10 AFFECTED ENVIRONMENT AND IMPACT ASSESSMENT FOR PROPOSED SOLAR ENERGY ZONES IN COLORADO

10.1 ANTONITO SOUTHEAST

10.1.1 Background and Summary of Impacts

10.1.1.1 General Information

The proposed Antonito Southeast solar energy zone (SEZ) has a total area of 9,729 acres (39.4 km^2). The SEZ is located in southeastern Conejos County, on the southern Colorado state boundary with New Mexico (Figure 10.1.1.1-1). In 2008, the county population was 8,232, while the surrounding six-county region in Colorado and New Mexico had a population of 116,511. The largest nearby town of Alamosa (Alamosa County, Colorado), which had a 2008 population of 8,745, is about 34 mi (55 km) to the north. Several small towns lie closer to the SEZ, with Antonito, Colorado, a short distance to the northwest on U.S. 285. The area is served by the San Luis & Rio Grande (SLRG) Railroad, while the San Luis Valley Regional Airport is in Alamosa on U.S. 285. Santa Fe, New Mexico, is 110 mi (177 km) to the south.

An existing 69-kV transmission line is located about 4 mi (6 km) north of the SEZ. It is assumed that a new transmission line would be needed to provide access from the SEZ to the transmission grid (see Section 10.1.1.2). There were no pending solar project applications within the SEZ as of February 2010.

The proposed Antonito Southeast SEZ is located in the south-central part of the San Luis Valley, a high-elevation (approximately 8,000 ft [2,440 m]) basin between two large mountain ranges. Other than a perlite processing plant approximately 0.75 mi (1.2 km) north-northwest of the northwest corner of the proposed SEZ, there is little industrial development in the vicinity of the SEZ. The area immediately to the north is used for agriculture, with irrigation water supplied mainly from surface water sources. Land within the SEZ is undeveloped scrubland characteristic of a high-elevation, semiarid, basin, which is currently used for grazing. Annual rainfall averages about 8 in. (20 cm).

The proposed Antonito Southeast SEZ and other relevant information are shown in Figure 10.1.1.1-1. The criteria used to identify the SEZ 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 (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 Antonito Southeast SEZ, other restrictions

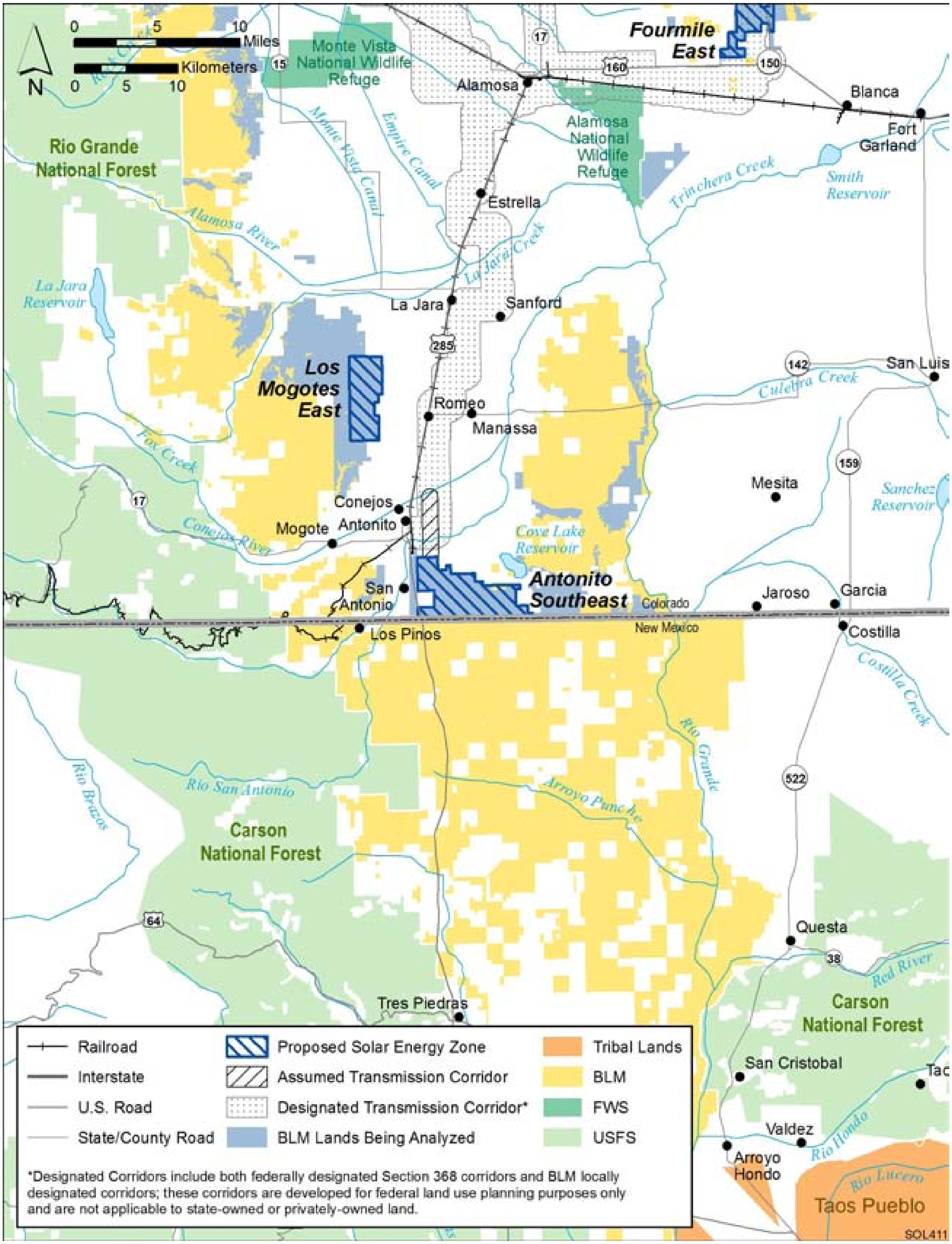

FIGURE 10.1.1.1-1 Proposed Antonito Southeast SEZ

might 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 Antonito Southeast SEZ encompassed 9,598 acres (39 km^2). Subsequent to the study area scoping period, the boundaries were altered slightly to include some small higher slope areas internal to and at the borders of the site. Although these higher slope areas would not be amenable to solar development, inclusion in the SEZ would facilitate straightforward administration of the entire area by the U.S. Department of the Interior (DOI) Bureau of Land Management (BLM). The revised SEZ is approximately 131 acres (0.5 km^2) larger than the original SEZ area as published in June 2009.

10.1.1.2 Development Assumptions for the Impact Analysis

Maximum development of the proposed Antonito Southeast SEZ was assumed to be 80% of the total SEZ area over a period of 20 years, a maximum of 7,783 acres (31.5 km^2). These values are shown in Table 10.1.1.2-1, along with other development assumptions. Full development of the Antonito Southeast SEZ would allow development of facilities with an estimated total of 865 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 1,557 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

Availability of electric transmission facilities from SEZs to load centers will be an important consideration for future development in SEZs. For the proposed Antonito Southeast SEZ, the nearest existing transmission line is a 69-kV line 4 mi (6 km) north of the SEZ. It is possible that a new transmission line could be constructed from the SEZ to this existing line, but the 69-kV capacity of that line would be inadequate for 865 to 1,557 MW of new capacity (note that a 500-kV line can approximately accommodate the load of one 700-MW facility). At full build-out capacity, it is clear that substantial new transmission and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Antonito Southeast 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 on various resources are discussed in Chapter 5. Project-specific analyses would need to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

For as complete an analysis of impacts of development in the SEZ as possible, it was assumed that, at a minimum, a transmission line segment would be constructed from the proposed Antonito Southeast SEZ to the nearest existing transmission line in order to connect the SEZ to the transmission grid. This assumption was made without information on whether the nearest existing transmission line would actually be available for connection of future solar facilities and without assumptions about upgrades of the line. Establishing a connection to the

TABLE 10.1.1.2-1 Proposed Antonito Southeast 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 BLM-Designated Transmission Corridor[e]
9,729 acres and 7,783 acres[a]	865 MW[b] 1,557 MW[c]	Adjacent (U.S. 285)	4 mi[d] and 69 kV	121 acres and 0 acres	NA[f]

[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 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.

[f] NA = no BLM-designated corridor is near the proposed Antonito Southeast SEZ.

line closest to the Antonito Southeast SEZ would involve the construction of about 4 mi (6 km) of new transmission line outside of the SEZ. The right-of-way (ROW) for this transmission line would occupy approximately 121 acres (0.5 km^2) of land, assuming a 250-ft (76-m) wide ROW, a typical width for such a ROW.

Existing road access to the proposed Antonito Southeast SEZ should be adequate to support construction and operation of solar facilities, because U.S. 285 runs along the western boundary of the SEZ. Thus, no additional road construction outside of the SEZ was assumed to be required to support solar development of the SEZ, as summarized in Table 10.1.1.2-1.

10.1.1.3 Summary of Major Impacts and Proposed SEZ-Specific Design Features

In this section, the impacts and proposed SEZ-specific design features assessed in Sections 10.1.2 through 10.1.21 for the proposed Antonito Southeast SEZ are summarized in tabular form. Table 10.1.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment. Section 10.1.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

TABLE 10.1.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Antonito Southeast SEZ and Proposed SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ (80% of the total area) could disturb up to 7,783 acres (31.5 km^2); utility-scale solar energy development would be a new and discordant land use to the area. Solar development would exclude most other uses of the public lands from the SEZ, perhaps in perpetuity.	None.
	Access to BLM, state, and private lands to the east and south of the SEZ could be affected by solar energy development if provision is not made to retain legal access through the proposed solar development area.	None.
	The current boundary of the SEZ would create a 1,240-acre (5-km^2) isolated parcel of public land that could be difficult to manage.	Future management of the 1,240-acre (5-km^2) BLM parcel that would be isolated by development of the proposed SEZ should be addressed as part of the site-specific analysis of any future solar development.
	About 121 acres (0.49 km^2) of private land would be disturbed in a 4-mi (6.4-km) ROW to tie the SEZ to the existing 69-kV transmission line.	None.
Specially Designated Areas and Lands with Wilderness Characteristics	The scenic Cumbres & Toltec ACEC could be moderately affected by development within the SEZ, and there is potential that the scenic train ride experience could be diminished for some visitors.	Restricting the type of solar technology or eliminating solar development in portions of the visible area of the SEZ within 3 mi (5 km) of the Cumbres & Toltec Scenic Railroad ACEC is recommended to limit impacts on scenic values in the ACEC.
	Wilderness characteristics within the San Antonio WSA in New Mexico could be impaired.	Pending congressional review of the BLM recommendations for wilderness designations, restricting or eliminating solar development in portions of the SEZ within 5 mi (8 km) of the San Antonio WSA is recommended to avoid impacts on wilderness characteristics within the WSA.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Specially Designated Areas and Lands with Wilderness Characteristics *(Cont.)*	Portions of U.S. 285 and CO 17 and CO 159 have been designated as a scenic byway, the Los Caminos Antiguos. This scenic byway passes within 2 mi (3 km) of the SEZ and is in full view of the SEZ for more than 35 mi (56 km) of its length in the San Luis Valley. Potential impact on use of the scenic byway is not known.	None.
	The SEZ is located within the recently (2009) designated Sangre de Cristo NHA, and it appears solar development could be inconsistent with the designation.	Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.
	The SEZ has the potential to adversely affect the West Fork of the North Branch of the Old Spanish Trail.	Pending completion of a study on the significance and definition of management needs (if any) of the West Fork of the North Branch of the Old Spanish Trail, solar development should be restricted to areas that do not have the potential to adversely affect the setting of the trail.
Rangeland Resources: Livestock Grazing	Three seasonal grazing allotments likely would be cancelled and 575 AUMs would be lost. Five grazing permittees would be displaced.	None.
Rangeland Resources: Wild Horses and Burros	None.	None.
Recreation	Current recreational users would be displaced from the SEZ but impacts would be minor.	None.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Military and Civilian Aviation	The SEZ is located under two MTRs that have a floor elevation of 200 ft (322 m) above ground level. The development of any solar or transmission facilities that encroach into the airspace of the MTRs would interfere with military training activities. There would be no impact on civilian aviation.	None.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling) especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbing activities (affecting 21 to 31% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 964 ac-ft (1.2 million m^3) of water during the peak construction year. Construction activities would generate as high as 74 ac-ft (91,300 m^3) of sanitary wastewater.	Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures. Land disturbance activities should avoid impacts to the extent possible in the vicinity of Alta Lake and two additional wetland areas, along with ephemeral washes present on the site.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	With full development of the SEZ, normal operations would use the following amounts of water: • For parabolic trough facilities (1,557-MW capacity), 1,111 to 2,357 ac-ft/yr (1.4 million to 2.9 million m^3/yr) for dry-cooled systems and 7,805 to 23,371 ac-ft/yr (9.6 million to 28.8 million m^3/yr) for wet-cooled systems; • For power tower facilities (865-MW capacity), 615 to 1,307 ac-ft/yr (0.8 million to 1.6 million m^3/yr) for dry-cooled systems and 4,334 to 12,982 ac-ft/yr (5.3 to 16.0 million m^3/yr) for wet-cooled systems; • For dish engine facilities (865-MW capacity), 442 ac-ft/yr (545,200 m^3/yr); • For PV facilities (865-MW capacity), 44 ac-ft/yr (54,200 m^3/yr). With full development of the SEZ, normal operations would generate up to 22 ac-ft/yr (27,100 m^3/yr) of sanitary wastewater. With full development of the SEZ, operation of solar energy facilities using wet-cooling systems (e.g., some parabolic trough and power tower facilities) would generate 246 to 442 ac-ft/yr (0.3 to 0.5 million m^3/yr) of cooling system blowdown wastewater.	During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain. Groundwater rights must be obtained from the Division 3 Water Court in coordination with the Colorado Division of Water Resources, existing water right holders, and applicable water conservation districts Groundwater monitoring and production wells should be constructed in accordance with state standards. Stormwater management plans and BMPs should comply with standards developed by the Colorado Department of Public Health and Environment. Water for potable uses would have to meet or be treated to meet water quality standards according to *Colorado Revised Statutes* 25-8-204.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Vegetation[b]	Up to 80% (7,678 acres [31.1 km^2]) of the SEZ would be cleared of vegetation; reestablishment of shrubland or grassland communities would be difficult. Invasive plant species could become established in disturbed areas, potentially resulting in widespread habitat degradation. Land disturbance could result in deposition of dust on nearby plant communities and adversely affect their characteristics. Grading, introduction of contaminants, groundwater withdrawal, and construction of access roads or transmission lines could result in direct or indirect impacts on wetlands both within and outside the SEZ. These impacts could potentially affect wetland function and degrade or eliminate wetland plant communities.	An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Semi-Desert Grassland habitats and minimize the potential for the spread of invasive species, such as Russian thistle or cheatgrass. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides. All wetland, dry wash, and riparian habitats within the SEZ (e.g., Alta Lake) and assumed transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetlands, dry washes, and riparian habitats to reduce the potential for impacts on Alta Lake and other wetlands on or near the SEZ and riparian habitats associated with the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir. Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, and riparian habitats, including downstream occurrences, resulting from surface-water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition. Appropriate buffers and engineering controls would be determined through agency consultation.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas associated with the Rio San Antonio, the Rio de los Pinos, and the Conejos River and span them whenever practicable. Groundwater withdrawals should be limited to reduce potential for indirect impacts on wetland habitats along the Rio San Antonio or the Conejos River or on springs that are associated with groundwater discharge.
Wildlife: Amphibians and Reptiles[b]	Small impacts on reptiles could occur from development on the SEZ. Few amphibian species are expected to occur on the SEZ.	All wetland and riparian habitats within the SEZ (e.g., Alta Lake) and transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable. Appropriate engineering controls should be used to minimize impacts on aquatic, riparian, and wetland habitats associated with Alta Lake, the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir resulting from surface-water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats. Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas and span them whenever practicable.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Wildlife: Birds[b]	Unmitigated direct impacts on land birds from habitat disturbance and long-term habitat reduction/fragmentation would be small. Impacts on shorebirds and waterfowl would primarily occur if the Alta Lake area was affected. Raptors would be affected as the result of any loss of habitat used by their prey.	The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed. Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the CDOW. A permit may be required under the Bald and Golden Eagle Protection Act. All wetland and riparian habitats within the SEZ (e.g., Alta Lake) and transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable. Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas and to span them whenever practicable. Appropriate engineering controls should be used to minimize impacts on aquatic, riparian, and wetland habitats associated with Alta Lake, the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir resulting from surface-water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats. Prairie dog colonies (which could provide habitat or food source for some bird species) should be avoided to the extent practicable.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Wildlife: Mammals[b]	Unmitigated direct impacts on small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/ fragmentation would be small. Impacts on bighorn sheep, American black bear, cougar, and mule deer are expected to be small. More than 5,440 acres (22 km^2) of winter and severe winter range of elk and 7,783 acres (31.5 km^2) of winter range of pronghorn could be affected by solar energy development; however, this is a small portion of the winter range for these species. About 250 acres (1 km^2) of a pronghorn summer concentration area overlaps small portions of the SEZ. Solar energy development could force the pronghorn to concentrate further in the area or disperse to other portions of their overall range.	Prairie dog colonies should be avoided to the extent practicable to reduce impacts on species such as the desert cottontail and thirteen-lined ground squirrel. Construction should be curtailed during winter when big game species are present. Disturbance near the elk and mule deer resident population areas should be avoided. Where big game winter ranges intersect or are within close proximity to the SEZ, use of motorized vehicles and other human disturbances should be controlled (e.g., through road closures). Development in the 253-acre (1-km^2) portion of the SEZ that overlaps the pronghorn summer concentration area should be avoided. The fencing around the solar energy development should not block the free movement of mammals, particularly big game species. Transmission lines should be sited to avoid disturbance of suitable roosting and foraging habitat for bat species that may be affected by such activities.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Aquatic Biota[b]	Water quantity in Alta Lake and nearby rivers could be affected by alterations to neighboring topography, and by usage of significant amounts of surface water or groundwater to provide power plant cooling water or other needs. Withdrawing water from the Rio San Antonio could affect water levels and aquatic organisms within the river.	All aquatic habitats within the SEZ (e.g., Alta Lake) and transmission line corridor should be avoided to the extent practicable. Transmission line towers should be sited and constructed to minimize impacts on aquatic habitats and span them whenever practicable.
Special Status Species[b]	Potentially suitable habitat for 38 special status species occurs in the affected area of the Antonito Southeast SEZ. For all special status species, less than 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 and transmission corridor (i.e., area of direct effects) to determine the presence and abundance of special status species. Disturbance of occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that uses 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 wetland, riparian, grassland, sagebrush, and woodland habitats in the area of direct effect could reduce impacts on 19 special status species. Transmission towers should be sited to allow spanning of wetlands and riparian areas whenever such habitats must be crossed.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Consultations with the USFWS and CDOW should be conducted to address the potential for impacts on the southwestern willow flycatcher, a species listed as endangered 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 CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and northern leopard frog—species that are either candidates or under review for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures, and, potentially, translocation or compensatory mitigation. Harassment or disturbance of federally listed species, candidates for federal listing, BLM designated sensitive species, state-listed species, rare 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 CDOW.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Air Quality and Climate	*Construction*: Temporary exceedances of AAQS for PM_{10} and $PM_{2.5}$ concentration levels at the SEZ boundaries and in the immediate surrounding area during the construction of solar facilities. These concentrations would decrease quickly with distance. Modeling indicates that emissions from construction activities could exceed Class I PSD PM_{10} increments at the nearest federal Class I areas (Wheeler Peak WA, New Mexico, and Great Sand Dunes WA, located about 35 mi [57 km] southeast and 45 mi [73 km] north-northeast of the SEZ); the potential impacts, however, would be moderate and temporary. In addition, construction emissions from the engine exhaust of heavy equipment and vehicles could affect AQRV (e.g., visibility and acid deposition) at nearby Class I areas. *Operations*: Positive impact due to avoided emission of air pollutants from combustion-related power generation: 3.2 to 5.7% of total SO_2, NO_x, Hg, and CO_2 emissions from electric power systems in the state of Colorado avoided (up to 3,607 tons/yr SO_2, 4,159 tons/yr NO_x, 0.023 tons/yr Hg, and 2,694,000 tons/yr CO_2).	None.
Visual Resources	Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape; potential additional impacts from construction and operation of transmission line. Viewshed analyses indicate visibility of power towers from many locations within the San Luis Valley, including residences, businesses, tourist destinations, and historic properties, as well as major and minor roadways, with substantial opportunities for extended viewing duration due to power tower height above potential screening. Viewshed analyses indicate visibility of the SEZ from the historic railroad depot in Antonito and along the rail line of the Cumbres & Toltec Scenic Railroad (including Cumbres & Toltec Scenic Railroad Corridor ACEC),	The development of power tower facilities should be prohibited within the SEZ. Within the SEZ, in areas visible from and within 1 mi (1.6 km) of the centerline of the West Fork of the North Branch of the Old Spanish Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives, as experienced from the WSA, and in areas visible from between 1 and 3 mi (1.6 and 4.8 km); visual impacts should be consistent with VRM Class III management objectives.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	although slight variations in topography and vegetation provide full or partial screening in some locations. Potentially strong visual contrasts as viewed from some locations within the San Antonio WSA, on the Los Caminos Antiguos Scenic Byway, and the Cumbres & Toltec Scenic Railroad depot in Antonito. Potentially moderate visual contrasts as viewed from some locations within the San Luis Hills WSA and scenic ACEC, and the Cumbres & Toltec Scenic Railroad scenic ACEC. The town of Antonito and the community of Conejos are located within the viewshed of the SEZ, although slight variations in topography and vegetation provide full or partial screening in some locations.	Within the SEZ, in areas visible from and within 3 mi (5 km) of the Cumbres & Toltec Scenic Railroad ACEC, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives. Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the San Antonio WSA, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives.
Acoustic Environment	*Construction:* For construction of a solar facility located near the northern or western SEZ boundary, estimated noise levels at the nearest residences located about 0.5 mi (0.8 km) from the SEZ boundary would be about 50 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. In addition, an estimated 47 dBA L_{dn} at these residences is below the EPA guidance of 55 dBA L_{dn} for residential areas. *Operations:* For operation of a parabolic trough or power tower facility located near the northern or western SEZ boundary, the predicted noise level would be about 45 dBA at the nearest residences, which is above the typical daytime mean rural background level of 40 dBA. If the operation were limited to daytime, 12 hours only, a noise level of about 44 dBA L_{dn} would be estimated for the nearest residences, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residences would be 55 dBA, which is fairly higher than the typical nighttime mean rural background level of 30 dBA. The day-night average	Noise levels from cooling systems equipped with TES should be managed so that levels at nearest residences to the north and west 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 the residences, limiting operations to a few hours after sunset, and/or installing fan silencers. Dish engine facilities within the SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from nearby residences around the SEZ (i.e., the facilities should be located in the central or southeast area of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts on nearby residences.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Acoustic Environment *(Cont.)*	noise level is estimated to be about 56 dBA L_{dn}, which is a little higher than the EPA guideline of 55 dBA L_{dn} for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residences would be about 50 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 47 dBA L_{dn} at these residences would be below the EPA guideline of 55 dBA L_{dn} for residential areas.	
Paleontological Resources	Few impacts are expected on significant paleontological resources because these resources are not exposed nor likely to occur within the SEZ. However, a more detailed look at the local geological deposits and their depth is needed to verify that the assignment of a PFYC of Class 1 is valid and that rock exposures of geologic formations known to contain paleontological resources are not present within the SEZ. The depth of the Alamosa Formation should be determined within the 4-acre (0.016-km^2) parcel and within the ROW for new transmission to identify whether mitigation measures might be necessary in these PFYC Class 4 and 5 areas.	Avoidance of PFYC Class 4/5 areas is recommended for development within the SEZ (i.e., the 4-acre [0.016-km^2] parcel in the north part of the SEZ) and transmission corridor placement. Where avoidance of Class 4/5 deposits is not possible in order to connect to existing transmission, a paleontological survey or monitoring may be required by the BLM.
Cultural Resources	Direct impacts on significant cultural resources could occur; however, a cultural resource survey would need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and to determine whether any are eligible for listing in the NRHP. Further evaluation is needed to determine the effects of solar energy development on the West Fork of the North Branch of the Old Spanish Trail.	A PA may need to be developed among the BLM, DOE, Colorado SHPO, ACHP, and the Trail Administration for the Old Spanish Trail to consistently address impacts on significant cultural resources from solar energy development within the San Luis Valley. Additional coordination with the Cumbres & Toltec Scenic Railroad Commission is recommended to address possible mitigation measures for reducing visual impacts.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Cultural Resources *(Cont.)*	Preliminary viewshed analyses indicate that the visual integrity of the Cumbres & Toltec Scenic Railroad Corridor ACEC and depot in the town of Antonito could be affected. A known eligible prehistoric archaeological site could be directly or indirectly affected by construction of a new transmission line depending on the location of the ROW.	
Native American Concerns	It is possible that there will be Native American concerns about potential visual and noise effects of solar energy development in the SEZ on Blanca Peak or on the valley as a whole as consultation continues and additional analyses are undertaken. Effects on traditionally important plants and animals are also possible.	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes (listed in Table 10.1.18.1-1).
Socioeconomics	Loss of grazing area could result in the loss of 7 jobs and $0.1 million in income; a loss of $575 annually in grazing fees. Transmission line construction: 18 total jobs; $0.7 million income. *Construction:* 218 to 2,885 total jobs; $11.6 million to $153.7 million income in the ROI. *Operations:* 24 to 530 annual jobs; $0.7 million to $16.7 million annual income in the ROI.	None.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Environmental Justice	Minority populations identified within 50 mi (80 km) of the proposed SEZ could be disproportionately affected by the construction and operation of solar facilities. Potential adverse impacts could result from noise and dust during construction; increased traffic related to construction; operations noise; visual effects of generation and auxiliary facilities on areas of traditional or cultural significance; restricted access to animals and vegetation on developed lands; curtailed mineral, energy, and forestry development in the region; and property values.	None.
Transportation	The primary transportation impact would result from commuting worker traffic, with single projects involving up to 1,000 workers each day, equating to as many as 2,000 additional vehicle trips. U.S. 285 and CO 17 would be affected by the increased traffic, nearly twice the current annual average daily traffic value in some sections. In addition, local road improvements would be necessary in any portion of the SEZ that might be developed so as not to overwhelm the local roads near any site access points.	None.

Abbreviations: AAQS = ambient air quality standards; ACEC = Area of Critical Environmental Concern; ACHP = Advisory Council on Historic Preservation; AQRV = air quality-related value; AUM = animal unit month; BLM = Bureau of Land Management; BMP = best management practice; CDOW = Colorado Division of Wildlife; CO = Colorado State Highway; CO_2 = carbon dioxide; DOE = U.S. Department of Energy; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; MTR = military training route; NHA = National Heritage Area; NO_x = nitrogen oxides; NRHP = *National Register of Historic Places*; PA = Programmatic Agreement; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 μm or less; PM_{10} = particulate matter with an aerodynamic diameter of 10 μm or less; PSD = Prevention of Significant Deterioration; PYFC = potential fossil yield classification; ROI = region of influence; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO_2 = sulfur dioxide; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service; VRM = visual resource management; WA = Wilderness Area; WSA = Wilderness Study Area.

[a] The detailed programmatic design features for each resource area 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 Antonito Southeast SEZ.

[b] The scientific names of all plants, wildlife, and aquatic biota are provided in Sections 10.1.10 through 10.1.12.

Only those design features specific to the Antonito Southeast SEZ are included in Sections 10.1.2 through 10.1.21 and in the summary table. The detailed programmatic design features for each resource area 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 this and other SEZs.

10.1.2 Lands and Realty

10.1.2.1 Affected Environment

The proposed Antonito Southeast SEZ is located on the Colorado–New Mexico border on the western side of the San Luis Valley. The small community of San Antonio is adjacent to the SEZ, and Antonito is less than 3 mi (5 km) north of the area. The SEZ contains only BLM-administered lands, but two sections of state-owned land (1,280 acres [5.2 km^2]) abut the area and numerous private lands lie north of the SEZ. BLM-administered public lands border the area immediately to the south of the SEZ in New Mexico. The SEZ is largely undeveloped, but the private lands north of the SEZ have been developed for irrigated agriculture. A farm/ranch headquarters abuts the site on the northwest corner. An operating perlite mill and an electric substation are also located near the northwest corner of the SEZ. Good access to the SEZ is available from U.S. 285, which is along the west side of the area. Remnants of a historic railroad, an irrigation reservoir, and a canal system are found in the SEZ. The overall character of the land in the SEZ is undeveloped and rural.

No existing transmission lines pass through the SEZ. However, through its Lands and Realty Program, the BLM has authorized ROWs for highway, telecommunications, and water facilities within the SEZ.

There are currently no applications for ROWs for solar facilities within the Antonito Southeast SEZ; however, there is one solar facility operating in the San Luis Valley on private land near Mosca, about 40 mi (64 km) north of the SEZ. There is ongoing interest in developing additional solar energy facilities on private lands in the valley.

10.1.2.2 Impacts

10.1.2.2.1 Construction and Operations

Development of the proposed Antonito Southeast 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 1,280 acres (5.2 km2) of state lands and private lands adjacent or near the SEZ could be developed in the same or a complementary manner as the public lands. Similarly, development of additional industrial or support activities also could be induced on private and state lands near the SEZ.

Current ROW authorizations on the SEZ would not be affected by solar energy development since they are prior rights. Should the proposed SEZ be identified as an SEZ in the Record of Decision (ROD) for this PEIS, the BLM would still have discretion to authorize additional ROWs in the area until solar energy development was authorized, and then any future ROWs would have to be compatible with the rights granted for solar energy development. Because the area currently has so few ROWs present, it is not anticipated that approval of solar energy development would have a significant impact on ROW availability in the area.

The western boundary of the SEZ terminates east of the existing public land boundary and leaves about 1,240 acres (5.0 km^2) as an isolated parcel. U.S. 285 is located in this parcel, and a portion of the route of the West Fork of the North Branch of the Old Spanish Trail passes through it. Because of its isolated nature, if the SEZ were developed, future management of the area would become more difficult and/or uneconomical.

Access to BLM, state, and private lands to the east and south of the SEZ could be affected by solar energy development if provision is not made to maintain public road access through the SEZ.

10.1.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

Should utility-scale solar development occur, new transmission facilities would be required to move electricity onto the regional grid. Since there is very little BLM-administered land in the San Luis Valley, additional transmission lines in that area would most likely cross private lands. It is assumed that solar facilities in the Antonito Southeast SEZ would connect to the existing 69-kV line near the northwest corner of the SEZ disturbing approximately 121 acres (0.5 km^2) of private land.

Road access to the SEZ is available directly from U.S. 285; thus only new internal roads in the SEZ accessing solar development areas are assumed to be required to begin solar development in the area. There is also access to the eastern third of the SEZ from Antonito via County Roads (CRs) G and 18. Should these roads be used, they would likely need to be upgraded, but no initial improvement of roads outside of the SEZ has been assumed to occur because access via U.S. 285 is assumed.

See Section 10.1.1.2 for a discussion of the assumptions regarding development of transmission facilities and roads that would serve the SEZ.

10.1.2.3 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 reduce the potential for impacts on authorizations within the SEZ under the BLM Lands and Realty Program. Possible non-mitigable impacts are related to construction of additional transmission lines that would connect the SEZ to the regional grid and to induced changes to existing land uses on state and private lands.

A proposed design feature specific to the proposed Antonito Southeast SEZ is as follows:

- Future management of the 1,240-acre (5-km^2) BLM parcel that would be isolated by development of the proposed SEZ should be addressed as part of the site-specific analysis of any future solar development.

10.1.3 Specially Designated Areas and Lands with Wilderness Characteristics

10.1.3.1 Affected Environment

Three ACECs are within the viewshed of the SEZ; these areas were at least partially designated because of their scenic values—San Luis Hills, Cumbres & Toltec Scenic Railroad in Colorado, and San Antonio Gorge in New Mexico. The nearest point of these ACECs to the SEZ is about 5, 3, and 2 mi (8, 5, and 3 km), respectively. Depending on the specific location and solar technologies employed, the Rio Grande River Corridor ACEC in Colorado also may have viewpoints where development within the SEZ could be seen, (see Section 10.1.14). The Rio Grande ACEC is within 6 mi (10 km) of the SEZ at the closest point. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the SEZ.

The congressionally designated Rio Grande Natural Area is located along the Rio Grande River from the southern border of the Alamosa National Wildlife Refuge to the New Mexico border. The natural area is partially overlapped by the BLM's Rio Grande ACEC.

The Rio Grande Corridor Special Recreation Management Area is a BLM-designated SRMA that follows the Rio Grande for 22 mi (35 km), beginning just south of La Sauses Cemetery in Colorado and extending to the New Mexico state line. It is 6 mi (10 km) east of the SEZ at the point of closest approach. The SRMA was designated to provide river-oriented recreational opportunities and facilities. The SRMA covers much of the same area as the Rio Grande River Corridor ACEC, but the ACEC boundary includes some public lands farther west of the river.

There are two BLM-administered Wilderness Study Areas (WSAs)—San Luis Hills in Colorado and San Antonio in New Mexico—from which people would have views of any development within the SEZ. The San Antonio WSA is located within 2 mi (3 km) of the SEZ at its nearest point, while San Luis Hills is about 6 mi (10 km) away at its nearest point.

Portions of the designated Rio Grande Wild and Scenic River (WSR) corridor in New Mexico, which comes within about 8.5 mi (14 km) of the eastern border of the SEZ, might also have viewpoints where development within the area could be seen, depending on the location and technologies employed.

Portions of three designated U.S. Forest Service (USFS) wilderness areas—South San Juan, Cruces Basin, and Latir Peak—are within 15 to 25 mi (24 to 40 km) of the SEZ, and visitors in portions of these areas would have a view of the SEZ. The SEZ also is visible from numerous USFS roadless areas located to the west and southeast of the SEZ on the Rio Grande and Carson National Forests.

Portions of U.S. 285 and CO 17 and CO 159 have been designated as the Los Caminos Antiguos Scenic Byway. This scenic byway passes within 2 mi (3 km) of the SEZ and is in full view of the SEZ for about 25 mi (40 km) of its length in the San Luis Valley.

The SEZ is located within the boundaries of the recently (2009) designated Sangre de Cristo NHA. The NHA includes three Colorado counties—Alamosa, Conejos, and Costilla.

The route of the West Fork of the North Branch of the Old Spanish Trail closely follows the western boundary of the SEZ. Studies are currently ongoing regarding the significance of this portion of the trail, and if found warranted, it could be included in the National Trail System. See Section 10.1.17 for additional information on the Old Spanish Trail.

10.1.3.2 Impacts

10.1.3.2.1 Construction and Operations

The potential impact on specially designated areas from solar development within the SEZ is difficult to determine and would likely vary by solar technology employed, the specific area being affected, and individual perception. Development of the SEZ, especially full development, would be a dominating factor in the viewshed from large portions of some of these specially designated areas (see Figure 10.1.3.2-1, which shows the location of the areas discussed below).

ACECs

- The Cumbres & Toltec ACEC was established to protect the viewshed of the scenic train route that passes through the ACEC. The principal "users" for this ACEC are people who ride the train and view these lands during their train ride. The nearest boundary of the SEZ is 3 mi (5 km) from the ACEC, and depending on the technology employed, about 83% of the ACEC would be within the viewshed of the SEZ (see Section 10.1.14.2.2.1). About 47% of the ACEC lies within the most sensitive zone from 0 to 5 mi (8 km) of the SEZ. Because of vegetative and topographic screening, visitors on the train within the ACEC would not have continuous views of development within the SEZ but views of the SEZ would be common. It is anticipated that scenic resources this ACEC would be moderately affected by development within the SEZ, and there is potential that the scenic train ride experience for some visitors could be diminished.

- Much of the San Luis Hills ACEC is elevated above the SEZ and visitors within portions of the ACEC would have a full view of solar development, although the minimum distance from the SEZ to the ACEC is about 5 mi (8 km). Because of the distance and the presence of agricultural development between the ACEC and the SEZ, the potential for adverse impact on users of the ACEC would be lessened and is assumed to be minimal.

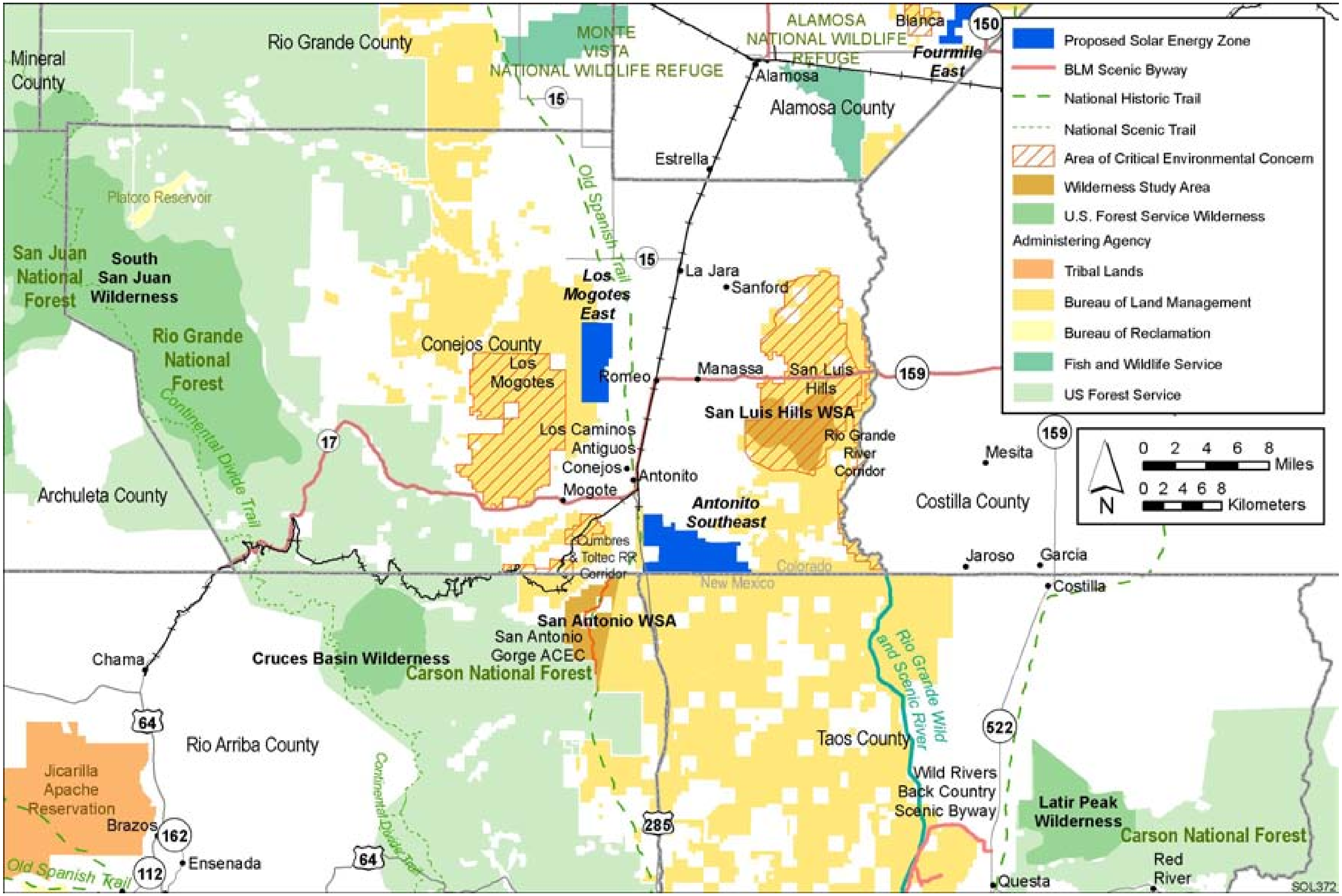

FIGURE 10.1.3.2-1 Specially Designated Areas in the Vicinity of the Proposed Antonito Southeast SEZ

- The San Antonio Gorge ACEC is within 2 mi (3 km) of the SEZ, but because the creek, which is the natural focus of the area, and the ACEC are within a canyon, persons within the ACEC likely would not see solar development within the SEZ; therefore, visual impacts on the ACEC would not be expected.

  The Rio Grande River Corridor ACEC is designated for recreation and scenic values and follows the Rio Grande River. Users within the ACEC are largely river users and generally would not have a view of the SEZ from the river since the river is incised below the level of the bordering lands. Some of the boundaries of the ACEC may have a view of the SEZ but at the closest, the SEZ would be 6 mi (10 km) distant. Because of the distance from the SEZ and the fact that most users would be on the river, the potential impact on the ACEC is minimal.

WSAs

- The San Luis Hills WSA is included within the exterior boundaries of the ACEC by the same name described above; that description also applies to the WSA, although the edge of the WSA is about 6 mi (10 km) from the SEZ. Largely because of the distance between the WSA and the SEZ and the existing agricultural and other human development visible from the WSA, it is not anticipated that solar development of the SEZ would have a significant impact on the wilderness characteristics of the WSA.

- The San Antonio WSA includes the San Antonio Gorge ACEC, but, unlike the ACEC, visitors within most of the WSA would have a full view of the SEZ. Since more than half of the WSA is within 2 to 5 mi (3 to 8 km) of the SEZ, it is likely that much of the wilderness character of the area would be adversely affected by development within the SEZ. The primary exception to this would be within the incised gorge of the ACEC.

Rio Grande Natural Area

- The Natural Area is overlapped by largely by the Rio Grande ACEC, and the impacts described above for the ACEC would be the same for the Natural Area.

Rio Grande WSR

- The situation with the designated WSR in New Mexico is similar to that of the Rio Grande ACEC in Colorado in that most visitors are river users and are floating the river that is incised below the level of the surrounding lands, with minimal opportunity to view development in the SEZ. The nearest distance from the river to the SEZ is 8.5 mi (14 km), and the most likely view of the SEZ would come from boundaries of the river corridor that are away from the river. It is anticipated there would be no impact on the WSR.

Rio Grande SRMA

- The SRMA is overlapped by largely by the Rio Grande ACEC and the Rio Grande Natural area, so the impacts would be the same as described above for the ACEC.

USFS Wilderness and Roadless Areas

- Portions of South San Juan, Cruces Basin, and Latir Peak Wilderness Areas (WAs) and numerous roadless areas would have long distance views of development within the SEZ at distances of 15 to 25 mi (24 to 40 km). Although the solar facilities would be visible, because of the distance, it is anticipated that there would be no effect on wilderness characteristics or visitor use.

Los Caminos Antiguos Scenic Byway

- Travelers along about 25 mi (40 km) of the scenic byway would have a view of solar development within the SEZ. A portion of the byway passes within 2 mi (3 km) of the SEZ, and about 8 mi (13 km) of the highway is within the most visually sensitive zone (0 to 5 mi [0 to 8 km]). The potential impact of development of the SEZ on the byway and byway users is not known, but the SEZ would be highly visible.

Sangre de Cristo National Heritage Area (NHA)

- The Sangre de Cristo NHA was recently designated, and planning for the NHA is not yet complete; thus it is difficult to assess the impact of solar development on the SEZ. However, an NHA is described as a place where natural, cultural, historic, and scenic resources combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (NPS 2008). This definition implies that visual impacts from solar energy development could be of concern.

West Fork of the North Branch of the Old Spanish Trail

- Solar development within the SEZ could be within 0.25 mi (0.40 km) of the route of the trail and would have a major impact on the historic and visual integrity of the trail. Until the ongoing trail study is complete, it is not possible to know whether this segment of the trail will have significant values that should be preserved or what potential management actions may be required. See Section 10.1.17 for additional information on the trail.

10.1.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

The nearest transmission line to the SEZ is about 4 mi (6 km) away**,** and construction of a transmission line to connect to that line would disturb about 121 acres (0.6 km^2). New transmission lines and associated construction and service roads would minimally add to the visual impact on specially-designated area associated with the SEZ facilities.

10.1.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts. The exceptions may be potential visual impacts on travelers on the scenic byway and impacts on the NHA. Impacts on these two areas would be better determined or mitigated once ongoing studies and planning are complete and could be considered as part of a project-specific proposal.

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

- Restricting the type of solar technology or eliminating solar development in portions of the visible area of the SEZ within 3 mi (5 km) of the Cumbres & Toltec Scenic Railroad ACEC is recommended to avoid impacts on scenic values in the ACEC (see Section 10.1.14 for specific recommendations for mitigating impacts on the ACEC).

- Pending congressional review of the BLM recommendations for wilderness designations, restricting or eliminating solar development in portions of the visible area of the SEZ within 5 mi (8 km) of the San Antonio WSA is recommended to avoid impacts on wilderness characteristics in the WSA.

- Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.

- Pending completion of a study on the significance and definition of management needs (if any) of the West Fork of the North Branch of the Old Spanish Trail, solar development should be restricted to areas that do not have the potential to adversely affect the setting of the trail. After the study is completed, if management actions are warranted for this portion of the trail, solar energy development should be consistent with protection of identified values of the trail.

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10.1.4 Rangeland Resources

Rangeland resources include livestock grazing and wild horses and burros, both of which are managed by the BLM. These resources and possible impacts on them from solar development within the proposed Antonito Southeast SEZ are discussed in Sections 10.1.4.1 and 10.1.4.2.

10.1.4.1 Livestock Grazing

10.1.4.1.1 Affected Environment

The SEZ includes portions of three seasonal grazing allotments—San Antonio (#04239), Alta Lake (#04240), and South Hills (#04241). These allotments are used by a total of 5 permittees and support production of 669 animal unit months (AUMs) of forage per year (Table 10.1.4.1-1).

10.1.4.1.2 Impacts

Should utility-scale solar development occur in the SEZ, grazing would be excluded from the areas developed as provided for in BLM grazing regulations (Title 43, Part 4100 of the *Code of Federal Regulations* [43 CFR Part 4100]). This would include reimbursement of the permittees for their portion of the value for any range improvements in the area removed from the grazing allotment. The impact of this change in the grazing permits would depend on several factors, including (1) how much of an allotment the permittee might lose to development, (2) how important the specific land lost is to the permittee's overall operation, and (3) the amount of actual forage production that would be lost by the permittee.

TABLE 10.1.4.1-1 Grazing Allotments within the Proposed Antonito Southeast SEZ

Allotment	Total Acres[a]	% of Acres in SEZ[b]	State Acres/ Authorized AUMs	Active BLM AUMs	No. of Permittees
San Antonio	5,840	64	640/65	222	1
Alta Lake	5,192	100	0	288	3
South Hills	1,963	67	640/29	65	1

[a] Total acres, including public and state land, and AUMs are from the BLM Rangeland Administration System report (BLM 2009a). To convert acres to km^2, multiply by 0.004047.

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

The public lands in the SEZ make up the majority of the lands in the three allotments. It is probable that if full solar development were to occur, the federal grazing permits for these allotments would be cancelled. This would result in displacing the permittees and in the loss of the 575 AUMs from BLM-administered lands. It would be possible to create a small allotment on the west boundary of the SEZ from the remaining BLM-administered land outside the SEZ in the San Antonio allotment and a state section. The state section currently in the South Hills allotment could be leased to another, adjacent permittee. The state sections are currently credited with supporting an additional 94 AUMs. If neither the state sections nor the BLM-administered lands are leased, a total of 669 AUMs would be lost. Section 10.1.19.2.1 provides more information on the economic impact of the loss of grazing opportunity on these allotments.

Although the degree of impact on these permittees would vary with their individual situations, there likely would be a major adverse economic impact to the permittees from the loss of use of their respective allotments and also, possibly an adverse social impact, since for many permittees, operating on public lands has been a longstanding tradition. It is possible that solar development proponents could purchase all or portions of the existing grazing permits and range improvements to facilitate solar operations and to minimize the impact on the existing permittees; however, that is not required as part of BLM regulations.

10.1.4.1.3 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, could minimize disruption of grazing operations; however, it may not be possible to fully mitigate the economic loss to the holders of grazing permits and the social impacts from loss of grazing rights.

10.1.4.2 Wild Horses and Burros

10.1.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Four wild horse herd management areas (HMAs) are located in Colorado and two in New Mexico, but none are near the proposed Antonito Southeast SEZ. The closest wild horse HMA to the SEZ is the Carracas Mesa HMA in New Mexico, which is about 75 mi (121 km) west of the SEZ. Located immediately south of the SEZ in New Mexico is the Punche Valley Herd Area (HA), which is a 70,809-acre (287-km^2) area (including 16,606 acres [67 km^2] of private lands) that historically was wild horse habitat but has not been designated for long-term management of wild horses. In fiscal year 2009, the BLM estimated that there were no horses or burros within the HA; however, there have been occasional reports of feral horses seen in the SEZ.

10.1.4.2.2 Impacts

Solar energy development of the SEZ would exclude horses from the area. Since there are no known populations of horses present and the area is not designated for management of wild horses, there would be no effect on wild horses and burros from solar energy development of the SEZ.

10.1.4.2.3 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.

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10.1.5 Recreation

10.1.5.1 Affected Environment

The proposed Antonito Southeast SEZ is flat, and the land is of a type and quality that would not generally attract recreational users from distant locations. Although there are no recreation data specific to the area, the area likely is used by local residents for general outdoor recreation, including horseback riding, off-highway vehicle (OHV) and backcountry driving, and hunting. Principal species of interest to hunters would likely include deer and pronghorn antelope. Rabbits, doves, and quail may also be also hunted in the area. Access into the area from the west is available from U.S. 285, and the eastern third of the SEZ can also be accessed via CR G and CR 18. The area has been designated in the San Luis Valley Travel Management Plan as Limited, Designated Roads and Trails. Several road/trail segments are located within the SEZ and have been identified as Open Motorized Road and Mechanized Use Trail. There is an area identified as Open to OHV use that is located outside of the SEZ but near the northwest corner of the area.

10.1.5.2 Impacts

10.1.5.2.1 Construction and Operations

Recreational users would lose the use of any portions of the SEZ developed for solar energy production. Access through areas developed for solar power production could be closed or rerouted. Access to BLM, state, and private lands to the east and south of the SEZ could be affected by solar energy development if provision is not made to maintain public road access through the SEZ.

The Cumbres & Toltec Scenic Railroad operates between May and October on an established rail line that runs from Antonito, Colorado, to Chama, New Mexico. The railroad passes within sight of the western border of the SEZ, and solar development on the site would be visible to railroad passengers. Because this portion of the route is relatively small when compared with the total route of the railroad, it is not anticipated that there would be any significant impact on recreational visitors' use of the railroad.

10.1.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

The nearest transmission line to the SEZ is about 4 mi (6 km) away**,** and construction of a transmission line to connect to that line would disturb about 121 acres (0.6 km^2). New transmission lines and associated construction and service roads would add to the visual impact associated with the SEZ facilities. This, however, would contribute only a minor amount to the direct impact on recreation resources relative to that caused by development within the SEZ.

10.1.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

There are no proposed design features specific to the proposed Antonito Southeast SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would minimize impacts to recreational use.

10.1.6 Military and Civilian Aviation

10.1.6.1 Affected Environment

The proposed Antonito Southeast SEZ is located under two military training routes (MTRs) that have a floor elevation of 200 ft (322 m) above ground level (AGL). One MTR is a visual corridor; the other is an instrument corridor. The area is identified in the BLM land records (BLM and USFS 2010a) as a consultation area for the U.S. Department of Defense (DoD).

There are no civilian aviation facilities in the vicinity of the SEZ.

10.1.6.2 Impacts

The development of any solar energy or transmission facilities that encroach into the airspace of the MTRs could interfere with military training activities. Power tower technology could be of special concern because of the height of this type of facility. Recent information from the DoD, however, indicates that there currently are no concerns about solar development in the proposed Antonito Southeast SEZ.

10.1.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. 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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10.1.7 Geologic Setting and Soil Resources

10.1.7.1 Affected Environment

10.1.7.1.1 Geologic Setting

Regional Geology

The proposed Antonito Southeast SEZ is located in the southern part of the San Luis Valley, an alluvium-filled basin within the Southern Rocky Mountain physiographic province in south-central Colorado (Figure 10.1.7.1-1). The San Luis Valley is part of the San Luis Basin, an axial basin of the Rio Grande rift (see Section 4.7). The Rio Grande rift is a north-trending, tectonic feature that extends from south-central Colorado to northern Mexico. Basins in the rift zone generally follow the course of the Rio Grande (river) and are bounded by normal faults that define the rift zone margins (Burroughs 1974, 1981; Emery 1979).

The San Luis Basin is an east-tilting half graben flanked by the San Juan Mountains to the west and the Sangre de Cristo Range to the east. It is generally divided into five physiographic subdivisions—the Alamosa Basin, the San Luis Hills, the Taos Plateau, the Costilla Plains, and the Culebra Reentrant (Figure 10.1.7.1-2). The proposed Antonito Southeast SEZ is situated along the northern edge of the Taos Plateau just south of the San Luis Hills, a series of northeast-trending basalt hills and mesas that form a physiographic, structural, and hydrological divide between the Alamosa Basin to the north and the Taos Plateau to the south. The Taos Plateau is characterized by numerous volcanic shields and cones that were active as recently as 2 million years ago (Burroughs 1974, 1981; Leonard and Watts 1989).

The Servilleta Formation (Pliocene), composed of basalts and interbedded gravels, covers most of the Taos Plateau near the Colorado–New Mexico border and is just below the surface (under a thin layer of alluvium) in the vicinity of the proposed Antonito Southeast SEZ (Figure 10.1.7.1-3). In this area, it is about 300 ft (90 m) thick and underlain by the intertongued sediments of the Santa Fe Group (to the east) and Los Pinos Formation (to the west). These formations are the likely source of groundwater below the site. The San Luis Hills, to the northeast of the SEZ, are the exposed portion of an intrarift horst, capped by Hinsdale basalts (Miocene).[1] Intrusions of quartz monzonite and diorite are exposed to the northeast (Burroughs 1974; Thompson et al. 1991; Machete 2006; Harmon 2009).

Exposed sediments in the San Luis Valley consist mainly of modern alluvial deposits and the fluviolacustrine clays and sands of the Alamosa Formation (Figure 10.1.7.1-4). Eolian

[1] Geologic maps based on Tweto (1979) show exposures of pre-ash flow andesitic lavas (Tpl) with an estimated age of about 30 to 35 million years at the San Luis Hills, and these are shown on Figure 10.1.7.1-4; the description provided here is based on Thompson et al. (1991) who reported that the San Luis Hills are capped by the younger Hinsdale basalt (3.5 to 26 million years old).

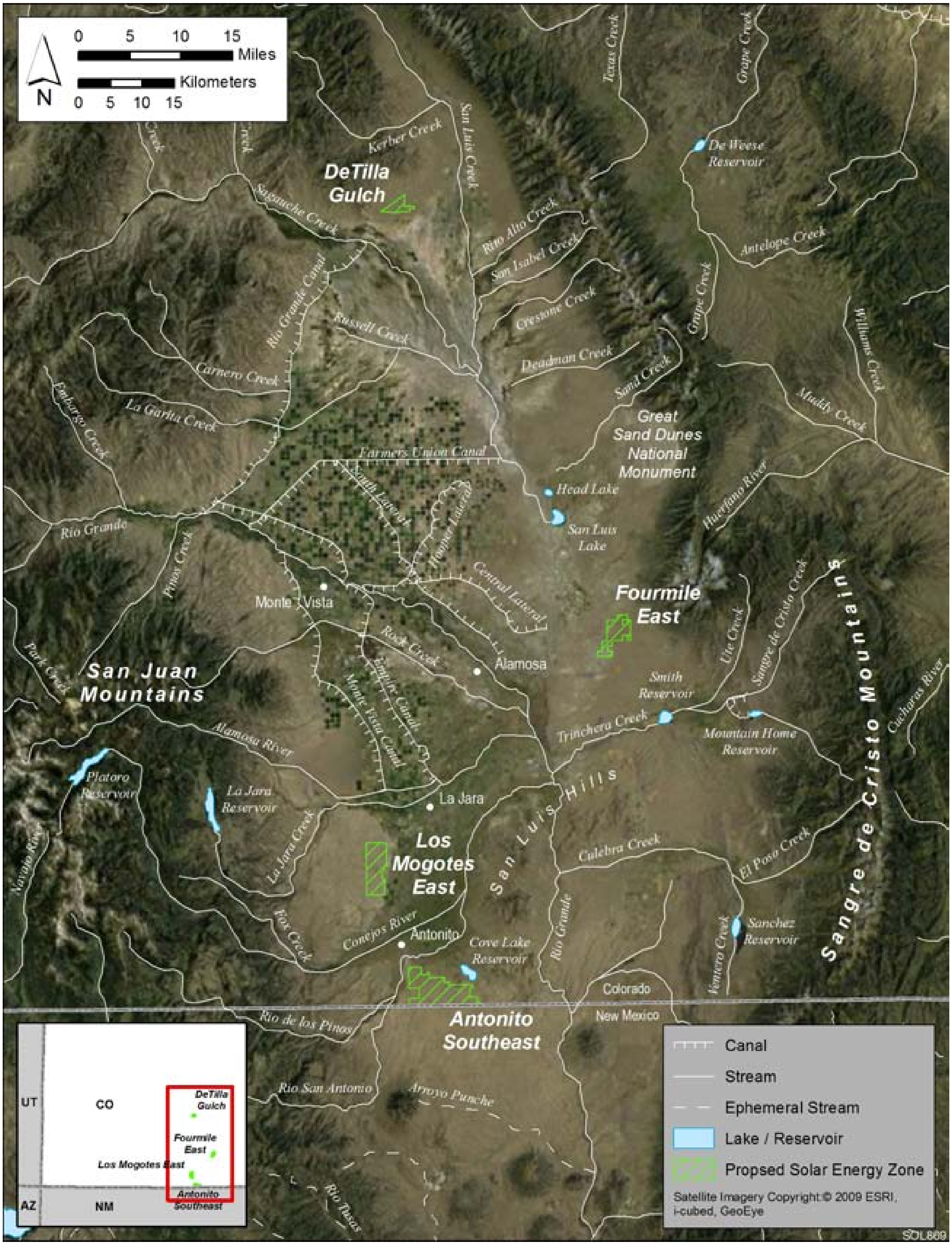

FIGURE 10.1.7.1-1 Physiographic Features of the San Luis Valley

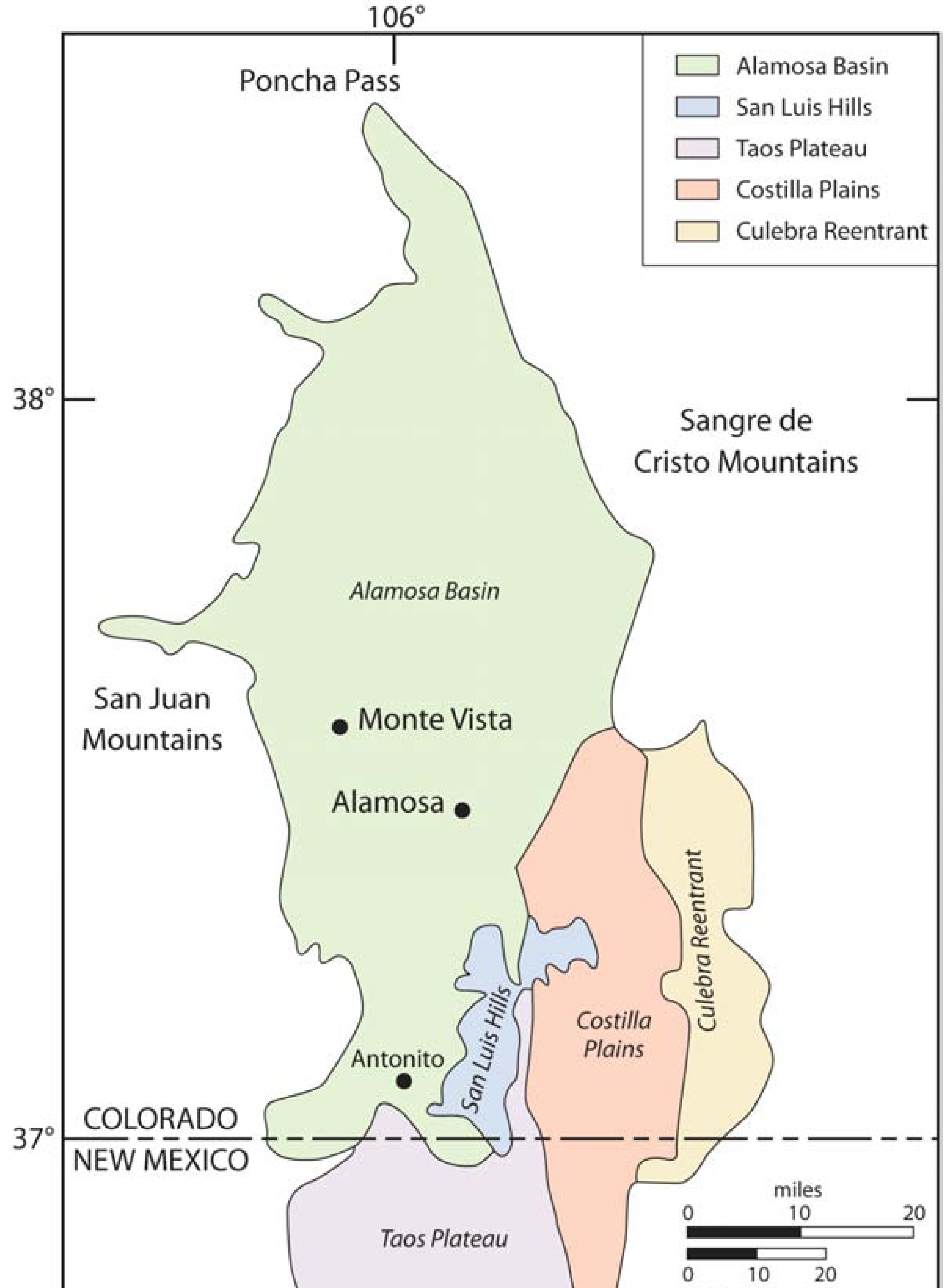

FIGURE 10.1.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

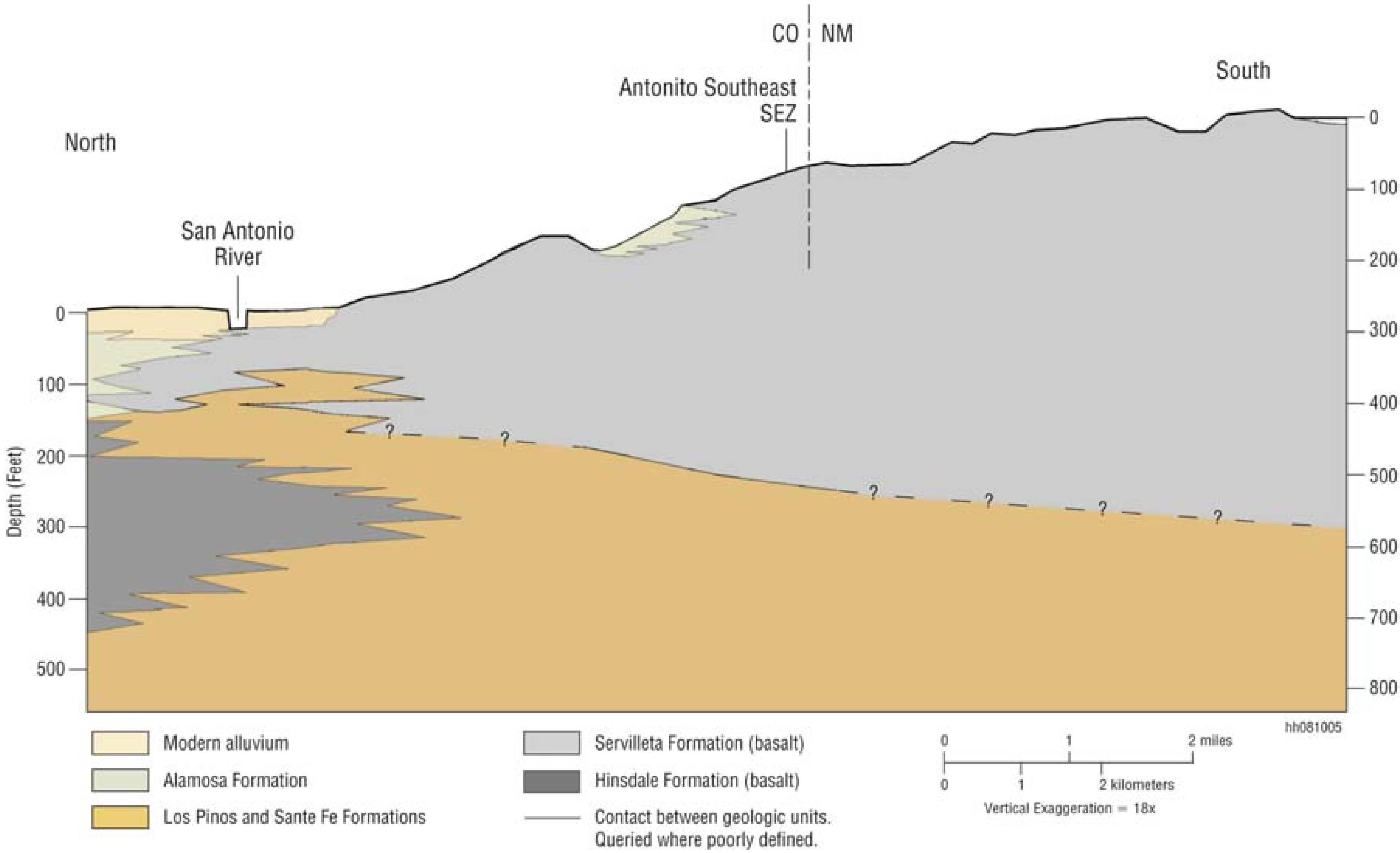

FIGURE 10.1.7.1-3 Generalized Geologic Cross Section (North to South) across the Taos Plateau and the Southern Part of the Alamosa Basin (see Figure 10.1.7.1-6 for Section Location [modified from Harmon 2009])

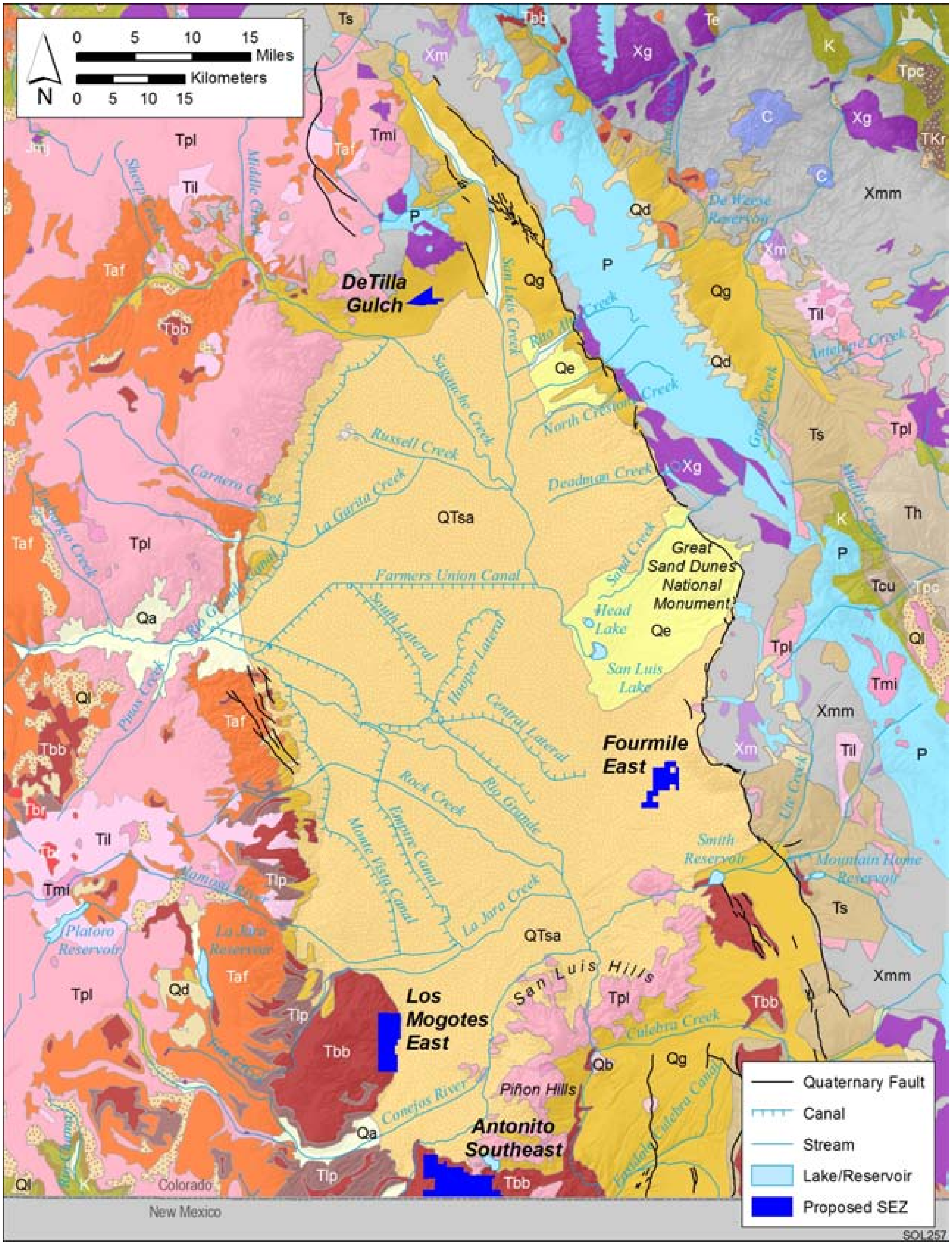

FIGURE 10.1.7.1-4 Geologic Map of the San Luis Valley and Vicinity (adapted from Stoeser et al. 2007 and Tweto 1979)

Cenozoic (Quaternary, Tertiary)

- Qa — Modern alluvium (Piney Creek and younger)
- Qg — Gravels and alluviums (Pinedale, Bull Lake and Pre-Bull Lake age)
- Qe — Eolian deposits; includes sand dune and silt and Peoria Loess
- Qd — Glacial drift (Pinedale, Bull Lake and Pre-Bull Lake glaciations)
- Ql — Landslide deposits
- Qb — Basalt flows (< 1.8 M.Y.)
- QTsa — Alamosa Formation (gravel, sand and silt) and unclassified surficial deposits
- Th — Huerfano Formation (shale, sandstone and conglomerate)
- Tcu — Cuchara Formation (sandstone and shale)
- Tpc — Poison Canyon Formation (arkosic conglomerate, sandstone and shale)
- Ts — Santa Fe Formation (siltstone, sandstone and conglomerate)
- Te — Prevolcanic sedimentary rocks (Eocene)
- Tlp — Los Pinos Formation (volcaniclastic conglomerate interbedded with Hinsdale Formation)
- Tbb — Basalt flows and associated tuffs, breccias, conglomerates and intrusives (3.5 - 2.6 M.Y.); includes basalts of Hinsdale Formation and Servilleta Formation
- Tbr — Ash flow tuff and rhyolites (22 - 23 M.Y.)
- Taf — Ash flow tuff (26 - 30 M.Y.)
- Til — Andesitic and quartz latitic lavas (intra-ash flow)
- Tpl — Andesitic lavas, breccias, tuffs and conglomerates (pre-ash flow)
- Tmi — Middle Tertiary intrusive rocks (20 - 40 M.Y.); intermediate to felsic composition
- TKr — Raton Formation (arkosic sandstone, siltstone, and shale)

Mesozoic (Cretaceous, Jurassic, Triassic)

- K — Sedimentary rocks of Cretaceous age; KJdr; Kpcl; Kmv
- Jmj — Morrison Formation and Junction Creek Sandstone

Paleozoic

- P — Sedimentary rocks of Ordovician to Permian age
- C — Diabase

Precambrian

- Xmm — Metamorphic rocks (1,700 - 1,800 M.Y.); biotite gneiss, schist, migmatite, and quartzite
- Xg — Granitic rocks (1,400 - 1,730 M.Y.); Yg
- Xm — Mafic rocks (1,700 M.Y.)

