub/data/noaa. Accessed Nov. 9, 2009.

NCDC, 2010, *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 Oct. 23, 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.

NPS (National Park Service), 2000, *Draft National Historic Trail Feasibility Study and Environmental Assessment: Old Spanish Trail*, Washington, D.C., July.

NRCS (Natural Resources Conservation Service), 2005, *Iron County, Utah Resource Assessment*, U.S. Department of Agriculture, Aug. Available at http://www.ut.nrcs.usda.gov/technical/nri/RA-data/Iron_Res_Assmnt.pdf. Accessed Nov. 20, 2009.

NRCS, 2008, *Soil Survey Geographic (SSURGO) Database for Maricopa County, Arizona.* Available at http://SoilDataMart.nrcs.usds.gov.

NRCS, 2009, *Major Land Resource Area 28A—Great Salt Lake Area Fact Sheet*. Available at http://www.ut.nrcs.usda.gov/technical/technology/range/mlra28a.html. Accessed Dec. 1, 2009.

NRCS, 2010, *Custom Soil Resource Report for Iron County (Covering the Proposed Escalante Valley SEZ), California*, U.S. Department of Agriculture, Washington, D.C., Oct. 7.

PacifiCorp, 2010, *Bringing New Transmission to the West*. Available at http://www.pacificorp.com/tran/tp/eg.html.

Pederson, J., undated, *Mountain Lion (Felis concolor)*, Wildlife Notebook Series No. 5, Utah Division of Wildlife Resources, Salt Lake City, Utah. Available at http://wildlife.utah.gov/publications/pdf/newlion.pdf. Accessed Nov. 25, 2009.

Prey, D., 2009, personal communication from Prey (Utah Department of Environmental Quality, Division of Air Quality, Salt Lake City, Utah) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), Nov. 17.

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.

Roe, S., et al., 2007, *Final Utah Greenhouse Gas Inventory and Reference Case Projections, 1990–2020*, prepared by Center for Climate Strategies, Washington, D.C., for Utah Department of Environmental Quality, Salt Lake City, Utah, Feb. Available at http://www.deq.utah.gov/BRAC_Climate/docs/fdocs/Final_Utah_GHG_I&F_Report_3-29-07.pdf. Accessed Nov. 19, 2009.

Romin, L.A., and J.A. Muck, 1999, *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances*, U.S. Fish and Wildlife Service, Utah Field Office, Salt Lake City, Utah, May. Available at https://fs.ogm.utah.gov/pub/coal_related/MiscPublications/USFWS_Raptor_Guide/RAPTORGUIDE.PDF. Accessed Oct. 25, 2010.

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.

Rusco, E.R., 1992, "Historic Change in Western Shoshone Country: The Establishment of the Western Shoshone National Council and Traditionalist Land Claims," *American Indian Quarterly* 16(3):337–360.

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.

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.

Simmons, V.M., 2000, *The Ute Indians of Utah, Colorado, and New Mexico*, University of Colorado Press, Boulder, Colo.

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.

SNWA (Southern Nevada Water Authority), 2010*, Southern Nevada Water Authority Clark, Lincoln, and White Pine Counties Groundwater Development Project, Conceptual Plan of Development*, prepared for Bureau of Land Management, Nevada State Office, Reno, Nev., April. Available at http://www.snwa.com/assets/pdf/gdp_concept_plan.pdf.

Solar Partners I, LLC, 2007, *Application for Certification*, submitted to the California Energy Commission, Sacramento, Calif., Aug.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, New York, N.Y.

Stegner, M., and M. Kelly, 2008, *Class III Cultural Resource Inventory of the Toquop Energy Project Power Plant and Rail Line, Lincoln County, Nevada*, prepared by URS Corporation, Portland, Ore., for U.S. Department of the Interior and Bureau of Land Management, Ely, Nev.

Stoffle, R.W., and H.F. Dobyns, 1983, *Nuvagantu: Nevada Indians Comment on the Intermountain Power Project, Cultural Resources Series No. 7*, Nevada State Office of the Bureau of Land Management, Reno, Nev.

Stoffle, R.W., et al., 1990, "Calculating the Cultural Significance of American Indian Plants: Paiute and Shoshone Ethnobotany at Yucca Mountain, Nevada," *American Anthropologist* 92(2):416–432.

Stoffle, R.W., et al., 1997, "Cultural Landscapes and Traditional Cultural Properties: A Southern Paiute View of the Grand Canyon and Colorado River," *American Indian Quarterly* 21(2):229–249.

Stoffle, R., et al., 1999, "*Puchuxwavaats Uapi* (To know about plants): Traditional Knowledge and the Cultural Significance of Southern Paiute Plants," *Human Organization* 58(4): 416–429.

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 and L. Resseguie (Bureau of Land Management Washington, D.C.), Sept. 14.

Thomas, D.H., et al., 1986, “Western Shoshone,” pp. 262–283 in *Handbook of North American Indians*, *Vol. 11, Great Basin*, W. D’Azevedo (editor), Smithsonian Institution, Washington, D.C.

Thomas, K., and M. Lowe, 2007, *Recharge and Discharge Areas for the Principal Basin-Fill Aquifer, Beryl-Enterprise Area, Iron, Washington, and Beaver Counties, Utah*, Utah Geological Survey, Map 225.

TransWest, 2010, *Delivering Wyoming Wind Energy to the West,* TransWest Express, LLC. Available at http://www.transwestexpress.net/index.shtml.

UBWR (Utah Board of Water Resources), 1995, *Utah State Water Plan*, *Cedar/Beaver Basin*, April.

UDA (Utah Department of Agriculture), 2008, *Utah Noxious Weed List*, Oct. Available at http://ag.utah.gov/divisions/plant/noxious/documents/noxUtah.pdf. Accessed May 26, 2010.

UDA, 2009, *County Declared Noxious Weeds in Utah*, Aug. Available at http://ag.utah.gov/divisions/plant/noxious/documents/noxCounty.pdf. Accessed May 26, 2010.

UDEQ (Utah Department of Environmental Quality), 2009, *Windblown Dust*, Division of Air Quality. Available at http://www.airquality.utah.gov/Public-Interest/Public-Commen-Hearings/Exceptional_Events/EE_Wind.htm. Accessed Nov. 19, 2009.

UDOT (Utah Department of Transportation), 2009, *Traffic on Utah Highways, 2008*, Systems Planning and Programming Division, Traffic Analysis Section. Available at http://www.udot.utah.gov/main/uconowner.gf?n=5829020562213603. Accessed Aug. 15, 2009.

UDWQ (Utah Division of Water Quality), 2008, *Authorization to Discharge under the Utah Pollutant Discharge Elimination System, Storm Water General Permit for Construction Activities Permit No. UTR300000*, June 2008.

UDWR (Utah Division of Wildlife Resources), 2003, *Vertebrate Information Compiled by the Utah Natural Heritage Program: A Progress Report*, Utah Department of Natural Resources. Available at http://dwrcdc.nr.utah.gov/ucdc/ViewReports/UNHPVertReport.pdf. Accessed Oct. 25, 2010.

UDWR, 2006, *UDWR Habitat Coverages*, Utah Department of Natural Resources, Salt Lake City, Utah. Available at http://dwrcdc.nr.utah.gov/ucdc/ downloadgis/disclaim.htm. Accessed Nov. 4, 2009.

UDWR, 2007, *Utah Sensitive Species List*, Utah Department of Natural Resources, Dec.

UDWR, 2008, *Utah Statewide Management Plan for Mule Deer*, Utah Department of Natural Resources, Salt Lake City, Utah. Available at http://wildlife.utah.gov/hunting/biggame/pdf/mule_deer_pla%20approved_12_4_2008.pdf. Accessed Nov. 2, 2009.

UDWR, 2009a, *Utah Conservation Data Center*, Utah Department of Natural Resources. Available at http://dwrcdc.nr.utah.gov/ucdc/default.asp. Accessed Nov. 3, 2009.

UDWR, 2009b, *Utah Cougar Management Plan V. 2.0, 2009–2021*, DWR Publication No. 09-15, Utah Department of Natural Resources, Salt Lake City, Utah. Available at http://wildlife.utah.gov/pdf/cmgtplan.pdf. Accessed Nov. 2, 2009.

UDWR, 2009c, *Utah Pronghorn Statewide Management Plan*, Utah Department of Natural Resources, Salt Lake City, Utah. Available at http://wildlife.utah.gov/hunting/biggame/pdf/Statewide_prong_mgmt_2009.pdf. Accessed Nov. 2, 2009.

UDWR, 2009d, *Utah Greater Sage-Grouse Management Plan*, Utah Department of Natural Resources, Publication 09-17, Salt Lake City, Utah.

UDWR, 2010a, *Utah Elk Statewide Management Plan*, Utah Department of Natural Resources, Salt Lake City, Utah. Available at http://wildlife.utah.gov/hunting/biggame/pdf/elk_plan.pdf. Accessed Oct. 11, 2010.

UDWR, 2010b, *Utah Sensitive Species List*, Utah Department of Natural Resources, May.

UGS (Utah Geological Survey), 2009, *Quaternary Faults*. Available at http://geology.utah.gov/emp/geothermal/quaternary_faults.htm. Accessed Dec. 3, 2009.

UGS, 2010, *Lake Bonneville: PI-39 Commonly Asked Questions about Utah's Great Salt Lake and Ancient Lake Bonneville*. Available at http://geology.utah.gov/online/PI-39/pi39pg01.htm. Accessed May 18, 2010.

University of Utah, 2009a, *Earthquake Education Services.* Available at http://www.seis.utah.edu/edservices/EES/EES.html. Accessed Dec. 3, 2009.

University of Utah, 2009b, *Utah History Encyclopedia*. Available at http://www.media.utah.edu/UHE/indeex_frame.html. Accessed Dec. 3, 2009.