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FIGURE 10.1.7.1-4 (Cont.)

deposits, such as those of the Great Sand Dunes National Monument, occur along the base of the Sangre de Cristo Mountains on the eastern side of the valley. The Rio Grande alluvial fan (at the base of the San Juan Mountains where the Rio Grande enters the valley) lies northwest of the town of Alamosa; it is one of the many fans that occur along the valley margins. The San Luis Hills, consisting of northeast-trending flat-topped mesas and irregular hills, are a prominent feature of the southern part of the valley.

Topography

The San Luis Valley is an elongated basin with a north-south trend and an area of about 2.0 million ac (8,288 km^2). Slopes of more than 50 ft/mi (24.5 m/km) occur on the alluvial fan deposits along the valley sides; the valley floor has more gentle slopes of about 6 ft/mi (2.9 m/km). Maximum relief from the mountain peak to the valley floor is about 6,800 ft (2,073 m); relief from the heads of alluvial fans to the valley floor is about 500 ft (152 m). The valley floor is broad and flat; topographic features include the basalt hills and mesas of the San Luis Hills and the dune fields of the Great Sand Dunes. Playa lakes are present in the north part of the valley (Leonard and Watts 1989; Emery 1979).

The proposed Antonito Southeast SEZ is located about 7.5 mi (12 km) to the west of the Rio Grande in Conejos County (Figure 10.1.7.1-1). Its terrain is relatively flat with a gentle dip to the northeast (Figure 10.1.7.1-5). The land surface is dissected by intermittent streams that flow to the northeast. Elevations range from about 8,033 ft (2,448 m) near the southwestern corner to less than 7,775 ft (2,370 m) along the northeast-facing boundary. The highest point in the area is 8,229 ft (2,508 m) in the South Piñon Hills just north of the northern boundary of the SEZ.

Geologic Hazards

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

Seismicity. Seismic activity associated with earthquakes in Colorado is low to moderate, with a slightly higher risk in and around the Rio Grande rift zone (Kirkham and Rogers 1981). The rift zone is an extensional stress regime and consists of a series of grabens (fault-bounded basins) that extend along the northeast-oriented rift axis. It is currently dormant; however, earthquakes could potentially occur as a result of movement along existing normal faults within and along the boundaries of the San Luis Basin (Blume and Sheehan 2002).

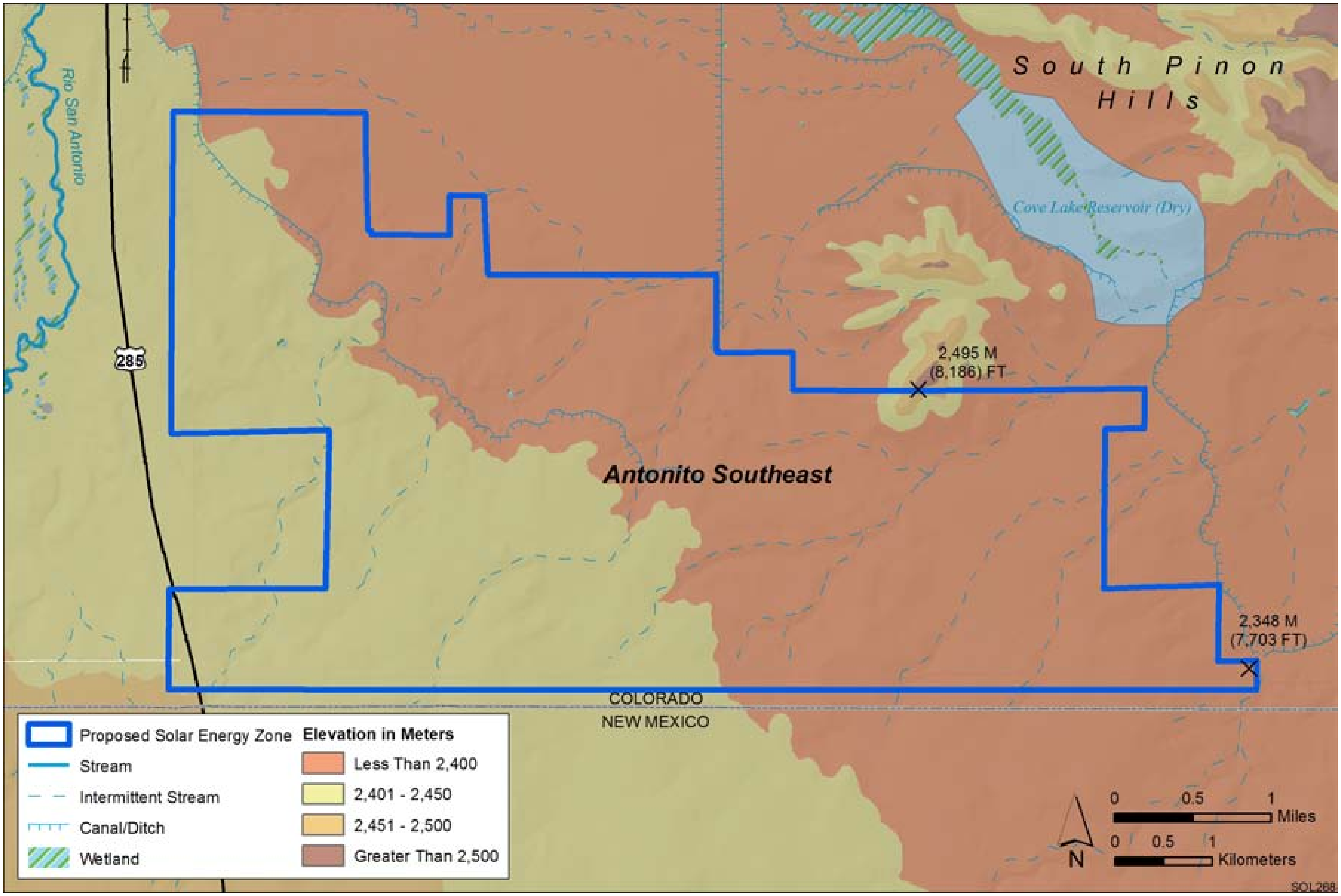

FIGURE 10.1.7.1-5 General Terrain of the Proposed Antonito Southeast SEZ

No known Quaternary faults occur within the proposed Antonito Southeast SEZ. The closest Quaternary fault is the Mesita fault, a north-striking normal fault that lies about 14 mi (23 km) to the east of the SEZ in Costilla County (Figure 10.1.7.1-6). The most recent movement along this fault dates to the middle to late Pleistocene (less than 130,000 years ago). Prominent topographic scarps along the west side of the San Luis Basin indicate that downward displacement is west of the fault line (Kelson and Personius 1996). The Southern Sangre de Cristo fault system occurs 4 to 9 mi (7 to 14 km) to the east of the Mesita fault and forms the border between the Sangre de Cristo Mountains and the San Luis Valley. Slip along this fault system uplifted the Sangre de Cristo Mountains to elevations greater than 14,108 ft (4,300 m) above the San Luis Valley. Although this fault system has been historically inactive, large fault scarps suggest late Pleistocene and Holocene movement (as recent as 5,000 years ago) along much of its length and past earthquakes of magnitude 7.0 to 7.3. The trace of the Southern Sangre de Cristo fault system is buried by landslide debris (Crone et al. 2006; Blume and Sheehan 2002; McCalpin 1986).

From June 1, 2000 to May 31, 2010, 68 earthquakes were recorded within a 61-mi (100-km) radius of the proposed Antonito Southeast SEZ. The largest earthquake during that period occurred on August 10, 2005 (it is also the largest recorded earthquake since 1980). It was located about 60 mi (95 km) east of the SEZ in the Canadian River Valley (New Mexico) and registered a moment magnitude (Mw)[2] of 5.0 (Figure 11.2.7.1-6). During this period, 41 (60%) of the recorded earthquakes within a 61-mi (100-km) radius of the SEZ had magnitudes greater than 3.0 (USGS 2010a).

Liquefaction. The proposed Antonito Southeast SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.05 and 0.06 g. Shaking associated with this level of acceleration is generally perceived as moderate; however, the potential for damage to structures is very light (USGS 2008). Given the low intensity of ground shaking and the low incidence of historic seismicity in the San Luis Valley, the potential for liquefaction in valley sediments is also likely to be low.

Volcanic Hazards. The San Juan Mountains west of the San Luis Valley are the largest erosional remnant of a nearly continuous volcanic field that stretched across the Southern Rockies during the Tertiary period (Lipman et al. 1970). Extensive volcanic activity occurred in this volcanic field about 35 to 30 million years ago, during which time lavas and breccias of intermediate composition were erupted from numerous scattered central volcanoes. About 30 million years ago, volcanic activity associated with large calderas throughout the central and western part of the San Juan Mountains changed to explosive ash-flow eruptions that deposited several miles (kilometers) of lava and ash throughout the area. Once extension began in the Rio Grande rift, about 27 million years ago, volcanic activity was predominantly basaltic. Flood

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2 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 2010b).

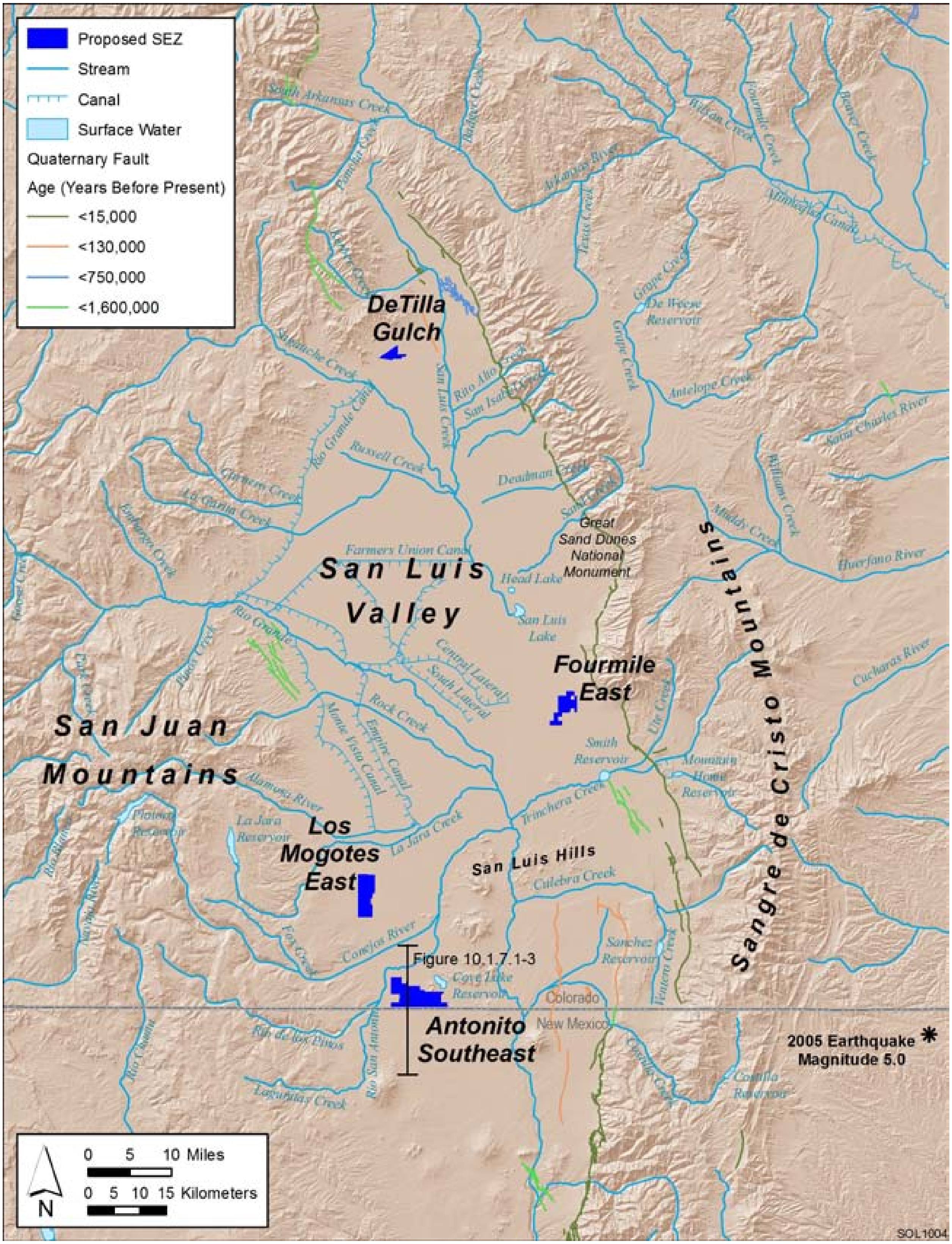

FIGURE 10.1.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010a)

basalts erupted intermittently from fissures in the rift valley from 26 to 14 million years ago. Examples include the Miocene basalts of the Hinsdale Formation, which occur along the western edge of the San Luis Valley and in the San Luis Hills, and the younger basalt flows (e.g., the Servilleta Basalt) of the Taos Plateau in the southern part of the valley (Lipman et al. 1970; Lipman and Mehnert 1979, Thompson et al. 1991; Brister and Gries 1994; Lipman 2006).

Although there are numerous volcanic vents and historic flows in the San Luis Valley region and volcanic activity has occurred as recently as 2 million years ago on the Taos Plateau, there is currently no evidence of volcanic eruptions or unrest in south-central Colorado

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 the San Luis 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.

There has been no land subsidence monitoring within San Luis Valley to date; however, the potential for subsidence (due to compaction) does exist, because groundwater levels are in decline. There is no subsidence hazard related to underground mining, because there are no inactive coal mines in Conejos County. Although subsidence features (e.g., sinkholes and fissures) due to the flowage or dissolution of evaporite bedrock have been documented in Colorado, they are not known to occur in south-central Colorado (CGS 2001).

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

Alluvial fan surfaces, such as those that occur along the valley margins, can be the sites of damaging high-velocity “flash“ floods and debris flows during periods of intense and prolonged rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris flow fans) will depend on specific morphology of the fan (National Research Council 1996). Section 10.1.9.1.1 provides further discussion of flood risks within the Antonito Southeast SEZ.

10.1.7.1.2 Soil Resources

Soils within the proposed Antonito Southeast SEZ are predominantly very stony loams and cobbly loams of the Travelers and Garita Series, which together make up about 96% of the soil coverage at the site (Figure 10.1.7.1-7). Soil map units within the Antonito Southeast SEZ are described in Table 10.1.7.1-1. Parent material consists of sediments weathered from basalt. Soils are characterized as shallow and deep and well to excessively well-drained. Most soils on the site have low to medium surface-runoff potential and moderate to moderately rapid permeability. The natural soil surface is suitable for roads, with a slight to moderate erosion

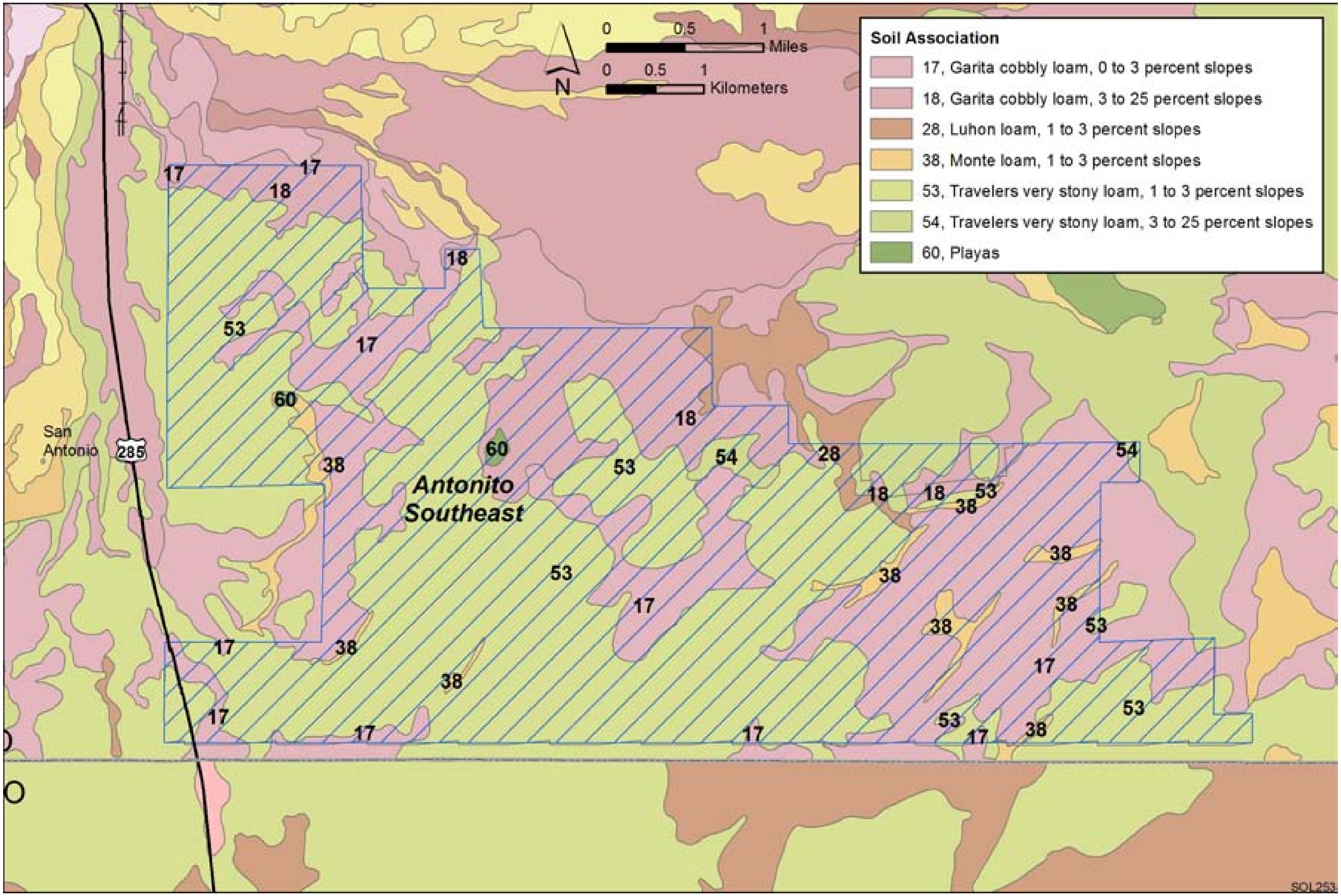

FIGURE 10.1.7.1-7 Soil Map for the Proposed Antonito Southeast SEZ (NRCS 2008)

TABLE 10.1.7.1-1 Summary of Soil Map Units within the Proposed Antonito Southeast SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
53	Travelers very stony loam (1 to 3% slope)	Slight	Low (WEG 8)[c]	Nearly level soils on mesas and hillslopes capped by basalts, andesite, and/or rhyolite. Parent material consists of thin calcareous sediments weathered from basalt. Shallow and well to somewhat excessively drained, with medium surface runoff potential and moderate to moderately rapid permeability. Available water capacity is very low. Used mainly as rangeland. Susceptible to compaction.	5,462 (57)
17	Garita cobbly loam (0 to 3% slope)	Slight	Moderate (WEG 4)	Nearly level soils on alluvial fans and fan terraces. Parent material consists of thick calcareous sediments from basalt. Deep and well drained, with very low surface runoff potential and moderate permeability. Available water capacity is low. Used mainly as native pastureland. Susceptible to compaction.	2,718 (28)
18	Garita cobbly loam (3 to 25% slope)	Slight	Moderate (WEG 4)	Nearly level to gently sloping soils on alluvial fans and fan terraces. Parent material consists of thick calcareous and gravelly alluvium from basalt. Deep and well drained, with low surface runoff potential and moderate permeability. Available water capacity is low. Used mainly as native pastureland. Susceptible to compaction.	1,014 (11)
38	Monte loam (1 to 3% slope)	Slight	Moderate (WEG 4)	Nearly level soils on alluvial fans and floodplains. Parent material consists of alluvium from rhyolite and latite. Deep and well drained, with low surface runoff potential and moderate permeability. Available water capacity is high. Used mainly for native rangeland and irrigated cropland; prime farmland if irrigated[d]. Susceptible to compaction; severe rutting hazard.	209 (2)

TABLE 10.1.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
54	Travelers very stony loam (3 to 25% slope)	Slight	Low (WEG 8)	Nearly level to gently sloping soils on mesas and hillslopes capped by basalts, andesite, and/or rhyolite. Parent material consists of thin calcareous material weathered from basalt. Shallow and well to somewhat excessively drained, with high surface runoff potential (very low infiltration) and moderate to moderately rapid permeability. Available water capacity is very low. Used mainly as rangeland. Susceptible to compaction.	97 (<1)
28	Luhon loam (1 to 3% slope)	Slight	Moderate (WEG 4)	Nearly level soils on alluvial fans and valley side slopes. Parent material consists of mixed calcareous alluvium. Deep and well drained, with low surface runoff potential and moderate permeability. Available water capacity is high. Used mainly as native pastureland; prime farmland if irrigated. Susceptible to compaction; severe rutting hazard.	78 (<1)
60	Playas	Not rated	Not rated	Very poorly drained soils formed in playas; moderately to strongly saline. Compaction resistance not rated; severe rutting hazard.	21 (<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 and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of “slight“ indicates that erosion is unlikely under ordinary climatic conditions.

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

[c] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also 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 4, 86 tons per acre per year; and WEG 8, 0 tons per acre per year.

[d] 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.

Source: NRCS (2009).

hazard when used as roads or trails. The water erosion potential is slight for all soils. The susceptibility to wind erosion is low to moderate, with as much as 86 tons of soil per acre eroded by wind each year. Except for the playa areas, which were not rated, all soils within the SEZ have features that are favorable for fugitive dust formation (NRCS 2009).

The Garita cobbly loam also occurs on the steeper slopes (3 to 25 percent) of intermittent drainages, especially in the northeast quadrant of T32N, R9E. Only the playa soils (Map Unit 60), composing less than 1 percent of the soils within the SEZ, are rated as hydric[3] and have a frequent flood rating (occurring often under normal weather conditions with a chance of more than 50 percent in any year). Flooding is not likely for other soils at the site (occurring less than once in 500 years). All soils at the site are vulnerable to compaction. About 3 percent of the soils (Luhon and Monte loams) are classified as prime farmland if irrigated (NRCS 2009).

10.1.7.2 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 impacts 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 facilities 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 time frame.

10.1.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed Antonito Southeast 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.

[3] A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding (NRCS 2009).

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10.1.8 Minerals (Fluids, Solids, and Geothermal Resources)

10.1.8.1 Affected Environment

The San Luis Basin is identified as an oil and gas producing region (Burnell 2008) although there is no current production; however, the whole San Luis Basin area has been identified in the BLM's San Luis Valley RMP (BLM 1991) as an area of low potential for oil and gas development. The area is still open for discretionary mineral leasing, including leasing for oil and gas.

There are no mining claims (BLM and USFS 2010b) or active oil and gas leases with the proposed Antonito Southeast SEZ, although there are two closed oil and gas leases on the western tier of sections in the area (BLM and USFS 2010c). Lands in the SEZ were closed to locatable mineral entry in June 2009, pending the outcome of this solar energy development PEIS.

The San Luis Basin is also a region of known and potential geothermal resources, and interest in the area for possible electric power generation based on geothermal resources has increased (Burnell 2008). Several geothermal springs and wells have been developed in the northern part of the basin, the nearest at Alamosa, about 34 mi (54 km) north of the proposed Antonito Southeast SEZ (Laney and Brizzee 2005). No geothermal leasing or development has occurred within the SEZ (BLM and USFS 2010c).

10.1.8.2 Impacts

If the proposed Antonito Southeast SEZ was identified by the BLM as an SEZ to be used for utility-scale solar development, it would continue to be closed to all incompatible forms of mineral development, including locatable minerals; however, since the SEZ does not contain existing mining claims, it is assumed there would be no loss of locatable mineral production there for the duration of any solar energy lease.

Since there are no oil and gas leases in the SEZ, it is assumed there would be no impacts on these resources if the SEZ wasdeveloped for solar energy production. In addition, should any oil and gas resources be found, they could be accessible via directional drilling from outside of the SEZ.

Solar energy development of the SEZ would preclude future surface use of the site to produce geothermal energy although geothermal resources, should any be found, might be accessed through directional drilling. Because of this option and the lack of current geothermal development within the SEZ, solar energy development of the SEZ is expected to have no impact on development of geothermal resources.

If the area is identified as a solar energy zone, some mineral uses might be allowed. For example, 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 and that would not interfere with solar energy operations.

10.1.8.3 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 reduce the potential for impacts on mineral leasing.

10.1.9 Water Resources

10.1.9.1 Affected Environment

The proposed Antonito Southeast SEZ is located in the San Luis Valley, which is in the Rio Grande Headwaters subbasin of the Rio Grande hydrologic region (USGS 2010c). The San Luis Valley covers approximately 2 million acres (8,094 km^2) and is bounded by the San Juan Mountains to the west the Sangre de Cristo Mountains to the east. The northern portion of the San Luis Valley is internally drained towards San Luis Lake and referred to as the “closed basin“ (see inset of Figure 10.1.9.1-1), while the southern portion of the valley drains to the Rio Grande (Topper et al. 2003, Mayo et al. 2007). The proposed Antonito Southeast SEZ is located in the southern portion of the San Luis Valley and has surface elevations ranging from 7,715 to 8,035 ft (2,352 to 2,449 m) with a general west to east drainage pattern. The climate of the San Luis Valley is arid, with evaporation rates often exceeding precipitation amounts (Robson and Banta 1995). The average annual precipitation and snowfall amounts in the southern San Luis Valley are on the order of 7 and 25 in. (18 and 64 cm), respectively (WRCC 2010a). Precipitation and snowfall amounts are much greater in the surrounding mountains and on the order of 27 and 237 in. (69 and 602 cm), respectively, at elevations higher than 10,000 ft (3,048 m) (WRCC 2010b). Pan evaporation rates are estimated to be 54 in./yr (137 cm/yr) in the San Luis Valley (Cowherd et al. 1988; WRCC 2010c) with evapotranspiration rates potentially exceeding 40 in./yr (102 cm/yr) (Mayo et al. 2007; Emery 1994; Leonard and Watts 1989).

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

The primary surface water features within the proposed Antonito Southeast SEZ include Alta Lake and several ephemeral washes (Figure 10.1.9.1-1) Alta Lake is a small, shallow pond that is located in the western portion of the site. The pond is in a depression that receives surface runoff from elevated areas to the south. At the time of a site visit in July 2009, it covered an area of about 2 acres (0.0040 km^2). The ephemeral washes on the site are shallow and are typically oriented to flow from southwest to northeast. Artificial ridges observed in the field were built more than 60 years ago to divert surface drainage to depressions to provide water for livestock. Cove Lake Reservoir is located about 2 mi (3 km) northeast of the SEZ; it is currently dry. The SEZ is about 1 mi (1.6 km) east of the Rio San Antonio. The Rio San Antonio discharges to the Conejos River to the northwest. The Conejos River ultimately discharges to the Rio Grande, about 15 mi (24 km) north of the SEZ (Figure 10.1.9.1-1).

Flood hazards have not been identified (Zone D) for all of Conejos County (FEMA 2009). Intermittent flooding may occur along the ephemeral washes and Alta Lake, with temporary ponding and erosion. The floodplain valleys of the Rio San Antonio and the Conejos River are not within the proposed SEZ. The drainage divides of these floodplains and the intermittent flows of these rivers (USGS 2010d, stream gauge 08247500-flows typically <10 ft^3/s [<0.3 m^3/s] with spring floods up to 500 ft^3/s [14 m^3/s]) suggest that flooding outside their valleys is rare.

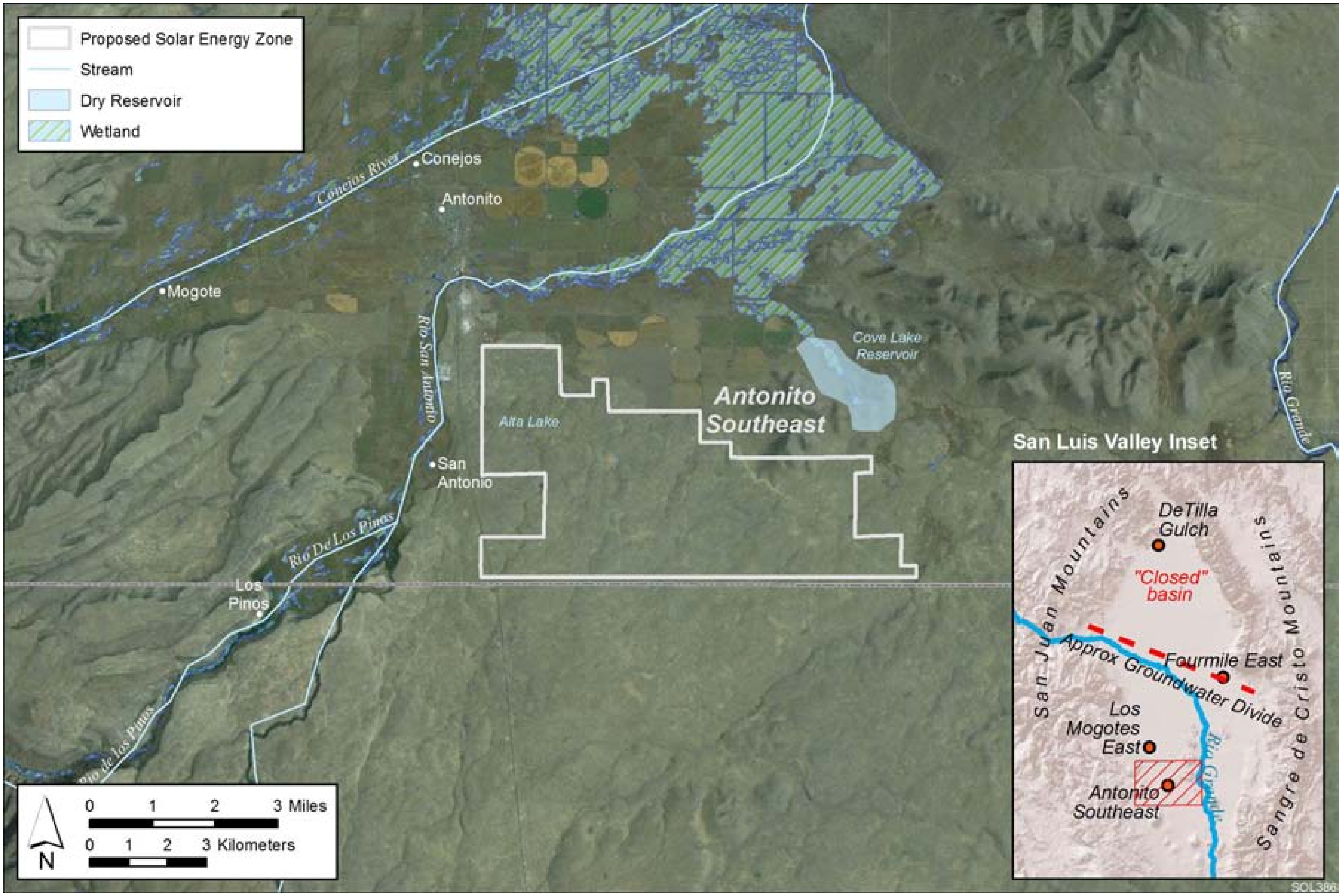

FIGURE 10.1.9.1-1 Surface Water Features near the Proposed Antonito Southeast SEZ

The National Wetlands Inventory (NWI) identified three palustrine wetlands within the proposed San Antonito Southeast SEZ that include Alta Lake; these are described in more detail in Section 10.1.10.1 (USFWS 2009a). These wetland features are temporally flooded throughout the year, and the groundwater level is often below the land surface. In addition, several palustrine and riverine wetlands are located in the riparian regions of the Rio San Antonio and the Conejos River located approximately 1 mi (1.6 km) west and north of the site (USFWS 2009a). These wetland features vary widely in their hydrologic characteristics, from being temporally flooded to containing surface water throughout the year.

10.1.9.1.2 Groundwater

Groundwater in the San Luis Valley is primarily in basin fill deposits ranging from 8,000 to 30,000 ft (2,438 to 9,144 m) in thickness and consisting of unconsolidated to moderately consolidated deposits of gravel, sands, and clays of Tertiary and Quaternary age (Robson and Banta 1995; Mayo et al. 2007). These basin fill deposits consist of two hydrogeologic units, the upper unconfined aquifer and the lower confined aquifer, which are separated by a series of confining clay layers and unfractured volcanic rocks (Brendle 2002). The unconfined aquifer covers most of the valley floor and occurs in unconsolidated valley sediments up to depths of 200 ft (61 m) (Mayo et al. 2007). The deeper confined aquifer covers about half of the valley floor and occurs in the unconsolidated sediments interlayered with basalt flows ranging in depth from 50 to 30,000 ft (15 to 9,100 m) (Emery 1994; Mayo et al. 2007). Groundwater flow in the upper unconfined aquifer follows the surface drainage divide in the San Luis Valley, with flows towards San Luis Lake in the northern portion of the valley (referred to as the closed basin) and flows towards the Rio Grande in the southern portion of the valley; however, flow is not separated in the lower confined aquifer, which in general flows towards the closed basin portion of the valley (Mayo et al. 2007).

Aquifers in the San Luis Valley are predominantly recharged by snowmelt runoff from higher elevations of the surrounding mountain ranges along the valley rim (Robson and Banta 1995), as well as by irrigation return flows, subsurface inflow, and seepage from streams (Emery 1994). The upper unconfined aquifer receives upward groundwater flows from the lower confined aquifer in some regions of the valley, but the conceptual model of leakage between the aquifers is not fully realized (Mayo et al. 2007). Because of the low precipitation rates and high evaporation rates in the valley, precipitation within the valley is not a significant recharge source (with only about 1% of the annual precipitation reaching the aquifers) (Robson and Banta 1995). Groundwater discharge is primarily through groundwater extractions, evapotranspiration, and surface water discharge to the Rio Grande (Emery 1994; Mayo et al. 2007). Estimates of groundwater recharge and discharge processes are variable depending upon assumptions made in performing a water balance, but total groundwater recharge and discharge for the entire San Luis Valley are on the order of 2.8 million ac-ft/yr (3.5 billion m^3/yr) (SLV Development Resources Group 2007).

The proposed Antonito Southeast SEZ is located southwest of the San Luis Hills on a thin, discontinuous veneer of alluvial sediments underlain by basalt (see Section 10.1.7.1 for further details) (Miggins et al. 2002; Machette and Thompson 2007). This region of the San Luis

Valley does not have the confining clay layer (Colorado DWR 2010a); however, the basalt is not fractured enough near the surface to yield sufficient groundwater and acts as a confining unit. The thickness of the basalt under the site has not been characterized but is expected to vary with the old terrain of the valley at the time the basalt filled the valley, about 3.7 million years ago (Machette and Thompson 2007). Groundwater monitoring wells located within the proposed SEZ have reported depths to groundwater ranging from 200 to 300 ft (61 to 91 m) below the surface with corresponding groundwater surface elevations ranging from 7,566 to 7,666 ft (2,306 to 2,337 m) that indicate a groundwater flow from west to east (USGS 2010b, well numbers 370140105593701, 70056105564301, and 370142105561101). A monitoring well operated by the Colorado Water Conservation Board just north of the proposed SEZ has a similar depth to groundwater, and the well driller‘s log summary categorizes this well as being in the confined San Luis Valley aquifer (Colorado DWR 2010b, well number P12). Several groundwater-monitoring wells in the agricultural fields north of the proposed SEZ (see Figure 10.1.9.1-1) are drilled to depths ranging from 17 to 65 ft (5 to 20 m) below the surface and show seasonal variations in groundwater surface elevations (rising during winter-spring and falling during summer-fall) that are typically within 50 ft (15 m) of the land surface (USGS 2010b, e.g., well number 370326105575501). This evidence suggests that groundwater in the lower confined aquifer below the proposed SEZ flows east towards the Rio Grande, while the upper unconfined aquifer of the agricultural fields north of the proposed SEZ is connected to the Rio San Antonio and Conejos River. The depth of the unconfined aquifer within the proposed SEZ and its connectivity to these alluvial river aquifers would need to be assessed during the site characterization phase.

Water quality in the aquifers of the San Luis Valley varies according to location, with good water quality along the valley edges to poor water quality in the vicinity of the natural depression around San Luis Lake (Topper et al. 2003). Total dissolved solids (TDS) concentrations are generally less than 300 mg/L in the southern portion of the San Luis Valley in the unconfined aquifer and less than 200 mg/L in the lower confined aquifer (Mayo et al. 2007).

10.1.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals in Conejos County were estimated to be 402,680 ac-ft/yr (497 million m^3/yr), of which about 94% was from surface water sources (streams, springs, and irrigation canals and laterals). The largest water use category was irrigation, at 386,965 ac-ft/yr (477 million m^3/yr) composing 96% of the water use, which was principally supplied by surface waters. Groundwater withdrawals were primarily used for supporting aquaculture at 13,740 ac-ft/yr (16.9 million m^3/yr), irrigation at 7,712 ac-ft/yr (9.5 million m^3/yr), and public water supply at 1,614 ac-ft/yr (2.0 million m^3/yr) (Kenny et al. 2009).

Colorado administers its water rights using the Doctrine of Prior Appropriation as its cornerstone; water rights are granted by a water court system and administered by the Colorado Division of Water Resources (BLM 2001). Surface waters in much of Colorado were over-appropriated before the turn of the twentieth century; groundwater was not actively managed until mid-1960; and the Water Rights Determination and Administration Act of 1969

(*Colorado Revised Statutes* 37-92-101 through 37-92-602) required that surface waters and groundwater be managed together (Colorado DWR 2010c).

The proposed Antonito Southeast SEZ is located in Colorado Division of Water Resources' Division 3 management zone (Rio Grande Basin), where both surface water and groundwater rights are over-appropriated. Securing water supplies for utility-scale solar energy projects in the Rio Grande Basin requires the purchase of an augmentation certificate (where available) or existing water rights and transfer to a new point of diversion (surface diversion or new well). Any transfer of existing water rights will be carried out through the Division 3 Water Court, which includes a review process by the Colorado Division of Water Resources with respect to the location of the new diversion and its potential impacts on senior water rights, aquifer conditions, and surface water flows (Colorado District Court 2004; Colorado DWR 2008). An additional burden for new water diversions in this region is the need for a plan for augmentation[4] to protect senior water rights (typically surface water rights) with respect to any potential depletions in terms of timing, location, amount, and quality (Colorado DWR 2008).

A major element of water management in the San Luis Valley is the Rio Grande Compact of 1938, which obligates Colorado to deliver a specified quantity of water (dependent on natural supply) in the Rio Grande as it crosses the Colorado–New Mexico state line (Colorado District Court 2004). Since its inception, several U.S. Supreme Court and Colorado Supreme Court decisions (e.g., *Texas v. Colorado* 1968; *Alamosa-La Jara Water Users Protection Association v. Gould* 1983) have imposed that the Colorado Division of Water Resources develop rules and regulations regarding surface water and groundwater appropriations within the Rio Grande Basin. The process of modifying and adopting new rules and regulations regarding surface water and groundwater rights is still ongoing. Recently in 2008, the San Luis Valley Rules Advisory Committee was established to develop new rules and regulations regarding groundwater use and water rights administration in the Rio Grande Basin (Wolfe 2008). Many issues concerning the Colorado Division of Water Resources' attempts to develop a management plan for surface waters and groundwater in the Rio Grande Basin are summarized in Case Numbers 06CV64 and 07CW52 brought before the Division 3 Water Court (Colorado District Court 2010).

The new rules and regulations governing surface water and groundwater in the Rio Grande Basin are not final; however, they will impose limits on groundwater withdrawals in order to reduce groundwater extractions to a sustainable level and help sustain treaty obligations (Colorado District Court 2010; Colorado DWR 2010c). The viability of any solar energy project will depend upon its ability to secure water rights, which would need to be done by coordination with the Colorado Division of Water Resources, existing water right holders, and potentially some of the water conservation districts in the San Luis Valley that provide augmentation water and will potentially be subdistrict groundwater managers depending upon pending court decisions (Colorado District Court 2010; McDermott 2010). The transfer of water rights will

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4 Plan for augmentation means a detailed program, which may be either temporary or perpetual in duration, to increase the supply of water available for beneficial use in a division or portion thereof by the development of new or alternate means or points of diversion, by a pooling of water resources, by water exchange projects, by providing substitute supplies of water, by the development of new sources of water, or by any other appropriate means. *Colorado Revised Statutes* 37-92-103 (9).

most likely involve agricultural surface and groundwater rights, which have been estimated to have a consumptive water use of 150 to 250 ac-ft/yr (185,000 and 308,400 m^3/yr) for a 125-acre (0.5-km^2) farm (SLV Development Resources Group 2007). The transfer of agricultural water rights for solar energy development will result in agricultural fields being put out of production and will significantly alter land use in the San Luis Valley.

Additional factors that solar projects will need to consider with respect to obtaining and transferring water rights include the location of the water right, whether it is a surface water or groundwater source, and the seniority of the water right. However, the biggest challenge in transferring water rights for solar energy projects will be coming up with a suitable augmentation plan, which will either be accomplished through the water courts, a groundwater management plan, or a substitute water supply plan (for temporary water uses) depending upon court decisions regarding groundwater management in the San Luis Valley that are expected in the near future (Colorado District Court 2010; Colorado DWR 2010d, McDermott 2010). Securing additional water supply sources for an augmentation plan reduces the amount of available water resources in the Rio Grande Basin. According to recent applications processed through the water court, it would be very difficult for any project seeking an amount of water more than approximately 1,000 ac-ft/yr (1.2 million m^3/yr) to be successful in obtaining needed water rights (McDermott 2010).

10.1.9.2 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 would be 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, normal 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).

10.1.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy facilities and are described in more detail for the four phases of development in Section 5.9.1. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2. The siting of utility-scale solar energy facilities should not interfere with the natural drainage to Alta Lake, as this shallow pond collects surface water runoff and serves as a local groundwater recharge zone. If projects are not properly sited and mitigated, runoff from development sites could interfere with the natural drainage and cause excess sedimentation to the lake, affecting groundwater recharge.

10.1.9.2.2 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 Antonito Southeast SEZ are as follows:

- On the basis of a total area of less than 10,000 acres (40 km^2), it is assumed that only one solar project would be constructed during the peak construction year;

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

- The maximum land disturbance for an individual solar facility during the peak construction year 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 up to 31% of the SEZ total area during the peak construction year; and

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

Site Characterization

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

Construction

During construction, water would be used mainly for controlling fugitive dust and the workforce potable water supply. Because there are no significant surface water bodies on the proposed Antonito Southeast SEZ (there is insufficient water in Alta Lake to meet construction demands), the water requirements for construction activities could be met by either trucking water to the site or by using on-site groundwater resources. Water requirements for dust suppression and the potable water supply during construction are shown in Table 10.1.9.2-1, and could be as high as 964 ac-ft (1.2 million m^3). In addition, the generation of up to 74 ac-ft (91,300 m^3) of sanitary wastewater would need to be treated either on-site or sent to an off-site facility.

Groundwater wells would have to yield an estimated 425 to 597 gpm (1,609 to 2,260 L/min) to meet the estimated construction water requirements. In the San Luis Valley, current well yields for large production wells are as high as 2,000 gpm (7,571 L/min); however, the majority of well yields are less than 200 gpm (757 L/min) (RGWCD 2010). The effects of groundwater withdrawal and the ability to obtain water rights needed to meet construction water needs would have to be assessed during the site characterization phase.

Normal Operations

During normal operations, water would be required for mirror/panel washing, the workforce potable water supply, and cooling (parabolic trough and power tower only) (Table 10.1.9.2-2). At full build-out capacity, water needs for mirror/panel washing are estimated to range from 43 to 778 ac-ft/yr (53,040 to 960,000 m^3/yr). As much as 22 ac-ft/yr (27,100 m^3/yr) would be needed for the potable water supply.

Cooling water is required for only the parabolic trough and power tower technologies. Water needs for cooling are a function of the type of cooling used—dry versus wet. Further refinements to water requirements for cooling would result from the percentage of time that the facility was operating (30 to 60% range assumed) and the output capacity of the facility. The

TABLE 10.1.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Antonito Southeast SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	612	919	919	919
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	686	964	938	928
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 Appendix M.

[b] Fugitive dust control estimation assumes a local pan evaporation rate of 54 in./yr (137 cm/yr) (Cowherd et al. 1988; WRCC 2010c).

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

TABLE 10.1.9.2-2 Estimated Water Requirements during Normal Operations at Full Build-out Capacity at the Proposed Antonito Southeast SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	1,557	865	865	865
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	778	432	432	43
Potable supply for workforce (ac-ft/yr)	22	10	10	<1
Dry-cooling (ac-ft/yr)[e]	311–1,557	173–865	NA[f]	NA
Wet-cooling (ac-ft/yr)[e]	7,005–22,571	3,892–12,540	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	442	44
Dry-cooled technologies (ac-ft/yr)	1,111–2,357	615–1,307	NA	NA
Wet-cooled technologies (ac-ft/yr)	7,805–23,371	4,334–12,982	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	442	246	NA	NA
Sanitary wastewater (ac-ft/yr)	22	10	10	<1

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

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

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

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

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

f NA = not applicable.

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

differences between the water requirements reported in Table 10.1.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per MW. 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 maximum total water usage during one year of normal operations would be greatest for those technologies using the wet-cooling option and is estimated to be as high as 23,371 ac-ft (28.8 million m^3) (Table 10.1.9.2-2). Water usage for dry-cooling systems would be as high as 2,357 ac-ft/yr (2.9 million m^3/yr), approximately a factor of 10 times less than the wet-cooling option. Water needs for normal operations could be met by trucking in water from an off-site source for technologies with low water demands (e.g., dish engine or PV) or from groundwater at the site, if it is available (see Sections 10.1.9.1.2 and 10.1.9.1.3). For example, a dish engine facility would require 442 ac-ft/yr (545,200 m^3/yr), which could be obtained from a groundwater well pumping continuously at 274 gpm (1,037 L/min). For a parabolic trough system using wet cooling with an operational time of 60% (maximum water use scenario), a groundwater yield of approximately 14,500 gpm (55,000 L/min) would be needed, which is approximately six times larger than the largest production wells in the San Luis Valley (RGWCD 2010). Based on water use requirements, wet-cooling technologies would not be feasible given their high water needs. In addition, any large groundwater withdrawals could adversely affect water flow in the Conejos River, which receives groundwater primarily from the unconfined aquifer and possibly the confined aquifer, given the potential for connectivity between the confined aquifer and alluvial river aquifers (Colorado District Court 2004).

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 were 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 by using water use factors described in Appendix M.

Normal operations at the proposed Antonito Southeast SEZ would produce up to 22 ac-ft/yr (27,100 m^3/yr) of sanitary wastewater (Table 10.1.9.2-2) that would need to be treated either on-site or sent to an off-site facility. In addition, parabolic trough or power tower projects using wet cooling would also discharge cooling system blowdown water that would need to be treated either on- or off-site. The quantity of water discharged would range from 246 to 422 ac-ft/yr (303,000 to 521,000 m^3/yr) (Table 10.1.9.2-2). Any on-site treatment of wastewater would have to ensure that treatment ponds are effectively lined in order to prevent any groundwater contamination.

Decommissioning/Reclamation

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

10.1.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Antonito Southeast SEZ is located adjacent to U.S. 285, and approximately 4 mi (6 km) from existing transmission lines, as described in Section 10.1.1.2. 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 mitigation measures described in Section 5.9.3 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the potential to increase sediment and dissolved solid loads in downstream waters would be conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts associated with alterations to natural drainage pathways and hydrologic processes.

10.1.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources associated with developing solar energy at the proposed Antonito Southeast SEZ are associated with land disturbance effects on the natural hydrology, water quality concerns, and water use requirements for the various solar energy technologies. Land disturbance activities can cause localized erosion and sedimentation issues, as well as alter groundwater recharge and discharge processes. Alta Lake, some small wetland areas, and several ephemeral washes are located within the proposed SEZ. Alterations to the natural drainage patterns of these surface features should be avoided to the extent possible in order to minimize erosion and sedimentation impacts, as well as the disruption of wildlife habitat and clogging of groundwater recharge areas.

Water in the Rio Grande Basin is managed strictly because of its scarcity, treaty obligations, and its necessity for supporting agriculture in the San Luis Valley. Both surface water and groundwater rights are over-appropriated, so water requirements for solar energy development would have to be met through the purchase of senior water rights. Water withdrawals in the basin are managed to control discharge to the Rio Grande system, in accordance with the Rio Grande Compact, so water withdrawals under purchased water rights would need to result in no net impact on the basin. In addition, applications for new points of groundwater diversion would have to demonstrate no impact on adjacent surface and groundwater rights holders. Since current water rights are used primarily for irrigation, the purchase and diversion of groundwater rights for solar energy development would put some agricultural lands out of production. For example, assuming a 125-acre (0.5-km^2) farm has a consumptive use of 200 ac-ft/yr (246,700 m^3/yr) (see Section 10.1.9.1.3), the water requirements for full build-out with dry-cooled parabolic trough technology would need to fallow 1,473 acres (6 km^2) of agricultural fields, whereas PV technology would need to fallow only 28 acres (0.1 km^2). This is a hypothetical example only, and it does not take into account securing water rights needed for an augmentation plan. However, the cost of obtaining the land-associated water rights and augmentation water could be high enough to render unfeasible projects seeking large amounts of water (Gibson 2010, McDermott 2010).

The scarcity and strict management of water resources in the San Luis Valley suggest that utility-scale solar energy facilities that require more than 1,000 ac-ft/yr (1.2 million m^3/yr) would have a difficult time securing water rights (McDermott 2010). Considering the estimated water use requirements for the four solar energy technologies presented in Table 10.1.9.2-2, wet-cooling technologies are not feasible and dry-cooling technologies would need to use water conservation measures to try and reduce water needs. Impacts associated with groundwater withdrawals are primarily addressed by the thorough process involved in obtaining water rights in the Rio Grande Basin, which is primarily overseen by the Colorado Division of Water Resources and the Division 3 Water Court (see Section 10.1.9.1.3). Securing water rights in the Rio Grande Basin is a complex and expensive process, so dish engine and PV technologies are the preferable solar energy technologies for the proposed Antonito Southeast SEZ because of their low water use requirements.

10.1.9.3 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 Antonito Southeast SEZ include the following:

- Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures;

- Land disturbance activities should avoid impacts to the extent possible in the vicinity of Alta Lake and two additional wetland areas, along with ephemeral washes present on the site;

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

- Groundwater rights must be obtained from the Division 3 Water Court in coordination with the Colorado Division of Water Resources, existing water right holders, and applicable water conservation districts;

- Groundwater monitoring and production wells should be constructed in accordance with state standards (Colorado DWR 2005);

- Stormwater management plans and best management practices (BMPs) should comply with standards developed by the Colorado Department of Public Health and Environment (CDPHE 2008); and

- Water for potable uses would have to meet or be treated to meet water quality standards in according to *Colorado Revised Statutes* 25-8-204.

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10.1.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Antonito Southeast SEZ. The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 250-ft (76-m) wide portion of an assumed transmission line corridor. The area of indirect effects was defined as the area within 5 mi [8 km] of the SEZ boundary and within the 1-mi [1.6-km] wide assumed transmission line corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. No area of direct or indirect effects was assumed for new access roads; they are not expected to be needed for development on the Antonito Southeast SEZ because of the proximity of an existing state highway.

Indirect effects considered in the assessment included 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 effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. Because there is some overlap between the area of indirect effect of the SEZ and the area affected by the transmission corridor, the size of the affected area is somewhat less than the sum of the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

10.1.10.1 Affected Environment

The proposed Antonito Southeast SEZ is located primarily within the San Luis Shrublands and Hills Level IV ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands (Chapman et al. 2006). The dominant species of the shrubland communities in this ecoregion are big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and winterfat (*Krascheninnikovia lanata*). Grassland species include western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Hesperostipa comata*). Small areas of the northern portions of the SEZ are within the San Luis Alluvial Flats and Wetlands Level IV ecoregion. Although most areas within this ecoregion have been converted to irrigated cropland, remaining shrubland communities include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), and greasewood (*Sarcobatus vermiculatus*). These ecoregions are located within the Arizona/New Mexico Plateau Level III ecoregion, which is described in Appendix I. Annual precipitation in the vicinity of the SEZ is very low, averaging 7.3 in. (18.5 cm) at Manassa (see Section 10.1.13).

Land cover types, described and mapped under the Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2005a) were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed Antonito Southeast SEZ are shown in Figure 10.1.10.1-1. Table 10.1.10.1-1 provides the surface area of each cover type within the potentially affected area.

Lands within the Antonito Southeast SEZ are classified primarily as two cover types: Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Semi-Desert Grassland. Additional cover types within the SEZ include Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Mixed Salt Desert Scrub, Invasive Annual and Biennial Forbland, and Agriculture.

Winterfat was observed to be the dominant species in some areas of the SEZ in July 2009. Sensitive habitats on the SEZ include wetlands and ephemeral dry washes. The area has had a long history of livestock grazing, and the plant communities present within the SEZ have likely been affected by grazing.

Lands within the transmission line corridor include 13 cover types. Agriculture is the predominant cover type in the corridor. Additional cover types include a wide variety of woodland, shrubland, and grassland types (Table 10.1.10.1-1).

The area surrounding the SEZ, within 5 mi (8 km), includes 26 cover types, which are listed in Table 10.1.10.1-1. The predominant cover types are Inter-Mountain Basins Semi-Desert Shrub Steppe and agriculture.

Alta Lake is a small wetland located in the northwestern portion of the SEZ. Alta Lake is identified by the NWI as a palustrine wetland supporting an emergent plant community; it is approximately 1.9 acres (0.0077 km^2) in size (Figure 10.1.10.1-2) (USFWS 2009a). Palustrine wetlands are relatively shallow freshwater wetlands that often support plant communities of trees, shrubs, emergents, or floating leaved plants. Emergent plant communities are composed primarily of herbaceous species rooted in shallow water or saturated soil. A grass-dominated plant community was observed along the margin of Alta Lake in July 2009. See Section 10.1.9.1.1 for a description of the hydrological characteristics of wetlands in the vicinity of the SEZ.

Alta Lake reservoir is located about 1 mi (1.6 km) southeast of Alta Lake and is identified as a palustrine unconsolidated shore wetland, about 1.0 acre (0.004 km^2) in size (USFWS 2009a). Unconsolidated shore wetlands have a sparse vegetation cover. Because surface water impoundment structures are no longer functional, Alta Lake Reservoir may no longer support a wetland plant community. A third wetland is located in the eastern portion of the SEZ along an intermittent stream. This 0.3-acre (0.001-km^2) palustrine wetland supports an emergent plant community. Numerous ephemeral dry washes occur within the SEZ and transmission line corridor. These dry washes typically contain water for short periods during or following precipitation events, and include temporarily flooded areas, but typically do not support wetland or riparian habitats.

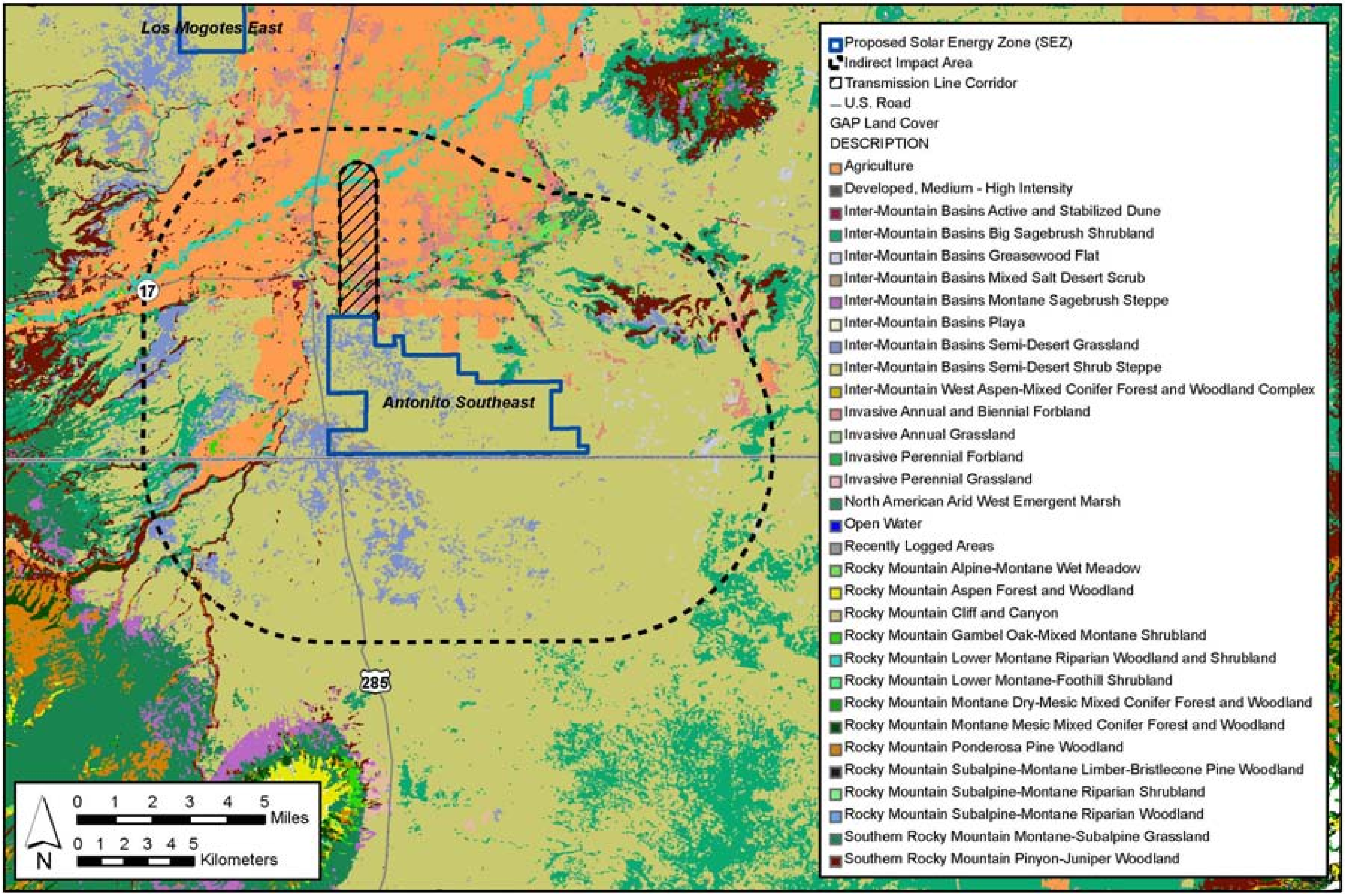

FIGURE 10.1.10.1-1 Land Cover Types within the Proposed Antonito Southeast SEZ (Source: USGS 2004)

TABLE 10.1.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Antonito Southeast SEZ and Potential Impacts

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	8,320 acres[g] (1.4%, 3.5%)	67,741 acres (11.0%)	6 acres (<0.1%)	Moderate
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.	1,278 acres (1.9%, 5.1%)	6,643 acres (10%)	1 acre (<0.1%)	Moderate
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.	72 acres (5.1%, 6.8%)	393 acres (28.1%)	0 acres	Moderate
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	27 acres (<0.1%, 1.4%)	24,101 acres (4.6%)	69 acres (<0.1%)	Small
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.	16 acres (<0.1%, <0.1%)	4,226 acres (0.6%)	1 acre (<0.1%)	Small
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	3 acres (<0.1%, 0.4%)	4,508 acres (9.2%)	20 acres (<0.1%)	Small

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TABLE 10.1.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
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.	<1 acre (<0.1%, <0.1%)	1,277 acres (0.4%)	1 acre (<0.1%)	Small
S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland: Occurs on streambanks, islands, and bars, in areas of annual or episodic flooding, and often occurs as a mosaic of tree-dominated communities with diverse shrubs.	0 acres	1,606 acres (5.6%)	7 acres (<0.1%)	Small
S102 Rocky Mountain Alpine-Montane Wet Meadow: Occurs on wet soils in very low-velocity areas along ponds, lakes, streams, and toeslope seeps. This cover type is dominated by herbaceous species, and often occurs as a mosaic of several plant associations. The dominant species are often grass or grass-like plants.	0 acres	1,769 acres (1.6%)	3 acres (<0.1%)	Small
S038 Southern Rocky Mountain Pinyon-Juniper Woodland: Occurs on dry mountains and foothills. The dominant trees are twoneedle pinyon (*Pinus edulis*) or oneseed juniper (*Juniperus monosperma*), or both. Rocky Mountain juniper (*Juniperus scopulorum*) may be a dominant in higher elevation occurrences. An understory may be absent or dominated by shrubs or graminoids.	0 acres	2,572 acre (0.6%)	1 acre (<0.1%)	Small

TABLE 10.1.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
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	322 acres (0.2%)	1 acre (<0.1%)	Small
S036 Southern Rocky Mountain Ponderosa Pine Woodland: Occurs on dry slopes. Ponderosa pine (*Pinus ponderosa*, primarily var *scopulorum*, and var *brachyptera*) is the dominant species. Other tree species may be present. The understory is usually shrubby and grasses may be present.	0 acres	94 acres (<0.1%)	<1 acre (<0.1%)	Small
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.	0 acres	606 acres (0.4%)	<1 acre (<0.1%)	Small
N11 Open Water: Plant or soil cover is generally less than 25%.	0 acres	14 acres (0.1%)	<1 acre (<0.1%),	Small
S012 Inter-Mountain Basins Active and Stabilized Dune: Includes Dune and sandsheet 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.	0 acres	87 acres (1.6%)	0 acres	Small

TABLE 10.1.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S100 North American Arid West Emergent Marsh: Occurs in natural depressions, such as ponds, or bordering lakes, or slow moving streams or rivers. Alkalinity is highly variable. The plant community is characterized by herbaceous emergent, submergent, and floating leaved species.	0 acres	78 acres (2.0%)	0 acres	Small
N22 Developed, Medium–High Intensity: Includes housing and commercial/industrial development. Impervious surfaces comprise 50–100 percent of the total land cover.	0 acres	53 acres (3.5%)	0 acres	Small
D06 Invasive Perennial Grassland: Dominated by non-native perennial grasses.	0 acres	51 acres (2.7%)	0 acres	Small
S032 Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland: Occurs on mountain slopes, canyon sideslopes, and ridgetops. Shrub and graminoid species are generally present.	0 acres	32 acres (<0.1%)	0 acres	Small
S091 Rocky Mountain Subalpine-Montane Riparian Shrubland: Occurs along low-gradient streams, alluvial terraces, and floodplains; around seeps, fens, and isolated springs on hillslopes; and in above-treeline snowmelt-fed basins. This cover type often occurs as a mosaic of shrub and herbaceous communities.	0 acres	18 acres (<0.1%)	0 acres	Small
S034 Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland: Occurs in lower and middle ravine slopes, along stream terraces, and on north- and east-facing slopes. Shrubs and herbaceous species are generally present.	0 acres	8 acres (<0.1%)	0 acres	Small

TABLE 10.1.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S006 Rocky Mountain Cliff and Canyon and Massive Bedrock: Occurs on steep cliffs, narrow canyons, rock outcrops, and scree and talus slopes. This cover type includes barren and sparsely vegetated areas (less than 10% cover) with scattered trees and/or shrubs, or with small dense patches. Herbaceous plant cover is limited.	0 acres	5 acres (<0.1%)	0 acres	Small
D07 Invasive Perennial Forbland: Dominated by non-native perennial forb species.	0 acres	3 acres (1.8%)	0 acres	Small
S023 Rocky Mountain Aspen Forest and Woodland: Dominated by quaking aspen (*Populus tremuloides)*, with without a significant presence of conifers. The understory may consist of only herbaceous species or multiple shrub and herbaceous layers.	0 acres	3 acres (<0.1%)	0 acres	Small
S071 Inter-Mountain Basins Montane Sagebrush Steppe: Occurs on flats, ridges, level ridgetops, and mountain slopes. Mountain big sagebrush (*Artemisia tridentata vaseyana*) and related taxa such as big sagebrush (*Artemisia tridentata spiciformis*) are typically the dominant species. Perennial herbaceous species, especially grasses, are usually abundant, although shrublands are also present.	0 acres	2 acres (<0.1%)	0 acres	Small
D08 Invasive Annual Grassland: Dominated by non-native annual grass species.	0 acres	1 acre (1.0%)	0 acres	Small

Footnotes on next page.

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TABLE 10.1.10.1-1 (Cont.)

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[a] Land cover descriptions are from USGS (2005). Full descriptions of land cover types, including plant species, can be found in Appendix I. Wetlands within the SEZ, such as Alta Lake, are not mapped as wetland cover types by SWReGAP.

[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. Wetlands within the SEZ, such as Alta Lake, are not mapped as wetland cover types by SWReGAP.

[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 a 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[e] For transmission, direct effects were estimated within a 4-mi (6.5-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 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] 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.

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

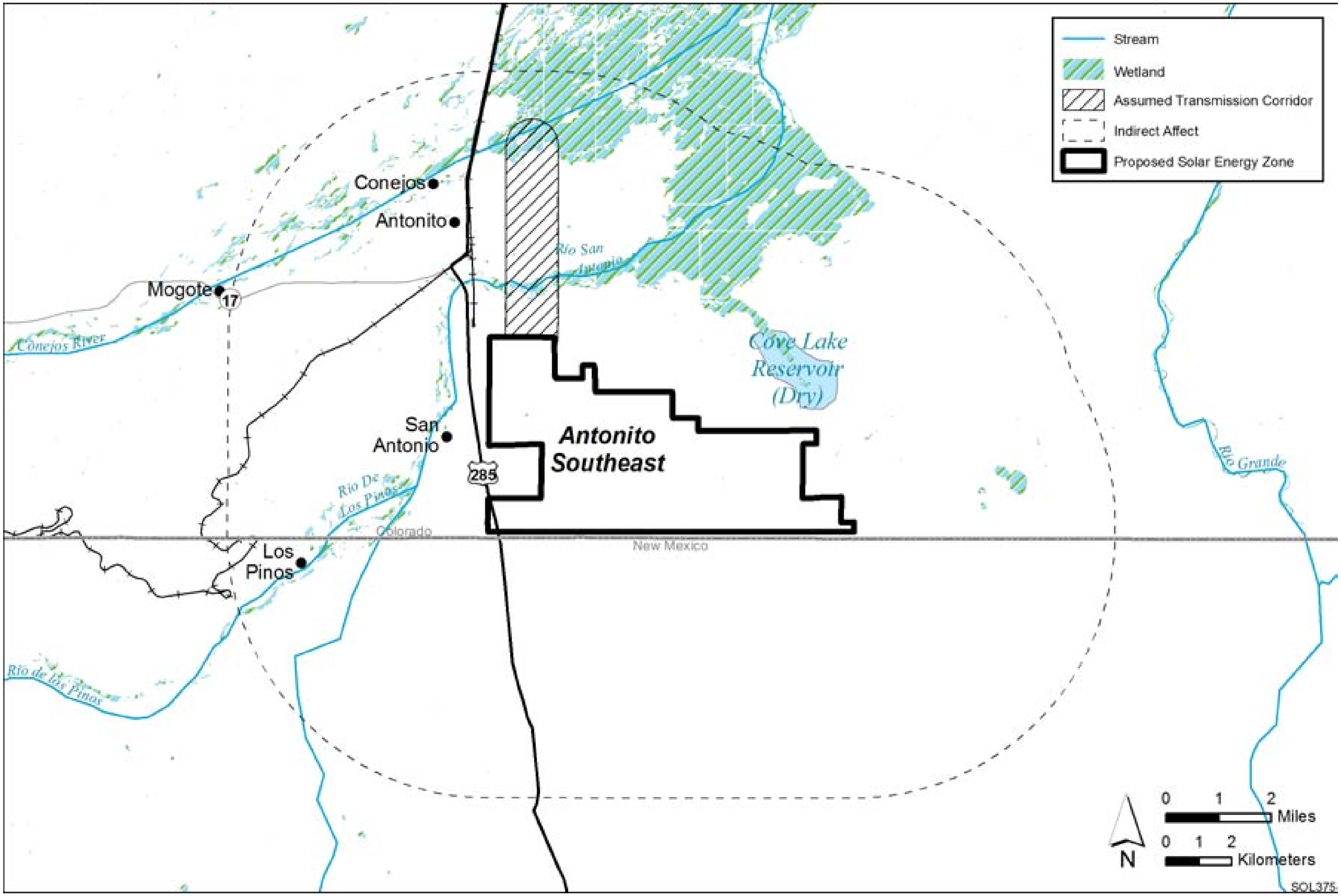

FIGURE 10.1.10.1-2 Wetlands within the Proposed Antonito Southeast SEZ (Source: USFWS 2009a)

Extensive areas of palustrine wetlands with emergent plant communities are located to the north and west of the SEZ, as mapped by the NWI (USFWS 2009a). Many of these areas are classified as wet meadow (see Table 10.1.10.1-1). These wetlands occur within the transmission line corridor and indirect impact area, and are primarily associated with the Rio San Antonio and Conejos River systems. These river systems also support extensive forested and scrub-shrub wetland habitats, many of which are classified as riparian woodland and shrubland cover types. Small, isolated aquatic bed and emergent wetlands also occur within the assumed transmission line corridor, with numerous occurrences of these, as well as unconsolidated shore wetlands, within the indirect impact area. Aquatic bed wetlands support a floating-leaved plant community. The NWI maps are produced from high-altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009a).

The State of Colorado maintains an official state list of weed species that are designated noxious species (CDA 2010). Table 10.1.10.1-2 provides a summary of the noxious weed species regulated in Colorado that are known to occur in Conejos County. Non-native species observed or expected to occur on the SEZ are Russian thistle and crested wheatgrass. No species included in Table 10.1.10.1-2 was observed on the SEZ.

The Colorado Department of Agriculture classifies noxious weeds into one of three lists (CDA 2010):

- “List A species in Colorado that are designated by the Commissioner for eradication.”

- “List B weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, develops and implements state noxious weed management plans designed to stop the continued spread of these species.”

- “List C weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans will not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species.”

There are 19 noxious weeds and invasive plant species that are known or suspected to occur in the San Luis Valley Resource Area, which includes the Antonito Southeast SEZ (Table 10.1.10.1-3).

Those species that are known to occur near the SEZ include black henbane, Canada thistle, and perennial pepperweed. The only species from Table 10.1.10.1-3 on List A, Hydrilla, is an aquatic species and not known to occur in the vicinity of the SEZ.

TABLE 10.1.10.1-2 Colorado Noxious Weeds Occurring in Conejos County

Common Name	Scientific Name	Status
Black henbane	*Hyoscyamus niger*	List B
Bull thistle	*Cirsium vulgare*	List B
Hoary cress,	*Cardaria draba*	List B
Leafy spurge	*Euphorbia esula*	List B
Oxeye daisy	*Chrysantheum leucanthemum*	List B
Perennial pepperweed	*Lepidium latifolium*	List B
Russian knapweed	*Acroptilon repens*	List B
Scotch thistle	*Onopordum acanthium*	List B
Yellow toadflax	*Linaria vulgaris*	List B
Canada thistle	*Cirsium arvense*	List B
Musk thistle	*Carduus nutans*	List B
Field bindweed	*Convolvulus arvensis*	List C

Source: CDA (2010). County occurrence was determined from USDA (2010).

TABLE 10.1.10.1-3 Noxious Weeds and Invasive Plants in the San Luis Valley Resource Area

Common Name	Scientific Name	Status
Leafy spurge	*Euphorbia esula*	List B
Black henbane	*Hyoscyamus niger*	List B
Dalmatian toadflax	*Linaria dalmatica*, *L. genistifolia*	List B
Scotch thistle	*Onopordum acanthium*, *O. tauricum*	List B
Spotted knapweed	*Centaurea maculosa*	List B
Russian knapweed	*Acroptilon repens*	List B
Canada thistle	*Cirsium arvense*	List B
Field bindweed	*Convolvulus arvensis*	List C
Hoary cress	*Cardaria draba*	List B
Perennial pepperweed	*Lepidium latifolium*	List B
Yellow toadflax	*Linaria vulgaris*	List B
Houndstongue	*Cynoglossum officinale*	List B
Russian olive	*Elaeagnus angustifolia*	List B
Cheatgrass	*Bromus tectorum*	List C
Oxeye daisy	*Chrysantheum leucanthemum*	List B
Salt cedar	*Tamarix chinensis*, *T. parviflora*, *T. ramosissima*	List B
Russian thistle/Kochia	*Bassia prostrata*	Not listed
Hydrilla	*Hydrilla verticillata*	List A
Eurasian water milfoil	*Myriophyllum spicatum*	List B

Source: BLM (2010a).

10.1.10.2 Impacts

The construction of solar energy facilities within the Antonito Southeast SEZ would result in direct impacts on plant communities because of the removal of vegetation within the facility footprint during land-clearing and land-grading operations. Approximately 80% of the SEZ (7,783 acres [31.5 km^2]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations and could include any of the communities occurring on the SEZ. Therefore, for 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 with another. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor/small level of impact.

Possible impacts from solar energy development on vegetation that are encountered within the SEZ or along related ROWs are described in more detail in Section 5.10.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through the application of any additional mitigation. SEZ-specific design features are given in Section 10.1.10.3.

10.1.10.2.1 Impacts on Native Species

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

Solar facility construction and operation would primarily affect communities of the Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Semi-Desert Grassland cover types. Additional cover types within the SEZ that would be affected include Inter-Mountain Basins Big Sagebrush Shrubland, and Inter-Mountain Basins Mixed Salt Desert Scrub. Although the Invasive Annual and Biennial Forbland and Agriculture cover types occur within the SEZ, these areas likely support few native plant communities. The potential impacts on land cover types resulting from solar energy development in the proposed Antonito Southeast SEZ are summarized in Table 10.1.10.1-1. Most of these cover types are relatively common in the San Luis Valley area; however, Inter-Mountain Basins Mixed Salt Desert Scrub is relatively uncommon, representing approximately 0.03% of the land area within the SEZ region. In addition, Open Water (0.4%) and Rocky Mountain Lower Montane Riparian Woodland and Shrubland (0.5%) would potentially be affected by the transmission line ROW.

The construction, operation, and decommissioning of solar projects within the SEZ would result in moderate impacts on Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Semi-Desert Grassland, and Inter-Mountain Basins Mixed Salt Desert Scrub. Solar energy development would result in small impacts on all other cover types in the affected area.

Re-establishment of shrub or grassland communities in temporarily disturbed areas would likely be very difficult because of the arid conditions and may 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.

Potential impacts on wetlands as a result of solar energy facility development are described in Section 5.10.1. Specific to the affected area of the proposed Antonito Southeast SEZ, approximately 3.2 acres (0.1 km^2) of wetland habitat occur within the SEZ and could be affected by project development.

Grading could result in direct impacts on the wetlands within the SEZ if fill material is placed within wetland areas. Grading near these wetlands could disrupt surface water or groundwater flow characteristics, resulting in changes in the timing, duration, or extent of inundation or soil saturation, and could potentially affect wetland function. The wetland located along the intermittent stream in the eastern portion of the SEZ, for example, would be vulnerable to any changes in streamflow characteristics. Increases in surface runoff from a solar energy project site could also affect wetland hydrologic characteristics. The introduction of contaminants into wetlands on the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation effects or hydrologic changes could also extend to wetlands outside of the SEZ, such as along the Rio Antonio or Conejos River. Communities associated with greasewood flats communities, riparian habitats, or other periodically flooded areas within the transmission line corridor or downstream from solar projects or the transmission line corridor could also be affected by ground-disturbing activities. Grading could also affect dry washes within the SEZ, and alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities. Vegetation within these communities could be lost by erosion or desiccation. See Section 10.1.9 for further discussion of impacts on washes.

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. Communities that would be most likely affected north–northeast of the SEZ, the predominant downwind direction, are those of the Inter-Mountain Basins Semi-Desert Shrub Steppe cover type. Inter-Mountain Basins Greasewood Flat, Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Semi-Desert Grassland, and Southern Rocky Mountain Pinyon-Juniper Woodland also occur to the east.

The construction of transmission lines in ROWs outside of the SEZ could potentially result in direct impacts on wetlands along the Conejos River or the Rio San Antonio, if fill material is placed within wetland areas, or indirect impacts as described above. Construction could also affect dry washes within or downstream of the ROW.

Although the use of groundwater within the Antonito Southeast SEZ for technologies with high water requirements, such as wet-cooling systems, may be unlikely, groundwater withdrawals for such systems could affect groundwater resources (see Section 10.1.9). Plant communities supported by groundwater discharge, such as riparian or wetland habitats along the Rio San Antonio or the Conejos River or springs associated with groundwater discharge, could become degraded or lost as a result of groundwater flow alterations.

10.1.10.2.2 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 that invasive species cause (*Federal Register*, Volume 64, page 61,836, Feb. 8, 1999). Potential impacts resulting from noxious weeds and invasive plant species as a result of solar energy facility development are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in and adjacent to the affected area of the proposed Antonito Southeast SEZ, such that weeds could be transported into areas previously relatively weed-free, and this could result in reduced restoration success and possible widespread habitat degradation.

Noxious weeds, including Russian thistle and cheatgrass, occur on the SEZ. Species that are known to occur in San Luis Valley near the SEZ include black henbane, Canada thistle, and perennial pepperweed. Additional species known to occur in Conejos County or the San Luis Valley Resource Area are given in Table 10.1.10.1-2 and Table 10.1.10.1-3, respectively. Small areas of Invasive Annual and Biennial Forbland, totaling about 3 acres (0.012 km^2), occur within the SEZ and assumed transmission line corridor, and approximately 3,600 acres (14.6 km^2) occur within 5 mi (8 km) of the SEZ. Invasive Perennial Grassland, Invasive Perennial Forbland, and Invasive Annual Grassland also occurs within 5 mi (8 km).

Past or present land uses may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Existing roads, grazing, and recreational OHV use within the SEZ area of potential impact would also likely contribute to the susceptibility of plant communities to the establishment and spread of noxious weeds and invasive species. Disturbed areas, including 24,101 acres (97.5 km^2) of Agriculture and 53 acres (0.2 km^2) of Developed, Medium-High Intensity occur within the area of indirect effects and may contribute to the establishment of noxious weeds and invasive species.

10.1.10.3 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 impacts on plant communities. While some SEZ-specific design features are best established when project details are considered, some design features 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 Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Semi-Desert Grassland habitats and minimize the potential for the spread of invasive species, such as Russian thistle or cheatgrass. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All wetland, dry wash, and riparian habitats within the SEZ (e.g., Alta Lake) and assumed transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable and any impacts minimized and mitigated. A buffer area should be maintained around wetlands, dry washes, and riparian habitats to reduce the potential for impacts on Alta Lake and other wetlands on or near the SEZ and riparian habitats associated with the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir.

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

- Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas associated with the Rio San Antonio, the Rio de los Pinos, and the Conejos River and span them whenever practicable.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetland habitats along the Rio San Antonio or the Conejos River or on springs that are associated with groundwater discharge.

If these SEZ-specific design features are implemented in addition to other programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on wetlands, springs, dry wash, and riparian habitat would be reduced to a minimal potential for impacts. Residual impacts on wetlands could result from remaining groundwater withdrawal, access road construction, and so forth; however, it is anticipated these impacts would be avoided in the majority of instances.

10.1.11 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 Antonito Southeast SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the Colorado Natural Diversity Information Source Species Page (CDOW 2009) and the SWReGAP (USGS 2007). Land cover types potentially suitable for each species were determined from the SWReGAP (USGS 2004, 2005, 2007). Big game activity areas were determined from Colorado Natural Diversity Information Source Data (CDOW 2008). 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 proposed 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 and a 250-ft (76-m) wide portion of an assumed 4-mi (6.4-km) long transmission line corridor. The maximum developed area within the SEZ would be 7,783 acres (31.5 km^2).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or transmission line construction area). Potentially suitable habitat for a species within the SEZ greater than the maximum of 7,783 acres (31.5 km^2) of direct effect was also included as part of the area of indirect effects. 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 effects are defined and the impact assessment approach is described in Appendix M. No area of direct or indirect effects was assumed for a new access road, because one is not expected to be needed for the SEZ with the proximity of an existing state highway.

The primary habitat type within the affected area is semiarid shrub steppe (Section 10.1.10), although aquatic and riparian habitats occur along Alta Lake, Cove Lake Reservoir, Conejos River, Rio de los Pinos, and Rio San Antonio (Figure 10.1.10.1-1). Surface water features within the proposed Antonito Southeast SEZ include Alta Lake and several ephemeral drainages occur within the proposed Antonito Southeast SEZ while the other aquatic habitats occur within the area of indirect effects (Figure 10.1.9.1-2).

10.1.11.1 Amphibians and Reptiles

10.1.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Antonito Southeast SEZ. The list of amphibian and reptile species potentially present in the SEZ was determined from the Colorado Natural Diversity Information Source (CDOW 2009) and habitat information from the Colorado Division of Wildlife (CDOW) (2009), USGS (2007), and NatureServe (2010). Land cover types suitable for each species were determined from the SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used.

Based on the distribution and habitat preferences of amphibian species in southern Colorado (USGS 2007; CDOW 2009), seven amphibian species could be associated with the aquatic habitats located within the area of indirect effects (e.g., Cove Lake Reservoir, Conejos River, Rio de los Pinos, and Rio San Antonio): the bullfrog (*Rana catesbeiana*), northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), New Mexico spadefoot (*Spea multiplicata*), plains spadefoot (*Spea bombifrons*), and Woodhouse's toad (*Bufo woodhousii*). Based on habitat preferences of the amphibian species, the Woodhouse's toad would be expected to occur within the SEZ (USGS 2007; Stebbins 2003). Amphibian surveys would need to be conducted to confirm which species occur within the area and whether any amphibian species occur near Alta Lake within the SEZ.

Reptile species that could occur within the SEZ include the eastern fence lizard (*Sceloporus undulatus*), gophersnake (*Pituophis catenifer*), many-lined skink (*Eumeces multivirgatus*), short-horned lizard (*Phrynosoma hernandesi*), western rattlesnake (*Crotalus viridis*), and western terrestrial garter snake (*Thamnophis elegans*) (CDOW 2009; NMDGF 2009; Stebbins 2003).

Table 10.1.11.1-1 provides habitat information for representative reptile species that could occur within the Antonito Southeast SEZ.

10.1.11.1.2 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 the application o fany additional mitigation. Section 10.1.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Antonito Southeast 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 10.1.11.1.1 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

TABLE 10.1.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Antonito Southeast SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Amphibians					
Woodhouse's toad (*Bufo woodhousii*)	Mesic areas near streams and rivers. Often in agricultural areas and river floodplains. Prefers sandy areas. Can move several hundred meters between breeding and nonbreeding habitats. About 2,613,200 acres[h] of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,645 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	87 acres of potentially suitable habitat lost and 1758 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoid wetland and riparian habitats.
Lizards					
Eastern fence lizard (*Sceloporus undulatus*)	Sunny, rocky habitats of cliffs, talus, old lava flows and cones, canyons, and outcrops. Various vegetation adjacent or among rocks include montane forests, woodlands, semidesert shrubland, and various forbs and grasses. About 1,831,800 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	79,256 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	9 acres of potentially suitable habitat lost and 181 acres of potentially suitable habitat 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.
Many-lined skink (Eumeces multivirgatus)	Mesic areas along streams and dense grassland edges of playas. Also loose sandy soils and prairie dog colonies; occasionally vacant lots in cities and residential areas. Most abundant where there is water or moist subsoil. About 1,005,200 acres of potentially suitable habitat occurs in the SEZ region.	1,278 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	9,216 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	2 acres of potentially suitable habitat in area of potential direct effect and 40 acres of potentially suitable habitat in area of indirect effect.	Small overall impact. Avoidance of riparian areas and prairie dog colonies would reduce the potential for impact.

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TABLE 10.1.11.1-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
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 3,432,600 acres of potentially suitable habitat occurs in the SEZ region.	1,294 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat)	17,891 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 322 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
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 2,273,200 acres of potentially suitable habitat occurs in the SEZ region.	1,321 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	34,685 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	80 acres of potentially suitable habitat in area of potential direct effect and 1,610 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Western rattlesnake (*Crotalus viridis*)	Most terrestrial habitats. Typically inhabits plains grasslands, sandhills, semidesert and mountain shrublands, riparian areas, and montane woodlands. About 3,675,900 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	105,793 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	87 acres of potentially suitable habitat in area of potential direct effect and 1,750 acres of potentially suitable habitat 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 10.1.11.1-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Western terrestrial garter snake (*Thamnophis elegans*)	Most terrestrial and wetland habitats near bodies of water, but can be found many miles from water. About 2,712,600 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	75,300 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 362 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoidance of wetlands and riparian areas would reduce the potential for 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 consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 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. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. 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 transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

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

Footnotes continued on next page.

TABLE 10.1.11.1-1 (Cont.)

[g] 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.

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

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 10.1.11.1.3).

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 impacts summarized in Table 10.1.11.1-1, direct impacts on representative amphibian and reptile species would be small, ranging from a high of 0.4% for the eastern fence lizard to a low of 0.04% for the short-horned lizard. Larger areas of potentially suitable habitats for the amphibian and reptile species occur within the area of potential indirect effects (e.g., up to 4.2% of available habitat for the eastern fence lizard). Indirect impacts on amphibian and reptiles could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, collection, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

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

10.1.11.1.3 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 utilize habitat types that can be avoided (e.g., dry lakes). 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 some SEZ-specific design features are best established when project details are considered, some design features can be identified at this time, as follows:

- All wetland and riparian habitats within the SEZ (e.g., Alta Lake) and transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable.

- Appropriate engineering controls should be used to minimize impacts on aquatic, riparian, and wetland habitats associated with Alta Lake, the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats.

- Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas and span them whenever practicable.

If these SEZ-specific design features are implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. Any residual impacts on amphibians and reptiles are anticipated to be small given the relative abundance of potentially suitable habitats in the SEZ region. 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.

10.1.11.2 Birds

10.1.11.2.1 Affected Environment

This section addresses bird species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Antonito Southeast SEZ. The list of bird species potentially present in the SEZ area was determined from the Colorado Natural Diversity Information Source (CDOW 2009) and habitat information from CDOW (2009), USGS (2007), and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used.

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 study area. However, within the proposed Antonito Southeast SEZ, waterfowl, wading bird, and shorebird species would be mostly absent to uncommon. Alta Lake, particularly when standing water is present, may attract shorebird species such as the killdeer (*Charadrius vociferus*) and mountain plover (*Charadrius montanus*). However, it is probably not an important habitat for shorebirds because of its small size. Due to its special status standing, the mountain plover is discussed in Section 10.1.12. Bodies of water such as the Rio San Antonio, located about 1 mi (1.6 km) from the western and northern borders of the proposed Antonito Southeast SEZ, provide more productive habitat for waterfowl, wading birds, and shorebirds.

Neotropical Migrants

As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse category of birds within the six-state study area. Species expected to occur within the proposed Antonito Southeast SEZ include the Brewer's blackbird (*Euphagus cyanocephalus*), Brewer's sparrow (*Spizella breweri*), common nighthawk (*Chordeiles minor*), horned lark (*Eremophila* *alpestris*), northern rough-winged swallow (*Stelgidopteryx serripennis*), vesper sparrow (*Pooecetes gramineus*), and western meadowlark (*Sturnella neglecta*) (CDOW 2009; USGS 2007).

Birds of Prey

Section 4.10.2.2.4 provides an overview of the birds of prey (raptors, owls, and vultures) within the six-state study area. Species expected to occur within the proposed Antonito Southeast SEZ include the American kestrel (*Falco sparverius*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), short-eared owl (*Asio flammeus*), Swainson's hawk (*Buteo swainsoni*), and turkey vulture (*Cathartes aura*) (CDOW 2009; USGS 2007). Special status birds of prey species are discussed in Section 10.1.12.

Upland Game Birds

Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state study area. The mourning dove (*Zenaida macroura*) is the only upland game bird species expected to occur within the proposed Antonito Southeast SEZ. The SEZ is located about 5 mi (8 km) east of the closest mapped wild turkey (*Meleagris gallopavo*) activity areas (CDOW 2008). The following are distances of the SEZ from wild turkey activity areas: overall range (area that encompasses all known seasonal activity areas within the observed range of a population), 4 mi (7 km); winter range (that part of the overall range where 90% of the individuals are located from November 1 to April 1 during an average of 5 winters out of 10), 4 mi (7 km); and winter concentration area (that part of the winter range where densities are at least 200% greater than they are in the surrounding winter range areas), 5 mi (8 km).

Table 10.1.11.2-1 provides habitat information for representative bird species that could occur within the Antonito Southeast SEZ. Special status bird species are discussed in Section 10.1.12.

10.1.11.2.2 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 the application of any additional mitigation measures. Section 10.1.11.2.3, below, identifies design features of particular relevance to the proposed Antonito Southeast 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 10.1.11.2.1 following the analysis approach described in Appendix M. Additional National Environmental Policy Act

TABLE 10.1.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Antonito Southeast 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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Shorebirds					
Killdeer *(Charadrius vociferus)*	Open areas such as fields, meadows, lawns, mudflats, and shores. Nests on ground in open dry or gravelly locations. About 686,300 acres[h] of potentially suitable habitat occurs within the SEZ region.	27 acres of potentially suitable habitat lost (0.004 of available potentially suitable habitat)	24,335 acres of potentially suitable habitat (3,5% of available potentially suitable habitat)	79 acres of potentially suitable habitat in area of potential direct effects and 1,589 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Avoid wetland and riparian habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Neotropical Migrants					
Brewer's blackbird *(Euphagus cyanocephalus)*	Meadows, grasslands, riparian areas, agricultural and urban areas, and occasionally in sagebrush in association with prairie dog colonies and other shrublands. Requires dense shrubs for nesting. Roosts in marshes or dense vegetation. In winter, most often near open water and farmyards with livestock. About 1,524,200 acres of potentially suitable habitat occurs in the SEZ region.	1,305 acresg of potentially suitable habitat lost (<0.1 of available potentially suitable habitat)	32,470 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	89 acres of potentially suitable habitat in area of potential direct effects and 1,791 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Avoidance of riparian areas and prairie dog colonies would further reduce the potential for impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Brewer's sparrow *(Spizella breweri)*	Breeds in sagebrush shrublands. Also occur in mountain mahogany or rabbitbrush. During migration, frequents woody, brushy, or weedy agricultural and urban areas. Inhabits sagebrush and shrubby desert habitat during winter. About 908,100 acres of potentially suitable habitat occurs in the SEZ region.	1,366 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	12,755 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	11 acres of potentially suitable habitat in area of potential direct effects and 221 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common nighthawk *(Chordeiles minor)*	Grasslands, sagebrush, semidesert shrublands, open riparian and ponderosa pine forests, pinyon-juniper woodlands, and agricultural and urban areas. Also occurs in other habitats when foraging. About 2,652,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	104,809 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	87 acres of potentially suitable habitat in area of potential direct effects and 1,750 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Horned lark *(Eremophila alpestris)*	Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and also occur in agricultural areas. They usually occur where plant density is low and there are exposed soils. About 2,001,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	102,128 acres of potentially suitable habitat (5.1% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effects and 1,690 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Northern rough-winged swallow *(Stelgidopteryx serripennis)*	Inhabits open country wherever suitable nest site near water can be found. Breeds in sandbanks, Occurs over riparian and agricultural areas during migration. About 698,100 acres of potentially suitable habitat occurs in the SEZ region.	27 acres of potentially suitable habitat lost (<0.01% of available potentially suitable habitat)	24,014 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	80 acres of potentially suitable habitat in area of potential direct effects and 1,610 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
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 2,409,500 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,186 acres of potentially suitable habitat (4.4% of available potentially suitable habitat)	107 acres of potentially suitable habitat in area of potential direct effect and 2,153 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Western meadowlark *(Sturnella neglecta)*	Agricultural areas, especially in winter. Also inhabits native grasslands, croplands, weedy fields, and less commonly in semidesert and sagebrush shrublands. About 2,440,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	104,652 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	89 acres of potentially suitable habitat in area of potential direct effects and 1,791 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey					
American kestrel *(Falco sparverius)*	Wide variety of open to semi-open habitats including agricultural areas, grasslands, riparian forest edges, and urban areas. Occurs in most habitats, especially during migration. About 4,362,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	107,795 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	95 acres of potentially suitable habitat in area of potential direct effects and 1,911 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,777,000 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	109,256 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	98 acres of potentially suitable habitat in area of potential direct effects and 1,972 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.

TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 3,214,300 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	101,658 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effects and 1,690 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Swainson's hawk *(Buteo swainsoni)*	Grasslands, agricultural areas, shrublands, and riparian forests. Nests in trees in or near open areas. Migrants occur often occur in treeless areas. Large flocks often occur in agricultural areas near locust infestations. About 1,638,700 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	99,416 acres of potentially suitable habitat (6.1% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effect and 1,690 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoidance of nest trees would further reduce the potential for impact.
Turkey vulture *(Cathartes aura)*	Occurs in areas of pastured rangeland, non-intensive agriculture, or wild areas with rock outcrops suitable for nesting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 1,053,800 acres of potentially suitable habitat occurs in the SEZ region.	99 acre of potentially suitable habitat lost (<0.01% of available potentially suitable habitat)	25,210 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effects and 1,690 acres of potentially suitable habitat in area of indirect effects	Small overall impact.

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TABLE 10.1.11.2-1 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Upland Game Birds					
Mourning dove *(Zenaida macroura)*	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, 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 3,427,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	110,006 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	115 acres of potentially suitable habitat in area of potential direct effect and 2,314 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 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. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. 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 transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

Footnotes continued on next page.

TABLE 10.1.11.2-1 (Cont.)

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

[g] Species-specific 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.

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

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

(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 10.1.11.2.3).

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 10.1.11.2-1 summarizes the potential impacts on birds resulting from solar energy development in the proposed Antonito Southeast SEZ. Direct impacts on bird species would be small, as only 0.5% or less of potentially suitable habitats identified for each species would be lost. Larger areas of potentially suitable habitat for bird species occur within the area of potential indirect effects (e.g., up to 6.0% of available potentially suitable habitat for Swainson's hawk). Other impacts on birds could result from collision with the transmission line 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 of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands and riparian areas.

10.1.11.2.3 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., dry lakes). 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 some SEZ-specific design features important to reducing impacts on birds are best established when project details are considered, some design features can be identified at this time, as follows:

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

- Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the

USFWS and the CDOW. A permit may be required under the Bald and Golden Eagle Protection Act.

- All wetland and riparian habitats within the SEZ (e.g., Alta Lake) and transmission line corridor (e.g., the Rio San Antonio) should be avoided to the extent practicable. Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas and to span them whenever practicable.

- Appropriate engineering controls should be used to minimize impacts on aquatic, riparian, and wetland habitats associated with Alta Lake, the Rio San Antonio, the Rio de los Pinos, the Conejos River, and Cove Lake Reservoir resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats.

- Prairie dog colonies (which could provide habitat or food source for some bird species) should be avoided to the extent practicable.

If these SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. Any residual impacts on birds are anticipated to be small given the relative abundance of potentially suitable habitats in the SEZ region. 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.

10.1.11.3 Mammals

10.1.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Antonito Southeast SEZ. The list of mammal species potentially present in the SEZ area was determined from the Colorado Natural Diversity Information Source (CDOW 2009) and habitat information from CDOW (2009), USGS (2007), and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used. The following discussion 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 similar habitats.

Big Game

The big game species that could occur within the area of the proposed Antonito Southeast SEZ include American black bear (*Ursus americanus*), bighorn sheep (*Ovis canadensis*), cougar (*Puma concolor*), elk (*Cervis canadensis*), mule deer (*Odocoileus hemionus*), and pronghorn (*Antilocapra americana*) (CDOW 2009). Table 10.1.11.3-1 provides a description of the various activity areas that have been mapped for the big game species in Colorado. Table 10.1.11.3-2 provides habitat information for representative mammal species, including big game species that could occur within the proposed Antonito Southeast SEZ.

TABLE 10.1.11.3-1 Descriptions of Big Game Activity Areas in Colorado

Activity Area	Activity Area Description
Concentration area	That part of the overall range where densities are at least 200% greater than they are in the surrounding area during a season other than winter.
Fall concentration area	That part of the overall range occupied from August 15 until September 30 for the purpose of ingesting large quantities of mast and berries to establish fat reserves for the winter hibernation period. Applies to the American black bear.
Migration corridor	Specific mappable site through which large numbers of animals migrate and the loss of which would change migration routes.
Overall range	Area that encompasses all known seasonal activity areas for a population.
Production area	That part of the overall range occupied by females from May 15 to June 15 for calving. Applies to ungulates.
Resident population area	Area used year-round by a population (i.e., an individual could be found in any part of the area at any time of the year).
Severe winter range	That part of the winter range where 90% of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum during the 2 worst winters out of 10. Applies to ungulates.
Summer concentration area	That portion of the overall range where individuals congregate from mid-June through mid-August.
Summer range	That portion of the overall range where 90% of the individuals are located between spring green-up and the first heavy snowfall.
Winter concentration area	That part of the winter range where densities are at least 200% greater than in surrounding winter range during an average of 5 winters out of 10.
Winter range	That part of the overall range where 90% of the individuals are located during an average of 5 winters out of 10 from the first heavy snowfall to spring green-up.

Source: CDOW (2008).

TABLE 10.1.11.3-2 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Antonito Southeast SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Big Game					
American black bear (*Ursus americanus*)	Montane shrublands and forests, and subalpine forests at moderate elevations. Fairly common in Conejos County. About 3,581,000 acres[h] of potentially suitable habitat occurs in the SEZ region.	1,294 acres[g] of potentially suitable habitat lost (<0.04% of available potentially suitable habitat)	17,886 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effects and 322 acres of potentially suitable habitat in area of indirect effects	Small overall impact.
Bighorn sheep (*Ovis canadensis*)	Prefers high-visibility habitat dominated by grass, low shrubs, and rock cover, areas near open escape terrain, and topographic relief. Due to human influence, typically occurs only on steep, precipitous terrain although some herds have habituated to areas adjacent to busy highways. Common in Conejos County. About 3,557,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	79,796 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	21 acres of potentially suitable habitat in area of potential direct effects and 423 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. Uncommon in Conejos County. About 4,120,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	86,045 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	19 acres of potentially suitable habitat in area of potential direct effect and 382 acres of potentially suitable habitat 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 10.1.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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. Abundant in Conejos County. About 3,023,300 acres of potentially suitable habitat occurs in the SEZ region.	16 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat)	9,987 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	8 acres of potentially suitable habitat in area of potential direct effects and 161 acres of potentially suitable habitat in area of indirect effects	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. Common in Conejos County. About 4,459,300 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	107,771 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	95 acres of potentially suitable habitat in area of potential direct effects and 1,911 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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. Common in Conejos County. About 2,312,600 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	102,881 acres of potentially suitable habitat (4.4% of available potentially suitable habitat)	86 acres of potentially suitable habitat in area of potential direct effects and 1,730 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.1.11.3-2 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers					
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,548,100 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	88,814 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	23 acres of potentially suitable habitat in area of potential direct effects and 463 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,964,800 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	113,150 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	120 acres of potentially suitable habitat in area of potential direct effect and 2,414 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert cottontail (*Sylvilagus audubonii*)	Grasslands, especially in prairie dog colonies. Also in other habitats such as montane shrublands, riparian lands, semidesert shrublands, pinyon-juniper woodlands, and various woodland-edge habitats. Can occur in areas with minimal vegetation as long as adequate cover is present. About 3,085,700 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,349 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	93 acres of potentially suitable habitat in area of potential direct effects and 1,871 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Avoidance of prairie dog colonies would further reduce the potential for impact.

TABLE 10.1.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Small Game and Furbearers (Cont.)					
Red fox (*Vulpes vulpes*)	Most common in open woodlands, pasturelands, riparian, and agricultural lands. Prefers areas with a mixture of these vegetation types occurring in small mosaics with good development of ground cover. Also is common in open space and other undeveloped areas adjacent to cities. Also occurs in mountains in montane and subalpine meadows and alpine and forest edges usually near water. About 4,100,000 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	108,281 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	98 acres of potentially suitable habitat in area of potential direct effects and 1,972 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Striped skunk (*Mephitis mephitis*)	Occurs in most habitats other than alpine tundra. Common at lower elevations, especially in and near cultivated fields and pastures. Generally inhabits open country in woodlands, brush areas, and grasslands, usually near water. Dens under rocks, logs, or buildings. About 4,131,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	105,259 aces of potentially suitable habitat (2.5% of available potentially suitable habitat)	96 acres of potentially suitable habitat in area of potential direct effects and 1,932 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.1.11.3-2 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
White-tailed jackrabbit (*Lepus townsendii*)	Occurs mostly in prairies, open parkland, and alpine tundra. Also occurs in semidesert shrublands and may migrate to such areas from other habitats in winter. About 2,795,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3 % of available potentially suitable habitat)	85,551 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	14 acres of potentially suitable habitat in area of potential direct effects and 282 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Nongame (Small) Mammals					
Deer mouse (*Peromyscus maniculatus*)	Most habitats (except well-developed wetlands) that contain cover including burrows of other animals, rock cracks and crevices, surface debris and litter, and man-made structures. About 4,443,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	109,434 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	98 acres of potentially suitable habitat in area of potential direct effects and 1,972 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Least chipmunk (*Tamias minimus*)	Low-elevation semidesert shrublands, montane shrublands and woodlands, forest edges, and alpine tundra. About 3,935,000 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	85,506 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effects and 362 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.1.11.3-2 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (Small) Mammals (Cont.)					
Northern pocket gopher (*Thomomys talpoides*)	Various habitats such as agricultural and pasture lands, semidesert shrublands, and grasslands. Most common in meadows and grasslands. About 3,886,700 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	104,015 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	96 acres of potentially suitable habitat in area of potential direct effects and 1,932 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Ord's kangaroo rat (*Dipodomys ordii*)	Various habitats ranging from semidesert shrublands and pinyon-juniper woodlands to shortgrass or mixed prairie and silvery wormwood. Also occurs in dry, grazed, riparian areas if vegetation is sparse. Most common on sandy soils that allow for easy digging and construction of burrow systems. About 1,876,900 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	75,524 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	9 acres of potentially suitable habitat in area of potential direct effects and 181 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*)	Short and mid-length grasslands. Also occurs in other habitats that are heavily grazed, mowed, or otherwise modified, including prairie dog colonies. About 2,097,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	94,408 acres of potentially suitable habitat (4.5% of available potentially suitable habitat)	85 acres of potentially suitable habitat in area of potential direct effects and 1,710 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Avoidance of prairie dog colonies would further reduce the potential for impacts.

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TABLE 10.1.11.3-2 (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 Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (Small) Mammals (Cont.)					
Western small-footed myotis (*Myotis ciliolabrum*)	Broken terrain of canyons and foothills, commonly in areas with tree or shrub cover. Summer roosts include rock crevices, caves, dwellings, burrows, among rocks, under bark, and beneath rocks scattered on the ground. About 4,269,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	107,864 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	95 acres of potentially suitable habitat in area of potential direct effects and 1,911 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 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. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. 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 transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

Footnotes continued on next page.

TABLE 10.1.11.3-2 (Cont.)

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

[g] Species-specific 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.

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

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

The following paragraphs present an overview of the big game species (Section 4.10.2.3 presents more detailed information on these species).

American Black Bear. The proposed Antonito Southeast SEZ is located within the American black bear's overall range but does not overlap with its mapped summer or fall concentration areas (CDOW 2008). The American black bear summer concentration area closest to the proposed Antonito Southeast SEZ is 11 mi (18 km) west of the SEZ. The closest fall concentration area is 8 mi (144 km) west of the SEZ. Since the American black bear prefers montane shrublands and forests and subalpine forests at moderate elevations in Colorado (CDOW 2009), it is not expected to frequent the proposed Antonito Southeast SEZ.

Bighorn Sheep. No mapped activity areas for the bighorn sheep occur in the proposed Antonito Southeast SEZ (Figure 10.1.11.3-1). The nearest that the SEZ is located to any bighorn sheep activity areas is 8 mi (13 km) east of the overall range, winter range, severe winter range, and summer range. Since bighorn sheep typically inhabit mountains and foothills in Colorado (CDOW 2009), they are not expected to frequent the proposed Antonito Southeast SEZ. However, SWReGAP (USGS 2004, 2005, 2007) mapped 8,408 acres (34.03 km^2) of suitable land cover on the SEZ and 79,171 acres (320.4 km^2) within 5 mi (8 km) of the SEZ boundary.

Cougar. The proposed Antonito Southeast SEZ occurs within the overall range of the cougar (CDOW 2008). Within Colorado, cougars mostly occur in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands (CDOW 2009). Thus, they are not expected to frequent the proposed Antonito Southeast SEZ.

Elk. The proposed Antonito Southeast SEZ occurs within the overall range, winter range, and severe winter range of the elk (Figure 10.1.11.3-2). The boundary of a resident population area occurs 0.5 mi (0.8 km) north of the SEZ (CDOW 2008). No other mapped elk activity areas occur within 5 mi (8 km) of the proposed Antonito Southeast SEZ.

Mule Deer. The proposed Antonito Southeast SEZ occurs within the mule deer's overall range but does not overlap any of its other mapped activity areas (Figure 10.1.11.3-3). Other mapped mule deer activity areas that occur within 5 mi (8 km) of the proposed Antonito Southeast SEZ are winter range, 4 mi (6 km); severe winter range, 4 mi (6 km); winter concentration area, 5 mi (8 km); and two resident population areas, 0.5 mi (0.8 km) and 0.9 mi (1.4 km). These activity areas are west of the proposed Antonito Southeast SEZ, except for the closest resident population area, which is north of the SEZ (Figure 10.1.11.3-3).

Pronghorn. The proposed Antonito Southeast SEZ occurs within the pronghorn's overall range, winter range, and concentration area; but does not overlap any of the other

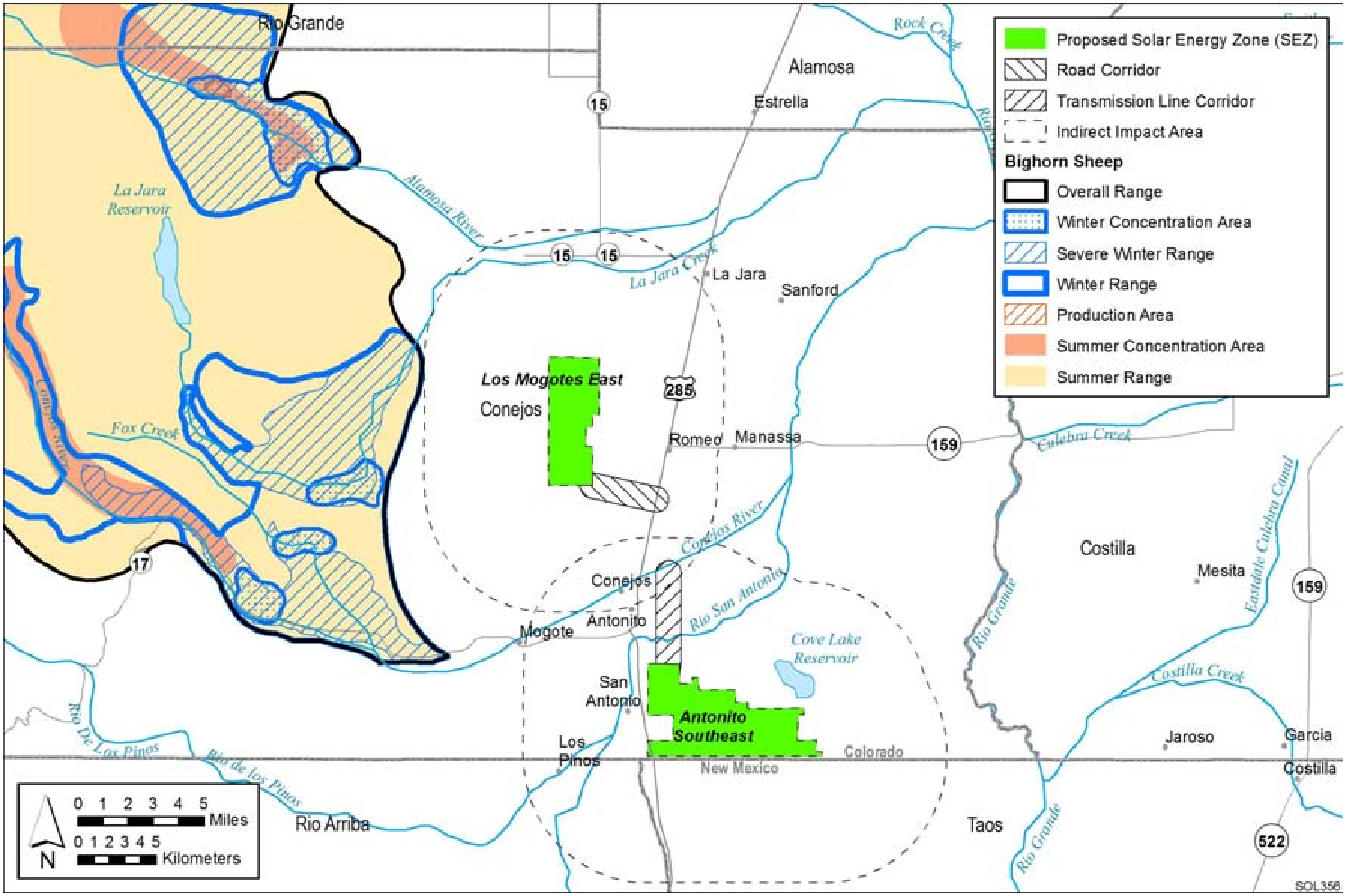

FIGURE 10.1.11.3-1 Bighorn Sheep Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

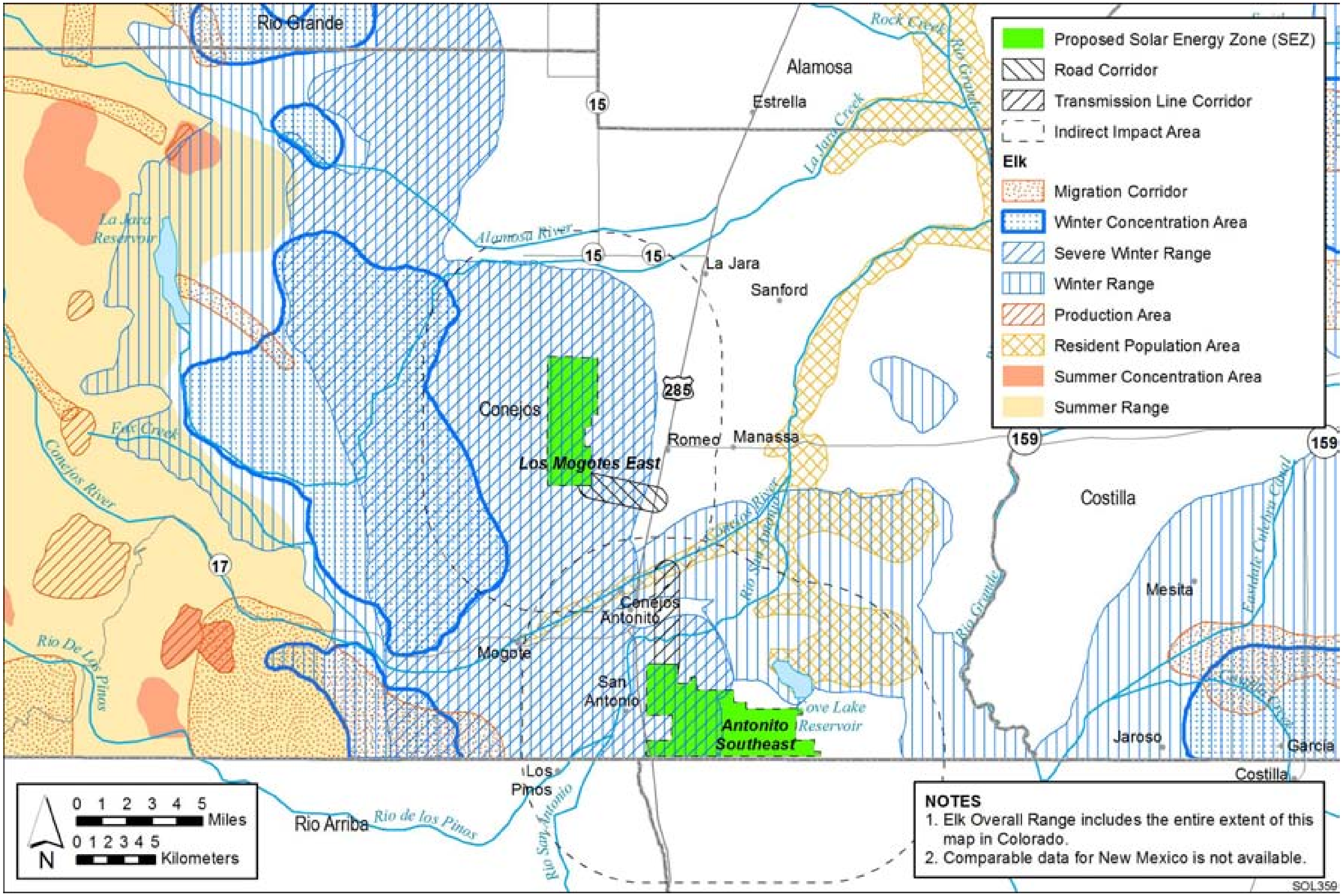

FIGURE 10.1.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

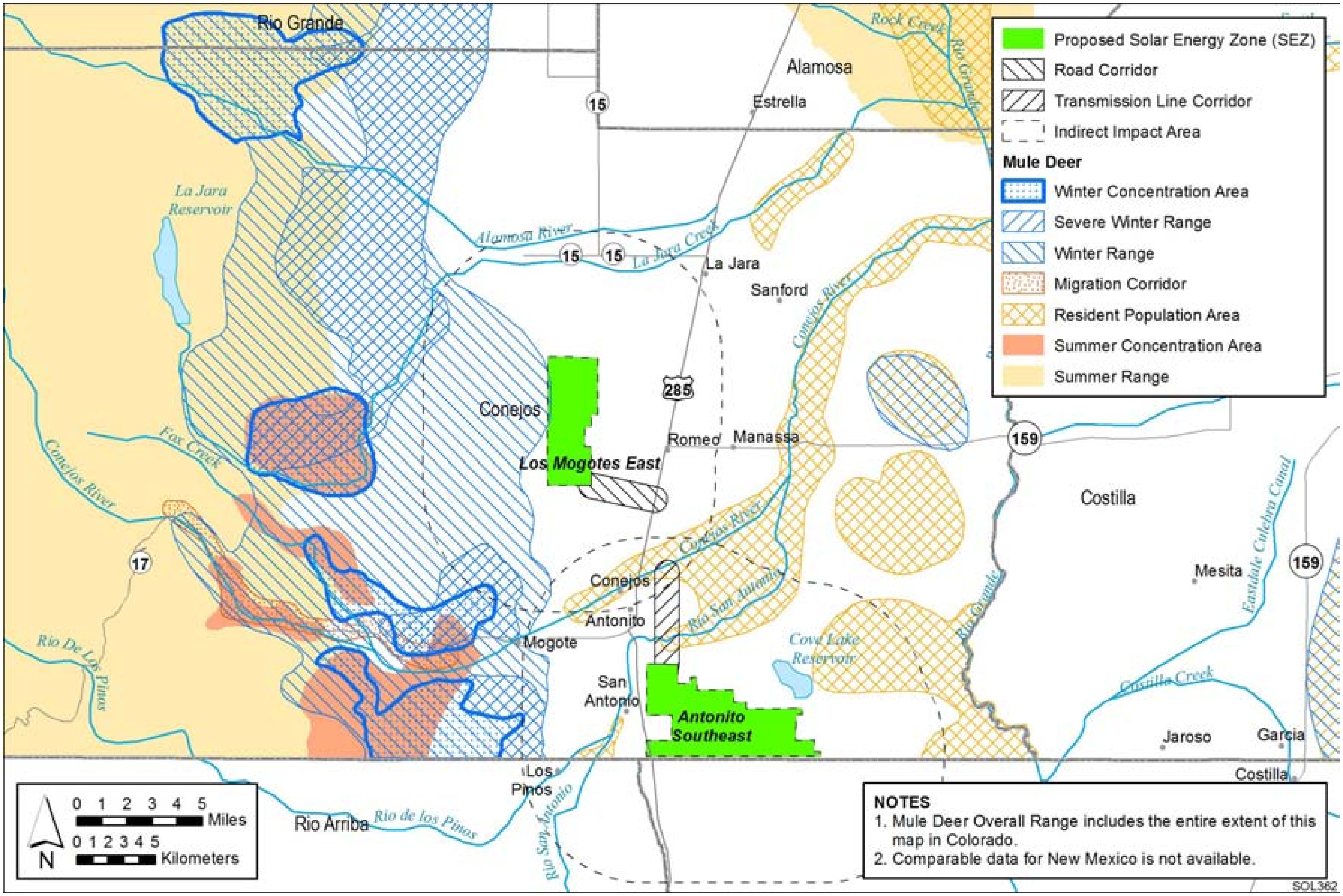

FIGURE 10.1.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

mapped pronghorn activity areas (Figure 10.1.11.3-4). Severe winter range located 3 mi (65 km) northwest of the proposed Antonito Southeast SEZ is the only other mapped activity area within 5 mi (8 km) of the SEZ.

Other Mammals

A number of furbearers and small game mammal species occur within the area of the proposed Antonito Southeast SEZ. Those species that are common or abundant within the Conejos County and that could occur within the area of the SEZ include the coyote (*Canis latrans*, common), desert cottontail (*Sylvilagus audubonii*, abundant), red fox (*Vulpes vulpes*, common), striped skunk (*Mephitis mephitis*, common), and white-tailed jackrabbit (*Lepus townsendii*, common) (CDOW 2009). Most of these species are hunted or trapped.

The small nongame mammal species generally include bats, rodents, and shrews. Those species that are common or abundant within Conejos County and that could occur within the area of the proposed Antonito Southeast SEZ include the big brown bat (*Eptesicus fuscus*, abundant), deer mouse (*Peromyscus maniculatus*, abundant), least chipmunk (*Tamias minimus*, common), little brown myotis (*Myotis lucifugus*, abundant), northern pocket gopher (*Thomomys talpoides*, common), Ord's kangaroo rat (*Dipodomys ordii*, abundant), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*, common), and western small-footed myotis (*Myotis ciliolabrum*, common). The Gunnison's prairie dog (*Cynomys gunnisoni*) is fairly common in the county and is also expected to occur within the semidesert habitat found within the SEZ (CDOW 2009). Due to its special status (candidate for listing under the ESA), the species is discussed in Section 10.1.12.

Table 10.1.11.3-2 provides habitat information for these other mammal species that could occur within the proposed Antonito Southeast SEZ.

10.1.11.3.2 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 the application of additional mitigation measures. Section 10.1.11.3.3, below, identifies SEZ-specific design features of particular relevance to the proposed Antonito Southeast 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 10.1.11.3.1, 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 10.1.11.3.3).

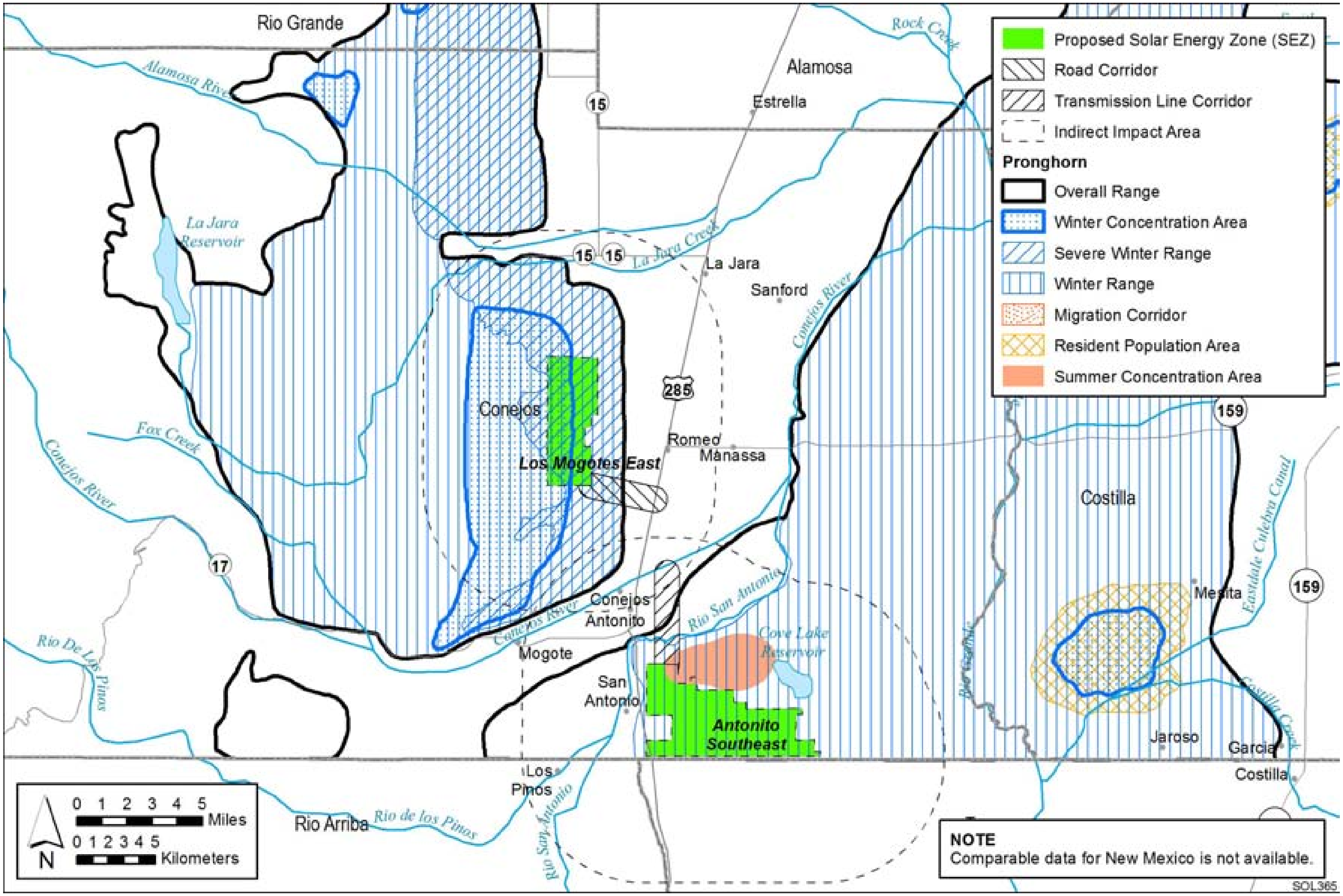

FIGURE 10.1.11.3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

Table 10.1.11.3-2 summarizes the potential impacts on representative mammal species resulting from solar energy development (with the implementation of required programmatic design features) in the proposed Antonito Southeast SEZ.

American Black Bear

Based on potentially suitable land cover, up to 1,294 acres (5.2 km^2) of potentially suitable American black bear habitat could be lost by SEZ development within the proposed Antonito Southeast SEZ and another 16 acres (0.6 km^2) by transmission line construction. This represents <0.04% of potentially suitable American black bear habitat within the SEZ region. Under 17,900 acres (72.4 km^2) of potentially suitable American black bear habitat occurs within the area of indirect effects. Overall, impacts on the American black bear from solar energy development in the SEZ would be small.

Bighorn Sheep

Based on potentially suitable land cover, up to 7,783 acres (31.5 km^2) of potentially suitable bighorn sheep habitat could be lost by SEZ development within the proposed Antonito Southeast SEZ and another 21 acres (0.08 km^2) by transmission line construction. This represents about 0.2% of potentially suitable bighorn sheep habitat within the SEZ region. Nearly 79,800 acres (323 km^2) of potentially suitable bighorn sheep habitat occurs within the area of indirect effects. Overall, impacts on bighorn sheep from solar energy development in the SEZ would be small.

Cougar

Based on potentially suitable land cover, up to 7,783 acres (31.5 km^2) of potentially suitable cougar habitat could be lost by SEZ development within the proposed Antonito Southeast SEZ and another 19 acres (0.08 km^2) by transmission line construction. This represents about 0.2% of potentially suitable cougar habitat within the SEZ region. More than 86,000 acres (348 km^2) of potentially suitable cougar habitat occurs within the area of indirect effects. Overall, impacts on cougar from solar energy development in the SEZ would be small.

Elk

Based on potentially suitable land cover, only 16 acres (0.06 km^2) of potentially suitable elk habitat could be lost by development within the proposed Antonito Southeast SEZ and another 8 acres (0.0.3 km^2) by transmission line construction. This represents <0.001% of potentially suitable elk habitat within the SEZ region. Nearly 10,000 acres (40.5 km^2) of potentially suitable elk habitat occurs within the area of indirect effects. Based on mapped activity areas, more than 5,400 acres (22 km^2) of elk winter and severe winter range could be directly impacted by solar energy development within the SEZ (Table 10.1.11.3-3). Direct loss

TABLE 10.1.11.3-3 Potential Magnitude of Impacts on Elk Activity Areas Resulting from Solar Energy Development within the Proposed Antonito Southeast SEZ

	Area of Habitat Affected (acres)[b]				
Activity Area[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line Corridor[e]	Area of Habitat within SEZ Region[f]	Overall Impact Magnitude[g]
Overall range	7,783 acres[h] of habitat lost (0.3% of available habitat)	65,121 acres of habitat (2.5% of available habitat)	121 acres of habitat in area of potential direct effect and 2,444 acres in area of indirect effect	2,603,850 acres	Small
Summer range	0 acres	0 acres	0 acres	1,088,842 acres	None
Summer concentration area	0 acres	0 acres	0 acres	248,999 acres	None
Winter range	5,433 acres of habitat lost (0.5% of available habitat)	55,270 acres of habitat (5.4% of available habitat)	94 acres of habitat in area of potential direct effect and 1,914 acres in area of indirect effect	1,024,318 acres	Small
Winter concentration area	0 acres	0 acres	0 acres	295,724 acres	None
Severe winter range	5,433 acres of habitat lost (1.5% of available habitat)	27,742 acres of habitat (7.8% of available habitat)	54 acres of habitat in area of potential direct effect and 1,091 acres in area of indirect effect	355,384 acres	Moderate
Production area	0 acres	0 acres	0 acres	233,339 acres	None
Migration corridor	0 acres	0 acres	0 acres	126,425 acres	None

TABLE 10.1.11.3-3 (Cont.)

	Area of Habitat Affected (acres)[b]				
Activity Area[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line Corridor[e]	Area of Habitat within SEZ Region[f]	Overall Impact Magnitude[g]
Resident population area	0 acres	13,185 acres of habitat (16.1% of available habitat)	16 acres of habitat in area of potential direct effect and 324 acres in area of indirect effect	82,094 acres	Small

[a] Activity areas are described in Table 10.1.11.3-1.

[b] Activity area habitat affected relative to total available within the SEZ region. A new transmission line is assumed to serve development on the SEZ; new access roads are not assumed to be needed because of proximity to an existing road.

[c] Direct effects within the SEZ consist of ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres (31.5 km^2) would be developed in the SEZ.

[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. 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 boundary or transmission line ROW.

[e] For transmission, direct effects were estimated within a 4-mi (6.5 km), 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[f] The SEZ region is limited to the Colorado portion of the area within a 50-mi (80-km) radius of the center of the SEZ, because no activity area data were available for the area within New Mexico.

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

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

Source: CDOW (2008).

of severe winter range within the SEZ would account for about 1.5% of the severe winter habitat occurring within Colorado portion of the SEZ region, and would be considered a moderate impact. Impacts on other mapped activity areas for the elk would be small to none (Table 10.1.11.3-3). Overall, impacts on elk from solar energy development in the SEZ would be small.

Mule Deer

Based on potentially suitable land cover, up to 7,783 acres (31.5 km^2) of potentially suitable mule deer habitat could be lost by SEZ development within the proposed Antonito Southeast SEZ and another 95 acres (0.4 km^2) by transmission line construction. This represents about 0.2% of potentially suitable mule deer habitat within the SEZ region. More than 107,000 acres (433 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects. A mule deer resident population does occur within 0.6 mi (1.0 km) of the proposed Antonito Southeast SEZ. Although some mule deer within this population could be disturbed, particularly during construction, no loss of resident population habitat would be expected. Based on mapped mule deer activity areas (Table 10.1.11.3-4) direct impacts on mule deer overall range would be small to no direct impacts would occur to other mule deer activity areas. Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Pronghorn

Based on potentially suitable land cover, up to 7,783 acres (31.5 km^2) of potentially suitable pronghorn habitat could be lost by SEZ development within the proposed Antonito Southeast SEZ and another 86 acres (0.3 km^2) by transmission line construction. This represents about 0.03% of potentially suitable pronghorn habitat within the SEZ region. More than 102,800 acres (416 km^2) of potentially suitable pronghorn habitat occurs within the area of indirect effects. Based on mapped pronghorn activity areas (Table 10.1.11.3-5), solar development in the proposed Antonito Southeast SEZ would directly impact 7,783 acres (31.5 km^2) of pronghorn overall range and winter range and 233 acres (0.9 km^2) of a pronghorn summer concentration area. A moderate impact could occur on a pronghorn summer concentration area. Solar energy development within the summer concentration area could force pronghorn to concentrate further within the remainder of the concentration area or disperse to other areas within the pronghorn's overall range. No impacts would occur on other activity areas (Table 10.1.11.3-5). Overall, impacts on pronghorn from solar energy development in the SEZ would be small.

Direct impacts on small game, furbearers, and nongame (small) mammal species would be small, as only 0.5% or less of potentially suitable habitats identified for each species would be lost (Table 10.1.11.3-2). Larger areas of potentially suitable habitat for these species occur within the area of potential indirect effects (e.g., up to 4.5% of available potentially suitable habitat for the thirteen-lined ground squirrel). Other impacts on mammals could result from collision with fences and vehicles, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental

TABLE 10.1.11.3-4 Potential Magnitude of Impacts on Mule Deer Activity Areas Resulting from Solar Energy Development within the Proposed Antonito Southeast SEZ

	Area of Habitat Affected (acres)[b]				
Activity Area[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line Corridor[e]	Area of Habitat within SEZ Region[f]	Overall Impact Magnitude[g]
Overall range	7,783 acres[h] of habitat lost (0.3% of available habitat)	65,121 acres of habitat (2.5% of available habitat)	121 acres of habitat in area of potential direct effect and 2,444 acres in area of indirect effect	2,603,850 acres	Small
Summer range	0 acres	0 acres	0 acres	1,285,768 acres	None
Summer concentration area	0 acres	0 acres	0 acres	77,015 acres	None
Winter range	0 acres	2,783 acres (0.5% of available habitat)	0 acres	613,943 acres	Small
Winter concentration area	0 acres	4 acres of habitat (0.005% of available habitat)	0 acres	80,720 acres	None
Severe winter range	0 acres	3 acres of habitat (0.001% of available habitat)	0 acres	247, 464 acres	None
Migration corridor	0 acres	0 acres	0 acres	7,532 acres	None
Resident population area	0 acres	20,203 acres of habitat (11.8% of available habitat)	35 acres of habitat in area of potential direct effect and 703 acres in area of indirect effect	170,545 acres	Small to none

a Activity areas are described in Table 10.1.11.3-1.

b Activity area habitat affected relative to total available within the SEZ region. A new transmission line is assumed to serve development on the SEZ; new access roads are not assumed to be needed because of proximity to an existing road.

Footnotes continued on next page.

TABLE 10.1.11.3-4 (Cont.)

[c] Direct effects within the SEZ consist of ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres (31.5 km^2) would be developed in the SEZ.

[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. 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 boundary or transmission line ROW.

[e] For transmission, direct effects were estimated within a 4-mi (6.5-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 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[f] The SEZ region is limited to the Colorado portion of the area within a 50-mi (80-km) radius of the center of the SEZ, because no activity area data were available for the area within New Mexico.