UNPS (Utah Native Plant Society), 2009, *Utah Rare Plants Guide*. Available at http://www.utahrareplants.org. Accessed Nov 3, 2009.

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), 1998, *Soil Survey of Iron–Washington Area, Utah, Parts of Iron, Kane and Washington Counties*, Natural Resources Conservation Service in cooperation with the Utah Agricultural Experiment Station and the Bureau of Land Management.

USDA, 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, 2007, *Escalante Valley—Iron County, Utah*, Rapid Watershed Assessment—8 Digit HUC # 16030006, May.

USDA, 2009a, *2007 Census of Agriculture: Utah 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/Utah/index.asp.

USDA, 2009b, *Western Irrigated Agriculture, Data Sets*. Available at http://www.ers.usda.gov/data/westernirrigation. Accessed Nov. 20, 2009.

USDA 2010, *United States Department of Agriculture Plants Database*. Available at http://plants.usda.gov/index.html. Accessed May 20, 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, 2008, *Crime in the United States: 2007*. Available at http://www.fbi.gov/ucr/cius2006/about/table_title.html.

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*, Rangelands Management, Washington, D.C. Available at http://www.fs.fed.us/rangelands/ecology/wildhorseburro//territories/index.shtml. Accessed Oct. 20, 2009.

USFWS (U.S. Fish and Wildlife Service), 2009, *National Wetland Inventory*, U.S. Department of the Interior, Washington, D.C. Available at http://www.fws.gov/wetlands.

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, 2005c, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—Land Cover Descriptions*, RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at http://earth.gis.usu.edu/swgap/legend_desc.html. Accessed March 15, 2010.

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, 2009, *Active Groundwater Level Network*. Available at http://groundwaterwatch.usgs.gov. Accessed Sept. 17, 2009.

USGS, 2010a, *Water Resources of the United States—Hydrologic Unit Maps*. Available at http://water.usgs.gov/GIS/huc.html. Accessed April 27, 2010.

USGS, 2010b, *National Earthquake Information Center (NEIC)—Circular Area Database Search (within 100-km of the center of the proposed Escalante Valley SEZ)*. Available at http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed Aug. 5, 2010.

USGS and UGS (U.S. Geological Survey and Utah Geological Survey), 2009, *Quaternary Faults*. Available at http://geology.utah.gov/emp/geothermal/quaternary_faults.htm. Accessed Dec. 3, 2009.

Utah Division of Water Resources, undated, *2003 Water Use Comparison and Summary*. Available at http://www.conservewater.utah.gov/success. Accessed Dec. 3, 2009.

Utah DWR (Division of Water Rights), 2004, *Escalante Valley Area 71*, July 27. Available at http://www.waterrights.utah.gov/wrinfo/policy/wrareas/area71.html. Accessed Dec. 3, 2009.

Utah DWR, 2005, *Water Right Information*. Available at http://www.waterrights.utah.gov/wrinfo/default.asp.

Utah DWR, 2008, *State of Utah Water Well Handbook*. Available at http://www.waterrights.utah.gov/wellinfo/handbook.pdf.

Utah DWR, 2009, *Beryl/Enterprise Ground Water Management Plan*. Available at http://www.waterrights.utah.gov/groundwater/ManagementReports/BerylEnt/berylEnterprise.asp. Accessed Sept. 17, 2009.

Utah Foundation, 2008, *The Impacts of Utah's Population Growth*, Research Brief, Oct. 9. Available at http://www.utahfoundation.org/reports/?page_id=270#_edn29. Accessed Dec. 2, 2009.

Utah Ornithological Society, 2007, *Bird List for Beaver County, Utah*, Utah Ornithological Society, Provo, Utah. Available at http://www.utahbirds.org/counties/xChecklists/BeaverCoChecklist.pdf. Accessed Oct. 23, 2009.

Utah SHPO (State Historic Preservation Office), 2009, data on file at the Utah Division of State History, Salt Lake City, Utah, Nov. 19.

Utah State Engineer, 2008, *Briefing Paper for the Utah Legislature Executive Appropriations Committee Regarding Ground Water Management Planning in Beryl-Enterprise Utah*, April 7.

Utah State Legislature, 2010, *S.B. 20: Local District Amendments*, 2010 General Session, State of Utah.

White, W.N., 1932, *A Method of Estimating Groundwater Supplies Based on Discharge by Plants and Evaporation from Soil—Results of Investigations in Escalante Valley*, U.S. Geological Survey Water Supply Paper 659-A.

Woods, A.J., et al., 2001, *Ecoregions of Utah (color poster with map, descriptive text, summary tables, and photographs)*, U.S. Geological Survey, Reston, Va. Available at http://www.epa.gov/wed/pages/ecoregions/ut_eco.htm. Accessed Nov. 24, 2009.

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), 2009, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed Nov. 9, 2009.

WRCC, 2010a, *Period of Record Monthly Climate Summary, Lund, Utah (425247)*. Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ut2561. Accessed April 23, 2010.

WRCC 2010b, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed Jan. 19, 2010.