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

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

Source: CDOW (2008).

spills, and harassment. These indirect impacts are expected to be negligible with implementation of proposed programmatic design features.

Summary

Overall, direct impacts on mammal species would be small for all species, as only 0.4% or less of potentially suitable habitats for the representative mammal species would be lost (Table 10.1.11.3-2). Larger areas of potentially suitable habitat for mammal species occur within the area of potential indirect effects (e.g., up to 4.5% for the thirteen-lined ground squirrel). Other impacts on mammals could result from collision with fences and vehicles, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. These indirect impacts are expected to be negligible with implementation of required programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed

TABLE 10.1.11.3-5 Potential Magnitude of Impacts on Pronghorn Activity Areas Resulting from Solar Energy Development within the Proposed Antonito Southeast SEZ

	Area of Habitat Affected (acres)[b]				
Activity Area[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line Corridor[e]	Area of Habitat within SEZ Region[f]	Overall Impact Magnitude[g]
Overall range	7,783 acres[h] of habitat lost (0.9% of available habitat)	52,747 acres of habitat (6.3% of available habitat)	54 acres of habitat in area of potential direct effect and 1,104 acres in area of indirect effect	834,271 acres	Small
Summer concentration area	253 acres of habitat lost (5.3% of available habitat)	4,391 acres of habitat (91.7% of available habitat)	7 acres of habitat in area of potential direct effect and 140 acres in area of indirect effect	4,791 acres	Moderate
Winter range	7,783 acres of habitat lost (1.0% of available habitat)	36,028 acres of habitat (4.7% of available habitat)	26 acres of habitat in area of potential direct effect and 535 acres in area of indirect	762,529 acres	Small
Winter concentration area	0 acres	0 acres	0 acres	60,045 acres	None
Severe winter range	0 acres	0 acres	0 acres	90,051acres	None
Resident population area	0 acres	0 acres	0 acres	22,792 acres	None

a Activity areas are described in Table 10.1.11.3-1.

b Activity area habitat affected relative to total available within the SEZ region. A new transmission line is assumed to serve development on the SEZ; new access roads are not assumed to be needed because of proximity to an existing road.

c Direct effects within the SEZ consist of ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres (31.5 km^2) would be developed in the SEZ.

Footnotes continued on next page.

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TABLE 10.1.11.3-5 (Cont.)

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[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. 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 boundary or transmission line ROW.

[e] For transmission, direct effects were estimated within a 4-mi (6.5-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 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[f] The SEZ region is limited to the Colorado portion of the area within a 50-mi (80-km) radius of the center of the SEZ, because no activity data were available for the area within New Mexico.

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

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

Source: CDOW (2009).

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.

10.1.11.3.3 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 some SEZ-specific design features are best established when project details are considered, some design features can be identified at this time, as follows:

- Prairie dog colonies should be avoided to the extent practicable to reduce impacts on species such as desert cottontail and thirteen-lined ground squirrel.

- Construction should be curtailed during winter when big game species are present.

- Disturbance near the elk and mule deer resident population areas should be avoided.

- Where big game winter ranges intersect or are within close proximity to the SEZ, use of motorized vehicles and other human disturbances should be controlled (e.g., through road closures).

- Development in the 253-acre (1-km^2) portion of the SEZ that overlaps the pronghorn summer concentration area should be avoided.

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

- Transmission lines should be sited to avoid disturbance of suitable roosting and foraging habitat for bat species.

Also, avoidance of Alta Lake, ephemeral drainages, and riparian areas would preserve more unique wildlife habitats within the SEZ and transmission line corridor. If these SEZ-specific design features are implemented in addition to programmatic design features, impacts on mammals could be reduced. Any residual impacts are anticipated to be small given the relative abundance of suitable habitats in the SEZ region.

10.1.11.4 Aquatic Biota

10.1.11.4.1 Affected Environment

The only surface water body on the Antonito Southeast SEZ is Alta Lake. While not an open water habitat, Alta Lake is a small wetland depression located in the northwestern corner of the SEZ. This surface water feature is maintained by surface water runoff, which may be partially controlled by earthen berms located nearby and associated with the relict Taos Valley Canal (Section 10.1.3.1). In July 2009, the observed wetted area of Alta Lake was less than 2 acres (0.008 km^2) in size. However, based upon measurements taken with satellite imagery, there is a potential for the lake to have a wetted area of up to about 13 acres (0.05 km^2). Because Alta Lake can periodically dry up, no fish are present.

The Taos Valley Canal, which consists of a series of earthen berms that cross the Antonito Southeast SEZ, was used in the 1800s to divert water into a shallow irrigation storage basin known as Alta Lake Reservoir. The dam that was historically used to hold water within this area is no longer in place; thus Alta Lake Reservoir is not currently a surface water feature and there is no aquatic habitat at this location.

Animals that live in fishless ephemeral or nonpermanent pools, such as Alta Lake, are typically 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 aquatic habitats are populated with widespread species, some contain species endemic to particular geographic regions or even specific habitats (Graham 2001). No surveys of organisms that inhabit Alta Lake have been conducted. However, 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 are also likely to occur, depending on pool longevity, nearness to permanent water, and the abundance of other invertebrates for prey (Graham 2001). Examples of insects that are likely to be present in Alta Lake include dragonflies and a variety of midges and other fly larvae.

Three perennial streams (Conejos River, the Rio de los Pinos, and the Rio San Antonio) are located outside the SEZ but still within the potentially affected area (Figure 10.1.11.3-1). The Rio San Antonio passes within 1 mi (1.6 km) of the western and northern SEZ boundaries and the Rio de los Pinos, a tributary of the Rio San Antonio, passes within 2 mi (3 km) of the western SEZ boundary. The Rio San Antonio also crosses the area that could be affected by a transmission line corridor to the north of the SEZ. These small rivers, which originate in the San Juan Mountains of New Mexico, join together near the western edge of the SEZ, and the Rio San Antonio continues on to join the Conejos River in Colorado approximately 10 mi (16 km) north of the SEZ. The area for indirect effects from the transmission line corridor assumed for the SEZ would also cross the Conejos River. The portion of the Rio San Antonio in the vicinity of the Antonito Southeast SEZ supports a warmwater fish fauna, while the Colorado portion of the Rio de los Pinos supports a coolwater fish community that includes brown trout.

Some earthen livestock watering ponds, agricultural waste ponds, and other small impoundments may occur within the indirect effects area surrounding the SEZ and the presumed transmission line corridor, but there are currently no significant natural open water habitats within the area of potential indirect effects. Although Cove Lake Reservoir, located about 2 mi (3 km) northeast of the SEZ, is indicated to be within the indirect effects area (Figure 10.1.11.3-1), the reservoir is currently dry (Section 10.1.9.1.1) and there is no aquatic habitat present.

10.1.11.4.2 Impacts

Because surface water habitats are a unique feature in the arid landscape of this area, the maintenance and protection of such habitats may be important to the survival of various aquatic and terrestrial organisms. Invertebrates supported by such habitats serve as food sources for various species of vertebrates. In addition, surface water features can serve as drinking water sources, migratory stopovers, and feeding stations for shorebirds.

Although there is no perennial stream habitat within the SEZ itself, approximately 250 ft of the Rio San Antonio would be crossed by the presumed transmission line corridor. Overall, less than 1% of the potentially available stream habitat within a 50-mi (80-km) radius of the SEZ is located in the area of potential direct effects (sum of SEZ area and transmission line corridor). There are 27 mi (44 km) of perennial stream habitat within the area of potential indirect effects (i.e., within 5 mi [8 km] of the SEZ boundary and within a 1-mi [1.6-km] wide corridor around the assumed transmission line), which is estimated to be about 2.5% of the overall potentially suitable perennial stream habitat located within a 50-mi (80-km) radius of the SEZ. There are no significant natural open water habitats (ponds, lakes, or reservoirs) within the potentially affected area.

The types of impacts that aquatic habitats and biota could incur from the development of utility-scale solar energy facilities are identified in Section 5.10.3. Aquatic habitats present on or near the Antonito Southeast SEZ could be affected by solar energy development in a number of ways, including (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of water quality.

Direct alteration of aquatic habitat would occur if construction activities or placement of facilities occurred directly in the Alta Lake area or in water bodies associated with the transmission line corridor. Filling the lake with materials in order to allow the placement of structures would eliminate the ecological functions served by the lake, and organisms within the lake would be killed. If the lake contains endemic aquatic organisms, there is a potential for substantial impacts on populations of such species, including potential extinction of undocumented species. Foraging and migratory habitat for some bird species, and potential drinking water sources for wildlife, would be adversely affected or possibly eliminated from the SEZ. The presumed 250-ft (76-m) wide transmission corridor would cross the Rio San Antonio, although streams can usually be spanned by overhead transmission lines so that there is no need to place structures directly within aquatic habitats.

Disturbance of land areas within the SEZ or in the transmission line corridors during construction of solar energy facilities could increase the amount of sediment in nearby waterways, such as Alta Lake, the Rio de los Pinos, the Rio San Antonio, and the Conejos River, through surface water runoff or deposition of dust. Such deposition could negatively affect aquatic biota by blocking respiratory structures (e.g., gills). The Rio San Antonio and the Rio de los Pinos are located west and north of the SEZ, and Alta Lake is located within the SEZ near the western edge. Because prevailing winds are primarily toward the east, it is likely that only a small portion of the airborne dust would settle in the Alta Lake catchment. The introduction of waterborne sediments to Alta Lake or nearby streams could be controlled through commonly used mitigation measures, such as settling basins and silt fences, or by directing water draining from the developed areas away from these surface water features.

In arid environments, reductions in the quantity of water in aquatic habitats are of particular concern. Reductions in runoff could occur as a result of solar energy facility development if the topography within the catchment basins were altered. Water quantity in Alta Lake, which depends on surface water runoff for maintenance, could be affected by alterations to neighboring topography. Water quantity could also be affected if significant amounts of surface water or groundwater were utilized for power plant cooling water, for washing mirrors, or for other facility needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, were developed at the site; the associated impacts would ultimately depend on the water source used (including groundwater from various depth aquifers). From observations, Alta Lake is clearly not large enough to serve as a water supply. Because Alta Lake is not maintained by groundwater recharge (Section 10.1.9), withdrawal of groundwater would not affect this feature on the SEZ. Depending on the volume of water involved, withdrawing water directly from nearby streams, such as the Rio de los Pinos or the Conejos River, or withdrawal of ground water within the San Luis Valley could affect water levels (Section 10.1.9.2.2) and, as a consequence, aquatic organisms within those streams. Additional details regarding the volume of water required, the level of water depletion, and the types of organisms present in potentially affected water bodies would be required to further evaluate the potential for impacts from water withdrawals.

As described in Section 5.10.3, 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 of a solar energy facility. Depending upon the types and quantity, contaminants that directly entered Alta Lake could have a considerable impact on the aquatic biota there because of the small size of the lake and low potential for the dilution of contaminants. Because of the distance from the Antonito Southeast SEZ to the nearest streams, the potential for solar energy development activities within the SEZ to introduce contaminants into stream habitats would be low.

10.1.11.4.3 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 effects on aquatic biota and aquatic habitats from development and operation of solar energy facilities. While some SEZ-specific design features are best established when project details are being considered, some design features can be identified at this time, as follows:

- All aquatic habitats within the SEZ (e.g., Alta Lake) and transmission line corridor should be avoided to the extent practicable.

- Transmission line towers should be sited and constructed to minimize impacts on aquatic habitats and span them whenever practicable.

If these SEZ-specific design features are implemented in addition to programmatic design features 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 at the Antonito Southeast SEZ would be small.

10.1.12 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 Antonito Southeast SEZ. Special status species include the following types of species[5]:

- 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 states of Colorado or New Mexico[6];
- Species that are listed by the BLM as sensitive; and
- Species that have been ranked by the states of Colorado or New Mexico as S1 or S2, or listed as species of concern by the state of Colorado or the USFWS; hereafter referred to as "rare" species.

Special status species known to occur within 50 mi (80 km) of the Antonito Southeast SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the Colorado and New Mexico Natural Heritage Programs (CNHP 2009; McCollough 2009), Colorado Division of Wildlife (CDOW 2009), New Mexico Department of Fish and Game (NMDGF 2009), the Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2004, 2005, 2007), and the USFWS Environmental Conservation Online System (ECOS) (USFWS 2010). Information reviewed consisted of county-level and USGS 7.5-minute quad-level occurrences provided by the CDOW, CNHP, NMDGF, and NatureServe, 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 Alamosa, Archuleta, Conejos, Costilla, Huerfano, Las Animas, Mineral, and Rio Grande Counties, Colorado, as well as Colfax, Rio Arriba, and Taos Counties, New Mexico. However, the SEZ occurs only in Colfax County, Colorado; the affected area (see below) intersects Colfax County, Colorado, and Rio Arriba and Taos Counties, New Mexico. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

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[5] 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 in BLM Manual 6840 (BLM 2008). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

[6] State listed species for Colorado are those species protected under *Colorado Revised Statutes* 33-2-101. State listed species for New Mexico are those plants listed as endangered under the Endangered Plant Species Act (*New Mexico Statutes Annotated* [NMSA] 1978 § 75-6-1) or wildlife listed as threatened or endangered by the Wildlife Conservation Act (NMSA 1978 § 17-2-37).

10.1.12.1 Affected Environment

The affected area considered in our 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 Antonito Southeast SEZ, the area of direct effect included the SEZ and the areas within the transmission corridor where ground-disturbing activities are assumed to occur. No new access road developments are expected to be needed to serve development on the SEZ due to the proximity of existing infrastructure (refer to Section 10.1.1.2 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 transmission corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. Indirect effects considered in the assessment included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ and transmission corridor, but do not include ground-disturbing activities. The potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary habitat type within the affected area is semi-arid shrub steppe (see Section 10.1.10). Potentially unique habitats in the affected area in which special status species may reside include rocky cliffs and outcrops, sand dunes, and woodlands. The only intermittent or perennial surface water feature on the SEZ is Alta Lake, which is a small, shallow pond in the western portion of the SEZ. However, other aquatic and riparian habitats occur along Cove Lake Reservoir, and the Conejos River, Rio de los Pinos, and Rio San Antonio (Figure 10.1.12.1-1).

All special status species that are known to occur within the Antonito Southeast SEZ region (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest location, and habitats, in Appendix J. Of these species, there are 38 that could occur on or in the affected area, based on recorded occurrences or the presence of suitable habitat in the area. These species, their status, and their habitats are presented in Table 10.1.12.1-1. 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 km) away from the SEZ.

Quad-level occurrences for the following 6 special status species intersect the affected area of the Antonito Southeast SEZ: halfmoon milkvetch, James' cat's-eye, Ripley's milkvetch, Rio Grande chub, mountain plover, and Gunnison's prairie dog. No other species have been recorded in the affected area. There are no groundwater-dependent species in the vicinity of the SEZ based upon CNHP records, information provided by the USFWS (Stout 2009), and the evaluation of groundwater resources in the Antonito Southeast SEZ region (Section 10.1.9).

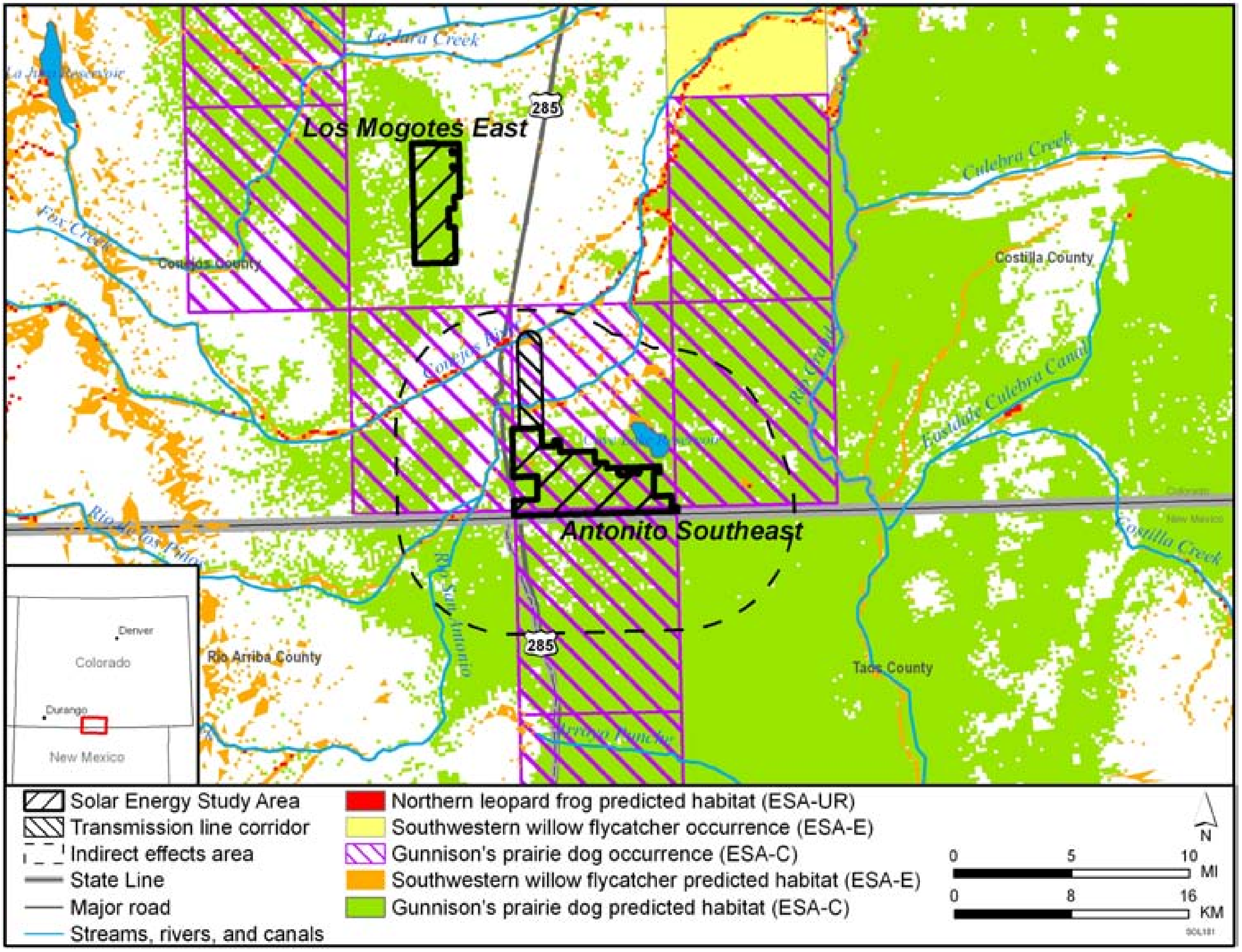

FIGURE 10.1.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed Antonito Southeast SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

TABLE 10.1.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Antonito Southeast SEZ

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants							
Aztec milkvetch	*Astragalus proximus*	CO-S2	Rocky Mountain ponderosa pine woodland, Colorado Plateau pinyon-juniper woodland, intermountain-basins, semidesert shrub-steppe, and Rocky Mountain Gambel oak-mixed montane shrublands at elevations between 5,400 and 7,300 ft[i]. Nearest known occurrences are within 15 mi[j] from the SEZ. About 2,556,000 acres[k] of potentially suitable habitat occurs in the analysis area.	8,320 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	7 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	70,600 acres of potentially suitable habitat (2.8% 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. Note that these same potential mitigations apply to all special status plants.
Blue-eyed grass	*Sisyrinchium demissum*	CO-S2	Moist areas, springs, streambanks, meadows, and forest seeps at elevations between 1,600 and 9,500 ft. Nearest occurrences are approximately 30 mi northeast of the SEZ. About 86,850 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	1,384 acres of potentially suitable habitat (1.6% of available habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

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TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Bodin milkvetch	*Astragalus bodinii*	CO-S2	Open forest clearings in association with aspen, pinyon-juniper, and ponderosa pine woodlands at elevations between 7,500 and 7,875 ft. Nearest known occurrences are 48 mi north of the SEZ. About 1,596,000acres of potentially suitable habitat occurs within the analysis area.	0 acres	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,680 acres of potentially suitable habitat (0.2% 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 Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Brandegee's milkvetch	*Astragalus brandegeei*	BLM-S; CO-S1	Sandy or gravelly banks, flats, and stony meadows within pinyon-juniper woodlands. Substrates are usually sandstone with granite or occasional basalt. Elevation ranges between 5,400 and 8,800 ft. Nearest occurrences are approximately 10 mi west of the SEZ. About 1,628,700 acres of potentially suitable habitat occurs within the analysis area.	0 acres	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,650 acres of habitat (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. Avoiding or minimizing disturbance of woodland habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Colorado larkspur	*Delphinium ramosum* var. *alpestre*	CO-S2; NM-S2	Meadows, aspen woodlands, and sagebrush scrub communities at elevations between 6,900 and 10,500 ft. Nearest known occurrences are approximately 50 mi from the SEZ. About 1,136,000 acres of potentially suitable habitat occurs within the analysis area.	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5,800 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of sagebrush habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Fragile rockbrake	*Cryptogramma stelleri*	BLM-S; CO-S2	Moist soils on shaded limestone cliffs at elevations greater than 7,000 ft, and often in association with mosses. Nearest known occurrences are located in the San Juan Mountains, approximately 25 mi northwest of the SEZ. About 21,500 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	5 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Grassy slope sedge	*Carex oreocharis*	CO-S1	Endemic to the southern Rocky Mountains on granitic soils on dry slopes at elevations between 7,200 and 10,800 ft. Nearest known occurrences are approximately 40 mi west of the SEZ. About 309,700 acres of potentially suitable habitat occurs within the analysis area.	0 acres	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,218 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassy slopes in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Halfmoon milkvetch[l]	***Astragalus allochrous* var. *playanus***	CO-S1	Gravelly washes and sandbars of summer-dry streams at elevations between 3,000 and 4,000 ft. Nearest known occurrences are approximately 7 mi from the SEZ. About 95,500 acres of potentially suitable habitat occurs in the analysis area.	0 acres	7 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,323 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of riparian habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
James' cat's-eye	***Oreocarya cinerea* var. *pustulosa***	CO-S1	Gypsum and sandy substrates within sagebrush, pinyon-juniper, oak mountain brush, and ponderosa pine communities at elevations between 4,500 and 8,500 ft. Nearest known occurrences are approximately 7 mi from the SEZ. About 1,700,000 acres of potentially suitable habitat occurs in the analysis area.	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	50 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	7,080 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of sagebrush and woodland habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Least moonwort	*Botrychium simplex*	CO-S1	Dry fields, marshes, bogs, swamps, and roadside ditches at elevations below 7,200 ft. Nearest known occurrences are approximately 42 mi from the SEZ. About 663,850 acres of potentially suitable habitat occurs in the analysis area.	1,278 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	6,672 acres of potentially suitable habitat (7.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland and wetland habitats in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Many-flowered gilia	*Ipomopsis multiflora*	CO-S1	Open sites, desert shrublands, and woodlands. Nearest known occurrences are approximately 14 mi from the SEZ. About 4,085,000 acres of potentially suitable habitat occurs in the analysis area.	9,686 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83,415 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Many-stemmed spider-flower	*Cleome multicaulis*	BLM-S; CO-S2; FWS-SC	Saturated soils created by waterfowl management on public lands. Primarily known from the Blanca Wetlands as near as 35 mi northeast of the SEZ. About 3,865 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	78 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Mountain whitlow-grass	*Draba rectifructa*	CO-S2	Openings in sagebrush, ponderosa pine, aspen, spruce-fir, lodgepole pine, and moderately moist alpine meadow communities at elevations between 6,400 and 9,600 ft. Nearest known occurrences are approximately 30 mi northwest of the SEZ. About 1,434,250 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	1,733 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Northern moonwort	*Botrychium pinnatum*	CO-S1	Grassy slopes, streambanks, and woodlands at elevations below 8,200 ft. Nearest known occurrences are approximately 35 mi northwest of the SEZ. About 2,710,000 acres of potentially suitable habitat occurs within the analysis area.	1,275 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	10 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	13,400 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland and woodland habitats in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Retorse sedge	*Carex retrorsa*	CO-S1	Perennially wet areas, especially banks along small channels, small to mid-size wetlands, open mudflats at pond margins, and surface drying mud. Elevations between 5,000 and 10,000 ft. Nearest known occurrences are approximately 40 mi west of the SEZ. About 62,250 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	78 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c] Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Ripley's milkvetch	***Astragalus ripleyi***	BLM-S; CO-S2; NM-SC; FWS-SC	Mixed conifer woodlands on rocky volcanic substrates at elevations above 8,000 ft. Known to occur approximately 5 mi west of the SEZ. About 1,819,100 acres of potentially suitable habitat occurs within the analysis area.	0 acres	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,680 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. Avoiding or minimizing disturbance of woodland habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Rock-loving aletes	*Neoparrya lithophila*	BLM-S; CO-S2	Endemic to south-central Colorado on igneous rock outcrops on north-facing cliffs and ledges within pinyon-juniper woodlands at elevations above 7,000 ft as near as 15 mi northwest of the SEZ. About 446,200 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	2,534 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Rocky Mountain bladderpod	*Lesquerella calcicola*	CO-S2	Shale bluffs, limy hillsides, gypseous knolls and ravines, and various calcareous substrates at elevations between 5,000 and 7,500 ft. Nearest known occurrences are approximately 10 mi west of the SEZ. About 21,500 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	5 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Rocky Mountain blazing-star	*Liatris ligulistylis*	CO-S1	Dry, rocky slopes, rocky woodlands, gravelly ground in valleys, stream sides, prairies, and open moist sites. Nearest known occurrences are approximately 30 mi from the SEZ. About 2,674,150 acres of potentially suitable habitat occurs in the affected area.	1,278 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	11 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	12,400 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grasslands, wetlands, and woodlands in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Western moonwort	*Botrychium hesperium*	CO-S2	Early successional habitats, including grassy mountain slopes, snow fields, road ditches, and gneiss outcrops and cliffs, and old fields at elevations between 650 and 11,300 ft. Nearest known occurrences are within 20 mi from the SEZ. About 113,200 acres of potentially suitable habitat occurs in the affected area.	3 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	20 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	3,606 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Arthropods							
Great Basin silverspot butterfly	*Speyeria nokomis nokomis*	BLM-S; CO-S1; NM-S1	Streamside meadows and open seepage areas associated with violets (*Viola* spp.). Nearest potentially suitable habitat is located on BLM lands in the La Jara Front Range approximately 20 mi northwest of the SEZ. About 168,350 acres of potentially suitable habitat occurs within the analysis area.	0 acres	0 acres	1,720 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Fish							
Rio Grande chub	***Gila pandora***	BLM-S; CO-S1; CO-SC; NM-S2	Clear, cool, fast-flowing water over rubble or gravel substrates. Quad-level occurrences intersect the affected area north of the SEZ. The nearest potentially suitable habitat is located in the Rio San Antonio, approximately 1 mi north (downgradient) from the SEZ. Approximately 29.3 mi of potentially suitable habitat in the Rio San Antonio, Rio de los Pinos, and the Conejos River occurs within the area of indirect effects.	0 acres	250 ft (76 m) of potentially suitable habitat (<0.1% of available potentially suitable habitat) crossed by transmission corridor	27.3 mi of potentially suitable habitat (3.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of riparian and aquatic habitats associated with the Rio San Antonio in the transmission corridor would further reduce impact.
Rio Grande sucker	*Catostomus plebeius*	CO-E; CO-S1; NM-S2	Restricted to streams of the Rio Grande Basin in channels and backwaters near rapidly flowing waters. Nearest potentially suitable habitat is located in the Rio San Antonio, approximately 1 mi north (downgradient) of the SEZ. Approximately 29.3 mi of potential habitat in the Rio San Antonio, Rio de los Pinos, and the Conejos River occurs within the area of indirect effects.	0 acres	250 ft (76 m) of potentially suitable habitat (<0.1% of available potentially suitable habitat) crossed by transmission corridor	27.3 mi of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of riparian and aquatic habitats associated with the Rio San Antonio in the transmission corridor would further reduce impact.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Amphibians							
Northern leopard frog	*Rana pipiens*	ESA-UR; BLM-S; CO-SC; NM-S1	Low-gradient creeks, moderate gradient rivers, pools, springs, canals, floodplains, reservoirs, shallow lakes, and wet meadows (especially with rooted aquatic vegetation), and fields. Known to occur in Conejos County, Colorado. About 40,100 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	540 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Reptiles							
Milk snake	*Lampropeltis triangulum*	BLM-S	Shortgrass prairie, sandhills, shrubby hillsides, pinyon-juniper woodlands, and arid river valleys at elevations below 8,000 ft. The species is known to occur in Conejos County, Colorado. About 42,000 acres of potentially suitable habitat occurs in the affected area.	0 acres	7 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	42,200 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of riparian woodland habitat in the transmission corridor would reduce impact. Alternatively, predisturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds							
American peregrine falcon	*Falco peregrinus anatum*	BLM-S; FWS-SC; CO-SC; CO-S2; NM-S2	Year-round resident in the SEZ region. Open spaces associated with high, near vertical cliffs and bluffs above 200 ft in height overlooking rivers. Nearest occurrences are from the Rio Grande National Forest approximately 20 mi west of the SEZ. About 3,747,350 acres of potentially suitable habitat occurs within the analysis area.	128 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	80 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	31,808 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact; direct 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.
Bald eagle	*Haliaeetus leucocephalus*	CO-T; NM-T; CO-S1; NM-S1	Year-round resident in the SEZ region. Seldom seen far from water, especially larger rivers, lakes, and reservoirs. Occurs locally in semiarid shrubland habitats where there is an abundance of small mammal prey. Known to occur in riparian habitats along the Rio Grande as near as 7 mi east of the Antonito Southeast SEZ. About 96,000 acres of potentially suitable habitat occurs in the affected area.	8,492 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	10 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	85,832 acres of potentially suitable habitat (5.3% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Predisturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Barrow's goldeneye	*Bucephala islandica*	BLM-S; CO-S2; NM-S2	Winter resident in the SEZ region on larger lakes and rivers. Known to occur in the San Luis Valley. About 150,000 acres of potentially suitable habitat occurs in the affected area.	43 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)	2,500 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of suitable riparian and aquatic habitats associated with the Rio San Antonio in the transmission corridor would further reduce impact.
Ferruginous hawk	*Buteo regalis*	BLM-S; CO-SC; NM-S2	Summer resident in the affected area, but year-round resident in the SEZ region. Grasslands, sagebrush and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the project area. Nests in tall trees or on rock outcrops along cliff faces. Known to occur approximately 10 mi east of the Antonito Southeast SEZ. About 28,000 acres of potentially suitable habitat occurs in the affected area.	43 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	70 acres of potentially suitable foraging and nesting habitat lost (<0.1% of available potentially suitable habitat)	25,708 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Mountain plover	***Charadrius montanus***	BLM-S; CO-SC; CO-S2; NM-S2	Summer resident in the SEZ region. Prairie grasslands and arid plains and fields. Nests in shortgrass prairies associated with prairie dogs, bison, and cattle. More than 50% of the global population nests in the states of Colorado and New Mexico. Known to occur about 5 mi east of the Antonito Southeast SEZ. About 100,000 acres of potentially suitable habitat occurs in the affected area.	9,642 acres of potentially suitable foraging and nesting habitat lost (0.8% of available potentially suitable habitat)	77 acres of potentially suitable foraging and nesting habitat lost (<0.1% of available potentially suitable habitat)	92,156 acres of potentially suitable habitat (7.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Short-eared owl	*Asio flammeus*	CO-S2; NM-S2	Year-round resident in the SEZ region. Nesting habitat includes grasslands, sagebrush, marshes, and tundra. Wintering habitat include grasslands and marshes. Nearest known occurrences are approximately 20 mi from the SEZ. About 110,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	89 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	101,430 acres of potentially suitable habitat (4.8% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Southwestern willow flycatcher	*Empidonax traillii extimus*	ESA-E; CO-E; NM-E; NM-S1	Nests in thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands in the Alamosa National Wildlife Refuge along the Rio Grande, approximately 25 mi northeast of the SEZ. About 4,400 acres of potentially suitable habitat occurs in the affected area.	34 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	13 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	4,028 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to suitable riparian habitat in the transmission corridor could reduce impacts on this species to negligible levels. The potential for impact and need for mitigation should be determined in consultation with the USFWS under Section 7 of the ESA.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; CO-T; FWS-SC; NM-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Known to occur in Conejos County, Colorado. About 1,984,700 acres of potentially suitable habitat occurs in the SEZ region.	9,700 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	80 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	101,400 acres of potentially suitable habitat (5.1% 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							
Big free-tailed bat	*Nyctinomops macrotis*	BLM-S; CO-S1; FWS-SC	Roosts in rock crevices on cliff faces or in buildings. Forages primarily in coniferous forests and arid shrublands. Known to occur in Conejos County, Colorado. About 120,000 acres of potentially suitable habitat occurs in the affected area.	9,729 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)	106,038 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact; direct 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 effects.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Gunnison's prairie dog	***Cynomys gunnisoni***	ESA-C; NM-S2	Mountain valleys, plateaus, and open brush habitats in the project area at elevations between 1,000 and 12,000 ft. Known to occur in the SEZ affected area in Colorado and northern New Mexico. About 83,000 acres of potentially suitable habitat occurs in the affected area.	8,293 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	9 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	75,310 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of active colonies in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Mitigation should be developed in coordination with the USFWS and CDOW.
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	BLM-S; CO-SC; CO-S2; FWS-SC	Semiarid shrublands, pinyon-juniper woodlands, and montane forests below elevations of 9,500 ft. Roosts in caves, mines, rock crevices, under bridges, or within buildings. Known to occur in the San Luis Valley about 10 mi north of the Antonito Southeast SEZ. About 110,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	82 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	99,983 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact; direct 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 effects.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Spotted bat	*Euderma maculatum*	BLM-S; NM-T	Ponderosa pine forests, pinyon-juniper woodlands, and open semiarid shrublands. Roosts on exposed rocky cliff faces. Known to occur in the western-most counties of Colorado and in northern New Mexico. May occur in Conejos County, Colorado. About 9,600 acres of potentially suitable habitat occurs in the affected area.	0 acres	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	9,189 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; direct 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 effects.
Yuma myotis	*Myotis yumanensis yumanensis*	BLM-S; FWS-SC	Primarily associated with canyonlands and mesas at lower elevations in southwestern Colorado and northern New Mexico. Foraging may occur in relatively dry shrubland habitats. Roosts in rock crevices, buildings, and mines. The species is known to occur in Conejos County, Colorado. About 92,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83,336 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	Small overall impact; direct 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 effects.

[a] BLM-S = listed as a sensitive species by the BLM; CO-E = listed as endangered by the state of Colorado; CO-S1 = ranked as S1 in the state of Colorado; CO-S2 = ranked as S2 in the state of Colorado; CO-SC = species of special concern in the state of Colorado; CO-T = listed as threatened by the state of Colorado; ESA-C = candidate for listing under the ESA; ESA-E = listed as endangered under the ESA; FWS-SC = USFWS species of concern; NM-E = listed as endangered by the state of New Mexico; NM-S1 = ranked as S1 in the state of New Mexico; NM-S2 = ranked as S2 in the state of New Mexico; NM-SC = species of special concern in the state of New Mexico; NM-T = listed as threatened by the state of New Mexico.

Footnotes continued on next page.

TABLE 10.1.12.1-1 (Cont.)

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[b] For plant and invertebrate species, potentially suitable habitat was determined using SWReGAP land cover types. For fish species, potentially suitable habitat was determined from USFWS ECOS, USFWS Recovery Plans, and USFS Conservation Assessments. For reptile, bird, and mammal species, potentially suitable habitat was determined using SWReGAP habitat suitability 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 potential habitat that could be affected relative to availability within the analysis area. Habitat availability for each species within the analysis area was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. No new access roads are assumed to be needed due to the proximity of existing roads to the SEZ.

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

[e] For transmission line development, direct effects were estimated within a 4-mi (6.5-km), 250-ft (76-m) wide ROW from the SEZ to the nearest transmission 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.

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

[g] Overall impact magnitude categories were based on professional judgment and include (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; *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 predisturbance surveys.

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

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

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

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

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

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not identify any ESA-listed species that may occur within the affected area of the SEZ (Stout 2009). However, one species listed under the ESA, the southwestern willow flycatcher, has the potential to occur within the affected area of the SEZ, on the basis of observed occurrences near the affected area and the presence of apparently suitable habitat in the area of indirect affects (Figure 10.1.12.1-1; Table 10.1.12.1-1). In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

The southwestern willow flycatcher is known to breed in riparian habitats along the Rio Grande in the Alamosa National Wildlife Refuge, approximately 25 mi (40 km) northeast of the Antonito Southeast SEZ. Individuals have also been observed along the Conejos River approximately 18 mi (29 km) northeast of the SEZ. These locations are considered to be outside of the area of direct and indirect effect. The species has not been recorded on the SEZ or within the affected area; however, SWReGAP indicates the presence of potentially suitable habitat for the species on the SEZ in the vicinity of Alta Lake. It is unlikely for the species to occur on the SEZ near Alta Lake because of the habitat's small size, isolation, and lack of suitable vegetation, as observed during a July 2009 field visit to the SEZ. Potentially suitable habitat also occurs outside of the SEZ in the area of indirect effects, particularly in riparian areas along the Conejos River and Rio San Antonio (Figure 10.1.12.1-1; Table 10.1.12.1-1). Designated critical habitat for this species does not occur in the SEZ region.

10.1.12.1.2 Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not identify any candidate species for listing under the ESA that may occur in the affected area of the SEZ (Stout 2009). However, there is one candidate species, the Gunnison's prairie dog, which may occur near the proposed Antonito Southeast SEZ (Table 10.1.12.1-1). The known distribution of this species relative to the Antonito Southeast SEZ is shown in Figure 10.1.12.1-1. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

Gunnison's prairie dog occurs in the San Luis Valley and has been recorded in the vicinity of the Antonito Southeast SEZ in Colorado (Figure 10.1.12.1-1). Quad-level occurrences for this species intersect the entire SEZ and the area of indirect effects to the west and east of the SEZ. Suitable habitat for the species exists on the SEZ, and Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009. Potentially suitable habitat occurs throughout the affected area and SEZ region (Figure 10.1.12.1-1; Table 10.1.12.1-1).

10.1.12.1.3 Species That Are under Review for Listing under the ESA

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not identify any species under review for listing under the ESA that may occur in the affected area of the SEZ (Stout 2009). However, the northern leopard frog, which is under review for ESA listing in the western United States, may occur near the proposed Antonito Southeast SEZ (Table 10.1.12.1-1). The known or potential distribution of this species relative to the Antonito Southeast SEZ is shown in Figure 10.1.12.1-1. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

The northern leopard frog is an amphibian widely distributed throughout North America. The western distinct population segment (DPS) of the northern leopard frog, which includes populations in Colorado, is currently under review for ESA listing. Within this DPS, the species is known to occur in various wetland communities including creeks, rivers, pools, springs, canals, and flooded fields. The northern leopard frog is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model for the species, suitable habitat does not occur on the SEZ or within the transmission corridor. However, potentially suitable habitat is predicted to occur within the area of indirect effects (Table 10.1.12.1-1).

10.1.12.1.4 BLM-Designated Sensitive Species

There are 18 BLM-designated sensitive species may occur in the affected area of the Antonito Southeast SEZ (Table 10.1.12.1-1). These BLM-designated sensitive species include the following (1) plants: Brandegee's milkvetch, fragile rockbrake, many-stemmed spider-flower, Ripley's milkvetch, and rock-loving aletes; (2) arthropods: Great Basin silverspot butterfly; (3) fish: Rio Grande chub; (4) amphibians: northern leopard frog; (5) reptiles: milk snake; (6) birds: American peregrine falcon, Barrow's goldeneye, ferruginous hawk, mountain plover, and western burrowing owl; and (7) mammals: big free-tailed bat, pale Townsend's big-eared bat, spotted bat, and Yuma myotis. 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 10.1.12.1-1. Of these BLM-designated sensitive species with potentially suitable habitat in the affected area, occurrences of the Rio Grande chub and mountain plover intersect the affected area of the Antonito Southeast SEZ. The northern leopard frog is discussed in Section 10.1.12.1.3 because it is under review for listing under the ESA. The remaining 17 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.

Brandegee's Milkvetch

The Brandegee's milkvetch is a perennial forb that is known from disjunct locations in Arizona, Colorado, New Mexico, and Utah. The species inhabits sandy or gravelly banks, flats, and rocky meadows within pinyon-juniper woodlands at elevations between 5,400 and 8,800 ft (1,645 and 2,680 m). Nearest quad-level occurrences of this species are approximately 10 mi (16 km) west of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable pinyon-juniper woodland habitat may occur in the transmission corridor and area of indirect effects. Potentially suitable mesic meadow habitats may also occur within the area of indirect effects (Table 10.1.12.1-1).

Fragile Rockbrake

The fragile rockbrake is a perennial forb that is widespread across North America, Europe, and Asia. The species inhabits moist soils on shaded limestone cliffs at elevations greater than 7,000 ft (2,130 m). Nearest quad-level occurrences of this species are from the San Juan Mountains, approximately 25 mi (40 km) northwest of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable rocky cliffs and outcrops may occur within the area of indirect effects (Table 10.1.12.1-1).

Many-Stemmed Spider-flower

The many-stemmed spider-flower is an annual forb that is known from disjunct locations from central Wyoming, south-central Colorado, southeast Arizona, and southwest Texas. The species inhabits saturated soils of saline depressions, such as alkali sinks, alkaline meadows, and playa margins. Within the San Luis Valley of south-central Colorado, the species is known from saturated soils created by waterfowl management on public lands. Nearest quad-level occurrences of this species are from the Blanca Wetlands, approximately 35 mi (56 km) northeast of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable playa or mesic meadow habitats may occur within the area of indirect effects (Table 10.1.12.1-1).

Ripley's Milkvetch

The Ripley's milkvetch is a perennial forb that is restricted to a range of less than 1,000 mi^2 (2,590 km^2) in Conejos County, Colorado and Taos and Rio Arriba Counties, New Mexico. The species inhabits mixed conifer woodlands on rocky volcanic substrates at elevations above 8,000 ft (2,440 m). Quad-level occurrences of this species intersect the area of indirect effects approximately 5 mi (8 km) west of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable woodland habitat may occur within the transmission corridor and the area of indirect effects (Table 10.1.12.1-1).

Rock-Loving Aletes

The rock-loving aletes is a perennial forb that is endemic to south-central Colorado. The species occurs on volcanic rock substrates such as outcrops, cracks, or ledges. It is associated with pinyon-juniper woodlands on these substrates at elevations greater than 7,000 ft (2,130 m). Nearest quad-level occurrences of this species are approximately 15 mi (24 km) northwest of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable rocky cliff and outcrops or pinyon-juniper woodland habitats may occur within the area of indirect effects (Table 10.1.12.1-1).

Great Basin Silverspot Butterfly

The Great Basin silverspot butterfly is known from northeastern Arizona, western Colorado, northern New Mexico, and eastern Utah. Within Colorado, this species occurs in isolated populations in streamside meadows and open seepage areas associated with violets (*Viola* spp.). Quad-level occurrence records for this species are known from the La Jara Front Range, approximately 20 mi (32 km) northwest of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor; however, potentially suitable habitat may occur within the area of indirect effects (Table 10.1.12.1-1).

Rio Grande Chub

The Rio Grande chub is known from the Rio San Antonio approximately 1 mi (1.6 km) north of the Antonito Southeast SEZ. The species is considered extirpated from the main stem Rio Grande (USFS 2005), but it is known to occur in tributary streams and some impoundments in the San Luis Valley. Quad-level occurrence records exist for the entire SEZ and the area of indirect effects to the west and north of the SEZ. No suitable habitat for the species occurs on the SEZ; however, potentially suitable habitat occurs in the area of direct effects within the Rio San Antonio within the assumed transmission corridor and potentially suitable habitat may occur in other portions of the area of indirect effects in the Rio San Antonio, Rio de los Pinos, and Conejos River (Table 10.1.12.1-1).

Milk Snake

The milk snake is known from a variety of habitats including shortgrass prairie, sandhills, shrubby hillsides, woodlands, and river valleys. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the Antonito Southeast SEZ; however, potentially suitable habitat (grassland, riparian woodland, and pinyon-juniper woodland) occurs in the transmission corridor and in portions of the area of indirect effects (Table 10.1.12.1-1).

American Peregrine Falcon

The American peregrine falcon is known to occur throughout the western United States in areas with high vertical cliffs and bluffs that overlook large open areas such as deserts, shrublands, and woodlands. Nests are usually constructed on rock outcrops and cliff faces. Foraging habitat varies from shrublands and wetlands to farmland and urban areas. Nearest quad-level occurrences of this species are from the Rio Grande National Forest, approximately 20 mi (32 km) west of the Antonito Southeast SEZ (Table 10.1.12.1-1). According to the SWReGAP habitat suitability model, potentially suitable year-round foraging and summer nesting habitat for the American peregrine falcon may occur on the SEZ, the transmission corridor, and throughout portions of the area of indirect effects. On the basis of an evaluation of SWReGAP land cover types, however, potentially suitable nesting habitat (cliffs or outcrops) does not occur within the area of direct effects but approximately 5 acres (<0.1 km^2) of cliff and rock outcrop habitat that may be potentially suitable nesting habitat occurs in the area of indirect effects.

Barrow's Goldeneye

According to the SWReGAP habitat suitability model, only potentially suitable wintering habitat for the Barrow's goldeneye is predicted to occur within the affected area of the Antonito Southeast SEZ. This waterfowl species occurs in Colorado on larger lakes and rivers. The Barrow's goldeneye is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, suitable habitat for this species may occur on the SEZ, transmission corridor, and within the area of indirect effects (Table 10.1.12.1-1). SWReGAP predicted suitable habitat on the SEZ is restricted to Alta Lake. It is unlikely for this species to use Alta Lake because of the habitat's small size and shallow depth as observed during a July 2009 field visit to the SEZ. Potentially suitable habitat occurs outside of the SEZ in the transmission corridor and area of indirect effects, particularly in the Conejos River and Rio San Antonio.

Ferruginous Hawk

The ferruginous hawk is known to occur as a summer resident in the Antonito Southeast SEZ affected area and a year-round resident in portions of the SEZ region. The species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. The ferruginous hawk is known to occur in the San Luis Valley within 10 mi (16 km) east of the Antonito Southeast SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species may occur on the SEZ, transmission corridor, and within the area of indirect effects (Table 10.1.12.1-1). Most of this suitable habitat is represented by foraging habitat (shrublands). On the basis of an evaluation of SWReGAP land cover types, there is no suitable nesting habitat on the SEZ. However, riparian, ponderosa pine, and pinyon-juniper woodland habitat within the transmission corridor and forested habitat and cliffs and rock outcrops within the area of indirect effects may be potentially suitable nesting habitat for the ferruginous hawk.

Mountain Plover

According to the SWReGAP habitat suitability model, only potentially suitable summer breeding habitat for the mountain plover is predicted to occur within the affected area of the Antonito Southeast SEZ. The species inhabits prairie grasslands and arid plains and fields; nesting occurs in shortgrass prairie habitats. The mountain plover is known to occur within the San Luis Valley, and quad-level occurrence records for this species intersect the affected area of the Antonito Southeast SEZ adjacent to the eastern boundary of the SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species may occur on the SEZ, transmission corridor, and within the area of indirect effects (Table 10.1.12.1-1). The availability of suitable nesting habitat within the affected area has not been determined, but grassland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

Western Burrowing Owl

According to the SWReGAP habitat suitability model for the western burrowing owl, the species is a summer breeding resident of open, dry grasslands and desert habitats in the Antonito Southeast SEZ region. The species occurs locally in open areas with sparse vegetation where it forages in grasslands, shrublands, open disturbed areas, and nests in burrows typically constructed by mammals. The species is known to occur in Conejos County, Colorado, and potentially suitable summer breeding habitat may occur in the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009, and shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident in the Antonito Southeast SEZ region where it forages in a variety of habitats including coniferous forests and desert shrublands. The species roosts in rock crevices or in buildings. The species is known to occur in the San Luis Valley of southern Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the big free-tailed bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). 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.

Pale Townsend's Big-Eared Bat

The Townsend's big-eared bat is widely distributed throughout the western United States. The species forages year-round in a wide variety of desert and non-desert habitats in the Antonito Southeast SEZ region. The species roosts in caves, mines, tunnels, buildings, and other manmade structures. Nearest recorded quad-level occurrences of this species are about 10 mi

(16 km) north of the Antonito Southeast SEZ. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Townsend's big-eared bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). 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.

Spotted Bat

The spotted bat is a year-round resident in the Antonito Southeast SEZ region where it occurs in desert shrublands, grasslands, and mixed coniferous forests. The species roosts in caves, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable habitat for the spotted bat does not occur on the SEZ, but suitable foraging habitat does occur in the transmission corridor and in portion s of the area of indirect effects (Table 10.1.12.1-1). 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.

Yuma Myotis

The Yuma myotis is a year-round resident in the Antonito Southeast SEZ region where it occurs in canyonlands, mesas, and arid shrubland habitats. The species roosts in mines, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Yuma myotis occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). 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.

10.1.12.1.5 State-Listed Species

There are five species listed by Colorado or New Mexico that may occur in the Antonito Southeast SEZ affected area (Table 10.1.12.1-1). Three species (southwestern willow flycatcher, western burrowing owl, and spotted bat) were discussed in Section 10.1.12.1.1 and Section 10.1.12.1.3 because of their status under the ESA and BLM. Other state-listed species that may occur in the Antonito Southeast SEZ affected area include the Rio Grande sucker and bald eagle. These two species as related to the SEZ are described in the remainder of this section and are presented in Table 10.1.12.1-1. Additional life history information for these species is provided in Appendix J.

Rio Grande Sucker

The Rio Grande sucker is restricted to streams of the Rio Grande Basin, from south-central Colorado to southern New Mexico. Nearest quad-level occurrences of this species are from the Alamosa River, approximately 20 mi (32 km) northwest of the Antonito Southeast SEZ. The species is not known to occur in the SEZ affected area and suitable habitat does not occur on the SEZ. However, potentially suitable habitat may occur in the area of direct effects in the Rio San Antonio within the assumed transmission corridor. Potentially suitable habitat also may occur in portions of the area of indirect effects in the Rio San Antonio, Rio de los Pinos, and Conejos River (Table 10.1.12.1-1).

Bald Eagle

The bald eagle is known to be a year-round resident in the San Luis Valley where it is associated with riparian habitats of larger permanent water bodies such as lakes, rivers, and reservoirs. This species also occasionally forages in arid shrubland habitats. Nearest quad-level occurrences of this species are from the Rio Grande, approximately 7 mi (11 km) east of the Antonito Southeast SEZ. According to the SWReGAP habitat suitability model, riparian areas that may provide suitable foraging and nesting habitat for the species could occur within the affected area along the Rio San Antonio, Rio de los Pinos, and Conejos River. No suitable aquatic or riparian habitat for this species occurs on the SEZ; however, potentially suitable roosting and nesting riparian habitat along the Rio San Antonio may be crossed by the assumed transmission corridor. In addition, potentially suitable foraging habitat is present on the SEZ and within other portions of the affected area (Table 10.1.12.1-1). This species has not been recorded in the affected area.

10.1.12.1.6 Rare Species

There are 37 species that have a state status of S1 or S2 in Colorado or New Mexico or species of concern by the USFWS, Colorado, or New Mexico may occur in the affected area of the Antonito Southeast SEZ (Table 10.1.12.1-1).Of these species, 18 have not been discussed as ESA-listed (Section 10.1.12.1.1), candidates for listing under the ESA (Section 10.1.12.1.2), under review for ESA listing (Section 10.1.12.1.3), BLM-designated sensitive (Section 10.1.12.1.4), or state-listed (Section 10.1.12.1.5).

10.1.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Antonito Southeast 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 10.1.12.1 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 10.1.12.3).

Solar energy development within the Antonito Southeast SEZ could affect a variety of habitats (see Section 10.1.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on CNHP records, occurrences for the following six special status species intersect the Antonito Southeast SEZ affected area: halfmoon milkvetch, James' cat's-eye, Ripley's milkvetch, Rio Grande chub, mountain plover, and Gunnison's prairie dog. Suitable habitat for each of these species may occur in the affected area. Other special status species were identified that may occur on the SEZ or within the affected area based on the presence of potentially suitable habitat. As discussed in Section 10.1.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur there, 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 effect outside the SEZ are presented in Table 10.1.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming 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 those activities were sited in areas where special status species are known to or could occur. As presented in Section 10.1.1.2, a 4-mi (6.5-km) long transmission line is assumed to be needed to serve solar facilities within this SEZ. No new access roads developments are assumed to be needed due to the proximity of U.S. Highway 285 adjacent to the western boundary of the SEZ.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ or within the assumed transmission line ROW 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 developments are anticipated to occur within the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts 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 design features, which are described 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., wetland and riparian habitats). Indirect impacts on special status species could be reduced to negligible levels by implementing design features especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.

10.1.12.2.1 Impacts on Species Listed under the ESA

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not express concern for impacts of project development within the SEZ to any ESA-listed species (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the southwestern willow flycatcher has the potential to occur in the affected area. The species has not been recorded on the SEZ or in the area of indirect effects, but, according to the SWReGAP habitat suitability model, approximately 34 acres (0.14 km^2) of potentially suitable habitat on the SEZ (associated with Alta Lake) and 13 acres (0.5 km^2) within the assumed transmission line corridor (along the Rio San Antonio) could be directly affected by construction and operations (Table 10.1.12.1-1). These direct impact areas each represent <0.1% of the available suitable habitat in the region (Table 10.1.12.1-1). Although SWReGAP indicates that Alta Lake provides suitable habitat for this species, only short (6 in. [15 cm]) herbaceous plants were observed around the lake at the time of the site visit in July 2009. It is unlikely that Alta Lake provides suitable riparian habitat for the southwestern willow flycatcher. About 4,028 acres (16 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 1.0% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

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

The implementation of design features and avoidance of riparian and wetland habitats in the assumed transmission corridor could reduce impacts on the southwestern willow flycatcher to negligible levels. Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) for the southwestern willow flycatcher, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, would require formal consultation with the USFWS per Section 7 of the ESA. These consultations may also be used to develop incidental take statements per Section 10 of the ESA (if necessary). Consultation with CDOW should also occur to determine any state mitigation requirements.

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

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not express concern for impacts of project development within the SEZ to any species that are candidates for listing under the ESA (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the Gunnison's prairie dog has the potential to occur in the affected area. Quad-level occurrences of this species intersect the Antonito Southeast SEZ affected area and Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009. According to the SWReGAP habitat suitability model, approximately 8,293 acres (34 km^2) of potentially suitable habitat on the SEZ and 9 acres (<0.1 km^2) of habitat within the assumed transmission line corridor could be directly affected by construction and operations (Table 10.1.12.1-1). These direct impact areas represent about 0.4% of available suitable habitat in the SEZ region. About 75,310 acres (305 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 4.0% of the available suitable habitat in the region (Table 10.1.12.1-1).

The overall impact on the Gunnison's prairie dog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents <1% of potentially suitable habitat in the region.

The implementation of design features may be sufficient to reduce indirect impacts on the Gunnison's prairie dog to negligible levels. Avoidance of all potentially suitable habitats for this species is not a feasible means of mitigating impacts because these habitats (shrublands) are widespread throughout the area of direct effect. However, direct impacts could be reduced by avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Development of mitigation for the Gunnison's prairie dog, including development of a survey protocol, avoidance and minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS per Section 7 of the ESA. Consultation with the CDOW should also occur to determine any state mitigation requirements.

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

In scoping comments on the proposed Antonito Southeast SEZ, the USFWS did not express concern for impacts of project development within the SEZ to any species that are under review for listing under the ESA (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the northern leopard frog has the potential to occur in the affected area, and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable habitat for the northern leopard frog does not occur on the SEZ or within the transmission corridor. However, about 540 acres (2 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 1.3% of the available suitable habitat in the region (Table 10.1.12.1-1).

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

If deemed necessary, development of mitigation for the northern leopard frog, including development of a survey protocol, avoidance and minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS per Section 7 of the ESA. Consultation with the CDOW should also occur to determine any state mitigation requirements.

10.1.12.2.4 Impacts on BLM-Designated Sensitive Species

Of the 18 BLM-designated sensitive species that could occur in the affected area of the Antonito Southeast SEZ, there is 1 species (northern leopard frog) that was discussed in Section 10.1.12.1.3 because of its pending status under the ESA. Impacts on the remaining BLM-designated sensitive species that have potentially suitable habitat within the affected area are discussed below.

Brandegee's Milkvetch

The Brandegee's milkvetch is known to occur approximately 10 mi (16 km) west of the SEZ and potentially suitable habitat occurs in the affected area of the Antonito Southeast SEZ. According to the SWReGAP land cover model, potentially suitable pinyon-juniper woodland and mesic meadow habitats do not occur on the SEZ. However, approximately 1 acre (<0.1 km^2) of potentially suitable pinyon-juniper woodland habitat in the in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. Approximately 2,650 acres (11 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents 0.2% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

The overall impact on the Brandegee's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because <1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoiding or minimizing disturbance of all woodland habitat or occupied habitat in the area of direct effects could further reduce direct impacts on this species. If avoidance or minimization is not a feasible option, plants could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Fragile Rockbrake

The fragile rockbrake is known to occur approximately 25 mi (40 km) northwest of the Antonito Southeast SEZ and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable rocky cliffs and outcrops do not occur on the SEZ or within the transmission corridor. However, approximately 5 acres (<0.1 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents <0.1% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

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

Many-Stemmed Spider-flower

The many-stemmed spider-flower is known to occur approximately 35 mi (56 km) northeast of the Antonito Southeast SEZ and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor. However, approximately 78 acres (0.3 km^2) of potentially suitable playa or mesic meadow habitats may occur in the area of indirect effects; this area represents 2.0% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

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

Ripley's Milkvetch

The Ripley's milkvetch is known to occur approximately 5 mi (8 km) west of the Antonito Southeast SEZ and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ. However, approximately 1 acre (<0.1 km^2) of potentially suitable pinyon-juniper woodland habitat in the in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. Approximately 2,680 acres (11 km^2) of potentially suitable woodland habitat may occur in the area of indirect effects; this area represents 0.1% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

The overall impact on the Ripley's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because <1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance of woodland habitat in the area of direct effects and the implementation of mitigation measures described previously for the Brandegee's milkvetch could reduce direct impacts on this species to negligible levels. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Rock-Loving Aletes

The rock-loving aletes is known to occur approximately 15 mi (24 km) northwest of the Antonito Southeast SEZ and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor. However, approximately 2,534 acres (10 km^2) of potentially suitable rocky cliffs and outcrops or pinyon-juniper woodland habitats may occur in the area of indirect effects; this area represents 0.6% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

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

Great Basin Silverspot Butterfly

The Great Basin silverspot butterfly is known to occur approximately 20 mi (32 km) northwest of the Antonito Southeast SEZ and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor. However, approximately 1,720 acres

(7 km^2) of potentially suitable mesic meadow habitats may occur in the area of indirect effects; this area represents 1.0% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

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

Rio Grande Chub

The Rio Grande chub historically inhabited the Rio San Antonio approximately 1 mi (1.6 km) north of the Antonito Southeast SEZ. The Rio Grande chub is considered extirpated from the mainstem Rio Grande (USFS 2005) and suitable habitat for the species does not occur on the SEZ. However, approximately 250 ft (76 m) of potentially suitable habitat within the Rio San Antonio may be directly affected by crossing of the assumed transmission line corridor (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. About 27 mi (44 km) of potentially suitable habitat occurs within the area of indirect effects within the Rio San Antonio, Rio de los Pinos, and Conejos River; this area represents about 3.2% of the available suitable habitat in the region (Table 10.1.12.1-1).

The overall impact on the Rio Grande chub from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents <1% of potentially suitable habitat in the region. The implementation of design features may be sufficient to reduce indirect impacts on the Rio Grande chub to negligible levels. Direct impacts on this species could be further reduced by minimizing disturbance of the Rio San Antonio and its riparian habitat during the development of the transmission line ROW.

Milk Snake

The milk snake is known to occur in Conejos County, Colorado, although the species is not known to occur in affected area of the Antonito Southeast SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species is not expected to occur on the SEZ. However, approximately 7 acres (<0.1 km^2) of suitable habitat within the assumed transmission line corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. About 42,200 acres (171 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 4.1% of the available suitable habitat in the region (Table 10.1.12.1-1).

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

Avoiding or minimizing disturbance of all grassland and woodland habitats or occupied habitats in the in the transmission corridor could further reduce direct impacts on this species. If avoidance or minimization is not a feasible option, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

American Peregrine Falcon

The American peregrine falcon is a year-round resident in the Antonito Southeast SEZ region and is known to occur in the Rio Grande National Forest, approximately 20 mi (32 km) west of the SEZ. According to the SWReGAP habitat suitability model, approximately 128 acres (0.5 km^2) of potentially suitable habitat on the SEZ and 80 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of potentially suitable habitat in the SEZ region. About 31,808 acres (129 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.0% of the potentially suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of this area could serve as foraging habitat (open shrublands). On the basis of an evaluation of SWReGAP land cover data, potentially suitable nest sites for this species (rocky cliffs and outcrops) do not occur on the SEZ or the transmission corridor, but approximately 5 acres (<0.1 km^2) of this habitat may occur in the area of indirect effects.

The overall impact on the American peregrine falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast 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 <1% of potentially suitable foraging habitat in the SEZ region. The implementation of design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of impacts on suitable foraging habitat is not a feasible way to mitigate impacts on the American peregrine falcon because potentially suitable shrubland is widespread throughout the area of direct effects and readily available in other portions of the affected area.

Barrow's Goldeneye

The Barrow's goldeneye is a winter resident within the San Luis Valley. The species has not been recorded on the SEZ or in the area of indirect effects. According to the SWReGAP habitat suitability model, approximately 43 acres (0.2 km^2) of potentially suitable habitat on the SEZ (associated with Alta Lake) and 5 acres (<0.1 km^2) within the assumed transmission corridor (along the Rio San Antonio) could be directly affected by construction and operations (Table 10.1.12.1-1). These direct impact areas each represent <0.1% of the available suitable habitat in the region (Table 10.1.12.1-1). Although SWReGAP indicates that Alta Lake provides suitable habitat for this species, it is unlikely to serve as suitable habitat because of its small size and shallow depth as observed during a site visit in July 2009. About 2,500 acres (10 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 1.7% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1).

The overall impact on the Barrow's goldeneye from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because <1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of design features and avoidance of riparian and wetland habitats in the assumed transmission corridor could reduce impacts on the Barrow's goldeneye to negligible levels.

Ferruginous Hawk

The ferruginous hawk is a summer breeding resident in the Antonito Southeast SEZ region and is known to occur as near as 10 mi (16 km) east of the SEZ. According to the SWReGAP habitat suitability model, approximately 43 acres (0.2 km^2) of potentially suitable habitat on the SEZ and 70 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of potentially suitable habitat in the SEZ region. About 25,708 acres (104 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.9% of the potentially suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of this suitable habitat could serve as foraging habitat (open shrublands). On the basis of an evaluation of SWReGAP land cover data, potentially suitable nest sites for this species (forests and rocky cliffs and outcrops) do not occur on the SEZ. However, approximately 175 acres (1 km^2) of woodland habitat within the transmission corridor and 3,960 acres (16 km^2) of forested habitats and 5 acres (<0.1 km^2) of cliffs and rock outcrops within the area of indirect effects may be potentially suitable nesting habitat for the ferruginous hawk.

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of 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 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 line corridor is feasible, and could reduce impacts. If avoidance or minimization of disturbance to all suitable nesting habitat or occupied habitat is not a feasible option, 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 design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Mountain Plover

The mountain plover is known to occur as a summer breeding resident in the Antonito Southeast SEZ region and is known to occur as near as 5 mi (8 km) east of the SEZ. According to the SWReGAP habitat suitability model, approximately 9,642 acres (39 km^2) of potentially suitable habitat on the SEZ and 77 acres (0.3 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents 0.8% of available suitable habitat in the region. About 92,156 acres (373 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 7.2% of the available suitable habitat in the region (Table 10.1.12.1-1). Most of this area could serve as foraging and nesting habitat. On the basis of an evaluation of SWReGAP land cover types, approximately 1,300 acres (5 km^2) of semi-desert grassland habitat may occur on the SEZ and transmission corridor; approximately 6,600 acres (27 km^2) of this grassland habitat occurs in the area of indirect effects. This grassland habitat may represent potentially suitable foraging or nesting habitat for the mountain plover.

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

Avoidance of all potentially suitable foraging and nesting habitats is not feasible to mitigate impacts on the mountain plover because potentially suitable shrubland and grassland habitats are widespread throughout the area of direct effect and readily available in other portions of the SEZ region. Direct impacts on the mountain plover could be reduced by avoiding or minimizing disturbance to occupied nests and suitable habitat in the area of direct effects. If avoidance or minimization of disturbance to all occupied habitat is not a feasible option, 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 design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Western Burrowing Owl

The western burrowing owl is considered a summer breeding resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 9,700 acres (39 km^2) of potentially suitable habitat on the SEZ and 80 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.5% of potentially suitable habitat in the SEZ region. About 101,400 acres (410 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 5.1% of the potentially suitable habitat in the SEZ region (Table 10.1.12.1-1). 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 Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents <1% of potentially suitable foraging and nesting habitat in the region. The implementation of 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 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 avoidance or minimization of disturbance to all occupied habitat is not a feasible option, 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 design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident within the Antonito Southeast SEZ region and is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, approximately 9,729 acres (39 km^2) of potentially suitable habitat on the SEZ and 85 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents

0.3% of potentially suitable habitat in the SEZ region. About 106,038 acres (429 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 3.8% of the available suitable habitat in the region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. 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; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the big free-tailed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of 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.

Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a year-round resident within the Antonito Southeast SEZ region and is known to occur approximately 10 mi (16 km) north of the SEZ. According to the SWReGAP habitat suitability model, approximately 9,729 acres (39 km^2) of potentially suitable habitat on the SEZ and 82 acres (0.3 km^2) of potentially suitable foraging habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.4% of available suitable habitat in the SEZ region. About 99,983 acres (405 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 3.8% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. 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; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the pale Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of 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.

Spotted Bat

The spotted bat is a year-round resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 12 acres (<0.1 km^2) of potentially suitable habitat within the assumed transmission line corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. About 9,189 acres (37 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 0.6% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. 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; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the spotted bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of 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.

Yuma Myotis

The Yuma myotis is a year-round resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 9,729 acres (39 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.4% of available suitable habitat in the SEZ region. About 83,336 acres (337 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 3.1% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. 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; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the Yuma myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of 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.

10.1.12.2.5 Impacts on State-Listed Species

There are 5 state-listed species that could occur in the affected area of the Antonito Southeast SEZ; three of these species (southwestern willow flycatcher, western burrowing owl, and spotted bat) were discussed in Section 10.1.12.2.1 and Section 10.1.12.2.3 because of their status under the ESA and BLM. Of the remaining state-listed species, the Rio Grande sucker and bald eagle may occur in the affected area due to the presence of suitable habitat. Impacts on these species from solar development within the Antonito Southeast SEZ are discussed below.

Rio Grande Sucker

The Rio Grande sucker is restricted to streams in the Rio Grande Basin and is known to occur as near as the Alamosa River, approximately 20 mi (32 km) northwest of the Antonito Southeast SEZ. Suitable habitat for this species does not occur on the SEZ. However, approximately 250 ft (76 m) of potentially suitable habitat within the Rio San Antonio may be directly affected by the crossing of the assumed transmission corridor (Table 10.1.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. About 27 mi (44 km) of potentially suitable habitat occurs within the area of indirect effects within the Rio San Antonio, Rio de los Pinos, and Conejos River; this area represents about 2.5% of the available suitable habitat in the region (Table 10.1.12.1-1).

The overall impact on the Rio Grande sucker from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents <1% of potentially suitable habitat in the region. The implementation of design features may be sufficient to reduce indirect impacts on the Rio Grande sucker to negligible levels. Direct impacts on this species could be further reduced by minimizing disturbance of the Rio San Antonio and its riparian habitat during the development of the transmission line ROW.

Bald Eagle

The bald eagle is a year-round resident within the Antonito Southeast SEZ region and is known to occur approximately 7 mi (11 km) east of the SEZ. According to the SWReGAP habitat suitability model, approximately 8,492 acres (35 km^2) of potentially suitable habitat on the SEZ and 10 acres (<0.1 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents 0.5% of available suitable habitat in the SEZ region. About 85,832 acres (347 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 5.3% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, riparian woodland habitats that could provide nesting sites could occur in the area of direct effect along the Rio San Antonio within the transmission corridor; as well as within the area of indirect effects along the Rio San Antonio, Rio de los Pinos, and Conejos River. No riparian woodland habitats occur on the SEZ (Table 10.1.12.1-1).

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents <1% of potentially suitable habitat in the SEZ region. The implementation of 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 bald eagle because potentially suitable shrubland habitats are widespread throughout the area of direct effects and readily available in other portions of the SEZ region. However, avoiding or minimizing disturbance to all potentially suitable nesting habitat (riparian woodlands) or occupied nests within the transmission line corridor is feasible, and could reduce impacts. If avoidance or minimization of disturbance to all occupied habitat is not a feasible option, 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 design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

10.1.12.2.6 Impacts on Rare Species

There are 37 species with a state status of S1 or S2 in Colorado or New Mexico or listed as species of concern by the USFWS, Colorado, or New Mexico may occur in the affected area of the Antonito Southeast SEZ. Impacts have been previously discussed for 19 of these species that are also listed under the ESA (Section 10.1.12.2.1), candidates for listing under the ESA (Section 10.1.12.2.2), under review for ESA listing (Section 10.1.12.2.3), BLM-designated sensitive (Section 10.1.12.2.4), or state-listed (Section 10.1.12.2.5). Impacts on the remaining 18 rare species that do not have any other special status designation are presented in Table 10.1.12.1-1.

10.1.12.3 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 effects on special status species. While some SEZ-specific design features are best established when project details are being considered, some design features can be identified at this time, including the following:

- Pre-disturbance surveys should be conducted within the SEZ and transmission corridor (i.e., area of direct effects) to determine the presence and abundance of special status species including those identified in Table 10.1.12.1-1; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts on occupied habitats is not possible, translocation of individuals from areas of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that uses one or more of these options to offset the impacts of projects should be developed in coordination with the appropriate federal and state agencies.

- Avoidance or minimization of disturbance to wetland and riparian habitats within the SEZ and assumed transmission line corridor could reduce impacts on halfmoon milkvetch, least moonwort, Rocky Mountain blazing-star, Rio Grande chub, Rio Grande sucker, milk snake, bald eagle, Barrow's goldeneye, ferruginous hawk, and southwestern willow flycatcher. Transmission towers should be sited to allow spanning of wetlands and riparian areas whenever such habitats must be crossed.

- Avoidance or minimization of disturbance to grassland habitat in the assumed transmission line corridor could reduce impacts on grassy slope sedge, least moonwort, northern moonwort, Rocky Mountain blazing-star, milk snake, mountain plover, and short-eared owl.

- Avoidance or minimization of disturbance to sagebrush habitat within the SEZ and assumed transmission line corridor could reduce impacts on the Colorado larkspur and James' cat's-eye.

- Avoidance or minimization of disturbance to woodland habitats in the assumed transmission line corridor could reduce impacts on Bodin milkvetch, Brandegee's milkvetch, James' cat's-eye, northern moonwort, Ripley's milkvetch, Rocky Mountain blazing-star, milk snake, and ferruginous hawk.

- Transmission towers should be sited to allow spanning of wetlands and riparian areas whenever such habitats must be crossed.

- Consultations with the USFWS and CDOW should be conducted to address the potential for impacts on the southwestern willow flycatcher, a species listed as endangered 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 CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and northern leopard frog—species that are either candidates or under review for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures, and, potentially, translocation or compensatory mitigation.

- Harassment or disturbance of federally listed species, candidates for federal listing, BLM-designated sensitive species, state-listed species, rare 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 CDOW.

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

10.1.13 Air Quality and Climate

10.1.13.1 Affected Environment

10.1.13.1.1 Climate

The proposed Antonito Southeast SEZ is in the south-central portion of Conejos County in south-central Colorado. The SEZ has an average elevation of about 7,860 ft (2,396 m) and is located in the southern part of the San Luis Valley in south-central Colorado. The valley lies in a broad depression between the Sangre de Cristo Mountain Range to the east and the San Juan and La Garita Mountain Ranges to the west; they converge to the north. As a result of these barriers, the valley experiences an arid climate, which is marked by cold winters and moderate summers, light precipitation, a high rate of evaporation, and abundant sunshine due to the thin atmosphere caused by its high elevation (NCDC 2009a). Meteorological data collected at the San Luis Valley Regional Airport and Manassa, which are 27 mi (43 km) and 8 mi (13 km) north of the Antonito Southeast SEZ, respectively, are summarized below.

A wind rose from the San Luis Valley Regional Airport in Alamosa, Colorado, for the 5-year period 2004 to 2008 taken at a level of 33 ft (10 m) is presented in Figure 10.1.13.1-1 (NCDC 2009b). During this period, the annual average wind speed at the airport was about 7.4 mph (3.3 m/s), with a relatively weak prevailing wind direction from the southwest (about 7.9% of the time). Winds that ranged from south to west–southwest accounted for about 30.5% of the time and occurred more frequently throughout the year, except in July and August when east–southeast winds prevailed. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about one-fifth of the time) because of the stable conditions caused by strong radiative cooling that lasted from late night to sunrise. Average wind speeds were highest in spring at 9.6 mph (4.3 m/s); lower in summer and fall at 7.4 mph (3.3 m/s) and 6.7 mph (3.0 m/s), respectively; and lowest in winter at 6.1 mph (2.7 m/s).

In Colorado, topography plays a large role in determining the temperature of any specific location (NCDC 2009c). The San Luis Valley sits at a higher elevation; thus temperatures there are lower than at lower elevations of comparable latitude. For the 1893 to 2009 period, the annual average temperature at Manassa was 42.5°F (5.8°C) (WRCC 2009). January was the coldest month, with an average minimum temperature of 2.0°F (–16.7°C), and July was the warmest month with an average maximum of 80.4°F (26.9°C). In summer, daytime maximum temperatures higher than 90°F (32.2°C) were infrequent, and minimums were in the low 40s. On most days of colder months (November through March), the minimum temperatures recorded were below freezing (≤ 32°F [0°C]); subzero temperatures also were common in January and December. During the same period, the highest temperature, 95°F (35.0°C), was reached in August 1919, and the lowest, –37°F (–38.3°C) was reached in January 1948. Each year, less than 1 day had a maximum temperature of ≥ 90°F (32.2°C), while about 213 days had minimum temperatures at or below freezing.

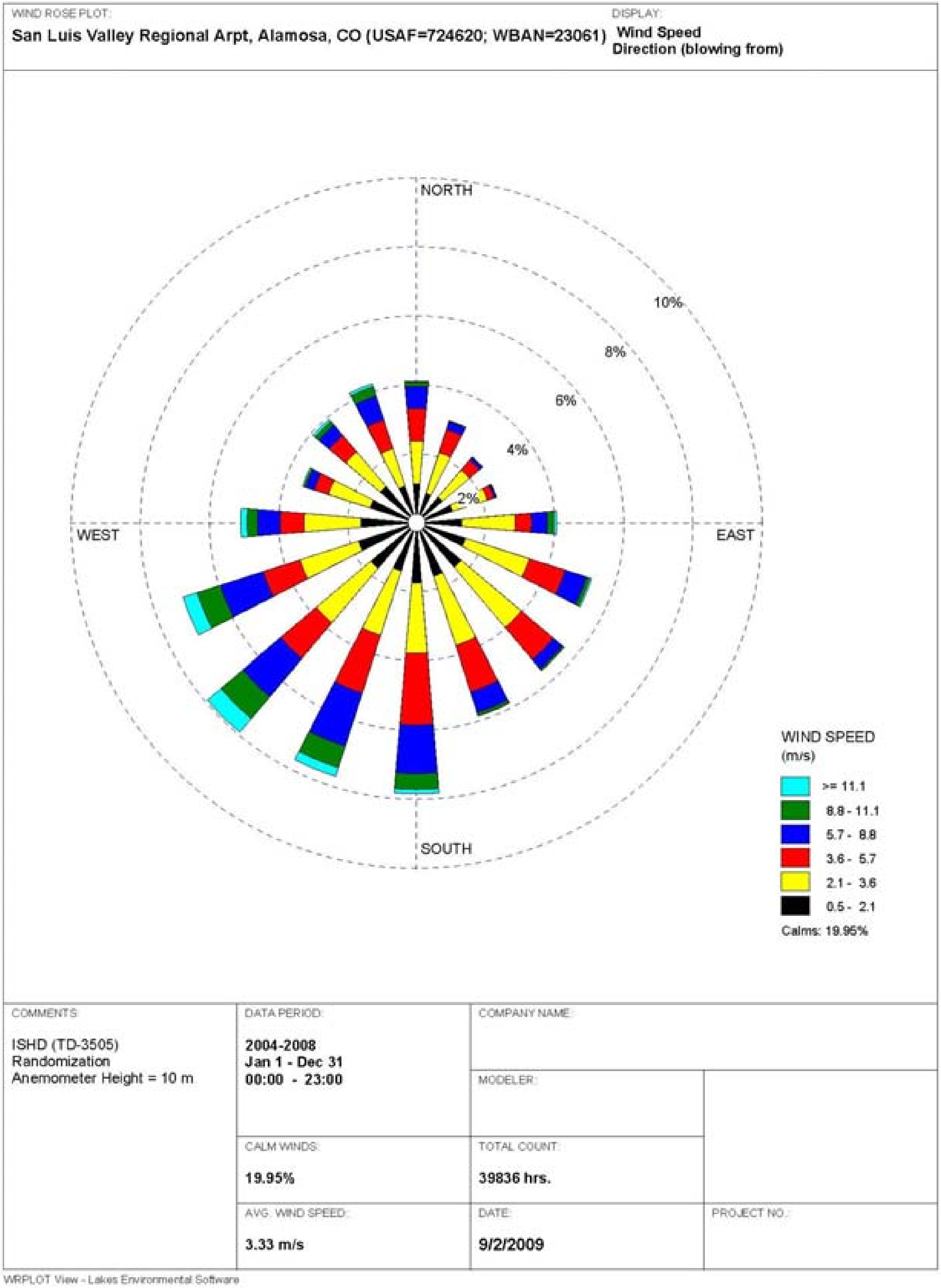

FIGURE 10.1.13.1-1 Wind Rose at 33-ft (10-m) Height at San Luis Valley Regional Airport, Alamosa, Colorado, 2004–2008 (Source: NCDC 2009b)

In Colorado, precipitation patterns are largely controlled by mountain ranges and elevation (NCDC 2009c). Because the San Luis Valley is so far from major sources of moisture and is surrounded by mountain ranges, precipitation there is relatively light. The valley is the driest area in Colorado. For the 1893 to 2009 period, annual precipitation at Manassa averaged about 7.30 in. (18.5 cm) (WRCC 2009). On average, 47 days a year have measurable precipitation (0.01 in. [0.025 cm] or higher). Nearly half of the annual precipitation occurs during summer months when the Southwest Monsoon is most active (NCDC 2009c). Most of it is in the form of scattered, light showers and thunderstorms that develop over the mountains and move into the valley from the southwest. Scattered afternoon thunderstorms can accompany locally heavy rain and occasional hail. Snow occurs mainly in light falls that start as early as September and continue as late as May; most of the snow falls from November through March. The annual average snowfall at Manassa is about 24.6 in. (62.5 cm).

Because the San Luis Valley is so far from major water bodies and because surrounding mountain ranges block air masses from penetrating into the area, severe weather events, such as tornadoes, are a rarity (NCDC 2010).

In 1994, one flash flood, which occurred near Manassa, was reported in Conejos County (NCDC 2010). This flash flood did cause minor property damage.

In Conejos County, hail has been reported seven times since 1961; none of these events caused property or crop damage (NCDC 2010). Hail measuring 1.75 in. (4.4 cm) in diameter was reported in 1961. In Conejos County, no high wind or thunderstorm wind events have been reported (NCDC 2010). However, considering that these wind events have been reported in Alamosa and Saguache Counties in San Luis Valley, there is a possibility that these winds could occur in Conejos County as well.

No dust storms were reported in Conejos County (NCDC 2010). However, the ground surface of the SEZ is covered predominantly with very stony and cobbly loams, which have relatively low-to-moderate dust storm potential. High winds can trigger large amounts of blowing dust in areas of Conejos County that have dry and loose soils with sparse vegetation. Dust storms can deteriorate air quality and visibility and may have adverse effects on health, particularly for people with asthma or other respiratory problems.

Infrequently, remnants from a decayed Pacific hurricane may dump heavy, widespread rains in Colorado (NCDC 2009c). Tornadoes in Conejos County, which encompasses the proposed Antonito Southeast SEZ, occur infrequently. In the period 1950 to June 2010, a total of four tornadoes (0.1 per year) were reported in Conejos County (NCDC 2010). However, most tornadoes occurring in Conejos County were relatively weak (i.e., three were F0 and one was F2 on the Fujita tornado scale), one of which caused minor property damage. All of these tornadoes occurred near the SEZ, that is, about 7 mi (11 km) from the SEZ.

10.1.13.1.2 Existing Air Emissions

Conejos County has only a few industrial emission sources, and the amount of their emissions is relatively low. Because of the sparse population, only a handful of major roads, such as U.S. 285, and several state routes exist in Conejos County. Thus, onroad mobile source emissions are not substantial. Data on annual emissions of criteria pollutants and volatile organic compounds (VOCs) in Conejos County, which encompasses the proposed Antonito Southeast SEZ, are presented in Table 10.1.13.1-1 for 2002 (WRAP 2009). Emission data are classified into six source categories: point, area, onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires, agricultural fires, and structural fires). In 2002, fire sources (mostly wildfires) were predominant contributors to all criteria pollutants and accounted for about one-third of VOC emissions. Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions accounted for about two-thirds of VOC emissions. Area sources accounted for the rest of county emissions of PM_{10} and $PM_{2.5}$, and onroad and nonroad sources were primary contributors to the remainder of the SO_2, NO_x, and CO emissions. In Conejos County, point sources were minor contributors to criteria pollutants and VOCs.

TABLE 10.1.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Conejos County, Colorado, Encompassing the Proposed Antonito Southeast SEZ, 2002[a]

Pollutant	Emissions (tons/yr)
SO_2	928
NO_x	4,073
CO	160,018
VOCs	21,966
PM_{10}	16,041
$PM_{2.5}$	13,126

[a] Includes point, area, 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).

In 2005, Colorado produced about 118 MMt of *gross*[7] carbon dioxide equivalent (CO_2e)[8] emissions (Strait et al. 2007). Gross greenhouse gas (GHG) emissions in Colorado increased by about 35% from 1990 to 2005, a increase twice that of the national increase (about 16%). In 2005, electricity use (36.4%) and transportation (23.8%) were the primary contributors to gross GHG emission sources in Colorado. Fossil fuel use (in the residential, commercial, and nonfossil industrial sectors) and fossil fuel production accounted for about 18% and 8.6%, respectively, of total state emissions. Colorado's *net* emissions were about 83.9 MMt CO_2e, considering carbon sinks from forestry activities and agricultural soils throughout the state. The U.S. Environmental Protection Agency (EPA) (2009a) also estimated that in 2005, CO_2 emissions from fossil fuel combustion were 94.34 MMt, which was comparable to the state's estimate. The electric power generation (43%) and transportation (31%) sectors accounted for

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

[8] This is 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.

about three-fourths of the CO_2 total, and the residential, commercial, and industrial (RCI) sectors accounted for the remainder.

10.1.13.1.3 Air Quality

Colorado State Ambient Air Quality Standards (SAAQS) include six criteria pollutants: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), PM_{10}, and lead (Pb) (5 *Code of Colorado Regulations* 1001-14 [5 CCR 1001-14], CDPHE 2008a). The Colorado SAAQS are identical to the National Ambient Air Quality Standards (NAAQS) for annual NO_2, CO, 1-hour O_3, and 24-hour PM_{10} (EPA 2010), but Colorado has no standards for 1-hour, 24-hour, and annual SO_2; 1-hour NO_2; 8-hour O_3; $PM_{2.5}$; and calendar quarter and rolling 3-month Pb. Colorado has more stringent standards than the NAAQS for 3-hour SO_2 and 1-month Pb, and it still maintains an annual average PM_{10} standard, for which the national standard was revoked by the EPA on December 18, 2006. The NAAQS/SAAQS for criteria pollutants are presented in Table 10.1.13.1-2.

Conejos County, which encompasses the proposed Antonito Southeast SEZ, is located administratively within the San Luis Intrastate Air Quality Control Region (AQCR) (40 CFR 81.176), along with other counties in and around the San Luis Valley, such as Alamosa, Costilla, Mineral, Rio Grande, and Saguache Counties, which is exactly the same as Colorado State AQCR 8. Currently, Colorado State AQCR 8 is designated as being in unclassifiable/ attainment for all criteria pollutants (40 CFR 81.306).

Because of the low population density, low level of industrial activities (except for agricultural-related activities), and low traffic volume in the San Luis Valley, the quantity of anthropogenic emissions is small, and thus ambient air quality is relatively good. The only air quality concern in the valley is particulates (primarily related to woodstoves, unpaved roads, and street sanding). Controlled and uncontrolled burns are a significant source of air pollution in the valley as well. Seasonal high winds and dry soil conditions in the valley result in blowing dust storms. In Alamosa, high PM_{10} concentrations have been monitored during these unusual natural events since 1988; they peaked at 494 and 473 $\mu g/m^3$ in 2007, 424 $\mu g/m^3$ in 2006, and 412 $\mu g/m^3$ in 1991 (CDPHE 2008).

Except for data on PM_{10} and $PM_{2.5}$, there are no recent measurement data for air pollutants in the San Luis Valley. Background concentrations representative of the San Luis Valley presented in Table 10.1.13.1-2 are based on intermittent monitoring studies and routine monitoring data (Chick 2009; EPA 2009b). Except for Pb,[9] these values are conservative indicators of ambient concentrations that were developed for the CDPHE's internal use in initial screening models for permit applications.

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[9] As a direct result of the phaseout of leaded gasoline in automobiles in the 1970s, average Pb concentrations throughout the country have decreased dramatically. Accordingly, Pb is not an air quality concern except at certain locations, such as lead smelters, waste incinerators, and lead-acid battery facilities, where the highest levels of lead in air are found.

TABLE 10.1.13.1-2 Applicable Ambient Air Quality Standards and Background Concentration Levels Representative of the Proposed Antonito Southeast SEZ in Conejos County, Colorado

Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	Background Concentration Level: Concentration[c,d]	Background Concentration Level: Measurement, Location, Year
SO_2	1-hour	75 ppb[e]	NA[f]	NA
	3-hour	0.5 ppm[g,h]	0.009 ppm (1.8%)	Golden Energy at Portland, 2005–2006
	24-hour	0.14 ppm[g]	0.002 ppm (1.4%)	
	Annual	0.030 ppm[g]	0.001 ppm (3.3%)	
NO_2	1-hour	100 ppb[i]	NA	NA
	Annual	0.053 ppm	0.006 ppm (11%)	Southern Ute Site, 7571 Highway 550, 2003–2006
CO	1-hour	35 ppm	1 ppm (2.9%)	Southern Ute Site, 1 mi northeast of Ignacio on CR 517, 2005–2006
	8-hour	9 ppm	1 ppm (11%)	
O_3	1-hour	0.12 ppm[j]	NA	NA
	8-hour	0.075 ppm	0.063 ppm (84%)	Southern Ute Site, 7571 Highway 550, 2004–2006
PM_{10}	24-hour	150 $\mu g/m^3$	27 $\mu g/m^3$ (18%)	Battle Mountain Gold Mine, San Luis, West Site, 1991
	Annual	50 $\mu g/m^3$ [k]	13 $\mu g/m^3$ (26%)	
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	16 $\mu g/m^3$ (46%)	Great Sand Dunes, 1998–2002
	Annual	15.0 $\mu g/m^3$	4 $\mu g/m^3$ (27%)	
Pb[l]	Calendar quarter	1.5 $\mu g/m^3$	0.02 $\mu g/m^3$ (1.3%)	Pueblo, 2002
	Rolling 3-month	0.15 $\mu g/m^3$[m]	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; SO_2 = sulfur dioxide.

b NAAQS/SAAQS for annual NO_2, CO, 1-hour O_3, and 24-hour PM_{10}; NAAQS for SO_2, 1-hour NO_2, 8-hour O_3, $PM_{2.5}$, and Pb; and SAAQS for annual PM_{10}.

c Monitored concentrations are the highest for calendar-quarter Pb; second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O_3; and arithmetic mean for annual SO_2, NO_2, PM_{10}, and $PM_{2.5}$. These values, except for Pb, are conservative indicators of ambient concentrations developed for internal use by the CDPHE in initial screening models for permit application.

d Values in parentheses are background concentration levels as a percentage of NAAQS/SAAQS. 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.

e Effective August 23, 2010.

f NA = not applicable or not available.

Footnotes continued on next page.

TABLE 10.1.13.1-2 (Cont.)

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[g] Colorado has also established increments limiting the allowable increase in ambient concentrations over an established baseline.

[h] Colorado state standard for 3-hour SO_2 is 700 μg/m^3 (0.267 ppm).

[i] Effective April 12, 2010.

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

[k] Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 μg/m^3.

[l] The Colorado Pb standard is 1-month average of 1.5 μg/m^3.

[m] Effective January 12, 2009.

Sources: CDPHE (2008); Chick (2009); EPA (2009b, 2010); 5 *Code of Colorado Regulations* 1001-14.

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 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 100 km (62 mi) of a Class I area. There are several Class I areas around the Antonito Southeast SEZ, three of which are situated within 100 km (62 mi). The nearest Class I area is the Wheeler Peak WA in New Mexico (40 CFR 81.421), about 35 mi (57 km) southeast of the Antonito Southeast SEZ. This Class I area is not located downwind of prevailing winds at the Antonito Southeast SEZ (Figure 10.1.13.1-1). The other two Class I areas within this range are Great Sand Dunes WA and Weminuche WA in Colorado (40 CFR 81.406), which are located about 45 mi (73 km) north–northeast and 54 mi (87 km) northwest of the Antonito Southeast SEZ, respectively. The Great Sand Dunes WA is located downwind of prevailing winds at the Antonito Southeast SEZ, while the Weminuche WA is not.

10.1.13.2 Impacts

Potential impacts on ambient air quality associated with a solar project would be of most concern during the construction phase. Assuming the application of extensive fugitive dust control measures and soil conservation mitigations, including adherence to vegetation management plans, 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 Antonito Southeast 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 10.1.13.3 identifies SEZ-specific design features of particular relevance to the Antonito Southeast SEZ.

10.1.13.2.1 Construction

The Antonito Southeast 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 with additional plume rise induced by buoyancy and momentum effects.

Methods and Assumptions

Air quality modeling for PM_{10} and $PM_{2.5}$ emissions associated with construction activities was performed using the EPA-recommended AMS/EPA Regulatory Model (AERMOD) (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/SAAQS levels at the site boundaries and nearby communities and with PSD increment levels at nearby Class I areas.[10] For the Antonito Southeast SEZ, the modeling was conducted based on the following assumptions and input:

- Uniformly distributed emissions over the 3,000 acres (12.1 km^2) in the northwest corner of the SEZ, close to the nearest town of Antonito;

- Surface hourly meteorological data from the San Luis Valley Regional Airport in Alamosa and upper air sounding data from Denver for the 2004 to 2008 period;

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

[10] To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS/SAAQS 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.

- Additional discrete receptors at the SEZ boundaries and at the nearest Class I area—Wheeler Peak WA—about 35 mi (57 km) southeast of the SEZ.

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 10.1.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled to occur at the site boundaries would be about 569 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 596 μg/m^3 would also exceed the standard level, by about a factor of 4, 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 230 μg/m^3 at the nearest residence, about 0.5 mi (0.8 km) north of the SEZ; about 100 μg/m^3 at Antonito; about 70 μg/m^3 at Conejos; about 60 μg/m^3 at San Antonio; and about 30 μg/m^3 at Manassa and Romeo. Annual average modeled and total PM_{10} concentration increments at the SEZ boundary would be about 106 μg/m^3 and 119 μg/m^3, respectively, which are higher than the standard level of 50 μg/m^3. Annual PM_{10} increments would be much lower for the mentioned locations, about 18 μg/m^3 at the nearest residence, about 3 to 4 μg/m^3 at Antonito and San Antonio, about 2 μg/m^3 at Conejos, and less

TABLE 10.1.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Antonito Southeast SEZ

			Concentration (μg/m^3)				Percentage of NAAQS/SAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background	Total	NAAQS/ SAAQS	Increment	Total
PM_{10}	24 hours	H6H	569	27	596	150	380	398
	Annual	–[c]	106	13	119	50	211	237
$PM_{2.5}$	24 hours	H8H	40.0	16	56.0	35	114	160
	Annual	–	10.6	4	14.6	15.0	70	97

[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] A dash indicates not applicable.

Source: Chick (2009) for background concentration data.

than 1 $\mu g/m^3$ at other towns. Total 24-hour $PM_{2.5}$ concentrations would be 56 $\mu g/m^3$ at the SEZ boundary, which is higher than the standard level of 35 $\mu g/m^3$; modeled concentrations are more than two times background concentrations. The total annual average $PM_{2.5}$ concentration would be 14.6 $\mu g/m^3$, which is just below the standard level of 15.0 $\mu g/m^3$. At the nearest residence, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about 15 and 1.8 $\mu g/m^3$, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the nearest Class I Area—Wheeler Peak WA, New Mexico—would be about 9.1 and 0.10 $\mu g/m^3$, or 114% and 3% of the PSD increments for Class I Areas. When distances, prevailing winds, and topography are considered, concentration increments at the Great Sand Dunes WA would be similar to those at Wheeler Peak WA but would be much lower at the Weminuche WA.

In conclusion, predicted 24-hour and annual PM_{10} and 24-hour $PM_{2.5}$ concentration levels could exceed the standard level at the SEZ boundaries and immediate surrounding areas during the construction of a solar facility. To reduce potential impacts on ambient air quality and in compliance with required programmatic design features, aggressive dust control measures would be used. Predicted total concentrations for annual $PM_{2.5}$ would be below its respective standard level at the site boundary. Additionally, potential air quality impacts on neighboring communities would be much lower. Modeling indicates that construction activities are anticipated to exceed Class I PSD PM_{10} increments at the nearest federal Class I areas (Wheeler Peak WA, New Mexico, and Great Sand Dunes WA). Accordingly, it is anticipated that impacts of construction activities on ambient air quality would be moderate and temporary.

Emissions from the engine exhaust from heavy equipment and vehicles could affect air-quality-related values (AQRVs) (e.g., visibility and acid deposition) at the nearby federal Class I areas. SO_x emissions from engine exhaust would be very low because required 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.

It is assumed that a transmission line would need to be constructed to connect to the nearest existing line located about 4 mi (6 km) north of the Antonito Southeast SEZ. As discussed in Section 5.11.1.5, this activity would result in fugitive dust emissions from soil disturbance and engine exhaust emissions from heavy equipment and vehicles (commuter, visitor, support, and delivery vehicles), as at other construction sites. Because of the short distance to the regional grid, transmission line construction from the Antonito Southeast SEZ could be performed in a relatively short time (likely a few months). 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 along the transmission line ROW would be minor and temporary.

10.1.13.2.2 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 the 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 Antonito Southeast SEZ are presented in Table 10.1.13.2-2. Total power generation capacity ranging from 865 to 1,557 MW was estimated for the Antonito Southeast SEZ for various solar technologies (see Section 10.1.1.2). 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 Antonito Southeast 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 3.2 to 5.7% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Colorado (EPA 2009d). Avoided emissions would be up to 1.4% 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 3.1% of SO_2, 1.0% of NO_x, and 2.6% of CO_2 emissions in the state of Colorado (EPA 2009a; WRAP 2009). These emissions would be up to 0.8% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for more than 96% of the total electric power generation in Colorado. The contribution of coal combustion is about 72%, followed by that of natural gas combustion at about 24%. Thus, solar facilities to be built in the Antonito Southeast 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 Antonito Southeast SEZ is 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.

TABLE 10.1.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Antonito Southeast SEZ

Area Size (acres)	Capacity (MW)[a]	Power Generation (GWh/yr)[b]	Emissions Displaced (tons/yr; 10^3 tons/yr for CO_2)[c]			
			SO_2	NO_x	Hg	CO_2
9,729	865–1,557	1,515–2,727	2,004–3,607	2,310–4,159	0.013–0.023	1,497–2,694
Percentage of total emissions from electric power systems in Colorado[d]			3.2–5.7%	3.2–5.7%	3.2–5.7%	3.2–5.7%
Percentage of total emissions from all source categories in Colorado[e]			1.7–3.1%	0.56–1.0%	–[f]	1.4–2.6%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.80–1.4%	0.62–1.1%	0.44–0.80%	0.57–1.0%
Percentage of total emissions from all source categories in the six-state study area[e]			0.43–0.77%	0.09–0.15%	–	0.18–0.32%

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

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

[c] Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 2.64, 3.05, 1.71×10^{-5}, and 1,976 lb/MWh, respectively, were used for the state of Colorado.

[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] A dash indicates not estimated.

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

10.1.13.2.3 Decommissioning/Reclamation

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

10.1.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the Antonito Southeast SEZ (e.g., by 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 (particularly at Wheeler Peak WA, New Mexico, and Great Sand Dunes WA) as low as possible during construction.

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10.1.14 Visual Resources

10.1.14.1 Affected Environment

10.1.14.1.1 Regional Setting

The proposed Antonito Southeast SEZ is located on the Colorado–New Mexico border on the western side of the San Luis Valley in Conejos County in southern Colorado. Figure 10.1.14.1-1 shows the major geographic features of the San Luis Valley. The San Luis Valley is a high desert valley (elevation approximately 7,500 ft [2,300 m]) within the Rio Grande Rift. The valley is approximately 75 mi wide (121 km) (east-west) and 122 mi long (196 km) (north-south) and is bounded by the San Juan Mountains to the west and the Sangre de Cristo Range of the Sangre de Cristo Mountains to the east. Local relief in the Colorado portion of the valley is relatively low; on the valley floor, local relief is generally less than 100 ft (30 m). The climate is arid, but a high water table supports ephemeral lakes, wetlands, springs, and wells and water for irrigation.

The San Luis Valley is within the EPA's *Arizona/New Mexico Plateau* Level III ecoregion (Chapman et al. 2006). Detailed ecoregion descriptions are available in Appendix I. Natural vegetation within the San Luis Valley is predominantly shrubland and grassland, with pinyon-juniper woodland at the highest elevations; however, on the valley floor, irrigated cropland has replaced much of the natural vegetation.

The valley is rural in character, with small towns and with irrigated and dryland agriculture and grazing as important land uses. Major crops are potatoes, alfalfa, barley, hay, and wheat, with small areas of vegetable farming. The largest towns are Alamosa (population estimated at 8,745 [2008]) and Monte Vista (population estimated at 4,009 [2008]), with a number of smaller towns all with fewer than 1,000 inhabitants (U.S. Bureau of the Census 2009a).

The valley floor is very flat (with the exception of the San Luis Hills and some isolated mountains), and except for planted trees in towns and around the ranches and farms throughout the valley, there is little screening from vegetation and landform; consequently, the valley is characterized by wide open views. Generally good air quality and a lack of obstructions allow visibility for 50 mi (80 km) or more under favorable atmospheric conditions. Aside from electric transmission towers, there are relatively few tall structures, and industrial development is light.

The San Luis Valley is a historic and culturally rich region, and tourism is important to the regional economy. Portions of the valley are within the recently designated Sangre de Cristo NHA, designated in part to recognize, protect, and enhance resource values within the Heritage Area, including natural, historical, scenic, and cultural values (NPS 2009b). The valley contains numerous historic sites, two scenic railways, two scenic highways, several wildlife refuges, Great Sand Dunes National Park and Preserve, and various other attractions that draw tourists to the region. The region's dark night skies are also a valued resource, particularly for Great Sand

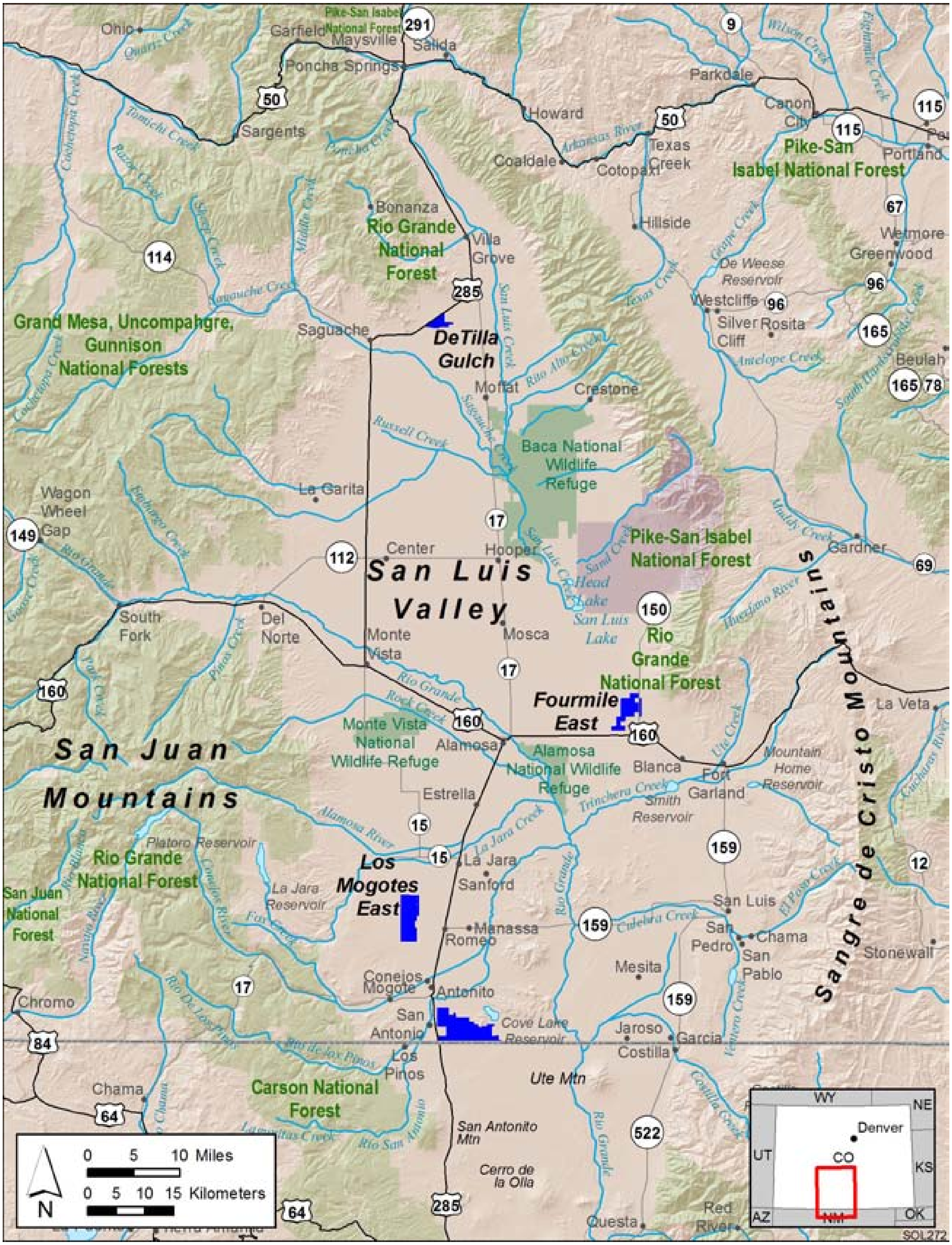

FIGURE 10.1.14.1-1 The San Luis Valley

Dunes National Park and Preserve visitors, and the valley is a destination for unidentified flying object (UFO)-related tourism.

The San Juan and/or Sangre de Cristo Mountains are visible from most locations within the valley, and the rolling grasslands in the foothills and mountain backdrops add to the scenic quality of the region. Views of the valley floor from the mountains are also important in terms of scenic quality, as much of the region's recreation takes place at higher elevations.

The San Luis Resource Area Travel Management Plan (BLM 2009b) describes the scenic resources within the San Luis Valley as follows:

- The San Luis Valley is widely known for its outstanding scenic qualities and impressive diversity of features such as rock formations, flora, fauna, and water features. This area is one of Colorado's most scenic places with seven of Colorado's 14,000 foot peaks on public lands, one of the four Sacred Mountains, and a diversity of vegetation, wildlife, and cultural elements that make this landscape a special scenic place.

- These features help distinguish areas of high scenic importance in comparison to areas of lower scenic importance. Areas such as Penitente Canyon, Zapata Falls, Sangre de Cristo Mountains, and the San Luis Hills contain many of these outstanding scenic features that visitors and local residents value as part of the characteristic landscape.

- This area has several special designations including the Los Caminos Antiguos Scenic and Historic Byway, the Rio Grande Corridor, Penitente Canyon, Blanca Wetlands Habitat Management Area, Zapata Falls, and the San Luis Hills WSA. Outstanding scenic qualities were part of the designation criteria or were the principal factor in their special designation. Preserving the scenic qualities of these areas is of primary concern for the economic improvement of the surrounding San Luis Valley communities due to the importance of heritage tourism.

10.1.14.1.2 Proposed Antonito Southeast SEZ

The Antonito Southeast SEZ (9,729 acres [39.4 km^2]) occupies an area approximately 7 mi (11 km) east to west (at greatest extent) and 44 mi (66 km) north to south and is located approximately 22 mi (33 km) (at closest approach) south-southeast of the town of Antonito, Colorado. The southwest corner is intersected by U.S. 285, which parallels most of the western boundary of the SEZ at a distance of less than 0.5 mi (0.8 km). The Rio San Antonio runs east-west approximately 0.8 mi (1.3 km) north of the northernmost boundary of the SEZ, as does CR E5, at a distance of 0.5 mi (0.8 km). The Rio San Antonio turns south beyond the western boundary of the SEZ and roughly parallels the western SEZ boundary at a distance of 0.6 mi (1.0 km). The SEZ ranges in elevation from 7,719 ft (2,353 m) in the southeastern portion to 8,037 ft (2,450 m) where U.S. 285 crosses the southwestern portion of the SEZ.

The SEZ is in a flat to gently rolling, largely treeless plain, with the strong horizon line being the dominant visual feature. Vegetation is primarily low shrubs such as rabbitbrush (generally less than 1 ft [0.3 m]) and grasses, with some areas of bare, generally reddish or tan soil and gravel patches in some places. During a July 2009 site visit, the vegetation presented a range of greens and blue-grays, with banding and other variation sufficient to add some visual interest. Some or all of the vegetation might be snow-covered in winter, which might significantly affect the visual qualities of the area. The SEZ is dissected by dry washes, generally running southwest to northeast. Several unpaved roads cross the SEZ. Alta Lake is an ephemeral water body located in the north-central portion of the SEZ; however, it is too small to add significantly to scenic quality in the area, even when water is present. No other water features are present in the SEZ. This landscape type is common within the region. A panoramic view of the SEZ, including Alta Lake, is shown in Figure 10.1.14.1-2.

Other than U.S. 285 passing through the far southwest corner of the SEZ, several unpaved roads throughout the SEZ, and wire fences, there is little evidence of cultural modifications that detract from the SEZ's scenic quality. There are no electric transmission lines in the SEZ; however, there are remnants of an historic railroad and an irrigation reservoir and canal system. In general, the SEZ is natural appearing. Panoramic views of the SEZ, including cultural modifications, are shown in Figures 10.1.14.1-3 and 10.1.14.1-4.

Off-site views include distant mountains (San Juan Mountains to the west, Sangre de Cristo Range to the east). Views to the south are more open, of a vast plain with a solitary mountain (San Antonio Mountain) that adds significant visual interest to views in that direction. Another solitary mountain (Ute Mountain) is visible to the west-southwest of the SEZ. Foreground views include a farm/ranch headquarters immediately north of the SEZ's northwest corner, a perlite processing plant approximately 0.75 (1.2 km) north–northwest of the northwest corner of the SEZ, and irrigated farmland along much of the northern border of the SEZ. Some of these cultural modifications are visible in Figure 10.1.14.1-4. U.S. 285 is visible from parts of the far western portion of the SEZ. In general, these off-site cultural modifications detract from the area's scenic quality. Mostly undeveloped land is visible directly east of the SEZ, as are the South Piñon Hills.

Views beyond the perlite plant in the direction of the town of Antonito are at least partially screened by structures, topography, and vegetation. A group of hills immediately north of the eastern portion of the SEZ adds visual interest, but these hills and others east of the SEZ (South Piñon Hills) partially block views of the Sangre de Cristo Range to the east.

The BLM conducted a visual resource inventory (VRI) for the SEZ and surrounding lands in 2009 (BLM 2010). 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 (KOPs). Based on these three factors, BLM-administered lands are placed into one of four VRI Classes, which represent the relative value of the visual resources. Class I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the

FIGURE 10.1.14.1-2 Approximately 180° Panoramic View of the Proposed Antonito Southeast SEZ, Including Alta Lake at Far Left (north) and San Antonio Mountain at Far Right (south)

FIGURE 10.1.14.1-3 Approximately 180° Panoramic View of the Proposed Antonito Southeast SEZ, Including South Pinon Hills and Sangre de Cristo Range at Left of Center (northeast), Taos Valley Canal Remnant at Center, and San Antonio Mountain on Far Right (southwest)

FIGURE 10.1.14.1-4 Approximately 180° Panoramic View of the Proposed Antonito Southeast SEZ, Including San Antonio Mountain at Far Left (south), Perlite Processing Plant and Other Cultural Modifications at the Right (north of the SEZ), and San Juan Mountains Left of Center

highest rating for lands without special designation. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The VRI values for the SEZ and most of the immediate surroundings are VRI Class III, indicating moderate relative visual values; however, a very small portion of the SEZ in the South Piñon Hills is VRI Class II. The inventory indicates low scenic quality for the SEZ and its immediate surroundings, based in part on the lack of topographic relief and water features and on the relative commonness of the landscape type within the region. Positive scenic quality attributes included some variety in vegetation types, and the open and attractive off-site views; however, these positive attributes were insufficient to raise the scenic quality rating to the "Moderate" level. The inventory indicates moderate to high sensitivity for the SEZ and its immediate surroundings. The inventory indicates relatively low levels of use and public interest for the eastern portion of the SEZ; however, because the SEZ is visible from the South Piñon Hills and the San Luis Hills Scenic ACEC, and is within the Sangre de Cristo NHA, and because historic sites and the Los Caminos Antiguos Scenic Byway are nearby, the western part of the SEZ has a sensitivity rating of "High" and the overall sensitivity rating is "Moderate."

Within the La Jara FO, lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain (63,438 acres [256.72 km^2]) of VRI Class II areas, primarily in higher-elevation areas with more rugged terrain west and northeast of the SEZ ; and (283,575 acres [1,147.59 km^2]) of Class III areas, primarily on the flat valley floor around the SEZ. Within the La Jara FO, there are no VRI Class IV areas within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ.

The VRI map for the SEZ and surrounding lands within the La Jara FO is shown in Figure 10.1.14.1-5. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The San Luis Resource Management Plan (RMP) (BLM 1991) indicates that most of the SEZ is managed as VRM Class IV, which permits major modification of the existing character of the landscape. The far western portion near U.S. 285 and small areas along the northeast boundary of the SEZ are managed as VRM Class III, which specifies partial retention of the existing character of the landscape and moderate levels of change. The VRM map for the SEZ and surrounding lands is shown in Figure 10.1.14.1-6. More information about the BLM VRM program is available in Section 5.12 and in *Visual Resource Management*, BLM Manual Handbook 8400 (BLM 1984).

10.1.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Antonito Southeast 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 zone-specific design features.

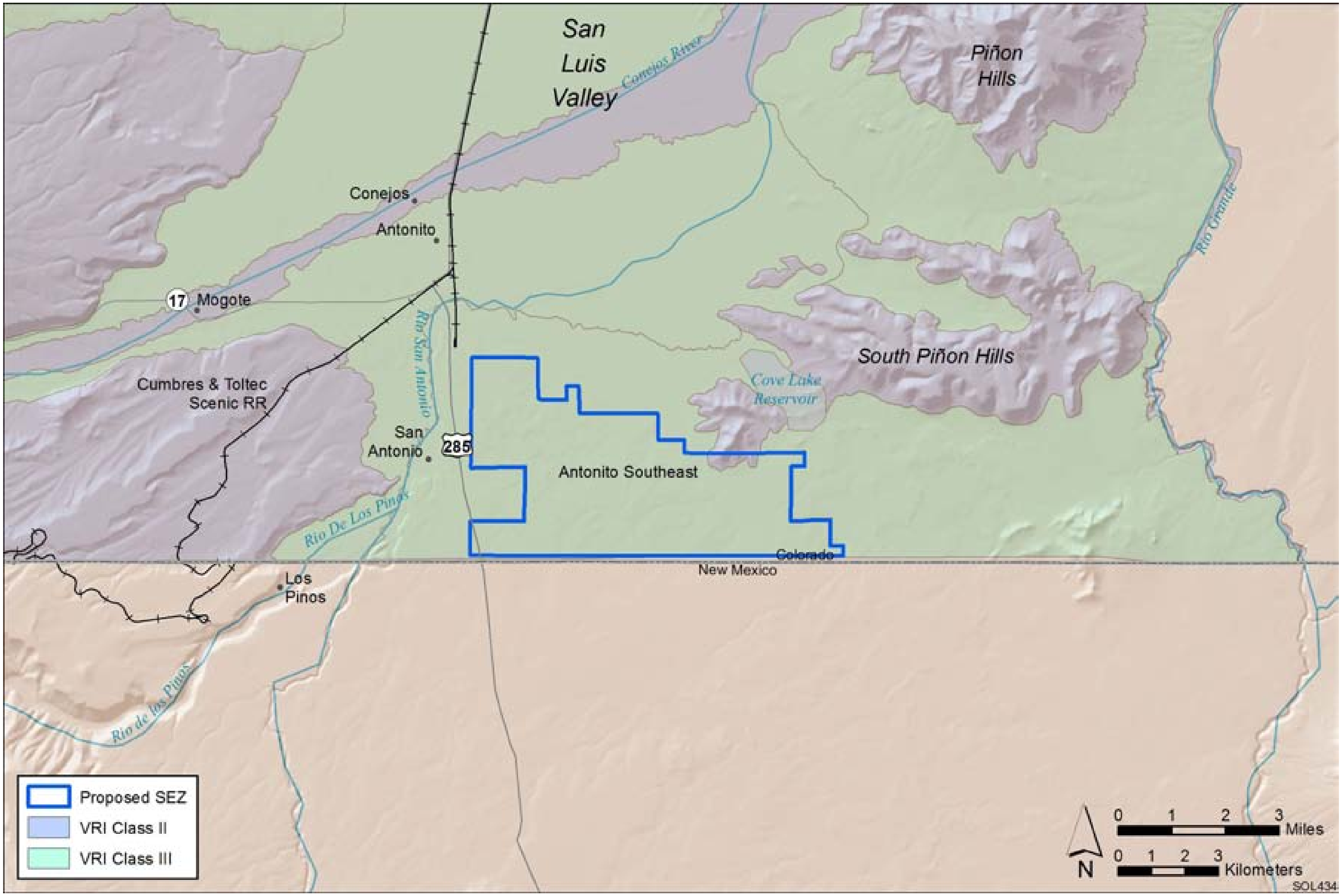

FIGURE 10.1.14.1-5 Visual Resource Inventory Values for the Proposed Antonito Southeast SEZ and Surrounding Lands

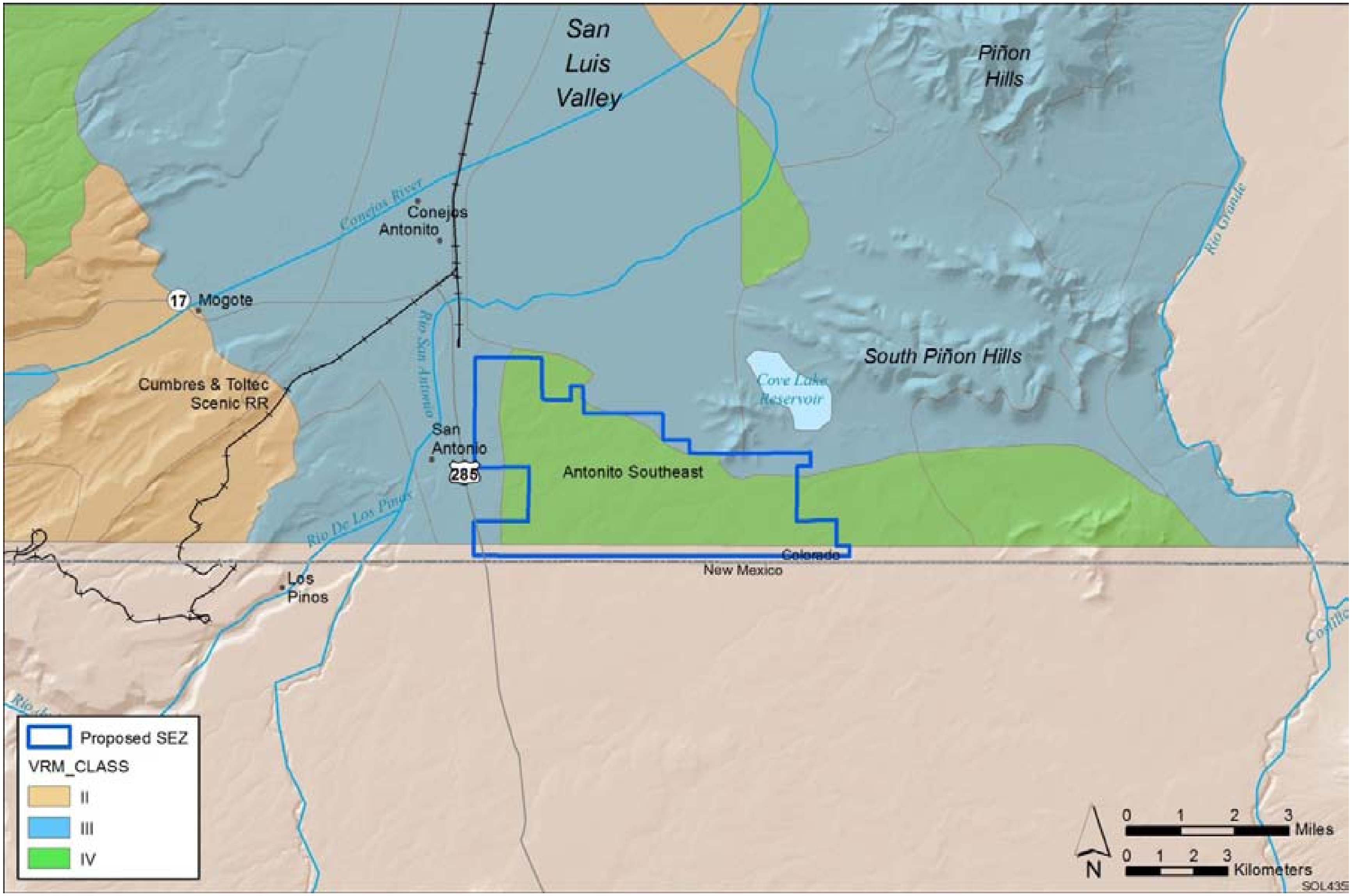

FIGURE 10.1.14.1-6 Visual Resource Management Classes for the Proposed Antonito Southeast SEZ and Surrounding Lands

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 this PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size, landscape setting, or technology type. The occurrence of glint and glare at solar facilities could potentially cause large though 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.

10.1.14.2.1 Impacts on the Proposed Antonito Southeast 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 facility components (solar dish, parabolic trough, and power tower technologies), with lesser impacts associated with reflective surfaces expected from PV facilities. These impacts would be expected to involve major modification of the existing character of the landscape and would likely dominate the views nearby. Additional, and potentially large, impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines. While the primary visual impacts associated with solar energy development within the SEZ would occur during daylight hours, lighting required for utility-scale solar energy facilities would be a potential source of visual impacts at night, both within the SEZ and on surrounding lands.

Common and technology-specific visual impacts from utility-scale solar energy development, as well as impacts associated with electric transmission lines, are discussed in Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and decommissioning, and some impacts could continue after project decommissioning. Visual impacts resulting from solar energy development in the SEZ would be in addition to impacts from solar energy and other projects 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 10.1.22.4.13of this PEIS.

The changes described above would be expected to be consistent with BLM VRM objectives for VRM Class IV, as seen from nearby KOPs. As shown in Figure 10.1.14.1-6, more than 75% of the SEZ is currently designated as VRM Class IV. For the remainder of the site, depending on the type of facility built, project layout, visibility factors, and mitigations employed, impacts could exceed those consistent with objectives for VRM Class III. 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).

10.1.14.2.2 Impacts on Lands Surrounding the Proposed Antonito Southeast SEZ

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

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

Figure 10.1.14.2-1 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 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

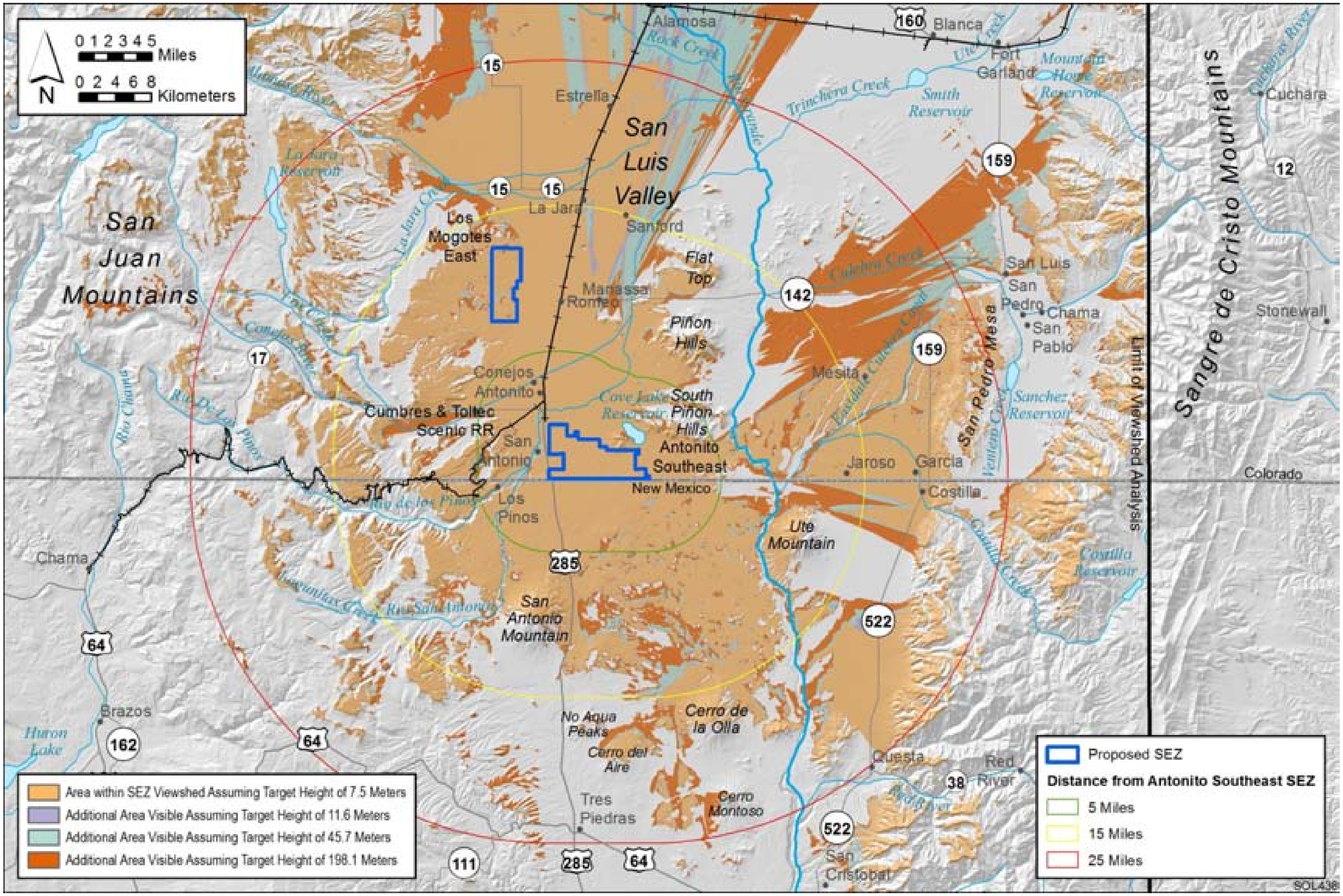

FIGURE 10.1.14.2-1 Viewshed Analyses for the Proposed Antonito Southeast SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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, light blue, and at least the upper portions of power tower receivers could be visible from the additional areas shaded in medium brown.

For the following visual impact discussion, the tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds are shown in the figures and discussed in the text. These heights represent the maximum and minimum landscape visibility for solar energy technologies analyzed in the PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]), and for transmission towers and short solar power towers (150 ft [45.7 m]) are 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 10.1.14.2-2 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, in order to illustrate 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 analysis 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;

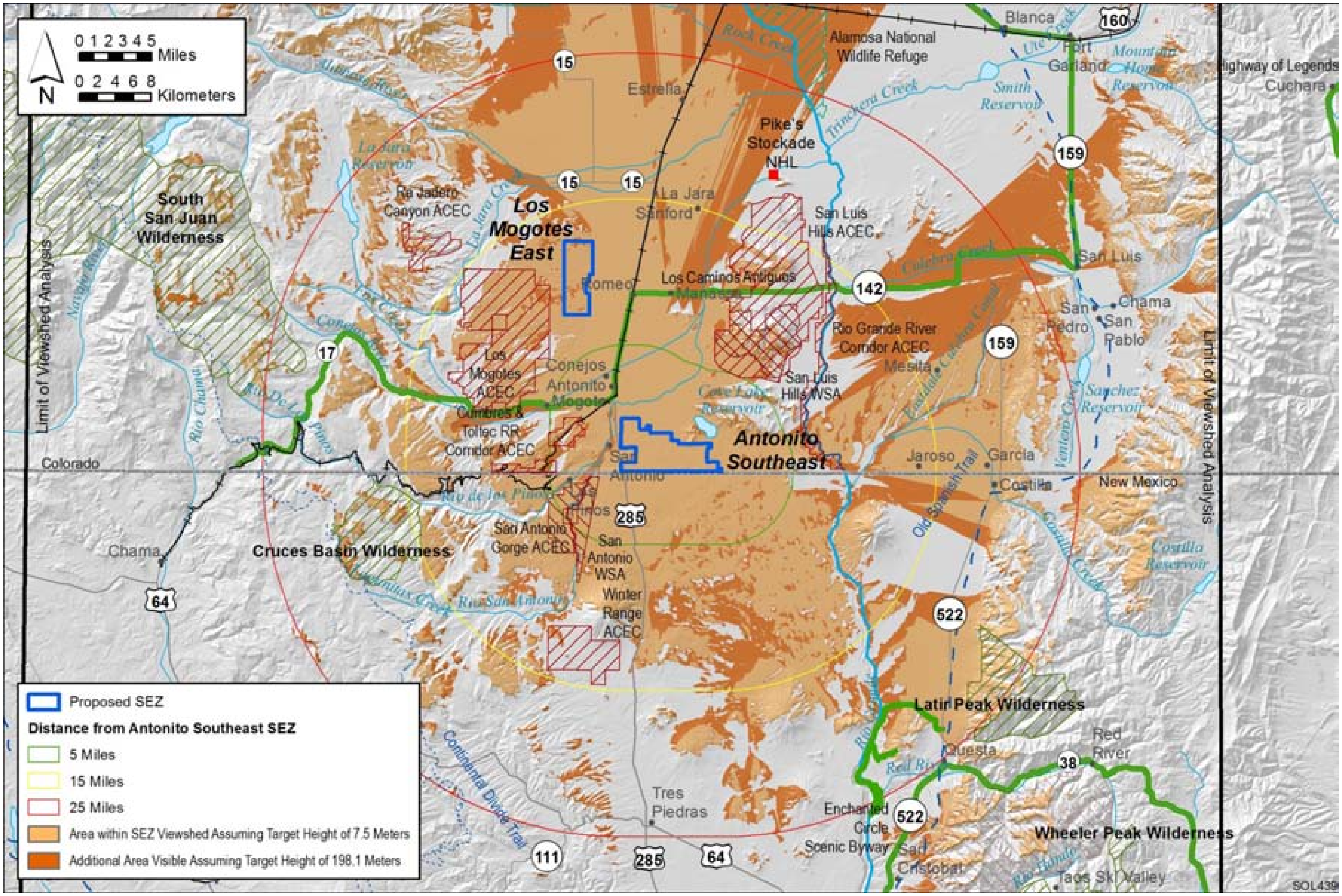

FIGURE 10.1.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

- All-American Roads, National Scenic Byways, State Scenic Highways; and BLM- and USFS-designated scenic highways/byways;

- BLM-designated Special Recreation Management Areas; and

- ACECs designated because of outstanding scenic qualities.

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Antonito Southeast SEZ are discussed below. The results of this analysis are also summarized in Table 10.1.14.2-1. Further discussion of impacts on these areas is available in Sections 10.1.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and 10.1.17 (Cultural Resources) of the PEIS.

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are 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 where the project might be viewed from; 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 of the PEIS.

National Wildlife Refuge

- *Alamosa*—The 12,098-acre (49-km^2) Alamosa NWR contains the headquarters and visitor center for the San Luis Valley National Wildlife Refuge Complex. The refuge is a haven for migratory birds and other wildlife. The Alamosa NWR consists of wet meadows, river oxbows and riparian corridor primarily within the flood plain of the Rio Grande, and dry uplands vegetated with greasewood and saltbush. It is located 24 mi (39 km) northeast of the SEZ at the closest point of approach. Approximately 441 acres (1.8 km$^{2)}$ of the site is within the 650-ft (198.1-m) viewshed of the SEZ. None of the NWR is within the 24.6-ft (7.5-m) viewshed.

  Views of the SEZ from the NWR are generally partially or fully screened by the intervening San Luis Hills. Because some parts of the NWR near the Rio Grande River would have more or less dense vegetation, there could be further screening of views from nearby vegetation that could further reduce or eliminate visibility of power towers within the SEZ from the NWR.

TABLE 10.1.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Antonito Southeast SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[a]		
			Visible between	
Feature Type	Feature Name (Total Acreage/Linear Distance)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
National Wildlife Refuge	Alamosa (12,098 acres)	0 acres	0 acres	441 acres (4%) [b]
Was	South San Juan (160,832 acres)	0 acres	0 acres	3 acres (0%)
	Latir Peak (20,421 acres)	0 acres	0 acres	4,851 acres (24%)
	Cruces Basin (18,876 acres)	0 acres	23 acres	3,950 acres (21%)
WSAs	San Antonio (7,321 acres)	3,193 acres (44%)	3,727 acres (51%)	0 acres
	San Luis Hills (10,896 acres)	0 acres	5,254acres (48 %)	4 acres
National Wild and Scenic Rivers	Rio Grande	0 mi	7.7 mi (12.4 km)	4.4 mi (7.1 km)
National Historic Trails	Old Spanish	0 mi	0 mi	177 mi (27 km)
National Scenic Trails	Continental Divide	0 mi	0 mi	11 mi (18 km)
Scenic Highways	Los Caminos Antiguos	8 mi (13 km)	18 mi (29 km)	12 mi (20 km)
	Wild Rivers Backcountry Scenic Byway	0 acres	0 acres	5 mi (8 km)
SRMAs	Rio Grande Corridor (4,368)	0 acres	735 acres (17%)	0 acres

TABLE 10.1.14.2-1 (Cont.)

Feature Type	Feature Name (Total Acreage/Linear Distance)	Feature Area or Linear Distance[a]: Visible within 5 mi	Visible between 5 and 15 mi	Visible between 15 and 25 mi
ACECs designated for outstanding scenic values	Cumbres & Toltec Railroad Corridor (3,868 acres)	1,818 acres (47%)	1,410 acres (36%)	0 acres
	Rio Grande River Corridor (4,644 acres)	0 acres	1,116 acres (24%)	1 acre (0%)
	San Antonio Gorge (377 acres)	155 acres (41%)	47 acres (12%)	0 acres

[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 acreage or road length viewable.

The elevation of the NWR is lower than the lowest elevation in the SEZ, and at 24 mi (39 km) distance, the vertical angle of view from the NWR to the SEZ would be very low. As shown in Figure 10.1.14.2-2, within the 25-mi (40-km) viewshed of the SEZ, if sufficiently tall power towers were located in the far northwestern portion of the SEZ, they could potentially be visible from a very small area within the NWR. Because of the very low viewing angle, when the power towers were operating, the receiver lights, if visible at all, would be seen as distant star-like points of light just above the southwestern horizon. At night, if sufficiently tall, the power towers could have flashing red or white hazard navigation warning lights that could potentially be visible from some locations in the NWR.

In general, the range of visual contrasts observed from the NWR would be highly dependent on viewer location within the NWR and the numbers, types, sizes and locations of solar facilities in the SEZ, as well as on other project- and site-specific factors. Under the 80% development scenario analyzed in this PEIS, primarily because of the very low viewing angle and long distance between the NWR and the SEZ, solar energy development within the SEZ would be expected to create minimal visual contrasts as viewed from the NWR.

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 note 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.

Wilderness Areas

- *South San Juan*—The South San Juan Wilderness is a 160,832-acre (650.864 km^2) congressionally designated WA located 22 mi (36 km) at the point of closest approach northwest of the SEZ. As shown in

  Figure 10.1.14.2-2, within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ could be visible from a very small portion of the WA (approximately 3 acres [0.1 km^2] within the 650-ft [198.1-m] viewshed, or 0.001% of the total WA acreage); however, the WA in the visible area is heavily forested, and views of the SEZ are screened by trees in most locations. Because of the screening and the relatively long distance to the SEZ, visual impacts on the WA would be expected to be minimal.

- *Latir Peak*—The Latir Peak Wilderness is a 20,421-acre (82.641-km^2) congressionally designated WA located 21 mi (34 km) at the point of closest approach southeast of the SEZ in New Mexico. As shown in Figure 10.1.14.2-2, within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ could be visible from much of the northwest portion of the WA (approximately 4,851 acres [19.63 km^2] in the 650-ft [198.1-m] viewshed, or 24% of the total WA acreage, and 4,806 acres [19.45 km^2] in the 24.6-ft [7.5-m] viewshed, or 23% of the total WA acreage). Portions of the WA in the visible area are heavily forested, and views of the SEZ are screened by trees in some locations; however, the upper slopes of Venado and Latir Peaks are not forested. If screening was absent, hikers on the Heart Lake Trail on Venado Peak would have an open view of the SEZ from an elevated viewpoint; however, because of the relatively long distance to the SEZ, solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the WA.

- *Cruces Basin*—The Cruces Basin Wilderness is a 18,876-acre (76.388-km^2) congressionally designated WA located 14 mi (23 km) at the point of closest approach west-southwest of the SEZ in New Mexico. As shown in Figure 10.1.14.2-2, within the WA, solar energy projects within the SEZ could be visible from higher elevations within the WA (approximately 4,444 acres [17.98-km^2] in the 650-ft [198.1-m] viewshed, or 23% of the total WA acreage, and approximately 3,066 acres [12.40 km^2] in the 24.6-ft [7.5-m] viewshed, or 16% of the total WA acreage). Portions of the WA in the visible area are heavily forested, and views of the SEZ are screened by trees in some locations; however, some higher elevation meadows are not forested, and hikers in these meadow areas would have open views of the SEZ. Under the 80% development scenario analyzed in this PEIS, where there were open views of the SEZ, solar energy facilities within the SEZ would be expected to create weak visual contrasts as viewed from the WA.

Wilderness Study Areas

- *San Antonio*—The San Antonio WSA is located in New Mexico, approximately 1.5 mi (2.4 km) southwest of the SEZ at the point of closest approach. The WSA encompasses 7,321 acres (29.63 km^2). As shown in Figure 10.1.14.2-2, nearly all the WSA (approximately 6920 acres [28.00 km^2], or 95% of the total WSA acreage) is within the 650-ft (198.1-m) viewshed of the SEZ, and 6,531 acres (26.43 km^2) or 89% of the total WSA acreage is within the 24.6-ft (7.5-m) viewshed. Roughly half of the WSA is within the BLM-designated foreground–middleground distance of 3 to 5 mi (5 to 8 km) from the SEZ. Portions of the WSA within the viewshed extend from approximately 1.5 mi (3.3 km) from the southwest corner of the SEZ to approximately 8 mi (13 km) from the SEZ. Viewpoints within the WSA are generally 100 to 500 ft (30to 150 m) higher in elevation than the nearest portion of the SEZ, with viewpoint elevation increasing as the distance from the SEZ increases.

  Figure 10.1.14.2-3 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be seen from a point in the northeast portion of the WSA, 2.6 mi (4.3 km) west–southwest of the southwest corner of the SEZ. The viewpoint is about 150 ft (46 m) higher in elevation than the nearest point in 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 models of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m)

FIGURE 10.1.14.2-3 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint within the San Antonio WSA

heliostats, and the tower/heliostat system represents about 100 MW of electric generating capacity. Four power tower models were placed in the SEZ for this and other visualizations shown in this section of this PEIS. In the visualization, the SEZ area is depicted in orange, the heliostat fields in blue.

The northeast portion of the WSA has open views of the SEZ, with little vegetative screening. The visualization suggests that at the relatively short distance involved, the SEZ would occupy a substantial portion of the horizontal field of view and that solar energy facilities in the nearer portions of the SEZ could strongly attract visual attention, depending on viewer location and project location and characteristics. The two nearest power towers in the visualization are about 4.7 mi (7.5 km) from the viewpoint.

Despite the short distance to the SEZ, because the viewpoint is only slightly elevated with respect to the SEZ, the vertical angle of view is low. The solar collector/reflector arrays for facilities within the SEZ would be seen nearly on-edge, which would reduce their apparent size, reduce the visibility of their strong regular geometry, and cause them to appear to repeat the strong horizontal line of the valley floor, tending to reduce visual contrast.

From this distance, taller ancillary facilities, such as buildings, steam turbine generators (STGs), cooling towers, and transmission components, as well as plumes (if present), would project above the collector/reflector arrays, which could result in form, line, and color contrasts with the strongly horizontal and uniform appearance of the solar arrays. Structural details of some ancillary facilities could be visible as well.

If operating power towers were located in the nearby portions of the SEZ, the receivers would likely appear as very bright or brilliant white cylindrical or non-point (i.e. appearing as a cylinder or other shape) light sources atop discernable tower structures, against or above the background of the South Piñon and San Luis Hills. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances and could be visually conspicuous from this viewpoint. Other lighting associated with solar facilities in the SEZ could be visible as well.

Visual contrast levels observed from this viewpoint would depend on project locations within the SEZ and project characteristics. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts as viewed from this location in the WSA.

In general, from most locations within the WSA, the slightly elevated viewpoints within the WSA would permit views of all types of solar technologies. Solar collector/reflector arrays, however, would be viewed at a low enough angle that their large areal extent and strong regular geometry would be less apparent, and the arrays would appear to repeat the line of the valley floor, tending to reduce contrast levels. From viewpoints within the WSA close to the SEZ, the forms, lines, and reflective surfaces of solar facilities would likely be discernable.

The range of visual contrasts observed would be highly dependent on viewer location and project location and characteristics. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak to strong visual contrasts as viewed from the WSA, depending on viewer location and other visibility factors.

- *San Luis Hills*—The San Luis Hills WSA is located approximately 6 mi (10 km) northeast of the SEZ at the point of closest approach and encompasses 10,896 acres (44.09 km^2). The WSA encompasses most of the Pinyon Hills. The San Luis Hills WSA is located entirely within the San Luis Hills ACEC, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The WSA provides panoramic views of the San Luis Valley and the surrounding mountain ranges.

  The SEZ viewshed includes the southwest-facing slopes of the Pinyon Hills and some lower elevation areas southwest of the Pinyon Hills. Portions of the WSA within the viewshed include approximately 5,258 acres (21.28 km^2) (or 48% of the total WSA acreage) within the 650-ft (198.1-m) viewshed, and 3,931 acres (15.91 km^2) (or 37% of the total WSA acreage) within the 24.6-ft (7.5-m) viewshed. As shown in Figure 10.1.14.2-2, visible areas within the WSA extend from approximately 6 mi (10 km) from the northern boundary of the SEZ to approximately 9 mi (15 km) from the SEZ.

  The upper slopes and peaks of the Pinyon Hills are sparsely vegetated, have relatively open views of both the Antonito Southeast and Los Mogotes East SEZs, and are sufficiently close to the Antonito Southeast SEZ that it occupies a significant portion of the field of view, although intervening terrain might screen some views of portions of the SEZ, depending on viewer location.

  Figure 10.1.14.2-4 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from a peak in the Piñon Hills west of John James Canyon within the WSA. The viewpoint is about 8.7 mi (14.0 km) from the nearest point in the SEZ and is elevated 1,600 ft (490 m) above the SEZ. At this high-elevation viewpoint, the vertical angle of view is great enough that the tops of solar collector/reflector arrays within the SEZ would be visible. The angle of view is not so high, however, that the arrays would not repeat the line of the valley floor, which would tend to reduce visual contrast somewhat. Taller

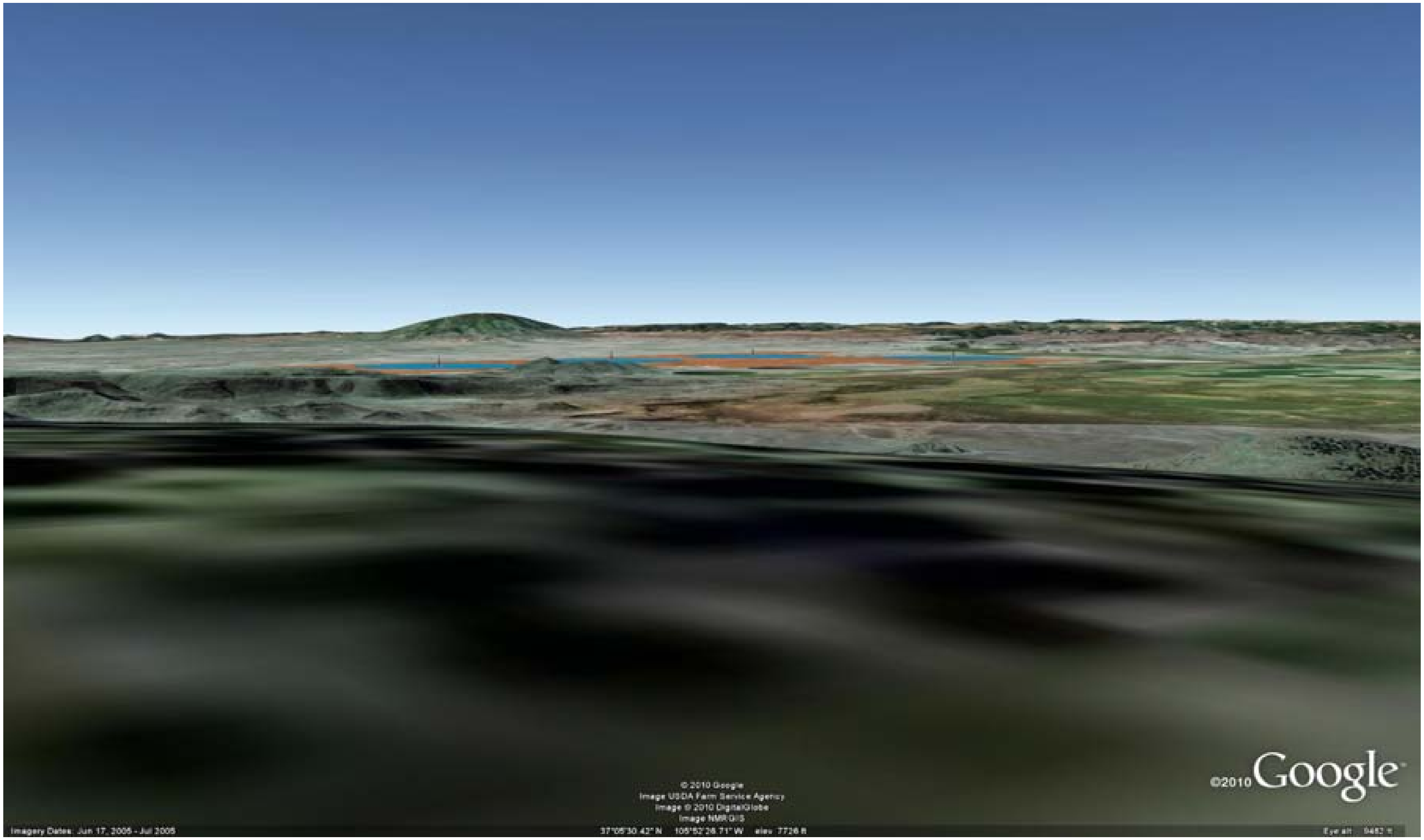

FIGURE 10.1.14.2-4 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Peak within the San Luis Hills WSA and the San Luis Hills ACEC

solar facility components, such as transmission towers, would likely be visible as well.

If operating power towers were located in the SEZ, the receivers would likely appear as bright points of light atop discernable tower structures, against a backdrop of the valley floor. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances and could be visually conspicuous from this viewpoint. Other lighting associated with solar facilities in the SEZ could be visible as well.

Expected visual contrast levels would depend on project locations within the SEZ and project characteristics, but under- the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would likely attract attention but would not likely dominate the view, and solar energy facilities within the SEZ would be expected to create moderate contrasts as viewed from this location.

In general, the range of visual contrasts observed from the WSA would be dependent on viewer location and project locations within the SEZ and the projects' characteristics. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak to moderate visual contrasts as viewed from the WSA, depending on viewer location and other visibility factors. Contrast levels would be highest at high-elevation viewpoints in the southwestern part of the WSA, and lower for low-elevation viewpoints such as in canyons or on bajadas.

Note that portions of the WSA are also in the viewshed of the Los Mogotes Proposed SEZ and could be subject to visual impacts from solar facilities in that SEZ as well.

National Wild and Scenic River

- *Rio Grande*—The Rio Grande National Wild and Scenic River is a congressionally designated wild and scenic river located about 8 mi (13 km) at the point of closest approach east-southeast of the SEZ in New Mexico. In this area, the river has been designated as having outstandingly remarkable scenic values. As shown in Figure 10.1.14.2-2, about 12 mi (19 km) of the Wild and Scenic River is within the SEZ 25-mi (40-km) viewshed. Because the river is within a canyon, boaters and other river users would not see solar development within the SEZ. However, the solar energy facilities within the SEZ could be visible to persons on the canyon rims within the 0.25-mi (0.4-km) management boundary of the National Wild and Scenic River. The elevation of the canyon rims varies but is lower than the elevation of the SEZ; therefore, lower-height solar facilities would not generally be visible from the canyon rims. The upper portions of power tower structures, plumes (if present), and other taller structures might be visible from the canyon rims depending on the facility locations within the SEZ.

If visible from the canyon rims, operating power towers in the SEZ would be seen as distant points of light on the northwestern horizon. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that could potentially be visible from the canyon rims in the National Wild and Scenic River.

Under the 80% development scenario analyzed in this PEIS, visual impacts on persons on the river would not be expected, and solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the canyon rims.

National Historic Trail

- *Old Spanish National Historic Trail*—The Old Spanish National Historic Trail is a congressionally designated multistate historic trail that passes within 19 mi (30 km) of the SEZ at the point of closest approach east-southeast of the SEZ in New Mexico. As shown in Figure 10.1.14.2-2, two sections of the trail are within the 650-ft (198.1-m) viewshed of the SEZ; these segments include approximately 17 mi (27 km) of the trail, and the distance to the SEZ within these trail segments ranges from 19 to 24 mi (30 to 39 km). In these areas, the trail is located in a relatively flat plain at the base of the Sangre de Cristo range, with generally open views of the San Luis Valley to the west, including the SEZ.

  If visible, operating power towers in the SEZ would be seen as distant points of light on the horizon. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that could potentially be visible from the trail. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

  Because of the relatively long distance to the SEZ and the lack of an elevated viewpoint from the trail within the SEZ viewshed, under the 80% development scenario analyzed in this PEIS, visual contrast levels observed by trail users would be expected to be minimal.

  The West Fork of the North Branch of the Old Spanish Trail is also within the viewshed of the Antonito Southeast SEZ; however, this portion of the trail has yet to receive a congressional designation. Potential impacts on the West Fork are discussed in Section 10.1.14.2.2.2.

National Scenic Trail

Continental Divide—The Continental Divide National Scenic Trail is a congressionally designated multistate scenic trail that passes within 17 mi (28 km) of the SEZ at the point of closest approach west of the SEZ; however, the major portion of the trail within the viewshed of the SEZ is approximately 20 mi (32 km) distant from the SEZ. Approximately 11 mi (18 km) of the trail are within the 650-ft (198.1-m) viewshed of the SEZ. This portion of the trail is largely within the Cruces Basin Wilderness (see above), and expected potential visual contrast levels for hikers on the trail are similar to those listed for the Cruces Basin Wilderness.

Scenic Highways/Byways

- *Los C*aminos Antiguous Scenic Byway—The Los Caminos Antiguos Scenic Byway is a state- and BLM-designated scenic byway that runs through a large section of the San Luis Valley and is located in close proximity to several of the proposed SEZs, including Antonito Southeast. The byway is an important tourist attraction, and in addition to scenic views of the San Luis Valley and surrounding mountain ranges, it provides access to numerous historic sites and cultural attractions.

  As shown in Figure 10.1.14.2-2, about 38 mi (62 km) of the byway is within the calculated 650-ft (198.1-m) viewshed of the SEZ; however undulations in topography; roadside and riparian vegetation; and buildings, such as those in the communities of Antonito and Conejos, screen views of much or all of the SEZ from many locations along the byway. At its point of closest approach to the SEZ, in the community of Antonito, the byway is approximately 2 mi (3 km) northwest of the northwest corner of the SEZ.

  Elevations along the byway north of the SEZ are slightly lower than in the northwest portion of the SEZ itself, but higher than in the eastern portion of the SEZ. Elevations along the byway west of the SEZ are higher than in any portion of the SEZ itself.

  Byway users approaching Antonito from the north might be able to see power tower receivers projecting above the trees and landforms of areas closer to the SEZ as they looked south down the byway. They would be less likely to see solar dish engines and would be unlikely to see solar trough arrays or PV arrays because of screening in most areas. Plumes, cooling towers, and other tall structures such as transmission towers might be visible above screening, depending on viewer location and project location and characteristics. If power towers were sufficiently tall and sufficiently close to the byway, the intense light of receivers could potentially appear to “loom” above the trees or buildings of Antonito and its surroundings. The facilities would tend to increase in apparent size as viewers moved toward them, and might be subject to sudden disappearance and reappearance because of intermittent screening.

Travelers on the byway approaching Antonito from the west would likely have more extended views of the SEZ as they gradually moved downslope along the byway. Because of the slightly elevated viewpoint, the tops of low-height collector/reflector arrays might be visible. Intermittent screening of views due to roadside vegetation or variations in landform would be possible.

Figure 10.1.14.2-5 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be seen from a point on the Los Caminos Antiguos Scenic Byway at the southern end of the community of Antonito, 1.6 mi (2.6 km) north of the northwest corner of the SEZ. The viewpoint is about 6 ft (2 m) lower in elevation than the nearest point in the SEZ.

The visualization shows the view without any potential screening from buildings or vegetation in the area; note that there are at least some buildings and vegetation screening portions of the SEZ from view at this location. The visualization suggests that if a clear view of the SEZ existed at this or nearby locations, at the relatively short distance involved, the SEZ would occupy nearly the entire horizontal field of view and solar energy facilities in the nearer portions of the SEZ could strongly attract visual attention. The nearest power tower in the visualization is about 3.0 mi (4.8 km) from the viewpoint.

Despite the short distance to the SEZ, because the viewpoint is only very slightly elevated with respect to the SEZ, the vertical angle of view is low. The solar collector/reflector arrays for facilities within the SEZ would be seen nearly on-edge, which would reduce their apparent size, reduce the visibility of their strong regular geometry, and cause them to appear to repeat the strong horizontal line of the valley floor, tending to reduce visual contrast; however, if facilities were located in the closest part of the SEZ, they could appear tall enough that their forms and surface details might be visible, which would increase contrast levels.

From this distance, taller ancillary facilities, such as buildings, STGs, cooling towers, and transmission components, as well as plumes (if present), would project above the collector/reflector arrays, which could result in form, line, and color contrasts with the strongly horizontal and uniform appearance of the solar arrays. Structural details of some ancillary facilities could be visible as well.

If operating power towers were located in the nearby portions of the SEZ, the receivers would likely appear as brilliant white cylindrical or non-point light sources (i.e., appearing as a cylinder or other shape) atop discernable tower structures, against or above the background of the Sangre de Cristo

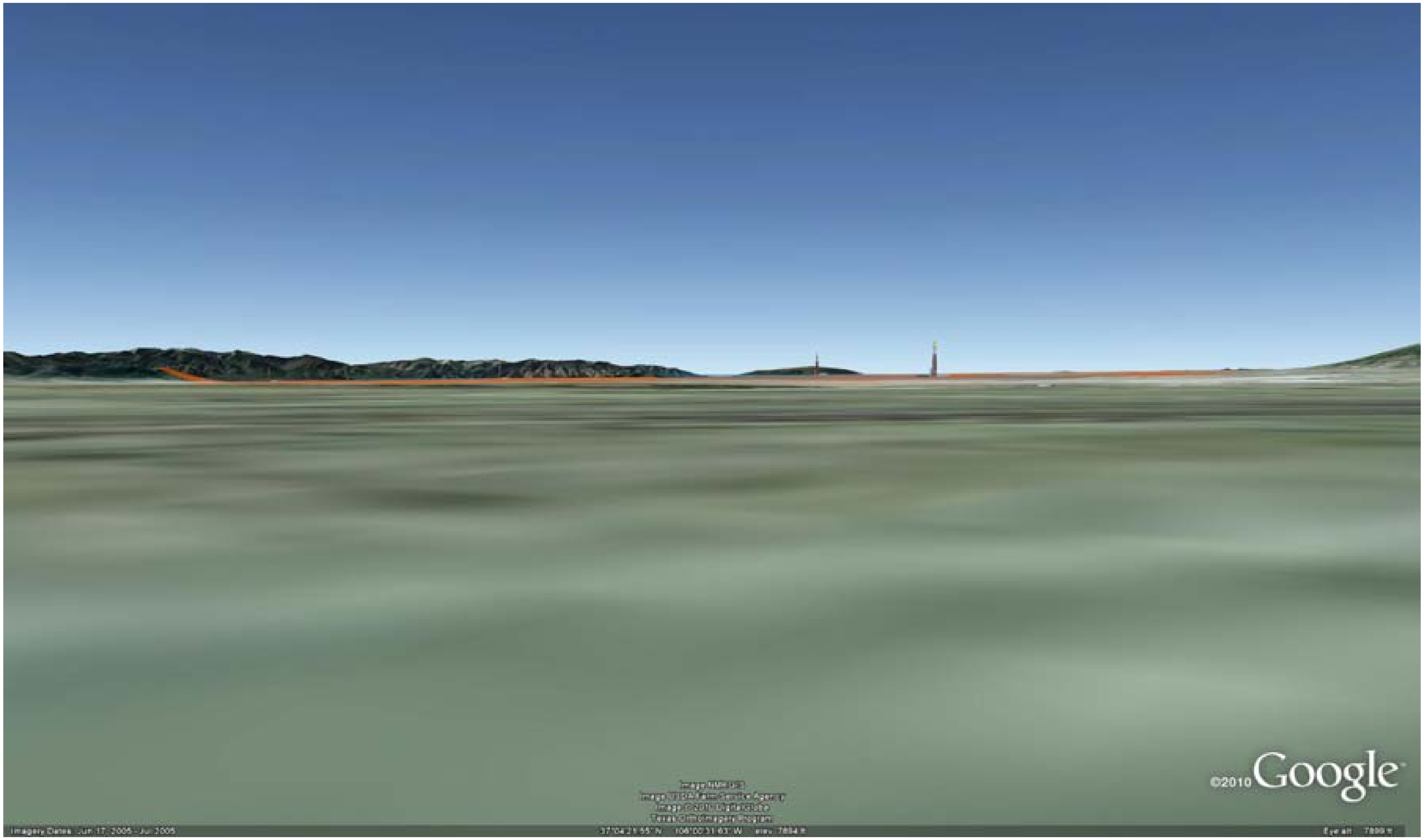

FIGURE 10.1.14.2-5 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Los Caminos Antiguos Scenic Byway in Antonito

Mountains. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances, and could be visually conspicuous from this viewpoint. Other lighting associated with solar facilities in the SEZ could be visible as well.

Visual contrast levels observed from this viewpoint would depend on project locations within the SEZ and project characteristics. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts as viewed from this location on the byway.

The range of impact experienced by byway travelers would be highly dependent on viewer location and project location and design. Under the development scenario analyzed in this PEIS, solar facilities within the SEZ could attract attention but are not generally likely to dominate views from the byway. Under the development scenario analyzed in the PEIS, solar energy development within the SEZ would be expected to create weak to strong visual contrasts as viewed from the Byway, depending on viewer location along the Byway, and other visibility factors.

- *Wild Rivers Backcountry Scenic Byway*—The Wild Rivers Backcountry Byway is located in northern New Mexico, 26 mi (42 km) north of Taos and 17 mi (27 km) south of the Colorado–New Mexico state line, near the town of Questa. The byway is a closed-loop road providing access to the BLM Wild Rivers Recreation Area north of Taos, New Mexico. The road is approximately 13 mi (21 km) long and provides the visitor with access to scenic views, including views of the Rio Grande Gorge. At the point of closest approach to the SEZ, the byway is located 20 mi (32 km) southeast of the southeastern corner of the SEZ.

  As shown in Figure 10.1.14.2-2, two portions of the byway are within the viewshed of the SEZ, including the northernmost portion of the byway running generally east to west along the northern base of Guadalupe Mountain (55 mi [88 km] of the byway within the 650-ft [198.1-m] viewshed of the SEZ), and a more southerly, very short section of the byway running east to west up the western slope of Guadalupe Mountain (0.4 mi [0.6 km] of the byway within the 650-ft [198.1-m] viewshed of the SEZ). Elevation at all points on the byway within the SEZ viewshed is lower than that of the SEZ. Thus, byway users would not be expected to see low-height solar facilities within the SEZ, but might see the upper portions of operating power tower receivers as points of light on the distant horizon. Much of the land surrounding the southern section of the byway within the SEZ viewshed is wooded, so many views likely are screened by trees. The northern portion of the byway within the SEZ viewshed has more open views, but is significantly lower in elevation, thus reducing the visibility of the SEZ. Given the relatively large distance to the SEZ, the low viewing angles, and screening of some views, visual impacts on the byway are expected to be minimal.

Special Recreation Management Areas

- *Rio* Grande Corridor—The Rio Grande Corridor Special Recreation Management Area is a BLM-designated SRMA that follows the Rio Grande for 22 mi (35 km), beginning just south of La Sauses Cemetery in Colorado and extending to the New Mexico state line. It is located 6 mi (10 km) east of the SEZ at the point of closest approach. The SRMA was designated to provide river-oriented recreational opportunities and facilities.

  The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 735 acres (2.97 km2), or 17% of the total SRMA acreage. The area of the SRMA within the 24.6-ft (7.5-m) viewshed of the SEZ includes 306 acres (1.24 km2), or 7% of the total SRMA acreage. As shown in Figure 10.1.14.2-2, the visible area extends from approximately 0.2 mi (0.3 km) north of the Colorado–New Mexico border to about 4 mi (6 km) north of the Colorado–New Mexico border.

  The SRMA covers much of the same area as the Rio Grande River Corridor ACEC, but the ACEC boundary includes some public lands farther west of the river. Because the river is within a canyon, boaters and other river users would not see solar development within the SEZ; however, persons on the canyon rims within the SRMA would see the solar energy facilities within the SEZ. The elevation of the canyon rims varies, but is lower than the elevation of the SEZ. Therefore, lower height solar facilities would not generally be visible from the canyon rims, but the upper parts of power towers, plumes, and other taller structures might be visible from some locations within the SRMA, depending on their location within the SEZ. Potential visual impacts on persons on the river would not be expected. Solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the canyon rims.

ACECs Designated for Outstandingly Remarkable Scenic Values

- *San Luis Hills*—The San Luis Hills ACEC is a 39,421-acre (159.53-km^2) BLM-designated ACEC located approximately 5 mi (8 km) at the point of closest approach north-northeast of the SEZ. The ACEC encompasses the Pinyon Hills and Flattop and nearby hills, and the lower slopes of some of these hills. The ACEC also encompasses the San Luis Hills WSA, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The ACEC provides panoramic views of the

San Luis Valley and the surrounding mountain ranges. The SEZ viewshed includes the southwest-facing slopes of the Pinyon Hills and Flattop, as well as some lower elevation areas southwest of these hills. Portions of the ACEC within the 650 ft (198.1-m) viewshed include approximately 12,516 acres (50.650 km^2), or 32% of the total ACEC acreage and extend from just under 5 mi (8 km) from the northern boundary of the SEZ to approximately 14 mi (23 km) from the SEZ. Portions of the ACEC within the 24.6-ft (7.5-m) viewshed include approximately 10,152 acres (41.084 km^2), or 26% of the total ACEC acreage.

The upper slopes and peaks of the Pinyon Hills are sparsely vegetated, have relatively open views of the SEZ, and are sufficiently close to the SEZ that they occupy a significant portion of the field of view, although intervening terrain might screen some views of portions of the SEZ, depending on viewer location. At the higher elevations, the angle of view is great enough that the tops of solar collector/reflector arrays might be visible. They are not so high, however, that the arrays would not repeat the line of the valley floor. Figure 10.1.14.2-4 (see figure and discussion above under San Luis Hills WSA impact analysis) is a Google Earth visualization of the SEZ (shown in orange tint) as seen from a peak within the San Luis Hills ACEC that is also within the WSA. The viewpoint and expected contrast levels, as discussed above, are typical of many of the high-elevation viewpoints within the southern portion of the ACEC.

Figure 10.1.14.2-6 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from the far western edge of Flattop. The viewpoint is about 14 mi (22 km) from the nearest point in the SEZ and is elevated 1,200 ft (370 m) above the SEZ. Despite the high-elevation viewpoint, because the distance to the SEZ is relatively long, the vertical angle of view is low. The solar collector/reflector arrays for facilities within the SEZ would be seen nearly on-edge, which would reduce their apparent size, reduce the visibility of their strong regular geometry, and cause them to appear to repeat the strong horizontal line of the valley floor, tending to reduce visual contrast. Taller solar facility components, such as transmission towers, and cooling towers, could be visible, depending on lighting, but might not be noticed by casual observers.

If operating power towers were located in the nearby portions of the SEZ, the receivers would likely appear as points of light against a backdrop of the valley floor south of the SEZ. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances and would likely be visible from this viewpoint. Other lighting associated with solar facilities in the SEZ could be visible as well.

Visual contrast levels observed from this viewpoint would depend on project locations within the SEZ and project characteristics. Under the 80%

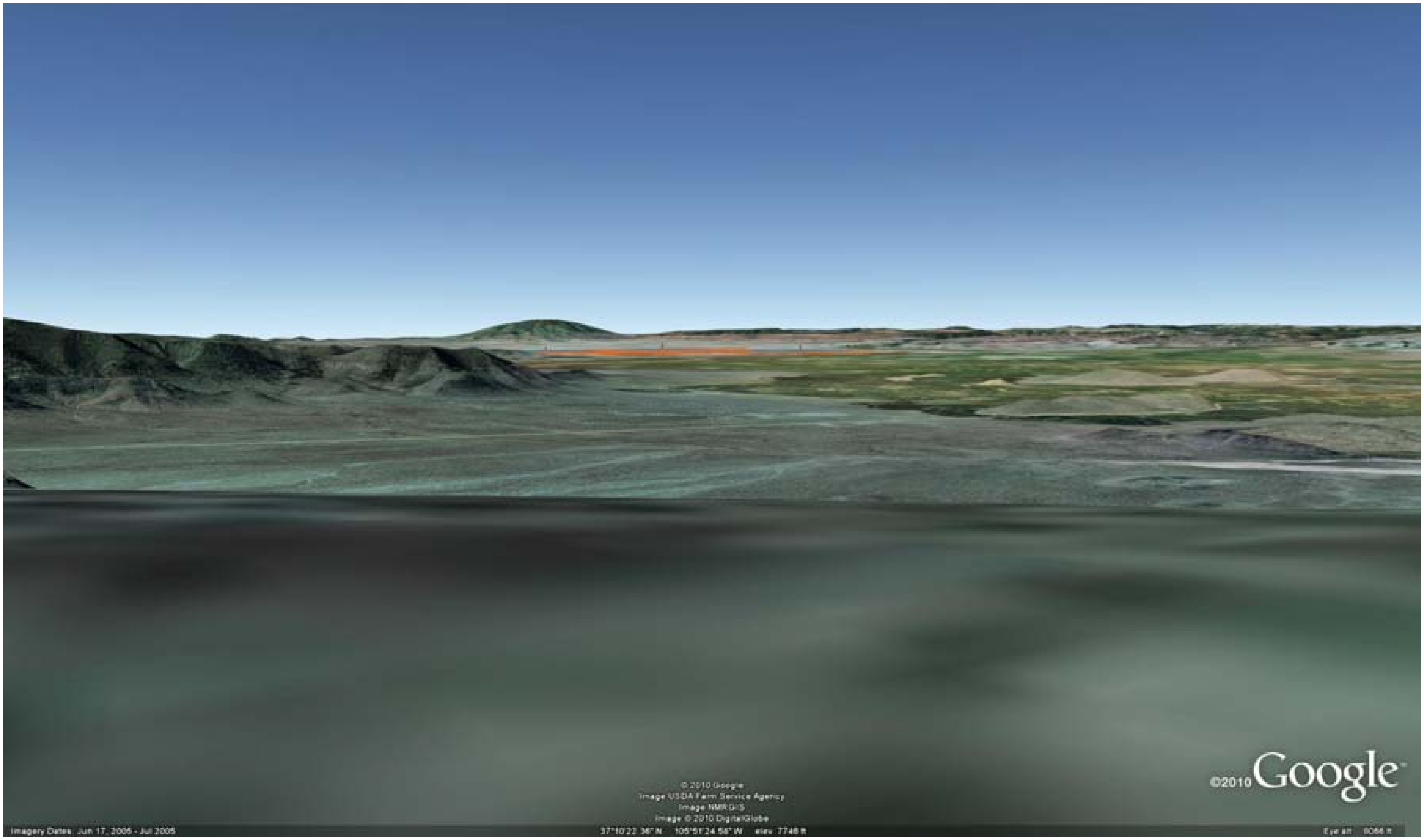

FIGURE 10.1.14.2-6 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Flat Top within the San Luis Hills ACEC

development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak contrasts as viewed from this location in the ACEC.

The range of visual contrasts observed from the ACEC would depend on viewer location and solar facility locations within the SEZ as well the projects' characteristics. Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ could attract attention but would not likely dominate the view. Solar energy facilities within the SEZ would be expected to create weak to moderate visual contrasts as viewed from the ACEC. Contrast levels would be highest at high-elevation viewpoints in the southern part of the ACEC, and lower for low-elevation viewpoints or high-elevation viewpoints in the northern portion of the ACEC, which is close to the BLM-designated background zone distance of 15 mi (24 km).

Note that portions of the ACEC are also in the viewshed of the Los Mogotes Proposed SEZ and could be subject to visual impacts from solar facilities in that SEZ as well.

- *Rio Grande River Corridor*—The Rio Grande River Corridor ACEC is a 4,764-acre (19.28-km^2) BLM-designated ACEC that follows the Rio Grande for 22 mi (35 km), beginning just south of La Sauses Cemetery in Colorado and extending to the New Mexico state line. It is located 6 mi (10 km) at the point of closest approach east of the SEZ. The ACEC was designated to provide special management for the significant natural, scenic, and recreational values along this stretch of the Rio Grande.

  As shown in Figure 10.1.14.2-2, the area of the ACEC within the viewshed of the SEZ extends from approximately 0.2 mi (0.3 km) north of the Colorado–New Mexico border to about 4 mi (6 km) north of the Colorado–New Mexico border, and encompasses 1,116acres (4.516 km^2) in the 650-ft (198.1-m) viewshed, or 25% of the total ACEC acreage. Portions of the ACEC within the 24.6-ft (7.5-m) viewshed include approximately 360 acres (1.46 km^2), or 8% of the total ACEC acreage.

  Because the river is within a canyon, boaters and other river users would not see solar development within the SEZ; however, solar energy facilities within the SEZ could be visible to persons on the canyon rims within the ACEC. The elevation of the canyon rims varies but is lower than the elevation of the SEZ. Therefore, lower height solar facilities would not generally be visible from the canyon rims, but the upper parts of power towers, plumes, and other taller structures might be visible from some locations within the ACEC, depending on their location within the SEZ. Potential visual impacts on persons on the river would not be expected, while solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the canyon rims.

- *San Antonio Gorge*—The San Antonio Gorge ACEC is a very small (377 acres [1.53 km^2]) BLM-designated ACEC that follows San Antonio Creek in New Mexico, and is located approximately 2 mi (3 km) west of the SEZ at the point of closest approach. The ACEC was designated to protect significant wildlife, natural, and scenic values along this stretch of the creek. Because the creek and the ACEC are within a canyon, persons within the ACEC would not see solar development within the SEZ. Potential visual impacts on the ACEC would not be expected.

- *Cumbres & Toltec Scenic Railroad (CTSR)*—Impacts on the CTSR ACEC are described in Section 10.1.14.2.2.2 (Impacts on Selected Nonfederal Lands and Resources), under the discussion of impacts on the CTSR.

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

In addition to impacts associated with the solar energy facilities themselves, sensitive visual resources could be affected by facilities that would be built and operated in conjunction with the solar facilities. With respect to visual impacts, the most important associated facilities would be access roads and transmission lines, the precise location of which cannot be determined until a specific solar energy project is proposed. There is currently no transmission line within the proposed SEZ, so construction and operation of a transmission line both inside and outside the proposed SEZ would be required. An existing 69-kV transmission line is located about 4 mi (6 km) north of the SEZ. Note that depending on project- and site-specific conditions, visual impacts associated with access roads, and particularly transmission lines, could be large. Detailed information about visual impacts associated with transmission lines is presented in Section 5.12.1. A detailed site-specific NEPA analysis would be required to determine visibility and associated impacts precisely for any future solar projects, based on more precise knowledge of facility location and characteristics.

Impacts on Selected Other Lands and Resources

Towns of Antonito and Conejos. As shown in Figure 10.1.14.2-2, the viewshed analyses indicate visibility of the SEZ from the town of Antonito (approximately 1.5 mi [2.5 km] north-northwest of the SEZ) and the unincorporated community of Conejos (approximately 3 mi [5 km] north-northwest of the SEZ). However, a site visit in July 2009 indicated at least partial screening of ground-level views of the SEZ due to either slight variations in topography, vegetation, or both. A detailed future site-specific NEPA analysis is required to determine visibility precisely. Even with the existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the development could potentially be tall enough to exceed the height of the screening and could in some cases cause visual impacts on these communities.

Figure 10.1.14.2-5 (see figure and discussion under Los Caminos Antiguos Scenic Byway impact analysis above) is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be seen from a point on the Los Caminos Antiguos Scenic Byway at the southern end of the community of Antonito, at the intersection of the byway (Main Street in Antonito) and 2nd Ave. The viewpoint is 1.6 mi (2.6 km) north of the northwest corner of the SEZ. The viewpoint is about 6 ft (2 m) lower in elevation than the nearest point in the SEZ. Expected visual contrast levels for this viewpoint (strong) are as described above, again not accounting for partial screening by vegetation and buildings.

Locations farther north in Antonito would generally be subject to lower visual contrast from solar facilities within the SEZ, partly because of the increased distance to the SEZ, but also because of the more extensive screening of views of the SEZ by vegetation and buildings within the community. Similarly, visual contrasts in Conejos would be expected to be lower than those in Antonito because of the increased distance to the SEZ and more extensive screening of the SEZ. As noted, a detailed future site-specific NEPA analysis would be required to determine visibility precisely for particular viewpoints in Antonito. At night, residents in both communities might be able to see hazard navigation lighting on sufficiently tall power towers. This lighting might be particularly noticeable in Antonito, because views from the community to the south are into a large expanse of the valley with relatively few lights, while residents of Conejos would be looking "through" the lights of Antonito. Other lighting associated with solar facilities in the SEZ could be visible from these communities as well.

Regardless of visibility from Antonito and Conejos, residents, workers, and visitors to the area would likely 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, particularly U.S. 285 and CO 17. Portions of both of these roads are included in the Los Caminos Antiguos Scenic Byway, a state- and BLM-designated scenic and historic byway within the viewshed of the SEZ in the immediate vicinity of Antonito (see Los Caminos Antiguos Scenic Byway impact analysis above).

Cumbres & Toltec Scenic Railroad. The CTSR is a narrow-gauge railroad running between Chama, New Mexico, and Antonito, Colorado, with an historic depot in Antonito. The railroad is an historic and cultural property owned by the states of Colorado and New Mexico and is operated for the states by the Cumbres & Toltec Scenic Railroad Commission, an interstate agency authorized by an act of Congress in 1974. The railroad is an important local tourist attraction, offering day-long rides through high-quality scenery, primarily in the San Juan Mountains. The railroad depot is on the southern edge of Antonito, and the rail line extends southwest of Antonio, climbing into the foothills of the San Juan Mountains and running southwest along the valley's western edge before turning west into the mountains after entering New Mexico.

The BLM has designated 3,868 acres (15.65 km^2) of land along the railroad route as the CTSR Corridor ACEC (see Figure 10.1.14.2-7), and the San Luis RMP (BLM 1991) states that the area will be subject to special management for "strict conformance to existing VRM class objectives" in order to protect historical and scenic values. The ACEC designation covers "the minimum necessary foreground viewshed" to "provide protection for the unique scenic resources viewed from the train."

As shown in Figure 10.1.14.2-2, the viewshed analyses indicate visibility of the SEZ from the railroad depot in Antonito (approximately 1.5 mi [2.4 km] north-northwest of the SEZ) and from much of the rail line southwest of Antonito up to approximately 10 mi (16 km) from the proposed SEZ's western boundary, with potential visibility reduced somewhat for the lower height solar technologies, as shown in Figure 10.1.14.2-1. Areas within the viewshed include much of the CTSR Corridor ACEC as shown in Figure 10.1.14.2-2. Portions of the ACEC within the 650-ft (198.1-m) viewshed include approximately 3,219 acres (13.03 km^2), or 83% of the total ACEC acreage. Portions of the ACEC within the 24.6-ft (7.5-m) viewshed include approximately 2,349 acres (9.506 km^2), or 61% of the total ACEC acreage.

The nature of the visual contrasts experienced by train passengers and other visitors to the ACEC and surrounding lands would depend largely on viewer location, the size of solar facilities in the SEZ, the solar technologies employed, the precise locations of the facilities within the SEZ, and other visibility factors discussed in Section 5.12. A detailed future site-specific NEPA analysis would be required to determine visibility and potential impacts precisely.

A site visit in July 2009 indicated at least partial screening of ground-level views of the SEZ from the CTSR depot in Antonito, due to slight variations in topography, vegetation, or both. However, some components of solar facilities sufficiently close to the northwest corner of the proposed SEZ (particularly power tower receivers) might be visible over the tops of screening vegetation or buildings and, if so, might create strong contrasts in form, line, color and texture, especially if viewed against a sky backdrop. Depending on location, tower height, and project design, the intense light emitted by a power tower receiver could potentially be visible from the depot and rail line above the screening objects, and could be quite noticeable, tending to draw viewers' attention. Where screening does not exist, more components of the solar facility would likely be visible, adding additional contrasts in form, line, color, and texture.

Trees and other vegetation along the rail line may screen some views of the SEZ from the rail line and from the Scenic ACEC. However, screening vegetation and landform is generally absent within the first 3 mi (5 km) of the rail line southwest of Antonito, and the viewpoint becomes increasingly elevated as the rail line approaches the San Juan Mountains, affording a largely open view of the proposed SEZ. Views within the mountains and some parts of the ACEC are more subject to screening from vegetation. However, many open views exist, and the viewpoints are further elevated, again affording unobstructed views of the SEZ. Even with any existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the solar energy facilities could potentially be tall enough to exceed the height of the screening and could in some cases cause visual impacts on the rail line

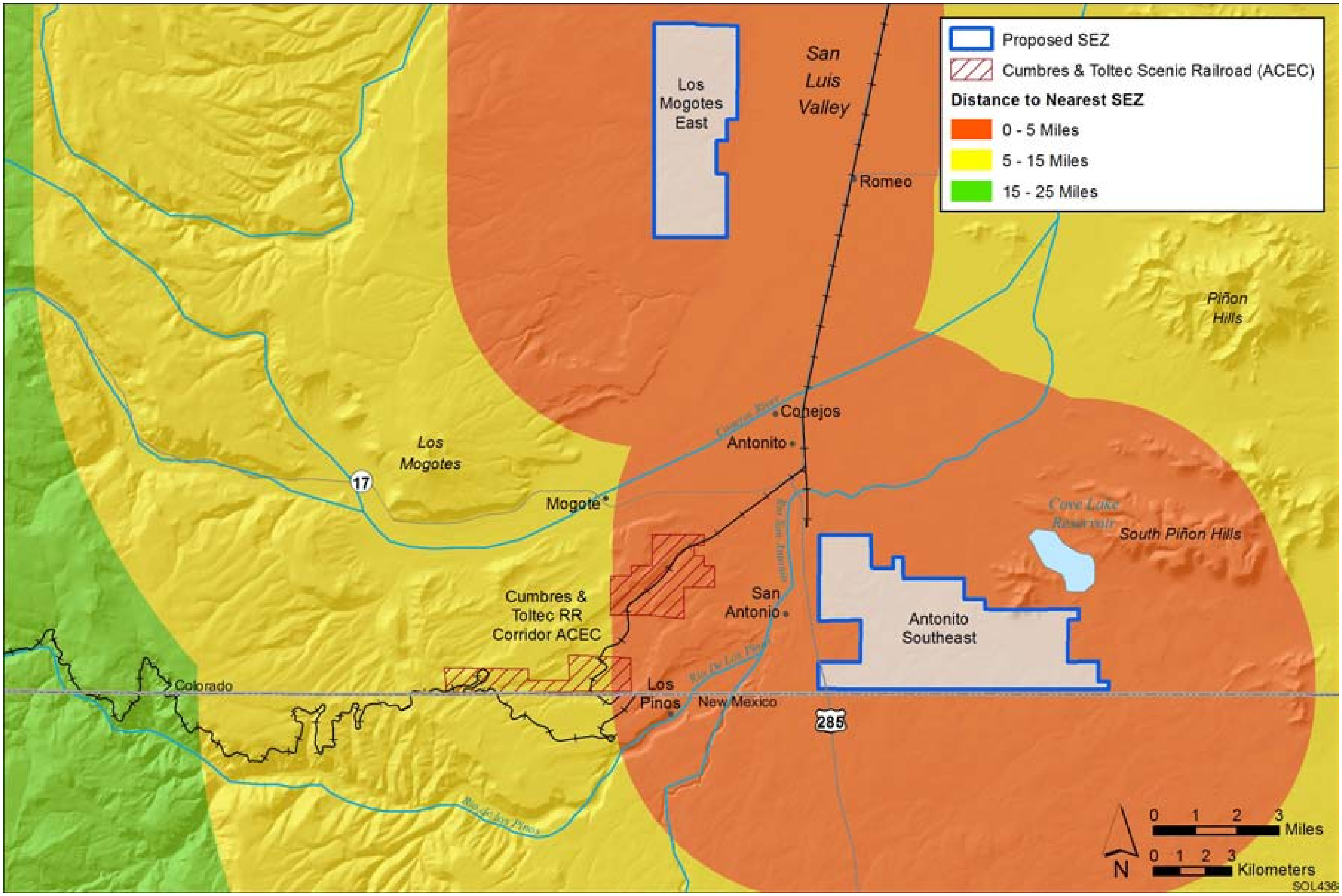

FIGURE 10.1.14.2-7 Cumbres & Toltec Scenic Railroad Corridor ACEC

and the CTSR Corridor ACEC. Under the development scenario analyzed in the PEIS, visual contrast from solar energy developments in the SEZ would be expected to range from weak to moderate.

Figures 10.1.14.2-8 and 10.1.14.2-9 are three-dimensional perspective visualizations created with Google Earth depicting views of the SEZ (highlighted in orange) as seen from points on the CTSR. The visualizations include four simplified wireframe models of a hypothetical solar power tower facility. The models omit some facility components and are not intended to simulate the actual appearance of the landscape or of proposed utility-scale solar energy projects. They do provide useful information about the apparent size, distance, and configuration of the SEZ and the apparent size of a typical solar power tower project and its relationship to the surrounding landscape, as seen from this potentially sensitive visual resource area. The receiver tower depicted in the visualizations is a properly scaled model 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. The SEZ area is depicted in orange, the heliostat fields in blue.

Figure 10.1.14.2-8 depicts a view of the SEZ as it would be seen from the CTSR line approximately 2 mi (3 km) southwest of the depot at Antonito, and 2 mi (3 km) from the closest point in the SEZ. The nearest power tower is located approximately 3 mi (5 km) from the viewpoint, and the farthest power tower is located approximately 8 mi (13 km) from the viewpoint. The viewpoint is elevated approximately 55 ft (16.8 m) above the western edge of the SEZ. The visualization suggests that solar projects within the SEZ would generally be viewed against the backdrop of the Sangre de Cristo range but, depending on tower location and height, power tower receivers could potentially be visible above the peaks of the mountain range. Lower components, such as heliostats, solar trough and PV arrays, would be seen almost on-edge, repeating the line of the valley floor, and would be expected to occupy very little of the visual field.

Figure 10.1.14.2-9 depicts a view of the SEZ as it would be seen from the CTSR line approximately 8 mi (13 km) southwest of the depot at Antonito. The nearest power tower is located approximately 7 mi (11 km) from the viewpoint, and the farthest power tower is located approximately 10 mi (16 km) from the viewpoint. The viewpoint is elevated approximately 544 ft (165.8 m) above the western edge of the SEZ. The visualization suggests that solar projects within the SEZ would be viewed against the backdrop of the Sangre de Cristo range. Because of the distance and elevated viewpoint, even tall power tower receivers would be unlikely to be visible above the peaks of the mountain range from this location. The elevated viewpoint could allow for greater visibility of lower height facility components.

West Fork of the North Branch of the Old Spanish Trail. The West Fork of the North Branch of the Old Spanish Trail roughly parallels the western boundary of the proposed SEZ, passing to within approximately 0.1 mi (0.16 km) of the proposed SEZ at closest approach. The West Fork is visible as a blue dashed line near the western boundary of the SEZ in Figure 10.1.14.2-10. The viewshed analyses depicted in the figure indicate that the SEZ would be visible from many points along the trail starting approximately 9 mi (15 km) south of the SEZ to farther than 25 mi (40 km) north of the SEZ.

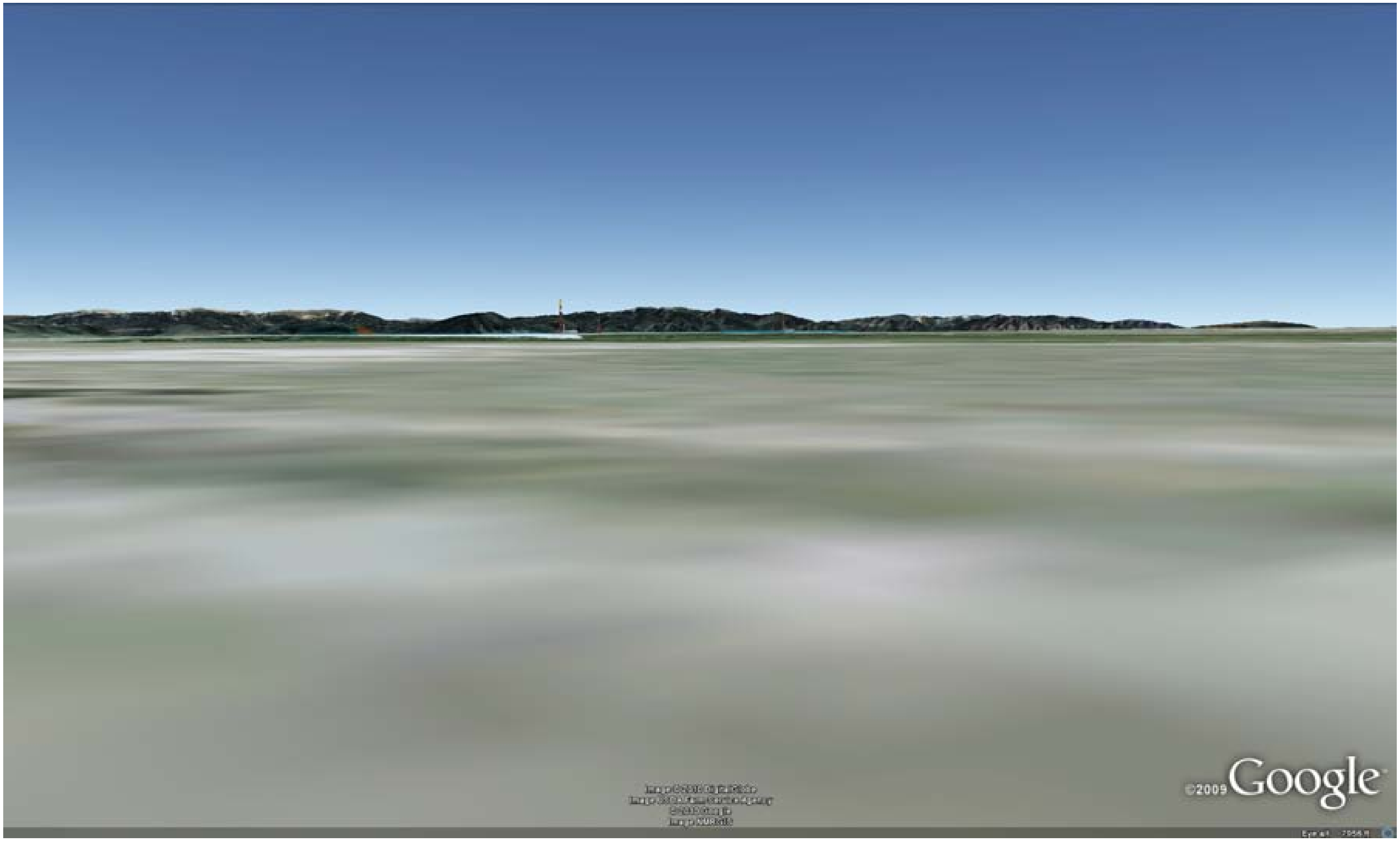

FIGURE 10.1.14.2-8 Google Earth Visualization of the Proposed Antonito Southeast SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the CTSR Approximately 2 mi (3 km) Southwest of the Depot at Antonito

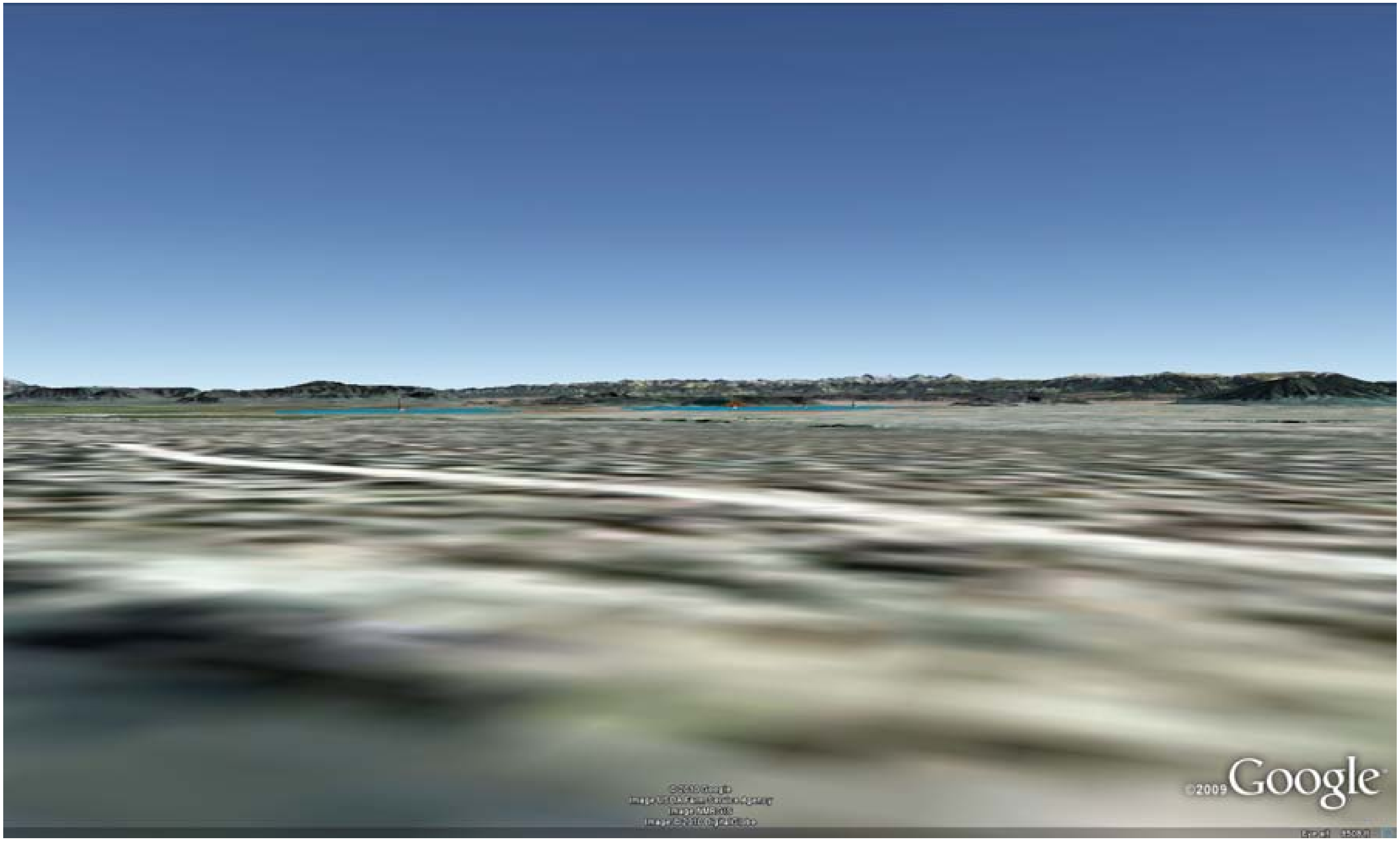

FIGURE 10.1.14.2-9 Google Earth Visualization of the Proposed Antonito Southeast SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the CTSR Approximately 8 mi (13 km) Southwest of the Depot at Antonito

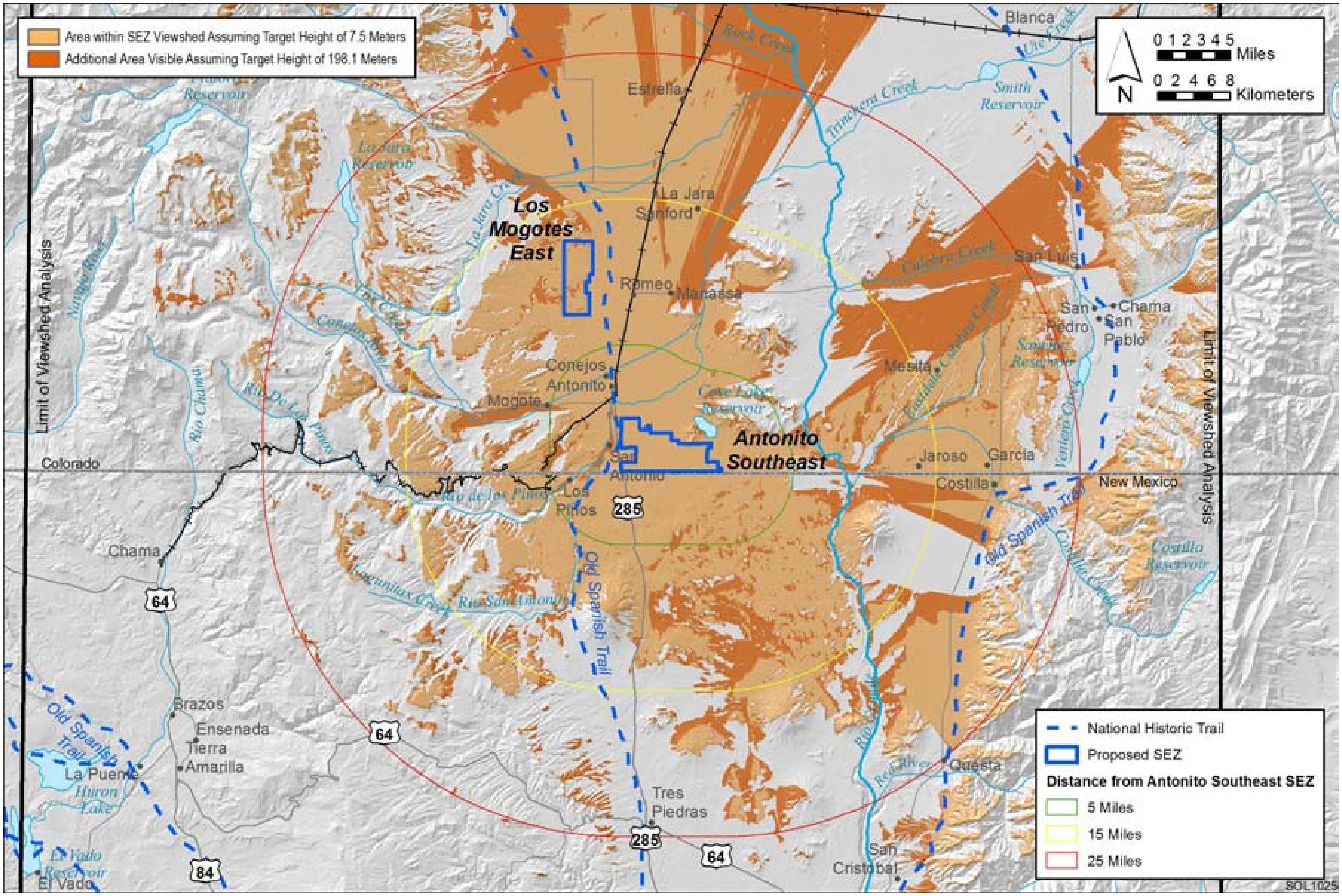

FIGURE 10.1.14.2-10 West Fork of the North Branch of the Old Spanish Trail in the Vicinity of the Proposed Antonito Southeast SEZ

U.S. 285 parallels the West Fork in the vicinity of the SEZ and constitutes a major cultural modification that would be visible to West Fork trail users in this area. The community of Antonito is located just north of the SEZ, and a variety of other cultural modifications typical of a rural setting are also visible in the area.

Trail users would have extended views of the Antonito Southeast SEZ as they approached and passed the SEZ. Away from the community of Antonito, the area is flat, with little or no possibility of screening from vegetation so that views of the SEZ are open. In the vicinity of Antonito, buildings and trees might screen much of the view of the SEZ from the trail. Where views are open, trail users distant from the SEZ would generally see solar facilities located near the western boundary of the SEZ close to the center of their field of view as they looked down the trail, causing weak visual contrasts with the surrounding landscape. As viewers approached the SEZ, the facilities would appear farther away from the center of the field of view looking down the trail. The facilities would appear larger and more detailed and would have greater contrast with their surroundings. Because of the very close approach of the West Fork trail to the SEZ (approximately 0.1 mi [0.2 km]), energy facilities located near the western boundary of the SEZ might be viewed in the immediate foreground for trail users and could potentially dominate views from the trail, creating strong visual contrasts with the surrounding landscape. There would be proportionally smaller visual impacts for facilities located farther from the western boundary of the SEZ.

The Los Mogotes East SEZ is relatively close to the Antonito Southeast SEZ (approximately 7 mi [11 km]). The West Fork of the North Branch of the Old Spanish Trail is located between the two SEZs, paralleling the western boundary of the Antonito Southeast SEZ and the eastern boundary of the Los Mogotes East SEZ. As a result, from some locations on the West Fork, both SEZs are within the field of view, or could be seen in succession as a viewer turned his or her head to scan the field of view. It is therefore possible that solar energy facilities in both SEZs could be visible simultaneously or in succession. However, the topography and viewing geometry are such that solar facilities in one of the two SEZs would be expected to cause much lower levels of visual impact than developments in the other SEZ, as viewed from most locations, due to its relative distance. Screening in some locations might also limit simultaneous viewing of both SEZs.

Figures 10.1.14.2-11 and 10.1.14.2-12 are Google Earth visualizations depicting views of the SEZ (highlighted in orange) as seen from points on the West Fork of the North Branch of the Old Spanish Trail. The visualizations include four simplified wireframe models of a hypothetical solar power tower facility. Heliostat fields are shown in blue.

Figure 10.1.14.2-11 depicts a view of the SEZ as it would be seen from the West Fork trail approximately 5 mi (8 km) southwest of the southwest corner of the SEZ. The nearest power tower is located approximately 7 mi (11 km) from the viewpoint, and the farthest power tower is located approximately 10 mi (16 km) from the viewpoint. The viewpoint is elevated approximately 370 ft (110 m) above the southwestern corner of the SEZ. The visualization suggests that solar projects within the SEZ would be viewed against the backdrop of the Sangre de Cristo range, and even taller power tower receivers would not likely be visible above the peaks of the mountain range. Lower components, such as heliostats or solar trough arrays,

FIGURE 10.1.14.2-11 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the West Fork of the North Branch of the Old Spanish Trail Approximately 5 mi (8 km) Southwest of the Southwest Corner of the SEZ

FIGURE 10.1.14.2-12 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the West Fork of the North Branch of the Old Spanish Trail Approximately 0.3 mi (0.445 km) from the Closest Point in the SEZ

would be seen almost on-edge, repeating the line of the valley floor. Less reflective objects, such as PV panel arrays, might be difficult to distinguish against the background. Taller solar facility components, such as transmission or cooling towers, or plumes (if present), would likely be visible as well, and their forms, lines, and colors could contrast noticeably with the strongly horizontal, regular geometry of the solar collector/reflector arrays,

Operating power towers in the closest part of the SEZ would likely appear as very bright non-point light sources atop towers with discernable structural details. They could strongly attract visual attention.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the trail and could attract visual attention. Other lighting from solar facilities in the SEZ could be visible as well.

Figure 10.1.14.2-12 depicts a view of the SEZ as it would be seen from the West Fork trail from a location directly west of the SEZ and approximately 0.3mi (0.5 km) from the closest point in the SEZ, looking northeast. The single power tower in this view is located approximately 1.3 mi (2.1 km) from the viewpoint. The viewpoint is elevated approximately 14 ft (4.3 m) above the western edge of the SEZ. The visualization suggests that solar projects within the SEZ would generally be viewed against the backdrop of the Sangre de Cristo range, but depending on tower location and height, power tower receivers could potentially be visible above the peaks of the mountain range. Lower-height facility components, such as heliostats or solar trough arrays, would be seen almost on-edge, repeating the line of the valley floor. But if lower-height components were located sufficiently close to the western boundary of the SEZ, they could be visible across much of the field of view. Facility details, such as the forms of individual structures and structure components, could be visible.

Operating power towers in the closest part of the SEZ would likely appear as brilliant white non-point light sources atop towers with clearly discernable structural details. They would strongly attract visual attention and could dominate views from this section of the trail.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the trail and could strongly attract visual attention. Other lighting from solar facilities in the SEZ could be visible as well.

Other impacts. In addition to the impacts described for the resource areas above, nearby residents and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) from their residences, or as they travel area roads. The range of impacts experienced would be highly dependent on viewer location, project types, locations, sizes, and layouts, as well as the presence of screening, but under the 80% development scenario analyzed in the PEIS, but from some locations, major visual contrast from solar development within the SEZ could potentially be observed.

10.1.14.2.3 Summary of Visual Resource Impacts for the Proposed Antonito Southeast SEZ

Under the 80% development scenario analyzed in this PEIS, there could be multiple solar facilities within the Antonito Southeast 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 be associated with solar energy development within the SEZ because of major modification of the character of the existing landscape. Additional impacts could occur from construction and operation of transmission lines and access roads within and/or outside the SEZ.

The SEZ is in an area of low scenic quality. Visitors to the area, workers, and residents of nearby areas 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.

Utility-scale solar energy development within the proposed Antonito Southeast SEZ is likely to result in strong visual contrasts for some viewpoints in the San Antonio WSA, which is located, 2.6 mi (4.3 km) west-southwest of the SEZ.

Moderate visual contrast levels would be expected for high-elevation viewpoints in the San Luis Hills WSA, located approximately 6 mi (10 km) northeast of the SEZ, and in the San Luis Hills ACEC, located about approximately 5 mi (8 km) from the SEZ.

Almost 38 mi (62 km) of Los Caminos Antiguos Scenic Byway is within the Antonito Southeast SEZ viewshed. Travelers on the byway would be likely to observe strong visual contrasts from solar energy development within the SEZ at some locations on the byway.

Portions of the CTSR Corridor and the CTSR Corridor ACEC are within the SEZ viewshed. Railroad passengers would be likely to observe moderate visual contrasts from solar energy development within the SEZ at some points on the railroad.

The West Fork of the North Branch of the Old Spanish Trail roughly parallels the western boundary of the proposed SEZ, passing to within approximately 0.1 mi (0.16 km) of the proposed SEZ. Trail users would be expected to observe strong visual contrasts from solar energy development within the SEZ at some points on the trail.

Where clear views to the SEZ existed, residents and visitors to the community of Antonito (about 1.5 mi [2.5 km] from the SEZ) could observe strong visual contrasts from solar facilities within the SEZ. Residents and visitors to Conejos (approximately 3 mi [5 km] north–northwest of the SEZ) would likely observe lower levels of contrasts.

Minimal to weak visual contrasts would be expected for some viewpoints within other sensitive visual resource areas within the SEZ 25-mi (40 km) viewshed.

10.1.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

The presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into non-industrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. However, the implementation of required programmatic design features presented in Appendix A, Section A.2.2, would reduce the magnitude of visual impacts experienced. While the applicability and appropriateness of some design features would depend on site- and project-specific information that would be available only after a specific solar energy project had been proposed, some SEZ-specific design features can be identified for the Antonito Southeast SEZ at this time, as follows:

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

- Within the SEZ, in areas visible from and within 1 mi (1.6 km) of the centerline of the West Fork of the North Branch of the Old Spanish Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives (see Table 10.1.14.3-1), as experienced from the trail, and in areas visible from between 1 and 3 mi (1.6 and 4.8 km), visual impacts should be consistent with VRM Class III management objectives. The VRM Class II impact level consistency mitigation would affect approximately 1,100 acres (4.5 km^2) within the western portion of the SEZ. The VRM Class III impact level consistency mitigation would affect approximately 3,250 additional acres (13.2 km^2).

- Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the CTSR ACEC, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from the ACEC. This VRM Class III impact level consistency mitigation would affect approximately 1,100 acres (4.5 km2) within the northwestern portion of the SEZ. The affected area is entirely within the acreage affected by VRM Class III impact level consistency mitigation for the West Fork of the North Branch of the Old Spanish Trail.

- Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the San Antonio WSA, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from the WSA. This VRM Class III impact level consistency mitigation would affect approximately 1,100 acres (4.5 km^2) within the southwestern portion of the SEZ. The affected area is entirely within the acreage affected by VRM Class III impact level consistency mitigation for the West Fork of the North Branch of the Old Spanish Trail.

TABLE 10.1.14.3-1 VRM Management Class Objectives

VRM Management Class Objectives	
Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Source: BLM (1986b).

Areas within the SEZ affected by these design features are shown in Figure 10.1.14.3-1. Because of the overlap in areas affected by the design features specified above, the total acreage affected by the design features is approximately 4,350 acres (17.6 km^2), or 44.7% of the total SEZ acreage. The acreage affected by VRM Class II impact level consistency is 1,100 acres (4.5 km^2), or 11.3% of the total SEZ acreage. The acreage affected by VRM Class III impact level consistency is 3,250 acres (13.2 km^2), or 33.4% of the total SEZ acreage.

Application of the SEZ-specific design features above would substantially reduce visual impacts associated with solar energy development within the SEZ.

The height of solar power tower receiver structures, combined with the intense light generated by the receiver atop the tower, would be expected to create strong visual contrasts that could not be effectively screened from view for most areas surrounding the SEZ, given the broad, flat, and generally treeless expanse of the San Juan Valley. In addition, for power towers exceeding 200 ft (61 m) in height, hazard navigation lighting that could be visible for very long distances would likely be required. Prohibiting the development of power tower facilities would remove this source of impacts, thus substantially reducing potential visual impacts on the CTSR, its depot, and the associated ACEC; the West Fork of the North Branch of the Old Spanish Trail; the other sensitive visual resource areas identified above; the community of Antonito; travelers

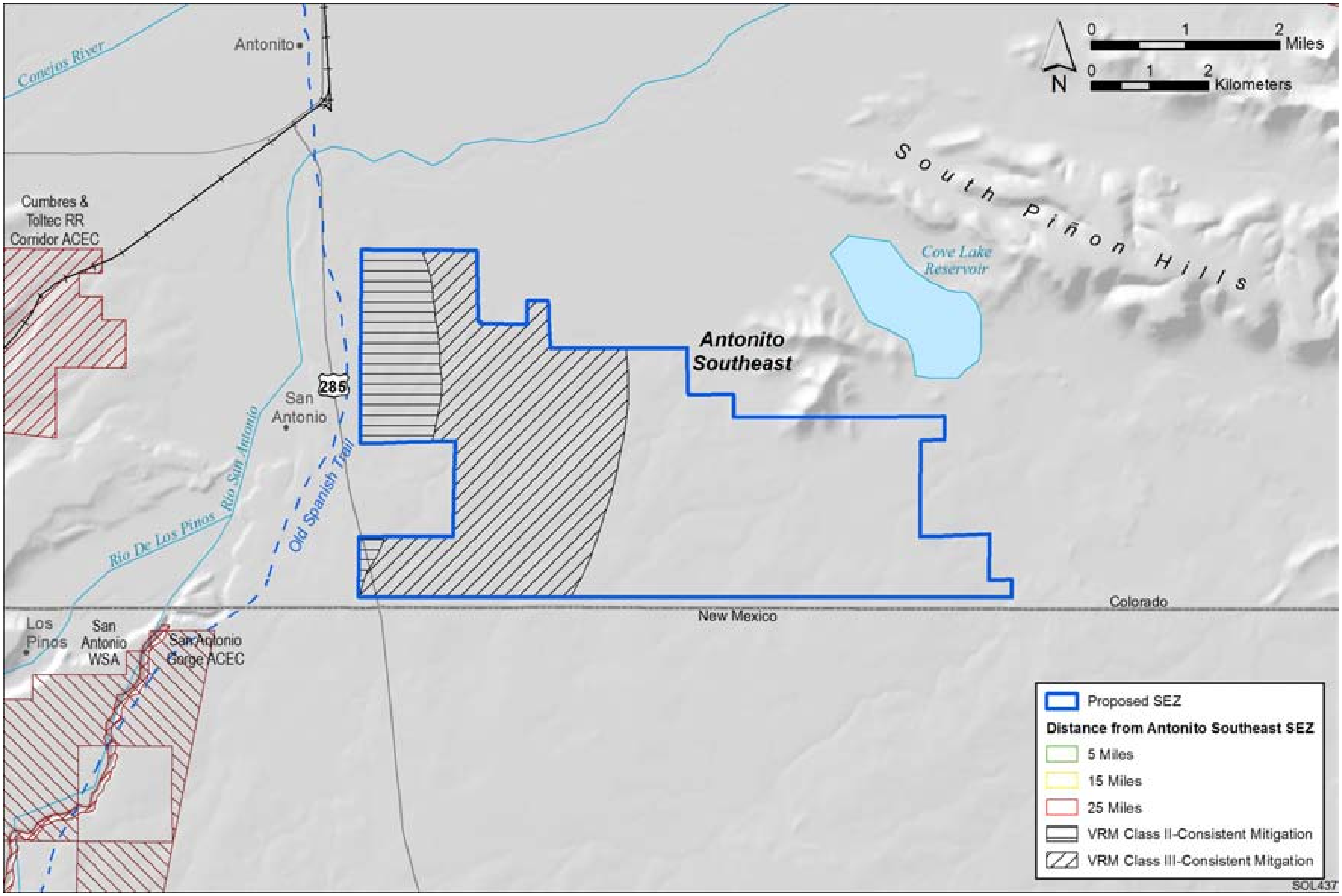

FIGURE 10.1.14.3-1 Areas within the Proposed Antonito Southeast SEZ Affected by SEZ-Specific Distance-Based Visual Impact Design Features

on U.S 285; and other residents and visitors to the San Luis Valley, a regionally important tourist destination.

Application of the distance-based design feature to restrict allowable visual impacts associated with solar energy project operations within 3 mi (5 km) of the West Fork of the North Branch of the Old Spanish Trail, the CTSR ACEC, and the San Antonio WSA would substantially reduce potential visual impacts on these resources by limiting impacts within the BLM-defined foreground of the viewsheds of these areas, where potential visual impacts would be greatest.

Implementation of the design features intended to reduce visual impacts (described in Appendix A, Section A.2.2, of this PEIS) 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.

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10.1.15 Acoustic Environment

10.1.15.1 Affected Environment

The proposed Antonito Southeast SEZ is in the south-central portion of Conejos County in south-central Colorado, which has no quantitative noise-level regulations. The State of Colorado, however, has established maximum permissible noise levels for the state by land use zone and by time of day, as shown in Table 4.13.1-1.

U.S. 285 lies to the west of and runs through the southwestern corner of the Antonito Southeast SEZ, while State Route 17 (heading westward from Antonito) runs as close as about 1.5 mi (2.4 km) to the northwest. There are some access roads to the SEZ. The nearest railroad runs as close as about 1.5 mi (2.4 km) to the northwest, and a railroad spur to the industrial facility exists about 0.3 mi (0.5 km) to the northwest. The nearest airport in Colorado is San Luis Valley Regional Airport, about 27 mi (43 km) north of the SEZ. Other nearby airports include Blanca Airport and Monte Vista Municipal Airport, which are located about 32 mi (51 km) northeast and north of the SEZ, respectively. There are several airports in northern central New Mexico; the closest one is Questa Municipal Airport, about 20 mi (32 km) southeast of the SEZ. Irrigated agricultural lands are present to the north and to the west. The SEZ has a long history of grazing (cattle and sheep) and is used as a winter range of mule deer, elk, and pronghorn. Several minerals and construction-related facilities are located to the northwest of the SEZ. A perlite plant is located next to the northwest border of the SEZ. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist around the Antonito Southeast SEZ. The nearest residences from the SEZ boundary are farms, located about 0.5 mi (0.8 km) to the north and the west. Although the small town of San Antonio is located directly west of the SEZ, the closest population center with schools or town infrastructure is Antonito, located about 2 mi (3 km) northwest of the SEZ. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal noise, industrial activities, and community activities and events. Another potential noise source is OHV use across the SEZ. The proposed Antonito Southeast SEZ is mostly undeveloped, the overall character of which is considered mostly rural to industrial in the northwest. To date, no environmental noise survey has been conducted around the Antonito Southeast SEZ. On the basis of the population density, the day-night average sound level (L_{dn} or DNL) is estimated to be 30 dBA for Conejos County, lower than 33 to 47 dBA L_{dn} typical of a rural area[11] (Eldred 1982; Miller 2002).

10.1.15.2 Impacts

Potential noise impacts associated with solar projects in the Antonito Southeast SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts associated with the operation of heavy equipment and vehicular traffic on the nearest

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[11] 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 daytime level, and it can be interpreted as 33 to 47 dBA (mean 40 dBA) during the daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

residences (within 0.5 mi [0.8 km] from the SEZ boundary) would be anticipated, albeit of short duration. During the operations phase, potential impacts on nearby residences would be anticipated, depending on the solar technologies employed. Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed Antonito Southeast 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 10.1.15.3). 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.

10.1.15.2.1 Construction

The proposed Antonito Southeast 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). Solar array construction would also generate noise, but it would be spread over a wide area.

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 are 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 the construction of the solar array would be lower than 95 dBA. When geometric spreading and ground effects are considered, as explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural background levels. In addition, mid- and high-frequency noise from construction activities is significantly attenuated by atmospheric absorption under the low-humidity conditions typical of an arid desert environment, and by temperature lapse conditions typical of daytime hours; thus noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur 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 residences closest to the northwest SEZ boundary, estimated noise levels at these residences would be about 50 dBA, which is higher than a typical daytime mean rural background level of 40 dBA. In addition, estimated 47 dBA L_{dn}[12] at these residences falls below the EPA guideline of 55 dBA L_{dn} for residential areas.

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

In addition, noise levels are estimated at the specially designated areas within a 5-mi (8-km) range of the Antonito Southeast SEZ, which is the farthest distance that noise (except extremely loud noise) would be discernable. There is only one specially designated area within the range where noise might be an issue: the San Antonio WSA in New Mexico, which is about 1.6 mi (2.6 km) southwest of the SEZ. For construction activities occurring near the southwestern boundary of the SEZ, the noise level is estimated to be about 37 dBA at the boundary of the San Antonio WSA, which is below the typical daytime mean rural background level of 40 dBA. Thus, construction noise from the SEZ is not likely to adversely affect wildlife at any of the nearby specially designated areas (Manci et al. 1988), as discussed in Section 5.10.2.

Depending on the soil conditions, pile driving might be required for the installation of solar dish engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively small and quiet, in contrast to the impulsive impact pile drivers frequently seen at large-scale construction sites. Potential impacts on neighboring residences would be anticipated to be minor, considering the distance to the nearest residence (more than 0.5 mi [0.8 km] from the SEZ boundary).

It is assumed that most construction activities would occur during the day, when noise is better tolerated, than at night because of the masking effects of background noise. In addition, construction activities for a utility-scale facility are temporary in nature (typically a few years). Construction would cause some unavoidable but localized short-term impacts on neighboring communities, particularly for activities occurring near the northern or western proposed SEZ boundary, close to the nearby 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 around 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 need to be constructed to connect to the nearest existing line located about 4 mi (6 km) north of the Antonito Southeast SEZ. Because of the short distance to the regional grid, such construction could be performed in a relatively short time (likely a few months). Construction sites along a new transmission line ROW would move continuously, and thus, no particular area would be exposed to noise for a prolonged period. The potential noise impacts on nearby residences along the transmission line ROW would therefore be minor and temporary in nature.

10.1.15.2.2 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 fire water 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. Dish engine technology, which employs collector and converter devices in a single unit, on the other hand, generally has the strongest noise sources.

For the parabolic trough and power tower technologies, most noise sources during operations would come from 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 corner of the SEZ, the predicted noise level from the power block would be about 45 dBA at the nearest residences, located about 0.5 mi (0.8 km) from the facility boundary, which is higher than 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[13]), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block area and thus would not be exceeded outside of the proposed SEZ boundary. At the nearest residences, about 44 dBA L_{dn} would be estimated, which is well below the EPA guideline level of 55 dBA L_{dn} for residential areas. However, day-night average sound 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 Antonito Southeast SEZ setting, the air temperature would likely increase with height (temperature inversion) because of strong radiative cooling. Such a temperature profile tends to focus noise downward toward the ground. There would be little, if any, shadow zone[14] within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions add to the effect of noise being more discernable during nighttime hours, when the background levels are the lowest. To estimate 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 noise levels estimated from the uniform atmosphere

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

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

(see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the nearest residences (about 1 mi [1.6 km] from the power block area for a solar facility located near the western or northern SEZ boundary) would be about 55 dBA, which is quite higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 56 dBA L_{dn}, which is a little higher than the EPA guideline of 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours, and no credit was given to other attenuation mechanisms; thus it is likely that sound levels would be lower than 56 dBA L_{dn} at the nearest residences, even if TES is used at a solar facility. Consequently, operating parabolic trough or power tower facilities using TES and located near the western or northern SEZ boundary could result in potential noise impacts on the nearest residences, depending on background noise levels and meteorological conditions.

With operation of a parabolic trough or power tower solar facility near the southwestern boundary of the SEZ, the estimated noise level would be about 40 dBA at the boundary of the San Antonio WSA, which is the same as the typical daytime mean rural background level. Thus, operation noise from a parabolic trough or power tower solar facility within the SEZ is not likely to adversely affect wildlife at any of the nearby specially designated areas (Manci et al. 1988).

In the permitting process, refined noise propagation modeling would be warranted along with measurement of background noise levels.

The solar dish engine is unique among concentrating solar power (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 Antonito Southeast SEZ, assuming a dish engine facility of up to 865-MW capacity (covering 80% of the total area, or 7,783 acres [31.5 km^2]), up to 34,600 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; the noise from these sources, however, 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 320 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 45 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both values are higher than the typical daytime mean rural background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residences, it was assumed that dish engines were placed all over the Antonito Southeast SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residences about 0.5 mi (0.8 km) from the SEZ boundary would be about 50 dBA, which is higher than the typical daytime mean rural background level of 40 dBA.

On the basis of 12-hour daytime operation, the estimated 47 dBA L_{dn} at these residences is below the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other attenuation mechanisms, noise levels at the nearest residences would be lower than the values estimated above. Noise from dish engines could cause adverse impacts on the nearest residences, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, the estimated noise level would be about 43 dBA at the boundary of the San Antonio WSA, which is a little higher than the typical daytime mean rural background level of 40 dBA. Thus, dish engine noise from the SEZ is not likely to adversely affect wildlife at any of the nearby specially designated areas (Manci et al. 1988).

Consideration of minimizing noise impacts is very important during the siting of dish engine facilities. Direct mitigation of dish engine noise through noise control engineering could also limit noise impacts.

During operations, no major ground-vibrating equipment would be used. In addition, no sensitive structures are located close enough to the Antonito Southeast SEZ to experience physical damage. Therefore, potential vibration impacts on surrounding communities and vibration-sensitive structures during operation of any solar facility 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 rarely be heard at nearby residences, assuming a 1-mi (1.6-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and another 0.5 mi [0.8 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the nearest residences would be minimal.

Regarding 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 towers would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of daytime and nighttime mean background levels in rural environments. Corona noise, which includes high-frequency components, is 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 Antonito Southeast SEZ is in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts on nearby residents from corona noise along the transmission line ROW would be negligible.

10.1.15.2.3 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 used for construction but on a more limited scale. Potential noise impacts on surrounding communities would be correspondingly lower than those for construction activities. Decommissioning activities would be of short duration, and their potential impacts would be minor and temporary. The same mitigation measures adopted during the construction phase could also be implemented during the decommissioning phase.

Similarly, potential vibration impacts on surrounding communities and vibration-sensitive structures during decommissioning of any solar facility would be lower than those during construction and thus minimal.

10.1.15.3 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 levels at nearest residences to the north and west 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 Antonito Southeast SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from nearby residences around the SEZ (i.e., the facilities should be located in the central or southeast 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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10.1.16 Paleontological Resources

The San Luis Valley is an alluvium-filled basin in the Southern Rocky Mountain physiographic province. The San Luis Basin is an intermontane structural depression within the Rio Grande rift zone. The valley is flanked by the Sangre de Cristo Range to the east, the San Juan Mountains to the west, and the San Luis Hills to the southeast. (See Section 10.1.7 for a more detailed description of the geological setting of the San Luis Valley.)

Little surveying for paleontological resources has been conducted in the San Luis Valley. The potential for paleontological resources to occur in the larger San Luis Resource Area (SLRA) was assessed in 1983 by K. Don Lindsey, the curator of paleontology at the Denver Museum of Natural History, for BLM planning purposes. Although several geological formations in the SLRA have produced fossils elsewhere in the region, such fossils have not been found to be abundant in the SLRA; this finding could possibly be due to a lack of sufficient sampling. Most SLRA fossils have been Paleozoic marine invertebrates and Tertiary vertebrates consistent with the types of sedimentary rocks found in the area (Lindsey 1983; see Table 4.14-2 for the ages of geologic units).

The valley is filled with Quaternary stream deposits, gravels, and alluvial fans overlying volcanic debris and interbedded basalt flows of the Alamosa and Santa Fe Formations. Lindsey (1983) states that the total thickness of these deposits in the northern part of the valley is estimated 19,000 to 30,000 ft (5,971 to 9,144 m).

The western part of the valley is tertiary volcanic tuffs, flows, and breccias. These deposits are not expected to contain significant paleontological resources (Lindsey 1983), and they have been classified as PFYC Class 1. (Section 4.14 has a discussion of the potential fossil yield classification [PFYC] system.)

The Santa Fe Formation is the basal formation of the valley and dates back to between the Miocene and Pleistocene. In some parts of the valley, it can be 5,000 ft (1,524 m) thick. The only fossils recovered from this layer have been from deep wells, and they have been fragmentary and of little research value. Several Pliocene and Pleistocene vertebrates were found in a similar context in New Mexico (Lindsey 1983); thus, the potential for significant resources exists. The PFYC for this formation is Class 4/5 in New Mexico; however, in Colorado the BLM classifies these deposits as Class 3, indicating that the potential for the occurrence of significant fossil materials is currently unknown and needs to be investigated further.

The Alamosa Formation has yielded Pleistocene—Pliocene mammal species, such as *Equus scotti*, *Camelops*, and *Microtus*, as well as a number of herpetofauna, birds, fish, mollusks, ostracods, and bryozoans. Although there are only a few outcrops of the Alamosa Formation in the San Luis Valley, one such outcrop, which is about 40 ft (12 m) thick, is located at Hansen's Bluff in Alamosa County, southeast of the town of Alamosa (Lindsey 1983). This formation is classified as PFYC Class 4/5. A recent report by the U.S. Forest Service indicates that exposures of the Alamosa Formation may also occur in the San Luis Hills (Dyer 2009).

Quaternary deposits (alluvial fans, terrace gravels, and loess) overlie the Alamosa Formation extensively throughout the valley. Vertebrate fossils are possible but, when found, are typically fragmentary and of little use for determining age (Lindsey 1983). Several mammoth sites have been reported in the valley (Martorano et al. 1999). These sites have been of greater interest to archaeologists than paleontologists because of potential associations with Paleoindian artifacts (see Section 10.3.17.1). The bones found to date have been highly fragmented and badly deteriorated (Martorano et al. 1999). Although Lindsey classifies the fossils as Condition 3 (PFYC Class 1), they are categorized by the BLM as Class 4/5 because of the potential for significant resources in the underlying Alamosa Formation. Some Quaternary gravels are classified by the BLM as PFYC Class 3.

10.1.16.1 Affected Environment

The proposed Antonito Southeast SEZ is covered predominantly by Tertiary basalt flows and associated tuff, breccia, and conglomerate (classified as Tbb on geologic maps). Of the entire 9,598-acre (38.84-km^2) area of SEZ land, 9,594 acres (38.82 km^2) or 99.99% is composed of this volcanic deposit. The PFYC for Tbb is Class 1, which indicates that the occurrence of significant fossil materials is nonexistent or extremely rare. No paleontological resources are known in the SLRA from this type of surface geology. Less than 0.01% of the SEZ (specifically, 4 acres [0.016 km^2] or 0.00004% of the SEZ) is composed of unclassified Quaternary surface deposits overlying the Alamosa Formation (classified as QTsa on geologic maps). This small area is at the northern boundary of the SEZ. The PFYC for QTsa is Class 4/5 (on the basis of the PFYC map from the Colorado State Office; see Murphey and Daitch 2007), although no known paleontological resources from these deposits in the San Luis Valley have been recorded (Lindsey 1983). As stated in Section 10.1.16, the nearest identified exposures of the Alamosa Formation are located in the San Luis Hills. Most areas immediately adjacent to the Antonito Southeast SEZ are also Tbb deposits and are unlikely to contain significant fossils. The exception would be the areas immediately north and east of the 4-acre (0.016-km^2) parcel of Quaternary surface deposits, which is also composed of QTsa deposits and is PFYC Class 4/5.

10.1.16.2 Impacts

Few, if any, impacts on significant paleontological resources are likely to occur in the proposed Antonito Southeast SEZ. However, a more detailed look at the local geological deposits and their depth is needed to verify that the assignment of a PFYC of Class 1 is valid by determining whether the Alamosa Formation is exposed and whether paleontological resources are present at the surface. Also, the depth to the Alamosa Formation should be determined within the 4-acre (0.016-km^2) parcel to identify whether the application of mitigation measures might be necessary in that specific PFYC Class 4 or 5 area to avoid the potential for adverse effects.

Indirect impacts on paleontological resources, such as looting or vandalism, north of the SEZ in areas classified as PFYC Class 4 or 5 are unknown, but not likely if the Alamosa Formation is not exposed at the surface. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

No new roads are anticipated to be needed to access the Antonito Southeast SEZ, but approximately 4 mi (6 km) of transmission line is anticipated be needed to connect to the nearest existing line. Areas of both PFYC Class 1 and Class 4/5 could be affected. No impacts on paleontological resources are anticipated in areas of PFYC Class 1 deposits related to a new ROW. In areas of PFYC Class 4/5, the depth to the Alamosa Formation should be determined to identify whether the application of mitigation measures might be necessary in that area to avoid the potential for adverse effects (both direct and indirect) related to construction within the ROW. Possible impacts from solar energy development on paleontological resources that are encountered within the SEZ or along related ROWs, as well as general mitigation measures, are described in more detail in Section 5.14.

10.1.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. A SEZ-specific design feature is as follows:

- Avoidance of PFYC Class 4 or 5 areas is recommended for development within the Antonito Southeast SEZ (i.e., the 4-acre [0.016-km^2] parcel in the north part of the SEZ) and for transmission corridor placement. Where avoidance of Class 4 or 5 deposits is not possible in order to connect to existing transmission, a paleontological survey or monitoring may be required by the BLM.

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10.1.17 Cultural Resources

10.1.17.1 Affected Environment—San Luis Valley

The San Luis Valley is rich in cultural history with documented evidence of human occupation extending as far back as 11,000 years. The valley is at the headwaters of the Rio Grande and is flanked by the Sangre de Cristo Range to the east, the San Juan Mountains to the west, and the San Luis Hills to the southeast.

Various geographic features located in the valley or seen from the valley have cultural significance. Blanca Peak (also called Mount Blanca, Sierra Blanca, and White Shell Mountain) is the highest peak in the Sangre de Cristo Range at 14,345 ft (4,372 m). It is the fourth-highest peak in Colorado. It is thought to be a sacred mountain and could be the place the Navajo refer to as Sisnaajini, or the Sacred Mountain of the East, one of the four sacred mountains of the Navajo (Simmons 1999; BLM 2009c).[15] The Great Sand Dunes, located at the base of the Sangre de Cristo Mountains, are also considered sacred by a number of different Tribes. They are the highest inland sand dunes in the United States and have been designated a National Park and Preserve.[16] Languages of both the Ute and Jicarilla Apache Tribes have words referring to these dunes near where they historically camped and hunted (NPS 2009a). Water features in the valley, consisting of several streams, a shallow water table producing marshy areas and shallow ponds, and natural springs, played a significant role in human use of the area despite the low annual rainfall it receives (Simmons 1999). The water features supported abundant game and waterfowl and eventually irrigation practices to promote agriculture and settlement in the valley. The San Luis Lakes could also be the location of a mythical emergence place based on Upper Rio Grande Pueblo (Tewa) oral histories (Simmons 1999), such as that of the Santa Clara Pueblo in New Mexico; their creation story begins near sand dunes to the north. These and other topographic features of the valley, along with an elaborate trail system established prehistorically, and various natural resources, such as mineral resources (gold, turquoise), flora, and fauna, would be important factors for prehistoric and historic settlement in the valley.

10.1.17.1.1 Prehistory

The earliest peoples known to have used resources present in the San Luis Valley are from the Paleoindian Era, dating from between roughly 12,000 years before present (B.P.) to 7,500 years 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 relatively smaller game animals and continued their reliance on wild plant foods as the larger megafauna became extinct. In Colorado, no evidence of sites earlier than

[15] Wheeler Peak, Abiquin Peak, Pedernal Peak, and Pelado Peak have also been mentioned as possible alternative locations (TwinRocks 2009).

[16] The Great Sand Dunes were designated a National Monument in 1932 and a National Park and Preserve in 2000.

approximately 11,200 B.P. have been identified (Martorano et al. 1999). The San Luis Valley has the highest density of Paleoindian finds in Colorado. Distinctive Paleoindian projectile points from the Clovis, Folsom, and Plano periods have been found in the valley (Guthrie et al. 1984; Martorano et al. 1999). Sites dating to the Paleoindian Era are typically represented throughout the state by isolated surface finds of single projectile points. However, bison kill sites have been recorded in the San Luis Valley. Folsom points in association with ancient bison (*Bison antiquus*, *Bison taylori*) remains are present at some of the more significant sites in the valley, such as those recorded in the northeast portion of Alamosa County[17] (Guthrie et al. 1984; Martorano et al. 1999). In addition to bison, other animals of interest to Paleoindian hunters as well as later populations in the valley and surrounding mountains included elk, mountain sheep, and mule deer. It is postulated that proximity to Pleistocene water sources and animal migration routes were primary factors in site location for camps and activity areas during this time (Guthrie et al. 1984; Martorano et al. 1999).

About 7,500 years B.P., the Archaic Era takes hold, as evidenced by changing subsistence patterns and associated tool production. The projectile points found 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 Archaic (7,500 to 5,000 years B.P.) sites are present in the San Luis Valley. Many of these sites are located near the Rio Grande and contain characteristic tools made of local basalt (Guthrie et al. 1984). Continued use of the valley is documented by Middle Archaic (5,000 to 3,000 years B.P.) sites in Saguache County and in the northern portion of the valley. Late Archaic Period (3,000 to 1,500 years B.P.) sites have been recorded throughout the valley as indicated in results from a surface survey of the Blanca Wildlife Refuge (Dick 1975, as cited in Guthrie et al. 1984),[18] a 1980 Closed Basin survey of a conveyance channel in Alamosa and Saguache Counties (Button 1980), and, in Conejos County, a survey of the La Jara Reservoir area (west of the Los Mogotes SEZ) for the Baca Land Exchange (Wells 2008). It is unclear based on the archaeological evidence when the Archaic Period classification should end as the lifestyle appears to continue throughout the Late Prehistoric Period.

The period between A.D. 500 and 1300 has been referred to as the Formative Era, which in most cases includes the presence of agriculture and sedentary villages. In the San Luis Valley a more Archaic lifestyle of hunting and gathering probably continued during this time, also known as the Late Prehistoric Period. However, although sufficient evidence of agriculture and village life does not appear in San Luis Valley, some influences from Formative groups in the surrounding areas did occur. Several sites dating to this time period are known in the San Luis Valley. Evidence includes the presence of ceramics, corn, and smaller projectile point sizes suggesting use of the bow and arrow (Martorano et al. 1999). Specifically, Pueblo ceramics, Northern Rio Grande ceramics, and Woodland ceramics characterize sites from this period within the valley, as well as diagnostic corner-notched points. Two rockshelters recorded in the

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[17] Linger, Zapata, and Stewart's Cattle Guard sites; Reddin site also in Saguache County (Guthrie et al. 1984; Martorano et al. 1999).

[18] A more recent context developed for the Rio Grande Basin in Colorado, Martorano et al. (1999), does not discuss the Early, Middle, or Late stages of the Archaic period for reasons of insufficient dated components and a lack of associated artifact assemblages as so far found in the basin.

region contained remnants of corn (Guthrie et al. 1984). The majority of known sites in the region dating to this period have been recorded near the San Luis Lakes and Great Sand Dunes in Alamosa and Saguache counties. Fewer sites have been identified in Conejos County; those that have been found are located along drainages or the bases of the San Juan Mountains or the Sangre de Cristo Range (Martorano et al. 1999).

10.1.17.1.2 Ethnohistory

Inhabitants of the valley during a transitional time between the Late Prehistoric Period and the beginning of Spanish contact (A.D. 1300 to 1600) would primarily include the Utes, nomadic bands of hunters and gatherers traveling in small groups foraging for food. Similar to the Formative or Late Prehistoric period, diagnostic artifacts include corner-notched points and some ceramics. Seasonal hunting was likely the predominant use of the valley, rather than year-round residency. The Apache[19] also claimed portions of the valley as their territory. Once the Ute and Apache started interacting with the Spanish, they obtained horses to help them hunt buffalo, trade goods, and fight (see below for a more detailed discussion of the Ute and Jicarilla Apache). Other Native American groups that likely visited the area during this time are the Navajo, Kiowa, Comanche, Arapaho, Pueblo people (mostly northern Pueblo groups) (BLM 2009c), and Cheyenne (Martorano 1999). Artifacts indicative of this period in the Rio Grande Basin include Euro-American trade goods, such as guns, metal projectile points and knives, and metal cooking pots; projectile points for use with a bow and arrow; glass artifacts, such as flaked glass and beads; wickiups; and brown ware ceramics. Other features of archaeological interest include culturally peeled trees and rock art depicting horses (Martorano et al. 1999).

Native American human skeletal remains have been found in the San Luis Valley, including several burial sites in Saguache and Alamosa Counties (Martorano et al. 1999).

Ute

Speakers of a dialect of Southern Numic, the Ute ranged from Utah's Oquirrh Mountains in the west to the Front Range in Colorado in the east (Callaway et al. 1986). Those who ranged primarily in Colorado are often classified as eastern Ute. Prior to their enforced settlement on reservations, the Ute led a mobile lifestyle. Groups centered on nuclear families followed a seasonal round, hunting and gathering in the various habitats that their range provided them as resources became available throughout the year. Family groups would join one another or hunt and gather separately depending on the abundance of the resource sought. They were loosely organized into regional groups or bands, whose composition continually fluctuated. These groups tended to prefer the upper basins of river drainages, which provided access to a wider range or resources. The Capote band was resident in the San Luis Valley as early as the eighteenth century, while their eastern neighbors, the Moache, are likely to have exploited the resources of the valley as well (Baker et al. 2007). In general, hunting grounds were open to all

[19] The Jicarilla Apache are most commonly associated with the San Luis Valley.

Ute groups, although etiquette demanded that local groups be consulted before hunting or gathering in their territory. Typical Ute dwellings were conical wickiups constructed of wooden poles. Camps also included brush structures and ramadas (Callaway et al. 1986); however, wickiups recorded in the San Luis Valley are scarce, suggesting an early change there to the tepee (Baker et al. 2007).

Beyond hunting and gathering, the Ute had trading and raiding relationships with neighboring tribes, including the Pueblos to the south, whom they supplied with buckskin. With the arrival of the Spanish in New Mexico, this relationship was easily extended to them. Located at the southern extent of the Ute range, the Capote would have been among the first Utes to encounter Spanish colonists and explorers. By 1765 when Juan Rivera made the first recorded exploration into the Ute heartland, the Ute were already engaged in down-the-line trade for Spanish goods, both from New Mexico and via Plains tribes from Mexico itself. Between their mobile lifestyle and trading expeditions, a network of foot trails extended throughout Ute territory and beyond (Baker et al. 2007).

The arrival of the Spanish in the early to mid-sixteenth century marked the beginning of an important change in Ute lifestyle. The Ute were anxious to obtain Spanish metal goods and were introduced to the horse. Until the introduction of the horse, dogs were the only beasts of burden known to the Ute. That which was not packed on dogs was carried, and travel was on foot. The incorporation of the horse was neither immediate nor universal, since many parts of Ute territory lacked forage. The Capote, however, being close to the Spanish, likely adopted the horse earlier and to a greater extent than many other bands along with a veneer of Plains horse culture. Horses allowed the Ute to range farther and to gather in larger numbers for short periods. Larger groups fostered the spread of new diseases introduced by the Spanish. The Ute were participants in the slave trade with the Spanish colonies, both as slaves and as slavers. The horse gave them an advantage over neighboring tribes and was one of the objects of the trade. Utes were among the *genizaros*, Native American captives forcibly taught a sedentary lifestyle by the Spanish (Baker et al. 2007).

Mexican independence in 1821 brought an increased Hispanic presence including traders and settlers in San Luis Valley. The Utes profited from the increased trade. Shortly thereafter, Euro-American trappers entered Ute territory from the north and east. The desire for furs increased the pressure on the wildlife that upon which the Ute depended. With the Treaty of Hidalgo in 1848 ending the Mexican War, Ute territory passed into the hands of the United States. The discovery of gold in eastern Colorado attracted settlers from the organized states. Immigration increased after the end of the Civil War. The disbanding of the huge armies of the north and south sent many veterans westward. Throughout the latter half of the nineteenth century, Euro-Americans in Colorado clamored for the removal of the Utes (Baker et al. 2007).

A Ute reservation was established in northeastern Utah in 1861, and much of western Colorado was included in a second reservation in 1868. There were significant reductions in the Colorado reservation in 1874 and 1880, when most Utes were required to move to reservations in northeastern Utah. The last remnants of the Colorado reservation are the Southern Ute and Ute Mountain Ute reservations in southwestern Colorado. The descendants of the Moache and

Capote Bands are located on the Southern Ute Reservation (Callaway et al. 1986; Simmons 2000).

Jicarilla Apache

The Jicarilla Apache group is one of six Southern Athapaskan or Apachean groups who arrived in the Southwest sometime between A.D. 1300 and 1500 (Tiller 1983). Primarily hunters and gatherers, their traditional range included northeastern New Mexico as far south as modern Mora and as far north as the Arkansas River in Colorado. While their hunting activities extended well into the plains east of the Rockies, their home ranges and base camps were in the mountains of northern New Mexico (Opler 1936). Their loosely organized matrilineal groups may be divided into two bands: the Olleros, or potters, ranged west of the Rio Grande and the Llanos, or plainsmen, to the east. The hunting and gathering range of each group included parts the San Luis Valley (Tiller 1983). Poised between the plains and pueblo cultures, they were influenced by each, while retaining an Apachean cultural foundation with mythology and ritual similar to that of the Navajo. The Ollero groups, the only groups to produce pottery, were more likely to include agriculture in their substance base and lived in flat-roofed rancherias, whereas the Llano groups relied less on horticulture and adopted the horse, tepee, and travois while on the plains and domed brush-covered structures when in the mountains. Like other Apaches, they traditionally saw the natural world as suffused with supernatural power. Natural features and phenomena are seen as expressions of that power. Individuals could receive power from animals, natural phenomena, or celestial bodies. Prominent physical features could be places of power and supernatural instruction (Opler 1936; Tiller 1983).

The Spanish entered New Mexico soon after the Jicarilla. While their relations with the Jicarilla were not always peaceful, by the seventeenth and eighteenth century, pressure from the Comanches, who obtained firearms from the French, caused the Spanish and Jicarilla to join forces in common defense. Once Mexico gained its independence, the new government encouraged settlement on its northern frontier and issued land grants in northern New Mexico without regard to Jicarilla presence or territory. With the acquisition of New Mexico and Colorado by the United States as a result of the war with Mexico, Mexican land grants were respected, but Jicarilla territorial claims ignored. Increasing American settlement encroached upon the traditional Jicarilla lifeway, resulting in raiding by the Apaches and retaliation by the United States Cavalry, which established Fort Massachusetts in the San Luis Valley. An initial attempt in 1873 to establish a reservation for the Jicarilla near the headwaters of the San Juan River was unsuccessful, as was an 1883 attempt to settle the Jicarilla with the Mescalero Apache. In 1887 a reservation was established somewhat east of their traditional range straddling the continental divide in the mountains of northern New Mexico. Little of this land was suitable for agriculture, and most agricultural lands and water rights that existed had already been taken by homesteaders. Initial attempts at raising sheep were enhanced by the addition of lower elevation lands in 1907 for winter pasturing. Raising sheep aided tribal finances, and the Jicarilla were able to organize in 1937 under the Indian Reorganization Act. In the 1950s, revenues from gas and oil resources on tribal lands began to supplement revenue from livestock. Increasingly the Jicarilla population congregated at Dulce, New Mexico, the center of tribal government, and emphasis shifted from stock raising to wage labor. By the 1960s, reliance on traditional gathering activities was limited. Identification with the former bands was diminished, replaced by identification with the tribe as a whole (Tiller 1983).

10.1.17.1.3 History

In 1598, Don Juan de Oñate took possession of New Mexico, including the San Luis Valley, for King Phillip II of Spain. The process by which the Spanish expanded across the frontier was through the issuance of land grants by the Spanish government. The San Luis Valley was initially administered by Spaniards in New Mexico but was designated *La Tierra de los Indios* (i.e., Indian Lands), so it was not initially authorized for Spanish settlement. Nevertheless, exploration, hunting, prospecting, and trading were being conducted in the valley. Interactions between the Utes and the Spaniards/New Mexicans varied in outcome: friendly encounters resulted in trade of horses, food, and material goods and access to Indian trails; less-than-friendly encounters, in raids, thefts, and enslavements. Various raids and attacks were also occurring during this time among the various Native American tribes.

Lieutenant Zebulon Pike can probably be credited as the first American explorer of the valley. He traversed the area in 1807 in search of the Red River, the perceived boundary between the United States and Spanish territories. He and his men built a fort along the Conejos River (mistaking it for the Red River) and raised a U.S. flag on land that he later found to be within Spanish territory (as he was escorted by Spanish soldiers to Spain's capital city, Santa Fe) (Bean 2001). Pike's Stockade, the first official fort in the region, is a National Historic Landmark, in addition to being listed in the *National Register of Historic Places* (NRHP) and is located several miles northeast of the Antonito Southeast and Los Mogotes East SEZs.

Numerous trading forts emerged to support the fur-trapping industry in the 1830s and 1840s. Utes were given guns and whiskey in exchange for livestock they had stolen from the New Mexicans; resistance to settlement continued. Three land grants were approved by the Mexican government[20] for the San Luis Valley between 1821 and 1845. Numerous attempts at settlement between 1840 and 1850 failed, and resistance from Ute Indians forced settlers out of the area on several occasions. In 1846 the Mexican-American War broke out, and no attempts at settlement in the region were made. At the close of the war, the land was purchased by the United States, and the New Mexicans became American citizens under the 1848 Treaty of Guadalupe Hidalgo. The first official non-Indian permanent settlement in Colorado, San Luis de la Culebra, was not established until 1851. San Luis is considered the oldest continually occupied town in Colorado and is located in the southeast corner of the San Luis Valley. Hispanic farmers and ranchers continued settling in the region throughout the 1850s, establishing a rich cultural heritage in the region that continues today. Several traditions have endured in the San Luis Valley, related to the Hispanic culture, specifically art, language, architecture, and farming techniques. The use of *acequias*, an historic communal irrigation system of canals, and the use of *la vega*, a communal grazing area, are still maintained today (BLM 2009c).

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[20] Mexico won its independence from Spain in 1821.

The U.S. military established Fort Massachusetts in 1852 to help the new settlements survive. This fort was poorly located at the foot of Mt. Lindsey and was not in use for very long (BLM 2009e). A second fort, Fort Garland, was built further to the south and served the area for 25 years in support of westward expansion. A notable resident was Kit Carson, who served as commander of the fort near the end of his career. Carson was instrumental in working with Ute Chief Ouray to ensure nonviolent settlement in the area. Men from Fort Garland also served in the only Civil War battle to take place in the West, at Glorietta Pass, to drive back Texas confederates. Buffalo Soldiers, African-American soldiers named as such by the Cheyenne, also served at Fort Garland between 1876 and 1879 (BLM 2009e).

In 1861, the area became part of the Colorado Territory, and Colorado achieved statehood in 1876. The ethnic and religious diversity of the valley continued to expand. Anglo settlers moved in under the Homestead Act of 1862. After 1870 Mormons also began settling in the valley. Cattle ranching on large tracts of land became the trend in the 1880s. Railroads established during the same decade brought waves of immigrants to the West. The next wave of settlement was in the 1920s with the arrival of Japanese-American tenant farmers in the valley (BLM 2009e).

Trails and Rails

Trails used by the early inhabitants of the valley did not go unnoticed by later visitors. It is likely that some trails started as migration routes used by large animals, including natural travel corridors along streams (Martorano et al. 1999). Not surprisingly, early hunters used the paths to track game for food and hides. Later, the same paths became conduits for trade. One trail system used throughout the history of the San Luis Valley, known as the Old Spanish Trail, was part of a much larger system of trails extending across several western states. Additional local paths through the area were also utilized for a long time by prehistoric peoples, Native Americans, explorers, trappers, military scouts, miners, and settlers. Two forks of the North Branch of the Old Spanish Trail are present in the San Luis Valley. The East Fork straddles the base of the Sangre de Cristo Mountains before cutting west across the valley to head through a pass west of Saguache. The West Fork follows the base of the San Juan Mountains from New Mexico through Antonito and north to Saguache. The wetlands in the valley restricted movement through the interior. By the time of European exploration, many of the paths were well-established and continued to be used. The Old Spanish Trail was likely used by Don Diego de Vargas in 1694, Juan Batista de Anza in 1779, Lieutenant Zebulon Pike in 1807, fur trapper Jacob Fowler in 1822, trapper Kit Carson throughout the 1830s and 1840s, several government expeditions between 1849 and1853 (by John C. Fremont and Captain John Gunnison), and sheep herders in the 1850s to get sheep to the California Gold Rush camps. By the 1870s many of the trails had turned into well-worn wagon roads (Old Spanish Trail Association 2007). The East Fork, which runs near the proposed Fourmile East and DeTilla Gulch SEZs, was congressionally designated in 2002 as part of the National Historic Trail system under the National Trail System Act. The West Fork, whose path is near the proposed Antonito Southeast and Los Mogotes East SEZs, is not currently part of the National Historic Trail system but is undergoing evaluation for possible inclusion.

During the late nineteenth century, the Denver & Rio Grande Railroad (D&RG) heavily affected the cultural landscape of the valley. It was established in the 1870s when General William Jackson Palmer decided to try narrow-gauge tracks in the West to maneuver through the Rocky Mountains and steep passes in the Colorado Territory. His idea was very successful and spurred tremendous expansion and economic growth. Railroad towns, like Alamosa and Antonito, emerged in the San Luis Valley with a whole host of businesses to support them (restaurants, saloons, gambling establishments, bordellos, and so on). Mining, ranching, and agricultural markets expanded because of the new accessibility. The San Juan extension of the D&RG became known as the Cumbres & Toltec Scenic Railroad and is important for aiding in the establishment of the major Colorado towns of Durango and Silverton. The line, which runs to Chama, New Mexico, was taken out of regular passenger service in 1951. The Cumbres & Toltec Scenic Railroad is listed in the NRHP and is a tourist attraction for the area. Portions of the line near Antonito have also been designated as an ACEC to be managed by the BLM to protect its historical and scenic values. Another spur of the D&RG in the San Luis Valley was the D&RG Western line at Antonito, which became known as the Chili Line. The Chili Line was taken out of service and was dismantled in the 1940s (*Time* 1941).

National Register of Historic Places

Within Alamosa, Conejos, and Saguache Counties, where the four proposed SEZs are located, 29 properties are listed in the NRHP (14 in Alamosa County, 9 in Conejos County, and 6 in Saguache County). The majority of these properties are related to town (churches, courthouses, schools, stores, banks) and railroad (railcars, depots, tracks) development. Other property types include bridges, homesteads/ranches, forts, and archaeological sites. The Superintendent's Residence for the Great Sand Dunes National Park is also listed. Pike's Stockade is a National Historic Landmark, and the NRHP-listed Cumbres & Toltec Scenic Railroad is currently being nominated for National Historic Landmark status.

Of additional note related to historic properties in the San Luis Valley, the Los Caminos Antiguos Scenic and Historic Byway was established by the Colorado Scenic and Historic Byways Commission to provide visitors a glimpse of exceptional scenic, historic, cultural, recreational, and natural features present within the valley. Also related to the cultural heritage of the region, the Sangre de Cristo NHA was created in 2009. The heritage area encompasses Alamosa, Conejos, and Costilla Counties; management implications of the heritage area are not yet clear (Section 10.1.3).

10.1.17.1.4 Traditional Cultural Properties—Landscape

Traditional cultural properties of significance to the Ute, Apache, Navajo, Kiowa, Arapaho, Comanche, Cheyenne, and Pueblo ancestral groups could be present in the valley. 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 10.1.18 on Native American Concerns and Chapter 14 and Appendix K for a summary of government-to-government consultations for this PEIS).

Identification of traditional cultural properties may be considered sensitive and therefore may not be fully described or disclosed in this PEIS.

Potential types of traditional cultural properties for the Navajo, Ute, and Tewa Clans of the Upper Rio Grande Pueblos are identified by Spero and Martorano (1999). The Navajo may consider natural features (such as mountains, canyons, springs, and areas containing significant plant species, clay sources, or minerals) and archaeological sites, such as battlefields, quarries, hunting traps, and other site types containing rock art, various types of cairns or stone caches, and certain artifacts, as culturally significant places. Blanca Peak has been identified as an important mountain of the Navajo, and protection of gathering rights for plants, soil, and spring water for ceremonies is an important concern (Spero and Martorano 1999). There are also reports of Jicarilla Apache traveling to Blanca Peak up until the 1930s (Martorano 1999). The Southern Ute have previously identified Great Sand Dunes National Monument and the Baca Land Grant, near Crestone, as culturally significant areas. In addition, stone circles, stone structures and alignments, wickiups, platform burials and other burial sites, quarries, caves, cairns, rock art, rockshelters, and battle or massacre sites are all types of sites and features that could be of cultural significance to the Southern Ute. The Pueblo people have previously identified the San Luis Valley as a place of emergence for the Tewa peoples.[21] Various researchers have suggested different locations within the valley as that emergence place, such as the Dry Lakes area and Great Sand Dunes National Monument. The Taos Pueblo also have an emergence myth that suggests a location near Blanca Peak (Spero and Martorano 1999).

Hispanic cultural tradition, which is strong in the San Luis Valley, began with the initial settlement of the area in the mid-1800s. The town of Antonito is one of the local settlements noteworthy for its strong Hispanic cultural heritage. The cultural tradition is evident in the art, architecture, and farming methods that continue to endure in the valley. Settlement in the San Luis Valley was based on ranching and farming economies, and the open agricultural expanses and communal irrigation systems, *acequias*, characterize the landscape today. *Acequias*, gravity-fed irrigation systems, are maintained by communal organizations and are dependent upon the cooperation of all of those who live along the canal for the care of the resource. The historic settlement patterns that were shaped by the geographical features and encounters with Native Americans remain visible on the landscape, and the historic methods of working the land are still employed and continue to be passed on through the generations (BLM 2009c).

10.1.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources

The proposed Antonito Southeast SEZ is the southernmost solar energy zone in Colorado, extending to the New Mexico state line. It is the only SEZ in Colorado with an existing surface water body, Alta Lake. No portions of the SEZ have been surveyed for cultural resources, and consequently no archaeological sites have been recorded within the SEZ (Colorado SHPO 2009). Eighty site points have been recorded within 5 mi (8 km) of the SEZ, including prehistoric and historic sites, features, structures, and isolated finds. Among those, several small sites were recorded in 1980 northwest of the SEZ, such as cairns, historic trash

[21] San Ildefonso, San Juan, Santa Clara, Nambe, and Tesuque Pueblos.

scatters, and a stone circle; a prehistoric open lithic site was recommended field eligible (Colorado SHPO 2009).

No properties currently listed in the NRHP for Conejos County are located within the SEZ; however, five properties are located nearby in the town of Antonito within 5 mi (8 km) of the SEZ. The Denver & Rio Grande Railroad San Juan Extension (also known as the Cumbres & Toltec Scenic Railroad) is one of the five properties listed in the NRHP and is located relatively close to the west side of the SEZ (within 22 mi [33 km] at the nearest point). Portions of the railroad are managed as an ACEC by the BLM; the SEZ comes within 33 mi (55 km) of the boundary of the ACEC at its nearest point.

No traditional cultural properties within the SEZ have been identified during government-to-government consultations, nor have concerns been raised to date for traditional cultural properties or sacred areas located in the vicinity of the SEZ, such as Blanca Peak (see also Section 10.1.18).

The proposed SEZ has the potential to contain significant cultural resources. The potential for finding significant Paleoindian sites exists throughout the entire valley. An isolated, corner-notched projectile point was found on the surface of a terrace overlooking Alta Lake during a preliminary site visit to the SEZ. Isolated (single) basalt flakes were also noted on the surface in at least two different locations within the SEZ; additional artifacts are likely to be encountered in the area. An earthen berm present within the SEZ could be related to the Taos Valley Canal. Taos Valley Canal 1, dating to approximately 1883, is indicated on maps at the Colorado State Engineer's Office as going through the proposed SEZ (Brown 2010). Site records from the Colorado SHPO indicate a recorded site named "Taos Valley Canal 2" is located nearby approximately 1 mi (1.6 km) to the east, outside of the SEZ boundary (Colorado SHPO 2009). The berm, which alternatively could be associated with the former Alta Lake Reservoir, as well as other man-made features within the SEZ, should be investigated by using both traditional field methods and historical documentation and maps. An old stagecoach route also may be present through or near the SEZ. The route is documented on a USGS historic trail map of the Trinidad quadrangle (Scott 2001) and should be investigated further. An additional trail, either an animal migration trail or prehistoric trail with trail markers and possible hunting blinds along it, has also been identified within the proposed SEZ and requires further investigation (Brown 2010). Other themes of potential archaeological interest in the Antonito Southeast SEZ area would include early Hispanic New Mexican settlement in the valley and rural agricultural and settlement practices (based on research questions posed in Church et al. 2007).

On the western edge of the SEZ, historic trash scatters are present that appear to be associated with the Chili Line rail bed; they should be investigated further. The Chili Line, also officially known as the Santa Fe Branch of the D&RG Western Railroad, was a narrow-gauge rail line that ran from Santa Fe, New Mexico, to Antonito, Colo. It was part of the more well-known D&RG founded by General William Jackson Palmer in 1870. The Chili Line was named after its main source of freight, red chili peppers, which were grown by the farmers along the line. Its last run was in September 1941 because use of the line had been dwindling since the Great Depression and the railroad was no longer profitable (Brief History undated; *Time* 1941).

The West Fork of the North Branch of the Old Spanish Trail proceeds close to the western boundary of the SEZ.[22] A survey of the West Fork is needed to verify the location of the trail and identify associated sites and features. Identification of evidence for use of the West Fork during the period of 1829 to 1848 would support local recommendations by the Old Spanish Trail Association to include the West Fork as part of the congressionally designated Old Spanish National Historic Trail. Until additional research has been completed, the West Fork is being managed as a significant cultural resource in order to maintain the historic and visual integrity of the corridor (Haas 2010).

10.1.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Antonito Southeast SEZ; however, as stated in Section 10.1.17.1, further investigation is needed in a number of areas. A cultural resource survey of the entire area of potential effect (APE) of a proposed project (including the construction footprint, staging areas, areas of anticipated erosion, access routes, and ROWs for transmission, water, and communication lines) 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 recorded sites meet the criteria for eligibility for listing in the NRHP. Depending on the integrity of various features within the proposed SEZ, several could be determined eligible, such as the Taos Valley Canal and the stagecoach route. Section 5.15 discusses the types of impacts that could occur on any significant cultural resources found to be present within the proposed SEZ. Possible impacts from solar energy development on cultural resources that are encountered within the SEZ or along related ROWs, as well as general mitigation measures, are described in more detail in Section 5.15. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

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 Section A.2.2). One eligible open lithic site[23] is located very near (within 0.5 mi [0.8 km]) to a reasonable location for a new transmission line to connect potential solar facilities within the SEZ to an existing 69-kV line. This site could be directly affected during construction, depending on the location of the ROW. Indirect impacts are possible from unauthorized surface collection depending on the proximity of the ROW to the site. No new road corridors have been assessed for the proposed SEZ, assuming existing roads would be used and no new areas of potential cultural significance would be opened to increased access. Impacts on cultural resources related to the creation of a new corridor would be evaluated at the project-specific level if new road construction were to occur.

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[22] The West Fork is located within 0.13 mi (0.2 km) of the SEZ at its closest point on the basis of preliminary maps; the mapped location of the trail is considered approximate.

[23] Site location information from Colorado SHPO (2009).

Although the West Fork of the North Branch of the Old Spanish Trail has not received congressionally designated National Historic Trail status, the potential effect of solar energy development on the nearby trail should be further evaluated. The historic Cumbres & Toltec Scenic Railroad is located near the proposed SEZ. The Cumbres & Toltec Scenic Railway Corridor ACEC was designated by the BLM to protect historical and scenic values associated with the railroad. As stated in Section 10.1.14.2, preliminary viewshed analyses indicate that the visual integrity of the railway corridor could be adversely affected by solar energy development within the Antonito Southeast SEZ, especially by solar power towers, cooling towers, steam plumes, transmission lines, or any other tall structures. The depot in Antonito, certain portions of the line not sufficiently screened by intervening topography, and the Cumbres & Toltec Scenic Railway Corridor ACEC are elements of the historic property that could be affected. However, the general area is not pristine, and some industrial development is present (e.g., the perlite facility adjacent to SEZ, an existing transmission line within 4 mi [6 km] to the north). Previous surface disturbances within the SEZ also include the existing highway (U.S. 285), a former irrigation reservoir (Alta Lake Reservoir), unpaved roads into the SEZ, the former railroad, and the artificial berm. Visual impacts on historic properties should be evaluated within that context to determine whether sufficient integrity of the setting can be maintained (if setting is an important element of the property's cultural significance).

10.1.17.3 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.

Ongoing consultation with the Colorado State Historic Preservation Office (SHPO) and the appropriate Native American governments would be conducted during the development of the Antonito Southeast SEZ. It is likely that adverse effects on significant resources in the valley could be mitigated to some degree through such efforts, although not enough to eliminate the effects unless a significant resource is avoided entirely. SEZ-specific design features could include the following:

- Development of a PA may be needed among the BLM, DOE, Colorado SHPO, and the Advisory Council on Historic Preservation (ACHP) to consistently address impacts on significant cultural resources within the San Luis Valley. Should a PA be developed to incorporate mitigation measures for resolving adverse effects on the Old Spanish National Historic Trail or the West Fork of the North Branch of the Old Spanish Trail, the Trail Administration for the Old Spanish Trail (BLM-NMSO and National Park Service (NPS) Intermountain Trails Office, Santa Fe) also should be included in the development of that PA.

- Additional coordination with the Cumbres & Toltec Scenic Railroad Commission is recommended to address possible mitigation measures for reducing visual impacts on the railroad.[24]

[24] Additional parties, such as the NPS and the ACHP, may need to be consulted if the railroad achieves National Historic Landmark status.

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10.1.18 Native American Concerns

10.1.18.1 Affected Environment

For a discussion of issues of possible Native American concern, several sections in this PEIS should be consulted. General topics of concern are addressed in Section 4.16. Specifically for the proposed Antonito Southeast SEZ, Section 10.1.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties; Section 10.1.9.1.3 discusses water rights and water use; Section 10.1.10 discusses plant species; 10.1.11 discusses wildlife species, including wildlife migration patterns; Sections 10.1.19 and 10.1.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21.

The valley was predominantly used by Tribes historically for hunting and trading rather than long-term settlement. The nearest Tribal land claim (judicially established as traditional tribal territory) to the proposed Antonito Southeast SEZ is for the Jicarilla Apache. Their land claim is located east and southeast of the Antonito Southeast SEZ, mostly in New Mexico but also up into southeastern Colorado. The Taos Pueblo has a judicially established land claim to the south of the SEZ in New Mexico.

Consultation for the Colorado SEZs has been initiated by the BLM with the Tribes[25] shown in Table 10.1.18.1-1. Details on government-to-government consultation efforts are presented in Chapter 14 and Appendix K.

10.1.18.1.1 Plant Resources

Native Americans continue to make use of a wide range of indigenous plants for food, medicine, construction materials, and the like. Although the proposed SEZs in the San Luis Valley are sparsely vegetated, some species traditionally used by Native Americans are possible. The vegetation present at the proposed Antonito Southeast SEZ is described in Section 10.1.10. In general, the vegetation consists of low shrubs. The vegetation cover types present are all part of the Inter-mountain Basin series. Semi-Desert Shrub Steppe dominates, but there are substantial areas of Semi-Desert Grassland, some Greasewood Flat, small areas of Mixed Salt Desert Scrub, and patches of Big Sagebrush Shrubland (USGS 2005b). As shown in Table 10.1.18.1-2, there are likely to be some plants in the SEZs that have been traditionally used by Native Americans for food and medicine (Fowler 1986; Callaway et al. 1986; Castetter 1935). However, project-specific analyses will be needed to determine their presence at any proposed development site. The importance of any stand to Native Americans must be determined in consultation with the affected Tribes.

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[25] Plains Tribes that may have used the valley ranged widely and may have been settled a great distance from the valley in Oklahoma and South Dakota.

TABLE 10.1.18.1-1 Federally Recognized Tribes with Traditional Ties to the Proposed SEZs in San Luis Valley

Tribe	Location	State
Cheyenne and Arapaho Tribes of Oklahoma	Concho	Oklahoma
Comanche Nation	Lawton	Oklahoma
Eastern Shoshone	Fort Washakie	Wyoming
Fort Sill Apache Tribe of Oklahoma	Apache	Oklahoma
Hopi	Kykotsmovi	Arizona
Jicarilla Apache Nation	Dulce	New Mexico
Kiowa Tribe of Oklahoma	Carnegie	Oklahoma
Navajo Nation	Window Rock	Arizona
Northern Arapaho	Fort Washakie	Wyoming
Northern Cheyenne	Lame Deer	Montana
Ohkay Owingeh	San Juan Pueblo	New Mexico
Pueblo of Nambe	Santa Fe	New Mexico
Pueblo of Santa Ana	Santa Ana Pueblo	New Mexico
Pueblo of Santo Domingo	Santo Domingo Pueblo	New Mexico
San Ildefonso Pueblo	Santa Fe	New Mexico
Santa Clara Pueblo	Espanola	New Mexico
Southern Ute	Ignacio	Colorado
Taos Pueblo	Taos	New Mexico
Tesuque Pueblo	Santa Fe	New Mexico
Ute Mountain Ute	Towaoc	Colorado
Ute Tribe of the Uinta and Ouray Reservation	Fort Duchesne	Utah
White Mesa Ute	Blanding	Utah

TABLE 10.1.18.1-2 Plant Species Important to Native Americans Observed or Likely To Be Present in the San Luis Valley

Common Name	Scientific Name	Status
Food		
Basin wildrye	*Leymus cinerus*	Possible
Dropseed	*Sporobolus airoides*	Possible
Galleta	*Pleuraphis jamesii*	Possible
Indian ricegrass	*Achnatherum hymenoides*	Possible
Rabbitbrush	*Chrysothamnus greenei*	Possible
Sagebrush	*Artemisia* spp.	Possible
Saltbush	*Atriplex* spp.	Possible
Wheatgrass	*Elymus lanceolatus*	Possible
Wolfberry	*Lycium andersonii*	Possible
Medicine		
Mormon tea	*Ephedra* spp.	Possible
Saltbush	*Atriplex* spp.	Possible

Sources: Field visit; USGS (2005b); Fowler (1986); Callaway et al. (1986); Castetter (1935).

10.1.18.1.2 Other Resources

Water is an essential prerequisite for life in the arid areas of the Southwest. As a result, it is a keystone of many desert cultures' religions. Springs are of particular importance. Tribes are also sensitive about the use of scarce local water supplies for the benefit of distant communities and recommend that determination of adequate water supplies be a primary consideration as to whether a site is suitable for the development of a utility-scale solar energy facility (Moose 2009).

The habitat found on the four proposed San Luis Valley SEZs is similar. The wildlife likely to be found there is similar as well. Wildlife likely to be found in the proposed Antonito Southeast SEZ is described in Section 10.1.11. Species traditionally hunted by local Native Americans whose range includes the proposed San Luis Valley SEZ are listed in Table 10.1.18.1-3. Most of these are common small animals and birds. Traditionally important large game animals include mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*) (Callaway et al. 1986). Pronghorn and mule deer are possible on the San Luis Valley floor. There is habitat for elk and bighorn sheep in the surrounding mountains.

TABLE 10.1.18.1-3 Animal Species Used by Native Americans as Food Whose Range Includes the Proposed San Luis Valley SEZs

Common Name	Scientific Name	Status
Mammals		
Badger	*Taxidea taxus*	All year
Chipmunks	*Tamias* spp	All year
Mountain cottontail	*Silvilagus nattallii*	All year
Coyote	*Canis latrans*	All year
Ground squirrels	*Spermophilus* spp.	All year
Jack rabbits	*Lepus* spp.	All year
Kangaroo rat	*Dipodomys ordii*	All year
Mountain lion	*Puma concolor*	All year
Mule deer	*Odocoileus hemionus*	All year
Pocket mouse	*Perognathus flavus*.	All year
Porcupine	*Erethizon dorsatum*	All year
Prairie dog	*Cynimys gunnisoni*	All year
Pronghorn	*Antilocapra americana*	All year
Red Fox	*Vulpes vulpes*	All year
Ringtail	*Bassariseus astutus*	All year
Striped skunk	*Mephilis mephilis*	All year
Wood rats	*Neotoma* spp.	All year
Birds		
Great horned owl	*Bubo virginianus*	All year
Northern mockingbird	*Mimus polyglottos*	All year

Sources: Field visit; USGS (2005b); Callaway et al. (1986); Fowler (1986).

10.1.18.2 Impacts

To date, no comments have been received from the Tribes referencing the proposed Antonito Southeast SEZ specifically. The Navajo Nation has responded that “the proposed undertaking/project area will not impact any Navajo traditional cultural properties,” with the caveat that the Nation be notified of any inadvertent discoveries that might take place related to the undertaking (Joe 2008; Joe 2009). No direct impacts from disturbance during project development would occur on areas previously indicated as culturally significant (San Luis Lakes, the Great Sand Dunes, Blanca Peak). For example, gathering rights on Blanca Peak will not be affected by development in the Antonito Southeast SEZ; however, it is possible that there will be Native American concerns about potential visual effects and the effects of noise from solar energy development in the SEZ on Blanca Peak (see Section 10.1.17) or on the valley as a whole as consultation continues and additional analyses are undertaken. If 80% of the proposed SEZ were developed, it is likely that some plants traditionally important to Native Americans will be destroyed and that habitat of traditionally important animals will be lost. Given that similar plants and habitat would remain in the valley, project-level consultation with affected Tribes will be necessary to determine the importance of the traditional resources.

Groundwater withdrawals in the valley are tightly regulated, and the use of programmatic design features described in Appendix A, Section A.2.2, would ensure that minimal impacts on surface waters and springs would occur.

10.1.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate impacts of potential concern to Native Americans, such as avoidance of sacred sites, water sources, and tribally important plant and animal species, are provided in Appendix A, Section A.2.2.

The need for and nature of SEZ-specific design features regarding potential issues of concern would be determined during government-to-government consultation with affected Tribes listed in Table 10.1.18.1-1.

10.1.19 Socioeconomics

10.1.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the proposed Antonito Southeast SEZ. The ROI is a six-county area comprising Alamosa, Conejos, Costilla, and Rio Grande Counties in Colorado and Rio Arriba and Taos Counties in New Mexico. 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 are expected to take place.

10.1.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 55,187 (Table 10.1.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Taos County (3.7%) and Rio Grande County (2.4%) than elsewhere in the ROI. Employment in Conejos County declined over this period. At 1.5%, the growth rate in the ROI as a whole was similar to the average state rates for Colorado (1.5%) and New Mexico (1.5%).

In 2006, the service sector provided the highest percentage of employment in the ROI at 47.7%, followed by agriculture (18.6%) and wholesale and retail trade (18.0%) (Table 10.1.19.1-2). Smaller employment shares were held by construction (7.0%) and finance,

TABLE 10.1.19.1-1 ROI Employment for the Proposed Antonito Southeast SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Alamosa County, Colorado	7,885	7,935	0.1
Conejos County, Colorado	3,498	3,402	–0.3
Costilla County, Colorado	1,234	1,268	0.3
Rio Grande County, Colorado	4,784	6,040	2.4
Rio Arriba County, New Mexico	18,426	19,886	0.8
Taos County, New Mexico	11,612	16,656	3.7
ROI	47,439	55,187	1.5
Colorado	2,269,668	2,596,309	1.5
New Mexico	793,052	919,466	1.5

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

TABLE 10.1.19.1-2 ROI Employment for the Proposed Antonito Southeast SEZ by Sector, 2006[a]

	Alamosa County, Colorado		Conejos County, Colorado		Costilla County, Colorado		Rio Grande County, Colorado	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,470	22.4	488	42.8	484	77.0	1,763	41.9
Mining	10	0.2	10	0.9	0	0.0	0	0.0
Construction	324	4.9	39	3.4	14	2.2	179	4.3
Manufacturing	93	1.4	60	5.3	10	1.6	79	1.9
Transportation and public utilities	201	3.1	100	8.8	10	1.6	70	1.7
Wholesale and retail trade	1,300	19.8	159	14.0	90	14.3	769	18.3
Finance, insurance, and real estate	434	6.6	41	3.6	10	1.6	197	4.7
Services	2,752	41.9	299	26.3	114	18.1	1,172	27.9
Other	9	0.1	0	0.0	10	1.6	10	0.2
Total	6,575		1,139		631		4,207	

	Rio Arriba County, New Mexico		Taos County, New Mexico		RIO	
	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,281	14.1	353	3.6	5,841	18.6
Mining	107	1.2	758	0.8	205	0.7
Construction	621	6.8	1,038	10.6	2,215	7.0
Manufacturing	176	1.9	133	1.4	551	1.8
Transportation and public utilities	225	2.5	199	2.0	805	2.6
Wholesale and retail trade	1,724	18.9	1,637	16.7	5,679	18.0
Finance, insurance, and real estate	290	3.2	495	5.0	1,467	4.7
Services	4,803	52.8	5,874	59.8	15,014	47.7
Other	10	0.1	10	0.1	49	0.2
Total	9,100		9,825		31,477	

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

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

insurance, and real estate (4.7%). Within the ROI, the distribution of employment across sectors was similar to that of the ROI as a whole; the percentage of employment in agriculture was lower in Rio Arriba County (14.1%) and in Taos County (3.6%) than in the ROI as a whole. Employment in agriculture was more significant in the four Colorado counties than in the ROI as a whole; more than 75% of total employment in this sector was in Costilla County and more than 40% in Rio Grande and Conejos Counties. Employment in services was much less significant than in the ROI as a whole.

10.1.19.1.2 ROI Unemployment

Unemployment rates have varied across the six counties in the ROI. Over the period 1999 to 2008, the average rate in Costilla County was 9.2%, with a relatively high rate of 6.9% in Taos and Conejos Counties; rates exceeded 5% in all counties except Alamosa over this period (Table 10.1.19.1-3). Rates have fallen over the period; in 1999, Taos and Conejos Counties experienced rates higher than 11%. The average rate in the ROI over this period was 6.1%, higher than the average rate for Colorado (4.5%) and New Mexico (5.0%). Unemployment rates for the first five months of 2009 contrast with rates for 2008 as a whole; in Costilla County, the unemployment rate increased to 11.1%, while rates reached 9.9% and 8.1% in Conejos County and Rio Grande County, respectively. The average rates for the ROI (7.0%), for Colorado (7.5%), and for New Mexico (5.6%) were also higher during this period than the corresponding average rates for 2008.

10.1.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 29% urban; the largest city, Alamosa, had an estimated population of 8,746; other cities in the ROI include Espanola, New Mexico (7,076), Taos, New Mexico (5,546) and Monte Vista, Colorado (4,015) (Table 10.1.19.1-4). In addition, there are ten smaller cities in the ROI with 2008 populations of less than 1,500.

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 10.1.19.1-4). Taos, New Mexico, grew at an annual rate of 2.1% during this period, with higher-than-average growth also experienced in Chama, New Mexico (1.4%) and Alamosa, Colorado (1.2%). The remaining cities experienced lower growth rates from 2000 to 2008, with majority of these cities experiencing negative growth rates during this period.

10.1.19.1.4 ROI Urban Income

Median household incomes vary across cities in the ROI. No data are available for cities in the ROI for 2006 to 2008. In 1999, only Taos Ski Village, New Mexico ($87,175) had median

TABLE 10.1.19.1-3 ROI Unemployment Rates (%) for the Proposed Antonito Southeast SEZ

Location	1999–2008	2008	2009[a]
Alamosa County	5.0	5.3	7.6
Conejos County	6.9	7.5	9.9
Costilla County	9.2	7.6	11.1
Rio Grande County	5.6	5.8	8.1
Rio Arriba County	5.9	5.1	6.1
Taos County	6.9	5.2	6.5
ROI	6.1	5.5	7.0
Colorado	4.5	4.2	7.5
New Mexico	5.0	4.9	5.6

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

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

TABLE 10.1.19.1-4 ROI Urban Population and Income for the Proposed Antonito Southeast SEZ

	Population			Median Household Income ($ 2008)		
City	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
Alamosa, Colorado	7,960	8,746	1.2	32,771	NA	NA
Espanola, New Mexico	7,105	7,076	–0.1	34,948	NA	NA
Taos, New Mexico	4,700	5,546	2.1	32,208	NA	NA
Monte Vista, Colorado	4,529	4,015	–1.5	36,556	NA	NA
Chama, New Mexico	1,199	1,344	1.4	39,286	NA	NA
Manassa, Colorado	1,042	936	–1.3	29,731	NA	NA
La Jara, Colorado	877	784	–1.4	31,115	NA	NA
Antonito, Colorado	873	776	–1.5	24,727	NA	NA
Sanford, Colorado	817	733	–1.3	32,993	NA	NA
San Luis, Colorado	739	641	–1.8	18,299	NA	NA
Blanca, Colorado	391	343	–1.6	29,452	NA	NA
Romeo, Colorado	375	340	–1.2	24,857	NA	NA
Hooper, Colorado	123	125	0.2	41,154	NA	NA
Taos Ski Village, New Mexico	56	58	0.4	87,175	NA	NA

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

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

incomes that were higher than the average for Colorado ($56,574) and New Mexico ($43,202) (Table 10.1.19.1-4).

10.1.19.1.5 ROI Population

Table 10.1.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 116,511 in 2008, having grown at an average annual rate of 0.7% since 2000. Growth rates for the ROI were lower than those for New Mexico (1.7%) and Colorado (1.9%) over the same period.

Three of the six counties in the ROI have experienced minor growth in population since 2000; the remainder experienced loss of population. Population in Taos County, New Mexico, grew at an annual rate of 1.2% from 2000 to 2008, while Alamosa County, Colorado, and Rio Arriba County, New Mexico, populations grew by 0.7% over the same period. The remaining counties saw declines in population of less than 1.0%. The ROI population is expected to increase to 132,554 by 2021 and to 134,655 by 2023.

10.1.19.1.6 ROI Income

Personal income in the ROI stood at $3.0 billion in 2007 and has grown at an annual average rate of 2.2% over the period 1998 to 2007 (Table 10.1.19.1-6). ROI personal income per

TABLE 10.1.19.1-5 ROI Population for the Proposed Antonito Southeast SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Alamosa County, Colorado	14,966	15,783	0.7	20,210	20,943
Conejos County, Colorado	8,400	8,232	–0.3	9,322	9,453
Costilla County, Colorado	3,663	3,465	–0.7	3,898	3,945
Rio Grande County, Colorado	12,413	12,279	–0.1	14,465	14,776
Rio Arriba County, New Mexico	41,190	43,653	0.7	46,300	46,487
Taos County, New Mexico	29,979	33,100	1.2	38,359	39,051
ROI	110,611	116,511	0.7	132,554	134,655
Colorado	4,301,261	5,010,395	1.9	6,398,532	6,613,747
New Mexico	1,819,046	2,085,115	1.7	2,573,667	2,640,712

Sources: U.S. Bureau of the Census (2009e,f); State Demography Office (2009); University of New Mexico (2009).

TABLE 10.1.19.1-6 ROI Personal Income for the Proposed Antonito Southeast SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Alamosa County, Colorado			
Total income[a]	0.4	0.4	1.1
Per-capita income	26,089	27,238	0.4
Conejos County, Colorado			
Total income[a]	0.2	0.2	0.9
Per-capita income	18,795	20,161	0.7
Costilla County, Colorado			
Total income[a]	0.1	0.1	0.9
Per-capita income	20,755	23,273	1.2
Rio Grande County, Colorado			
Total income[a]	0.3	0.4	0.5
Per-capita income	27,435	27,814	0.1
Rio Arriba County, New Mexico			
Total income[a]	0.8	1.0	2.4
Per-capita income	19,865	23,321	1.6
Taos County, New Mexico			
Total income[a]	0.7	0.9	3.6
Per-capita income	23,005	28,763	2.3
ROI			
Total income[a]	2.4	3.0	2.2
Per-capita income	22,360	25,637	1.4
Colorado			
Total income[a]	118.5	199.5	2.8
Per capita income	37,878	41,955	1.0
New Mexico			
Total income[a]	48.8	62.4	2.5
Per-capita income	27,182	30,497	1.2

[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).

capita also rose over the same period at a rate of 1.4%, increasing from $22,360 to $25,637. Per-capita incomes were higher in Taos ($28,763), Rio Grande ($27,814), and Alamosa ($27,238) Counties in 2007 than elsewhere in the ROI. Personal income and per-capita income growth rates have been higher in Rio Arriba and Taos Counties than in New Mexico as a whole; in 2007 per-capita personal income, however, was higher in New Mexico ($30,497) than in both New Mexico counties. In the Colorado counties, per-capita income growth rates in Costilla County were higher than the state rate, but per-capita incomes were significantly lower in these counties than in Colorado as a whole ($41,955).

Median household income over the period 2006 to 2008 varied from $25,146 in Costilla County to $41,387 in Rio Arriba County (U.S. Bureau of the Census 2009d).

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10.1.19.1.7 ROI Housing

In 2007, more than 57,300 housing units were located in the six ROI counties; more than 6% of these were located in Rio Arriba and Taos Counties (Table 10.1.19.1-7). Owner-occupied units compose approximately 75% of the occupied units in the six counties, with rental housing making up 25% of the total. Vacancy rates in 2007 were significantly higher in Taos County (32.4%) and Costilla County (31.7%) than elsewhere in the ROI, although a significant portion of vacant housing in Taos County were units used for seasonal or recreational purposes. With an overall vacancy rate of 25.6% in the ROI, there were 14,691 vacant housing units in the ROI in 2007, of which 2,844 are estimated to be rental units that would be available to construction workers. There were 5,837 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 1.0% over the period 2000 to 2007, with 3,729 new units added to the existing housing stock in the ROI (Table 10.1.19.1-7).

The median value of owner-occupied housing in 2008 varied from $58,980 in Costilla County to $233,000 in Taos County (U.S. Bureau of the Census 2009g).

10.1.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 10.1.19.1-8. There are five Tribal governments located in the ROI, and there are members of other Tribal groups located in the ROI but whose Tribal governments are located in adjacent counties or states.

10.1.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

TABLE 10.1.19.1-7 ROI Housing Characteristics for the Proposed Antonito Southeast SEZ

Parameter	2000	2007[a]
Alamosa County, Colorado		
Owner-occupied	3,498	3,713
Rental	1,969	2,090
Vacant units	621	659
Seasonal and recreational use	75	NA[b]
Total units	6,088	6,463
Conejos County, Colorado		
Owner-occupied	2,347	2,590
Rental	633	699
Vacant units	906	1,000
Seasonal and recreational use	544	NA
Total units	3,886	4,289
Costilla County, Colorado		
Owner-occupied	1,175	1,230
Rental	328	343
Vacant units	699	732
Seasonal and recreational use	447	NA
Total units	2,202	2,305
Rio Grande County, Colorado		
Owner-occupied	3,323	3,676
Rental	1,378	1,524
Vacant units	1,302	1,440
Seasonal and recreational use	761	NA
Total units	6,003	1,641
Rio Arriba County, New Mexico		
Owner-occupied	12,281	11,164
Rental	2,763	2,831
Vacant units	2,972	4,731
Seasonal and recreational use	1,042	NA
Total units	18,016	18,726
Taos County, New Mexico		
Owner occupied	9,570	9,166
Rental	3,105	3,609
Vacant units	4,729	6,129
Seasonal and recreational use	2,968	NA
Total units	17,404	18,904

TABLE 10.1.19.1-7 (Cont.)

Parameter	2000	2007[a]
ROI Total		
Owner-occupied	32,194	31,540
Rental	10,176	11,097
Vacant units	11,229	14,691
Seasonal and recreational use	5,837	NA
Total units	53,599	57,328

[a] 2007 data for number of owner-occupied, rental, and vacant units for Colorado counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

[b] NA = data not available.

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

TABLE 10.1.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Antonito Southeast SEZ

Governments	
City	
Alamosa, Colorado	Manassa, Colorado
Antonito, Colorado	Monte Vista, Colorado
Blanca, Colorado	Romeo, Colorado
Chama, New Mexico	San Luis, Colorado
Espanola, New Mexico	Sanford, Colorado
Hooper, Colorado	Taos, New Mexico
La Jara, Colorado	Taos Ski Village, New Mexico
County	
Alamosa County, Colorado	Rio Grande County, Colorado
Conejos County, Colorado	Rio Arriba County, New Mexico
Costilla County, Colorado	Taos County, New Mexico
Tribal	
Jicarilla Apache Nation, New Mexico	Pueblo of Santa Clara, New Mexico
Pueblo of Picuris, New Mexico	Pueblo of Taos, New Mexico
Pueblo of San Juan, New Mexico	

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

Schools

In 2007, the six-county ROI had a total of 92 public and private elementary, middle, and high schools (NCES 2009). Table 10.1.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Costilla County schools (11.1) is slightly lower than for schools in the remaining five counties, while the level of service is slightly higher in Conejos County (15.4); in Taos County, there are fewer teachers per 1,000 population (8.8).

Health Care

While Taos County has a much larger number of physicians (98), the number of physicians per 1,000 population is also higher there than in the majority of the remaining counties in the ROI and significantly higher than in Costilla County (0.8) (Table 10.1.19.1-10). The smaller number of health care professionals in Conejos and Costilla Counties may mean that residents of these counties have poorer access to health care; a substantial number of county residents might also travel to other counties in the ROI for their medical care.

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI (Table 10.1.19.1-11). Conejos County has 7 officers and would provide law enforcement services to the SEZ; there are 69 officers in the remainder of the ROI counties. Currently, there is only one professional firefighter in the ROI, with the majority of firefighting services provided

TABLE 10.1.19.1-9 ROI School District Data for the Proposed Antonito Southeast SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Alamosa County, Colorado	2,483	166	14.9	10.5
Conejos County, Colorado	1,830	129	14.2	15.4
Costilla County, Colorado	535	48	11.1	13.6
Rio Grande County, Colorado	2,272	170	13.4	13.5
Rio Arriba County, New Mexico	6,550	447	14.7	10.3
Taos County, New Mexico	4,315	287	15.1	8.8
ROI	17,985	1,246	14.4	10.7

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

Source: NCES (2009).

TABLE 10.1.19.1-10 Physicians in the Proposed Antonito Southeast SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Alamosa County, Colorado	41	2.6
Conejos County, Colorado	8	1.0
Costilla County, Colorado	3	0.8
Rio Grande County, Colorado	13	1.0
Rio Arriba County, New Mexico	47	1.1
Taos County, New Mexico	98	3.0
ROI	210	1.8

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

Source: AMA (2009).

TABLE 10.1.19.1-11 Public Safety Employment in the Proposed Antonito Southeast SEZ ROI

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Alamosa County	21	1.3	0	0.0
Conejos County	7	0.8	0	0.0
Costilla County	5	1.4	0	0.0
Rio Grande County	8	0.6	0	0.0
Rio Arriba County	18	0.4	1	0.0
Taos County	17	0.5	0	0.0
ROI	76	0.7	1	0.0

[a] 2007 data.

[b] Number per 1,000 population.

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

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

by volunteers (Table 10.1.19.1-9). Levels of service of police protection in Costilla County (1.4) and Alamosa County (1.3) are higher than those for the counties in the remainder of the ROI and lower than those in Rio Arriba County (0.4).

10.1.19.1.10 ROI Social Structures 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, social conflict, divorce, and delinquency would increase, and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 10.1.19.1-12 and 10.1.19.1-13 present data for a number of indicators of social change, including violent crime and property crime rates, alcoholism and illicit drug use, and mental health and divorce, that might be used to indicate social change.

The level of crime varies somewhat across the ROI, with slightly higher rates of violent crime in Rio Arriba County (5.1 per 1,000 population) and Alamosa County (4.1) and lower rates elsewhere in the ROI (Table 10.1.19.1-12). Property-related crime rates are much higher in Alamosa County (30.2) than in the remainder of the ROI; overall crime rates in Alamosa County were almost double the rate for the ROI as a whole. No crime rates were reported for Conejos County and Costilla County.

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) regions in which the ROI is located. There is some variation across the ROI, with slightly higher rates in the Colorado portion of the ROI than in the New Mexico counties (Table 10.1.19.1-13). Divorce rates are also slightly higher in Colorado as a whole than in New Mexico.

10.1.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for 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 10.1.5.

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).

TABLE 10.1.19.1-12 County and ROI Crime Rates for the Proposed Antonito Southeast SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
Location	Offenses	Rate	Offenses	Rate	Offenses	Rate
Alamosa County, Colorado	65	4.1	477	30.2	542	34.3
Conejos County, Colorado	NA[d]	NA	NA	NA	NA	NA
Costilla County, Colorado	NA	NA	NA	NA	NA	NA
Rio Grande County, Colorado	26	2.1	139	11.3	165	13.4
Rio Arriba County, New Mexico	224	5.1	669	15.3	893	20.5
Taos County, New Mexico	58	1.8	448	13.5	506	15.3
ROI	368	3.2	1,696	14.6	2,064	17.7

[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.

[d] NA = not available.

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

TABLE 10.1.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Antonito Southeast SEZ ROI

Geographic Area	Alcoholism[a]	Illicit Drug Use[a]	Mental Health[b]	Divorce[c]
Colorado Region 4 (includes Alamosa, Conejos, Costilla, and Rio Grande Counties)	9.7	3.1	10.2	–[d]
New Mexico Region 2 (includes Rio Arriba and Taos Counties	9.3	2.6	9.8	–
Colorado				4.4
New Mexico				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 or 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 2004.

[d] A dash indicates not applicable.

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

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 facilities 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, 5,577 people were employed in the ROI in the various sectors identified as recreation, constituting 10.0% of total ROI employment (Table 10.1.19.1-14). Recreation spending also produced almost $104.3 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

10.1.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts on recreation, social change and livestock grazing. 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.

10.1.19.2.1 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 of 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

TABLE 10.1.19.1-14 Recreation Sector Activity in the Proposed Antonito Southeast SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	336	8.1
Automotive rental	18	0.6
Eating and drinking places	3,479	55.7
Hotels and lodging places	882	19.4
Museums and historic sites	55	4.9
Recreational vehicle parks and campsites	187	3.7
Scenic tours	154	5.7
Sporting goods retailers	486	6.2
Total ROI	5,577	104.3

Source: MIG, Inc. (2010).

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 migration of workers and their families into the ROI surrounding the site, which would affect population, rental housing, and health service and public safety employment. Socioeconomic impacts common to all utility-scale solar energy developments are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of 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). 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 facilities in the ROI would be visible from popular recreation locations, and that construction workers residing temporarily in the ROI would occupy accommodations 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 is still unclear (see Section 5.17). 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; an annual rate of 5 to 10% growth in population is 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 1.4 % in ROI population during construction of the trough technology and smaller increases for the power tower, dish engine and photovoltaic 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 an insufficient range of housing choices to suit all solar occupations, many workers are likely to commute to the SEZ from larger communities elsewhere in the ROI, reducing the potential impact of solar developments on social change. Regardless of the pace of population growth associated with the commercial development of solar resources and the likely residential location of in-migrating workers and families in communities some distance from the SEZ itself, the number of new residents from outside the region of influence is likely to lead to some demographic and social change in small rural communities in the ROI. Communities hosting solar developments are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

Cattle ranching and farming supported 847 jobs and $5.0 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed SEZ could result in a decline in the amount of land available for livestock grazing, resulting in the loss of a total (direct plus indirect) of 7 jobs and $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 $575 annually on land dedicated to solar development in the SEZ.

Transmission Line Impacts

The impacts of transmission line construction could include the addition of 18 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 10.1.19.2-1). Construction activities in the peak year would constitute less than 0.1% of total ROI employment. A transmission line would also produce $0.7 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, less than $0.1 million.

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 21 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 11 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% of the vacant rental units expected to be available in the ROI.

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

TABLE 10.1.19.2-1 Proposed Antonito Southeast SEZ ROI Socioeconomic Impacts of Transmission Line Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	8	<1
Total	18	<1
Income[b]		
Total	0.7	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	21	<1
Vacant housing[c] (no.)	11	<1
Local community service employment		
Teachers (no.)	<1	<1
Physicians (no.)	<1	<1
Public safety (no.)	<1	<1

[a] Construction impacts assume 4 mi [6 km] of transmission line is required to connect SEZ solar facilities to the grid. Construction impacts were assessed for a single representative year, 2021.

[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.

Total operations employment impacts on the ROI (including direct and indirect impacts) of a transmission line would be less than 1 job (Table 10.1.19.2-1) and would also produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, 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.

10.1.19.2.2 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), BLM acreage rental and capacity payments, population in-migration, housing, and community service employment (education, health, and public safety). More information on the data and methods used in the analysis can be found in Appendix M.

The assessment of the impact of the construction and operation of each technology was based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of possible impacts, solar facility size was estimated on the basis of 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) for solar trough technologies. Impacts of multiple facilities employing a given technology at each SEZ were assumed to be the same as impacts for a single facility with the same total capacity. Construction impacts were assessed for a representative peak year of construction, assumed to be 2021 for each technology. Construction impacts assumed that a maximum of one project could be constructed within a given year, with a corresponding maximum land disturbance of up to 3,000 acres (12 km^2). For operations impacts, a representative first year of operations was assumed to be 2023 for each technology. 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 2,885 jobs (Table 10.1.19.2-2). Construction activities in 2021would constitute 4.6% of total ROI employment. A solar development would also produce $153.7 million in income. Direct sales taxes would be $0.1 million in 2021; direct income taxes, $5.9 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 1,827 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 914 rental units expected to be occupied in the ROI. This occupancy rate would represent 28.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would also affect community service employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 21 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 1.4% of total ROI employment expected in these occupations.

TABLE 10.1.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Trough Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	1,641	339
Total	2,885	530
Income[b]		
Total	153.7	16.7
Direct state taxes[b]		
Sales	0.1	0.1
Income	5.9	0.5
BLM payments[b]		
Rental	NA[d]	0.6
Capacity[c]	NA	10.2
In-migrants (no.)	1,827	216
Vacant housing[e] (no.)	914	194
Local community service employment		
Teachers (no.)	21	2
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 1,557 MW.

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

[c] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 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.

[d] NA = not available.

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

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 530 jobs (Table 10.1.19.2-2). Such a solar development would also produce $16.7 million in income. Direct sales taxes would be $0.1 million; direct income taxes, $0.5 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $10.2 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 216 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 194 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, two new teachers would be required in the ROI in 2021.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be 1,149 jobs (Table 10.1.19.2-3). Construction activities would constitute 1.8% of total ROI employment. Such a solar development would also produce $61.2 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $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 728 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 364 rental units expected to be occupied in the ROI. This occupancy rate would represent 11.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would 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, eight new teachers, one physician, and one public safety employee (career firefighters and

TABLE 10.1.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Power Tower Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	654	175
Total	1,149	247
Income[b]		
Total	61.2	7.6
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	2.4	0.3
BLM payments[b]		
Rental	NA[d]	0.6
Capacity[c]	NA	5.7
In-migrants (no.)	728	112
Vacant housing[c] (no.)	364	100
Local community service employment		
Teachers (no.)	8	1
Physicians (no.)	1	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 33 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 865 MW.

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

c The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 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.

d NA = not available.

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

uniformed police officers) would be required in the ROI in 2021. These increases would represent 0.5% 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 247 jobs (Table 10.1.19.2-3). Such a solar development would also produce $7.6 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.3 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $5.7 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 112 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 100 owner-occupied units expected to be required 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.

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technologies would be 467 jobs (Table 10.1.19.2-4). Construction activities would constitute 0.7% of total ROI employment. Such a solar development would also produce $24.9 million in income. Direct sales taxes would be less than $0.1 million; 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 296 persons in-migrating into the ROI. Although in migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent 4.6% of the vacant rental units expected to be available in the ROI.

TABLE 10.1.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Dish Engine Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	266	170
Total	467	240
Income[b]		
Total	24.9	7.4
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	1.0	0.3
BLM payments[b]		
Rental	NA[c]	0.6
Capacity[d]	NA	5.7
In-migrants (no.)	296	108
Vacant housing[e] (no.)	148	98
Local community service employment		
Teachers (no.)	3	1
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 865 MW.

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

[c] NA = not available.

[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 (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, three 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 on the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 240 jobs (Table 10.1.19.2-4). Such a solar development would also produce $7.4 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.3 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $5.7 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a dish engine solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 108 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 98 owner-occupied units expected to be required in the ROI.

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, one new teacher would be required in the ROI.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) in 2021 from use of PV technologies would be 218 jobs (Table 10.1.19.2-5). Construction activities in 2021would constitute 0.3 % of total ROI employment. Such a solar development would also produce $11.6 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $0.4 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 138 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large,

TABLE 10.1.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with PV Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	124	17
Total	218	24
Income[b]		
Total	11.6	0.7
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.4	<0.1
BLM payments[b]		
Rental	NA[c]	0.6
Capacity[d]	NA	4.5
In-migrants (no.)	138	11
Vacant housing[e] (no.)	69	10
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 865 MW.

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

[c] NA = not available.

[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.

with 69 rental units expected to be occupied in the ROI. This occupancy rate would represent 2.1% 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 on the ROI (including direct and indirect impacts) of a build-out using PV technologies would be 24 jobs (Table 10.1.19.2-5). Such a solar development would also produce $0.7 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 $0.6 million, and solar generating capacity payments would total at least $4.5 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 11 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 10 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.

10.1.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

10.1.20 Environmental Justice

10.1.20.1 Affected Environment

On February 11, 1994, the President signed E. O. 12898,"Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which formally requires federal agencies to incorporate environmental justice as part of their missions (*Federal Register*, Volume 59, page 7629, Feb. 11, 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the Council on Environmental Quality's (CEQ's) *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area is undertaken; (2) an assessment is conducted to determine whether construction and operation would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a determination is made as to whether these impacts 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 resulting from either phase of development are significantly high and if these impacts would disproportionately affect minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. In the event impacts are significant, disproportionality would be determined by comparing the proximity of any high and adverse impacts with the location of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the SEZ and an associated 50-mi (80-km) radius around the boundary of the SEZ. A description of the geographic distribution of minority and low-income groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,l). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

  Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origin. In addition, persons who classify themselves as being of multiple racial origins may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50%, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

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 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 younger than 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (U.S. Bureau of the Census 2009l).

The data in Table 10.1.20.1-1 show the minority and low-income composition of total population located in the proposed SEZ based on 2000 Census data and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number also includes individuals also identifying themselves as being part of one or more of the population groups listed in the table.

A large number of minority and low-income individuals are located in the 50-mi (80-km) area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Colorado, 48% of the population is classified as minority, while 19.0% is classified as low-income. Although the number of minority individuals does not exceed 50% of the total population in the area, the number of minority individuals exceeds the state average by 20 percentage points or more, meaning that there is a minority population in the Colorado portion of the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the Colorado portion of the SEZ.

Within the 50-mi (80-km) radius in New Mexico, 65.1% of the population is classified as minority, while 18.8% is classified as low-income. Although the number of minority individuals does not exceed the state average by 20 percentage points or more, the number of minority individuals exceeds 50% of the total population in the area, meaning that there are minority populations in the New Mexico portion of the 50-mi (80-km) area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average

TABLE 10.1.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

Parameter	Colorado	New Mexico
Total population	49,258	41,558
White, non-Hispanic	25,603	14,514
Hispanic or Latino	22,130	24,259
Non-Hispanic or Latino minorities	1,525	2,785
One race	955	2,228
Black or African American	162	101
American Indian or Alaskan Native	486	1,855
Asian	212	128
Native Hawaiian or Other Pacific Islander	18	10
Some other race	77	134
Two or more races	570	557
Total minority	23,655	27,044
Low-income	9,362	7,797
Percent minority	48.0	65.1
State percent minority	25.5	55.3
Percent low-income	19.0	18.8
State percent low-income	9.3	18.4

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

by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the New Mexico portion of the SEZ.

Figures 10.1.20.1-1 and 10.1.20.1-2 show the locations of the minority and low-income population groups within the 50-mi (80-km) radius around the boundary of the SEZ.

In the Colorado portion of the 50-mi (80-km) radius, more than 50% of the population in all but one of the block groups in Conejos County consists of minority population groups, together with all the block groups in adjacent Costilla County. Block groups in the cities of Alamosa (Alamosa County), Monte Vista, and Del Norte (both in Rio Grande County) are also more than 50% minority. In the New Mexico portion of the radius, Rio Arriba County has three block groups in which the minority population is more than 20 percentage points higher than the state average and one block group that is more than 50% minority. Tao County has six block groups with more than 50% minority, and five block groups in the vicinity of the City of Taos (Taos County) have minority populations that are 20 percentage points higher than the state average.

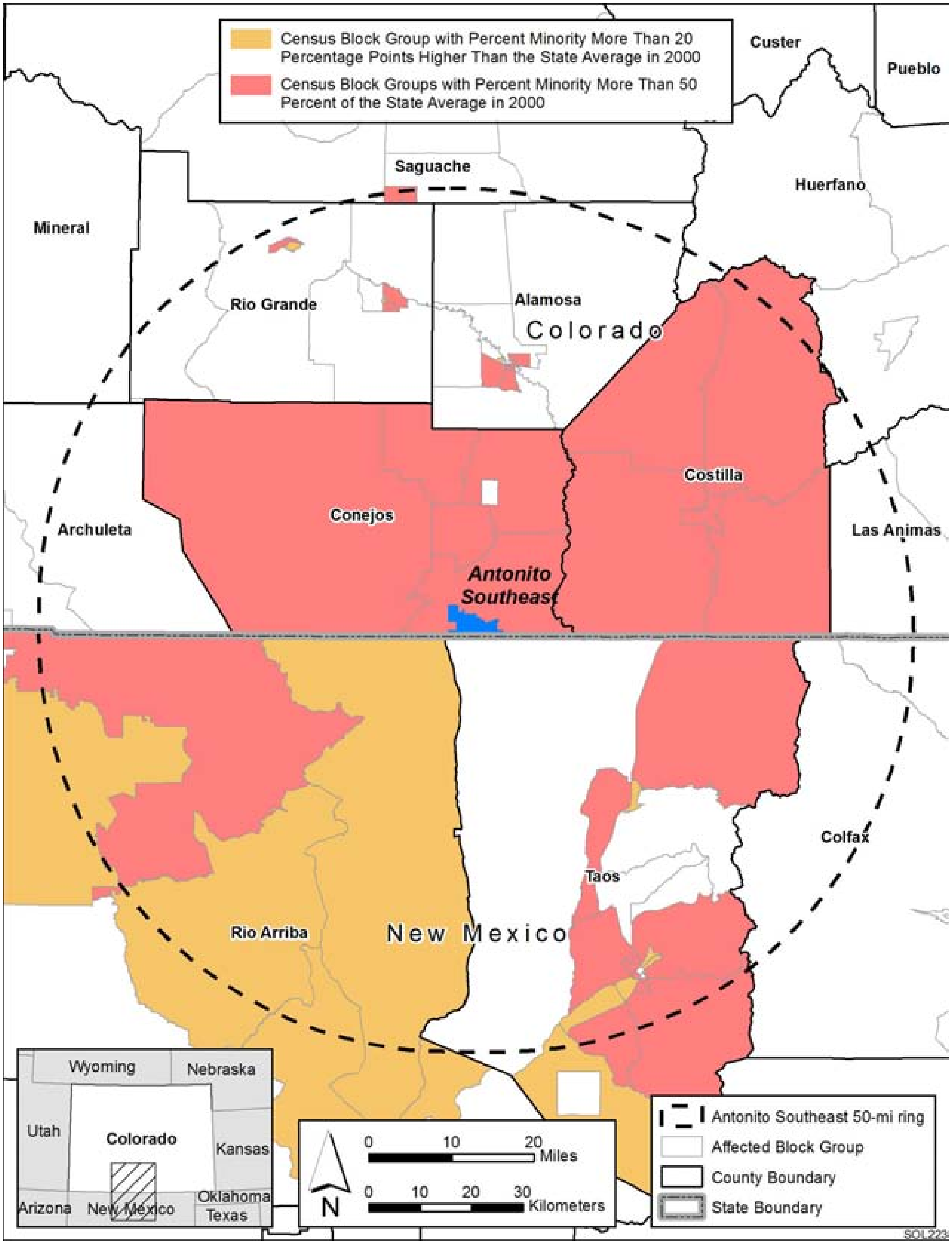

FIGURE 10.1.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

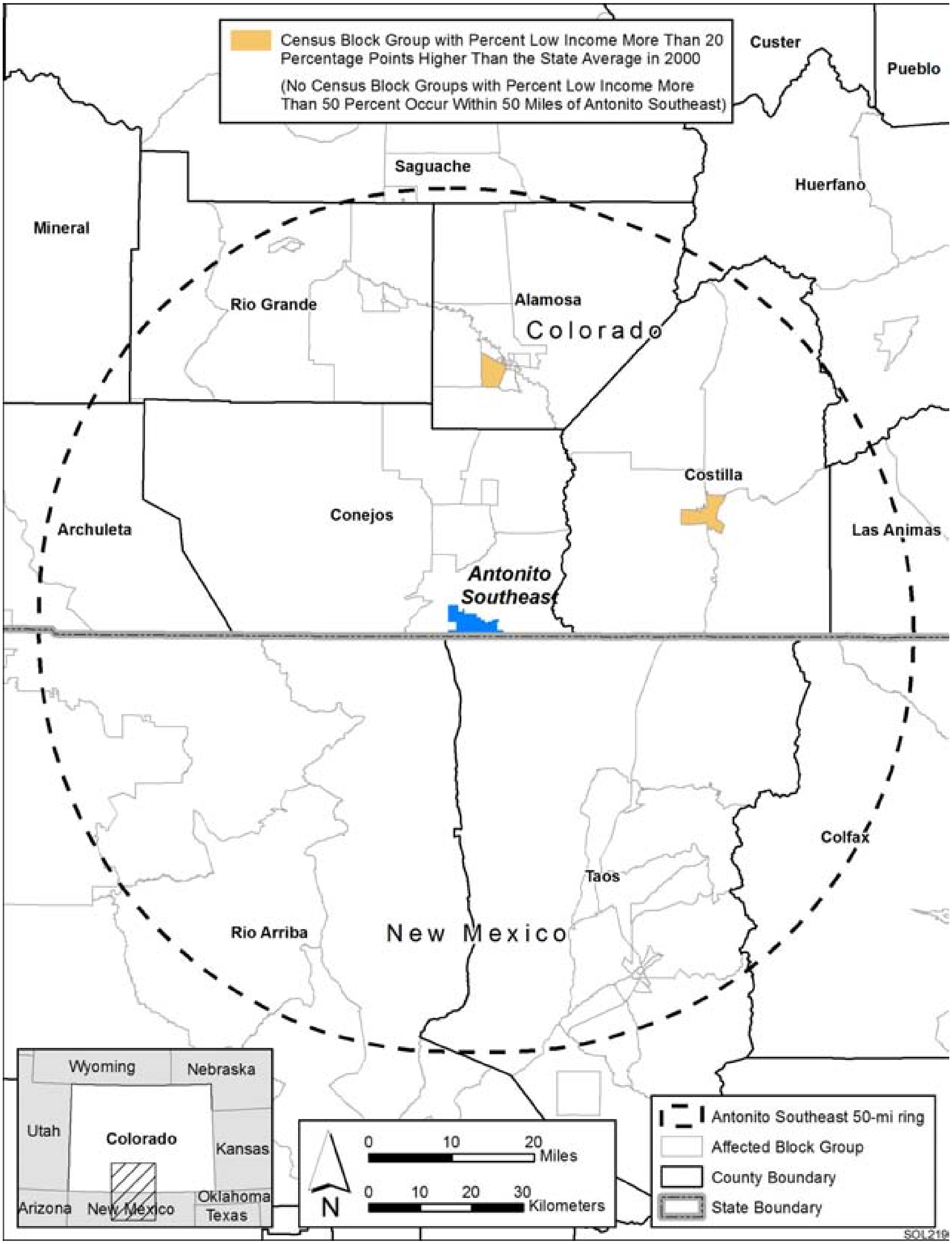

FIGURE 10.1.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

Low-income populations in the 50-mi (80-km) radius are limited to two block groups in the Colorado portion in the cities of San Luis (Costilla County) and Alamosa, both of which have low-income population shares that are more than 20 percentage points higher than the state average.

10.1.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy developments are described in detail in Section 5.18. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar development within the proposed SEZ include noise and dust during the construction of solar facilities; noise and electromagnetic field (EMF) effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values 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, there are minority populations defined by CEQ guidelines (Section 10.1.20.1) within both the Colorado and New Mexico portions of the 50-mi (80-km) radius around the boundary of the SEZ, meaning that any adverse impacts of solar projects could disproportionately affect minority populations. Because there are also low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would also be impacts on low-income populations.

10.1.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

10.1.21 Transportation

The proposed Antonito Southeast SEZ is accessible by road and rail networks. One U.S. highway and one regional railroad serve the area. A small regional airport is located 34 mi (55 km) north of the SEZ. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

10.1.21.1 Affected Environment

U.S. 285, a two-lane highway, passes along the western border of the proposed Antonito Southeast SEZ, as shown in Figure 10.1.21.1-1. The small town of Antonito is located to the northwest of the SEZ along U.S. 285 on its way to Alamosa, which is 34 mi (55 km) to the north. Santa Fe, New Mexico, can be reached traveling south on U.S. 285 to U.S. 84 for a total distance of 110 mi (177 km). A number of local roads cross the SEZ. Annual average traffic volumes for the major roads for 2008 are provided in Table 10.1.21.1-1. Several road/trail segments are located within the SEZ and have been identified as Open Motorized Road and Mechanized Use Trail. There is an area identified as Open to OHV use that is located outside of the SEZ but near the northwest corner of the area (see Section 10.1.5.1).

The SLRG Railroad serves the area (SLRG 2009). This regional railroad has rail stops in the towns of Antonito and Conejos several miles to the northeast of the SEZ. A freight dock and warehouse are also available in Antonito. The SLRG Railroad runs to the northeast from Antonito for a distance of approximately 100 mi (161 km), where it connects to the Union Pacific (UP) Railroad in Walsenburg.

The nearest public airport is San Luis Valley Regional Airport located 34 mi (55 km) north of the SEZ in Alamosa along U.S. 285. The airport has two runways, one of which is restricted to light aircraft. One regional airline provides daily scheduled service to Denver. No commercial cargo shipped to or from the airport has been reported by the Bureau of Transportation Statistics (BTS), and about 7,800 passengers departed from or arrived at the airport in 2008 (BTS 2008).

10.1.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 285 provides a regional traffic corridor that could experience moderate impacts for single projects that may have up to 1,000 daily workers with an additional 2,000 vehicle trips per day (maximum), an increase nearly twice the current annual average daily traffic (AADT) value for this route, as shown in Table 10.1.21.1-1. In addition, local road improvements would be necessary in any portion of the SEZ that might be developed so as not to overwhelm the local roads near any site access point(s).

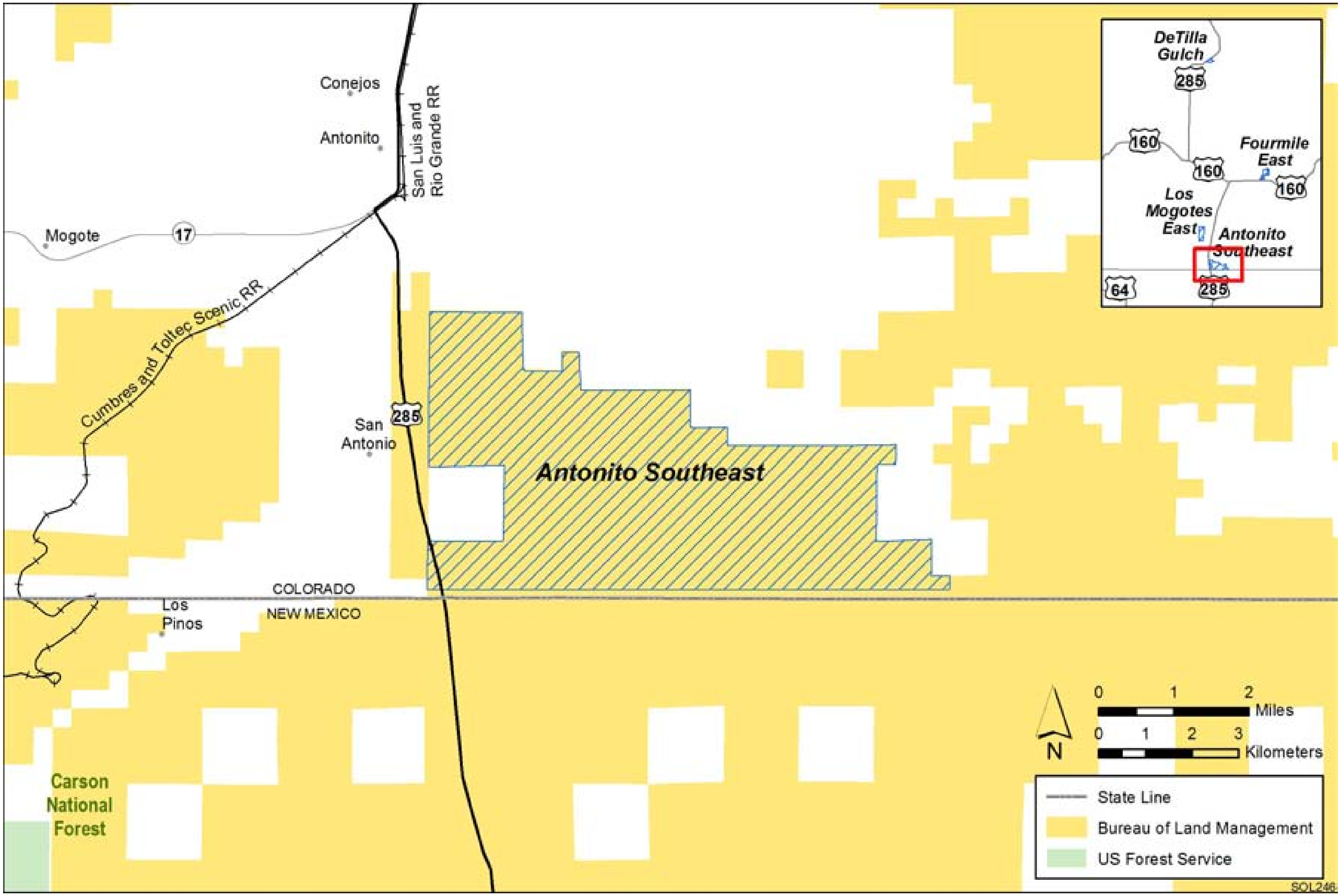

FIGURE 10.1.21.1-1 Local Transportation Network Serving the Proposed Antonito Southeast SEZ

TABLE 10.1.21.1-1 Annual Average Daily Traffic on Major Roads near the Proposed Antonito Southeast SEZ, 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. 285	North–south	New Mexico–Colorado border	1,300
		Junction with CO RD 12, just south of Antonito	1,500
		Between Antonito and Romeo; junction with CO RD 18 (CR J)	3,900
CO 17	East–west	Junction with CO RD 13; west of Antonito and junction with U.S. 285	1,500

Source: CDOT (undated).

10.1.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the Antonito Southeast SEZ. The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride sharing, would all provide some relief to traffic congestion on local roads leading to the site. Depending on the location of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

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10.1.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Antonito Southeast SEZ in the southern part of the San Luis Valley, Colorado. 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 what agency (federal or nonfederal), organization, or person 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 proposed Antonito Southeast SEZ is located on and is surrounded on the east by relatively flat BLM-administered land in Conejos County, Colorado. On the north and west, it is bounded by private land, while the southern boundary of the area abuts BLM-administered public lands in New Mexico. The private lands to the north are extensively developed for irrigated agriculture. There are two state-owned sections of land near the area, one to the west and one to the east. The area is rural in nature, and most of the land within the SEZ and to the east, south, and west is grazed (BLM and USFS 2010a). The Conejos River, which flows to the northeast toward the Rio Grande, runs north of the SEZ. The Rio Grande is to the east. U.S. 285 is located immediately to the west of the SEZ. The area is located within the boundaries of the Sangre de Cristo NHA. The designated Los Caminos Antiguos Scenic Byway passes by the northwest corner of the area. There are no active oil and gas leases in or near the SEZ. The nearest active mining (lode) claims on BLM land are located about 6 mi (10 km) to the northeast near the South Piñon Hills at the Conejos–Costilla County boundary. There are many other closed lode claims in this area. The SEZ is within a DoD airspace consultation area (BLM and USFS 2010a).

The geographic extent of the cumulative impacts analysis for potentially affected resources near the proposed Antonito Southeast SEZ is identified in Section 10.1.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 10.1.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 10.1.22.3. Cumulative impacts for each resource area are discussed in Section 10.1.22.4.

10.1.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 10.1.22.1-1 presents the geographic extent of the cumulative impacts analysis for potentially affected resources near the Antonito Southeast 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 privately owned, administered by the USFS, or

TABLE 10.1.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Antonito Southeast SEZ

Resource Area	Geographic Extent
Lands and Realty	Southern San Luis Valley
Specially Designated Areas and Lands with Wilderness Characteristics	Southern San Luis Valley
Rangeland Resources	Southern San Luis Valley
Recreation	Southern San Luis Valley
Military and Civilian Aviation	Southern San Luis Valley
Soil Resources	Areas within and adjacent to the Antonito Southeast SEZ
Minerals	Southern San Luis Valley
Water Resources	
Surface Water	Conejos River, Rio San Antonio, and Rio Grande
Groundwater	Rio Grande Basin within the San Luis Valley (unconfined and confined aquifers)
Vegetation, Wildlife and Aquatic Biota, Special Status Species	Known or potential occurrences within a 50-mi (80-km) radius of the Antonito Southeast SEZ, including Alamosa, Conejos, Costilla, Rio Grande, and Saguache Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Air Quality and Climate	San Luis Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ
Acoustic Environment (noise)	Areas adjacent to the Antonito Southeast SEZ
Paleontological Resources	Areas within and adjacent to the Antonito Southeast SEZ
Cultural Resources	Areas within and adjacent to the Antonito Southeast SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ for other properties, such as historic trails and traditional cultural properties.
Native American Concerns	San Luis Valley; viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ
Socioeconomics	Conejos County
Environmental Justice	Conejos County
Transportation	U.S. 285

administered by the BLM. The BLM administers approximately 11% of the lands within a 50-mi (80-km) radius of the SEZ.

10.1.22.2 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:

- 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 (e.g., the Iowa Pacific Holding Railway Hub) were not included in the cumulative impacts analysis.

The 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 10.1.22.2.1); 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 10.1.22.2.2). Together, these actions have the potential to affect human and environmental receptors within the geographic range of potential impacts over the next 20 years.

10.1.22.2.1 Energy Production and Distribution

Reasonably foreseeable future actions related to energy development and distribution within the San Luis Valley are identified in Table 10.1.22.2-1 and are described in the following sections. Figure 10.1.22.2-1 shows the approximate locations of the key projects.

Renewable Energy Development

In 2007, the State of Colorado increased its Renewable Portfolio Standard by requiring that large investor-owned utilities produce 20% of their energy from renewable resources by 2020; of this total, 4% must come from solar-electric technologies. Municipal utilities and

TABLE 10.1.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Antonito Southeast SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Renewable Energy Development			
Renewable Portfolio Standards	Ongoing	Land use	State of Colorado
San Luis Valley GDA (Solar) Designation	Ongoing	Land use	San Luis Valley
Xcel Energy/SunEdison Project; 8.2 MW, PV	Ongoing	Land use, ecological resources, visual	San Luis Valley GDA
Alamosa Solar Energy Project; 30 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
Greater Sandhill Solar Project; 17 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
San Luis Valley Solar Project; Tessera Solar, 200 MW, dish engine	Proposed	Land use, ecological resources, visual, cultural	San Luis Valley GDA
Solar Reserve; 200 MW, solar tower	Preliminary Application	Land use, ecological resources, visual	San Luis Valley GDA (Saguache)
Cogentrix Solar Services; 30 MW, CPV	Approved/ Underway	Land use, ecological resources, visual	San Luis Valley GDA
Lincoln Renewables; 37 MW PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
NextEra; 30 MW, PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
Transmission and Distribution Systems			
San Luis Valley–Calumet-Comanche Transmission Project	Proposed	Land use, ecological resources, visual, cultural	San Luis Valley (select counties)

rural electric providers must provide 10% of their electricity from renewable sources by 2020 (Pew Center on Global Climate Change 2009).

Also in 2007, the General Assembly of Colorado passed Colorado Senate Bill (SB) 07-100, which established a task force to develop a map of existing generation and transmission lines and to identify potential development areas for renewable energy resources within Colorado. These areas, called Renewable Resource Generation Development Areas (GDAs), are regions within Colorado with a concentration of renewable resources that provide a minimum of 1,000 MW of developable electric generating capacity. The task force identified

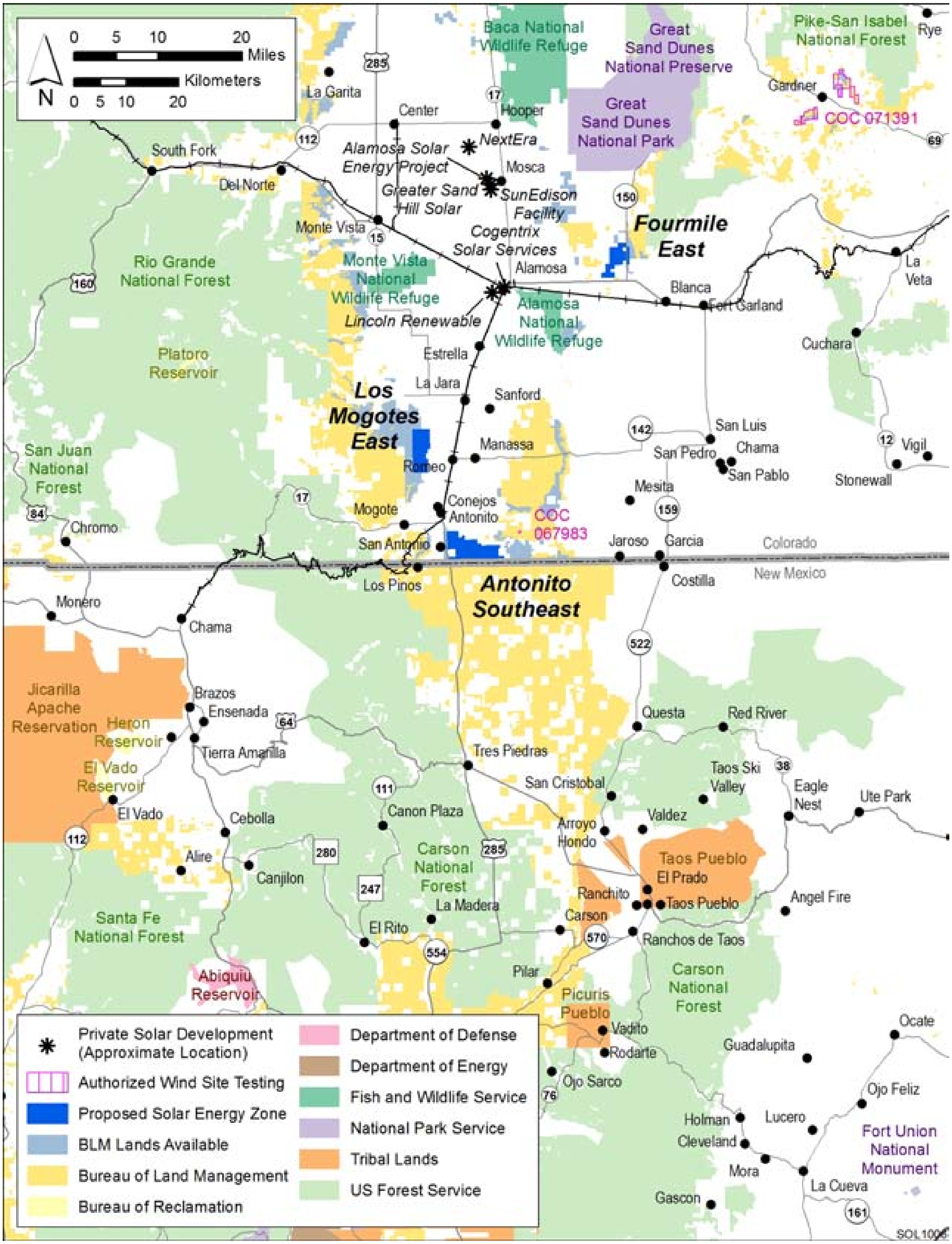

FIGURE 10.1.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

eight wind GDAs (mainly on the Eastern Plain) and two solar GDAs. The National Renewable Energy Laboratory (NREL) conducted detailed analyses of these areas and concluded that the San Luis Valley GDA is one of two regions in southern Colorado capable of generating large blocks of power—as much as 5.5 GW—via utility-scale solar power technologies. Although geothermal power is a potentially vast resource in Colorado (and in the San Luis Valley), no single site was found to generate 1,000 MW. As a result, the task force did not identify geothermal GDAs (Colorado Governor's Energy Office 2007).

In addition to the Antonito Southeast SEZ, the BLM has proposed three other proposed SEZs in the San Luis Valley: the De Tilla Gulch SEZ (1,522 acres [6.2 km^2]), the Fourmile East SEZ (3,882 acres [15.7 km^2]), and the Los Mogotes SEZ (5,918 acres [23.9 km^2]) (Figure 10.1.22.2-1). The four proposed SEZs together constitute 21,050 acres (85 km^2) of land and could provide as much as 3,368 MW of solar energy capacity. The Los Mogotes SEZ is close to the Antonito Southeast SEZ, only 7 mi (11 km) to the northwest; the other two SEZs are much farther away (De Tilla Gulch is about 80 mi [140 km] to the north, and Fourmile East is about 40 mi [64 km] to the northeast).

Solar Energy Development. Several solar power projects are planned or under way in the San Luis Valley GDA, as follows:

- *Xcel Energy/Sun Edison Project.* The 8.2-MW project began operations in August 2007. Located on 82 acres (0.3 km^2) of private land just west of CO 17 near Mosca in Alamosa County, the facility consists of three different solar technologies, including an array of PV panels, a PV system of single-axis trackers, and a system of CSP units. It generates power for distribution both within the San Luis Valley and outside the region.

- *Alamosa Solar Energy Project.* The 30-MW PV project will be located near Mosca, just west of CO 17 and 8 Mile Lane North, on private land currently being used for agriculture. The facility is being built by Iberdrola Renewables in two 15-MW phases and will connect to the San Luis Valley Substation, about 4.5 mi (7.2 km) to the west of the project site. A Special Use and Site Plan application was submitted to Alamosa County in July 2009; the first half of the facility is scheduled to begin operations in early 2011.

- *Greater Sandhill Solar Project.* Located on 200 acres (0.8 km^2) to the east of CO 17 near Mosca (across from the Xcel Energy/Sun Edison Project), the 17-MW PV facility to be built by Xcel Energy and SunPower has been approved by the Colorado Public Utilities Commission and will begin operations in 2011.

- *San Luis Valley Solar Project.* Tessera Solar North America submitted a Final 1041 Permit Application to Saguache County in June 2010 for a 200-MW dish engine solar facility to be built on a 1,525-acre (6.2-km^2) site near Saguache. The facility would employ 8,000 SunCatcher dish engines and cost $300 to

$500 to build. It would use only 10 ac-ft/yr of water for operation and maintenance and employ 45 full-time workers. The permit application identified expected significant effects of the proposed facility on visual resources and on socioeconomics, while effects on biological, cultural, and water resources and from noise were not expected to be significant. Construction would start in late 2010 (TSNA 2010). Tessera has offered to sell power to Xcel Energy. A 500-ft (150-m) transmission line would be built to connect to an existing 230 kV line owned by Xcel.

- *Solar Reserve.* Solar Reserve submitted a Preliminary 1041 Permit Application to Saguache County in July 2010 for a 200-MW solar tower facility. The project would be built in two 100-MW phases, each covering 1,400 acres (5.7 km^2) and employing 17,500 heliostats serving a 650-ft (200-m) power tower in southern Saguache County. A power block will house a steam turbine generator and molten salt thermal energy storage tanks. The facility would use wet cooling. Total water required for operation would be up to 1200 ac-ft/yr. An on-site switchyard would connect to an existing 230-kV line crossing the site. Construction would start in 2011 and operation in June 2013, employing 250 and 50 workers on average, respectively (Solar Reserve 2010).

- *Cogentrix Solar Services.* Cogentix Energy plans to build a 30-MW PV facility near Alamosa. The facility would use dual-axis-mounted concentrating solar cells from Amonix and would be the largest facility using this technology. The facility would cost $140 to $150 million and would be located on 225 acres (0.9 km^2) adjacent to an existing Xcel Energy transmission line. It would employ up to 140 during construction and 5 to 10 during operation and would begin operating in mid-2012. Cogentrix would sell power to Xcel Energy.

- *Lincoln Renewables.* Alamosa County issued a permit to Lincoln Renewables in April 2010 to build a 37-MW PV facility on 255 acres (1.0 km^2) south of Alamosa. As of that date, the project was still in need of interconnection and power purchase agreements. Construction would be completed by 2012, employing 125 workers. Operation would require only a couple of full-time workers.

- *NextEra.* Alamosa County issued a permit to NextEra in August 2010 to build a 30-MW PV facility on 279 acres (1.1 km^2) in northern Alamosa County. As of that date, the project was still in need of a power purchase agreement. Construction would start in 2011, employing 125 workers. Operation would require 1 to 3 full time workers. The plant would require a 3.5-mi (5.6-km) transmission line to connect to the power grid.

Transmission and Distribution System

Colorado SB 07-100 also directed rate-regulated utilities, such as Xcel Energy's Public Service Company of Colorado (Public Service), to develop plans for constructing or expanding transmission facilities to provide for the delivery of electric power consistent with the timing of the development of beneficial energy (including renewable) resources in Colorado. In response, Public Service has identified transmission-constrained areas in south-central Colorado, including the San Luis Valley and Walsenburg areas. Tri-State Generation and Transmission Association (Tri-State) and Public Service are proposing to construct a transmission project called the San Luis Valley–Calumet-Comanche Transmission project to meet the requirements of SB 07-100 and to improve the load service and system reliability throughout the San Luis Valley (Tri-State Generation and Transmission Association, Inc. 2008, 2009; Tri-State and Public Service Company of Colorado 2009) and are pursuing financial support from the USDA Rural Utilities Service electric program. The proposed project would consist of four parts:

1. A new 345- to 230-kV substation called Calumet, located about 6 mi (10 km) north of Tri-State's existing Walsenburg Substation in Huerfano County;

2. A double-circuit 230-kV line between the San Luis Valley Substation just north of Alamosa and the Calumet Substation;

3. A new (second) single-circuit 230-kV line between the Calumet Substation and Tri-State's existing Walsenburg Substation; and

4. A new double-circuit 345-kV transmission line connecting the Calumet Substation to the existing Comanche Substation in Pueblo County.

Parts 2 and 3, the 230-kV projects between the San Luis Valley and Walsenburg to Calumet, would take the place of Tri-State's proposed San Luis Valley Electric System Improvement project.

The segment crossing the San Luis Valley would consist of a new double-circuit 230-kV transmission line extending 95 mi (153 km) from the San Luis Valley Substation near Alamosa eastward to the Walsenburg Substation. The San Luis Valley Substation would also be expanded to a five-breaker ring to allow for the two new 230-kV line bays and future generator interconnections (Tri-State Generation and Transmission Association, Inc. 2009).

A detailed environmental assessment (EA) of the San Luis Valley–Calumet-Comanche Transmission project is planned; public meetings were held in August 2009. Route refinement workshops are scheduled to occur by the end of 2010. The partnership plans to have the transmission lines in service by May 2013 (Tri-State and Public Service Company of Colorado 2009).

10.1.22.2.2 Other Actions

Other ongoing and reasonably foreseeable future actions within the San Luis Valley are identified in Table 10.1.22.2-2 and are described in the following sections.

Mining and Mineral Processing

Mining and mineral-processing activities in the immediate vicinity of the proposed Antonito Southeast SEZ include private facilities, such as an active perlite expanding plant (Harborlite) owned by Dicalite-Dicaperl Corporation, a red rock mining operation (Colorado Lava, Inc.), and a gravel, sand, and landscape rock mining operation (Valdez Gravel).

Grazing Management

Within the San Luis Valley, the BLM's La Jara and Saguache Field Offices authorize grazing use on public lands. The current average active grazing use authorized by these offices is 13,719 and 17,506 AUMs, respectively. 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 this average level of use will continue in the near term. Grazing use on private lands in the San Luis Valley is frequently (but not always) related to grazing use of public and other federal lands since it is common for federal grazing permittees to utilize USFS- and BLM-administered lands as part of their annual operating cycle. For these operations, a long-term reduction or increase in federal authorized grazing use would affect the value of the private grazing lands.

Transportation

The travel planning area addressed in the BLM's Travel Management Plan encompasses BLM lands within the San Luis Valley and includes portions of Saguache, Rio Grande, Alamosa, Conejos, and Costilla Counties. The plan for the San Luis Resource Area amends the San Luis Resource Area Resource Management Plan (RMP) by changing all area OHV designations of "OHV Open" to "OHV Limited" on various designated roads and trails. The two exceptions to the amendment are the Manassa area of 179 acres (0.7 km^2) and the Antonito area of 82 acres (0.3 km^2), which will be retained as OHV Open areas. Prior to this amendment, 389,279 acres (1,575 km^2) of the 520,945 acres (2,108 km^2) with OHV area designations (i.e., OHV Open, OHV Limited, OHV Closed) were designated as "OHV Open." The proposed ROD was signed on June 4, 2009 (BLM 2009d).

Recreation

Two scenic railroads operate in the San Luis Valley:

- *Rio Grande Scenic Railroad.* Operated by the SLR&G railroad, the scenic railroad has about 17,600 visitors each year. Scenic routes run between

TABLE 10.1.22.2-2 Reasonably Foreseeable Future Actions near the Proposed Antonito Southeast SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Mining and Mineral Processing			
Harborlite (perlite processing plant)	Ongoing	Visual, ecological resources; socioeconomics	Area northwest of the Antonito Southeast SEZ (Conejos County)
Colorado Lava Inc. (Permit #93CN318)	Ongoing	Visual, ecological resources; socioeconomics	Area northwest of the Antonito Southeast SEZ (Conejos County)
Valdez Gravel (Permit #M-91-133)	Ongoing	Visual, ecological resources; socioeconomics	Area south of the Antonito Southeast SEZ (Conejos County)
Transportation			
Travel Management Plan (BLM)	Proposed	Transportation, ecological resources, recreation	San Luis Valley
Recreation			
Rio Grande Scenic Railroad	Ongoing	Visual, ecological resources; socioeconomics	San Luis Valley, including routes adjacent to the Antonito Southeast SEZ (Conejos County)
Cumbres & Toltec Scenic Railroad	Ongoing	Visual, ecological resources; socioeconomics	San Luis Valley, including routes adjacent to the Antonito Southeast SEZ (Conejos County)
Water Management			
Rio Grande Compact	Ongoing	Water, ecological resources	San Luis Valley
San Luis Valley Project—Conejos Division (CWCD)	Ongoing	Water, ecological resources	San Luis Valley
Conservation			
Rio Grande Riparian Enhancement Project	Proposed	Ecological resources	San Luis Valley (areas along the Rio Grande)
Old Spanish National Historic Trail Comprehensive Management Plan (BLM and NPS)	Proposed	Cultural, visual resources	San Luis Valley (and immediately west of the Antonito Southeast SEZ)
Sangre de Cristo National Heritage Area	Ongoing	Cultural, visual resources	San Luis Valley (areas along the east side)
San Luis Valley Regional Habitat Conservation Plan	Ongoing	Ecological resources	Areas along the Rio San Antonio (near Antonito)

Alamosa and La Veta, Alamosa and Monte Vista, and Alamosa and Chama (New Mexico) via Antonito. The route between Alamosa and La Veta is especially famous for traversing over the historic La Veta Pass, the highest point (at 9,242 ft [2,817 m]) that standard gauge track crosses the Rocky Mountains (RGSR 2009).

- *Cumbres & Toltec Scenic Railroad.* The Cumbres & Toltec Scenic Railroad is a narrow gauge railroad that runs along the Colorado–New Mexico border. It has depots in Antonito and Chama (New Mexico) (CTSR 2009).

Water Management

Water management is of great importance in the San Luis Valley because it supports agriculture and the raising of livestock, the primary economic activities in the valley. It is estimated that an average of more than 2.8 million ac-ft (3.5 billion m^3) of water enters and leaves the valley each year. Surface water inputs are estimated to be about 1.2 million ac-ft (1.5 billion m^3), providing recharge to the valley's aquifers and nearly all the water for irrigation. Several actions by the State of Colorado, the Rio Grande Water Conservation District (RGWCD), and the U.S. Bureau of Reclamation (BOR) affect the distribution priorities of water in the San Luis Valley. These include the Rio Grande Compact, the San Luis Valley Project (Conejos and Closed Basin Divisions), and the recent Subdistrict 1 Water Management Plan.

Rio Grande Compact. The Rio Grande Compact is an agreement among the states of Colorado, New Mexico, and Texas signed in 1938 and ratified in 1939 to apportion the waters of the Upper Rio Grande Basin (north of Fort Quitman, Texas) among the three states. The compact established a sliding scale for the annual volume of water that must be delivered to the Colorado–New Mexico border (as measured at the Lobatos streamflow gage) that depends on the volume of water measured each year at the Del Norte, Colorado streamflow gage. Under the compact, Colorado is obligated to provide an annual delivery of 10,000 ac-ft (12 million m^3) of water into the Rio Grande at the Colorado–New Mexico state line (as measured at the Lobatos gage station) less quantities available for depletion from the Rio Grande at Del Norte and the Conejos River. If the delivery is not met, it creates a debit that has to be repaid in later years. Delivery requirements are administered by the State Engineer and the Colorado Division of Water Resources, Water Division III, in Alamosa (Hinderlider et al. 1939; SLV Development Resources Group 2007).

San Luis Valley Project—Conejos Division. The Conejos Division encompasses the Platoro Dam and Reservoir, located on the Conejos River within the Rio Grande National Forest. Managed by the Conejos Water Conservancy District, the Platoro Project provides flood control and storage of supplemental water for the irrigation of about 81,000 acres (328 km^2) within the district. The reservoir also provides recreational opportunities such as fishing, boating, hiking, and camping (Simonds 2009).

Conservation

There are several conservation-related projects and plans in the San Luis Valley, as follows:

Rio Grande Riparian Enhancement Project. This riparian enhancement project along the Rio Grande is to be completed by the BLM with American Recovery and Reinvestment Act of 2009 (ARRA) funds. The project falls under a Categorical Exclusion under NEPA.

Old Spanish Historic Trail Comprehensive Management Plan. In preparation by the BLM and the NPS. The purpose of the plan is to provide a long-term strategy for managing and interpreting the Old Spanish Historic Trail.

Sangre de Cristo National Heritage Area. The Sangre de Cristo NHA was designated an NHA in March 2009. NHAs are designated by Congress and are intended to encourage the conservation of natural, historical, scenic, and cultural resources within the area of their designation. NHAs are managed by the NPS (Heide 2009; NPS 2009b).

The Sangre de Cristo NHA covers more than 3,000 mi^2 (7,770 km^2) of land in Alamosa, Conejos, and Costilla Counties and encompasses the Monte Vista National Wildlife Refuge, the Baca National Wildlife Refuge, and the Great Sand Dunes National Park and Preserve. In addition, it has more than 20 cultural properties listed on the NRHP (including the Cumbres & Toltec Scenic Railroad). The NHA has been home to native tribes, Spanish explorers, and European settlers over more than 11,000 years of settlement (NPS 2009b; SLV Development Resources Group 2009). Three of the four SEZs (Fourmile East, Los Mogotes East, and Antonito Southeast) are within the Sangre de Cristo NHA; the De Tilla Gulch SEZ is about 15 mi (24 km) to the north.

San Luis Valley Habitat Conservation Plan. The USFWS, with the RGWCD and the State of Colorado, is developing a regional Habitat Conservation Plan (HCP) to address more than 150 mi (241 km) of riparian habitat and land use activities on more than 2 million acres (8,090 km^2) of land that affect the southwestern willow flycatcher, the bald eagle, and the yellow-billed cuckoo throughout the San Luis Valley. Funds were granted in 2004 and 2005 to prepare the plan and NEPA documentation (USFWS 2009b). The NOI to prepare an environmental analysis and to hold public scoping meetings was published by the USFWS in the *Federal Register* on January 7, 2005 (70 FR 5). The agency's intent is to apply for an incidental take permit (ITP) for the flycatcher, bald eagle, and yellow-billed cuckoo and possible other rare and/or sensitive species that may be affected by various activities within the San Luis Valley. The Notice of Availability (NOA) for the draft EIS and receipt of application for an ITP were published on June 23, 2006 (71 FR 121). It is not clear at the time of this report whether a final EIS was issued.

Miscellaneous Other Actions

The BLM has several small-scale and administrative projects that require NEPA documentation that are not addressed individually in this cumulative impacts analysis. These projects include many that pertain to grazing permits, such as permit renewals, transfer of permits, changes in grazing dates (seasons), changes in pasture rotations; and changes in AUMs. Other small-scale projects on the NEPA register include the construction of a wildlife boundary fence, an illegal dump remediation project, rock removal, weed control, and a creek restoration project. Some of these projects could occur within 50 mi (80 km) of the Antonito Southeast SEZ.

10.1.22.3 General Trends

Table 10.1.22.3-1 lists general trends within the San Luis Valley with the potential to contribute to cumulative impacts; these trends are discussed in the following sections.

10.1.22.3.1 Population Growth

The 2006 official population estimate for the San Luis Valley (48,291) represents a 4.5% increase over that reported by the 2000 Census, with an annual increase of about 0.75% over the 6-year period (Table 10.1.22.3-2). The growth rate in Conejos County over the same 6-year period was 2.2%. Most of this growth was in unincorporated areas. Population growth

TABLE 10.1.22.3-1 General Trends in the San Luis Valley

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

within the valley is expected to increase at a rate of about 0.6% each year from 2006 to 2011, then 1.1% each year after that to 2016. This represents about 60 to 70% of the projected Colorado statewide growth rates of 1.0% for 2006 to 2011 and 1.5% for 2012 to 2016. In the 10-year period between 2006 and 2016, population growth within Conejos County is projected to be 9.2% (SLV Development Resources Group 2007).

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 San Luis Valley (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). Energy consumption for the transportation, residential, and industrial sectors is expected to grow by about 0.5%, 0.4%, and 0.1%, respectively, each year (EIA 2009).

10.1.22.3.3 Water Availability

Significant water loss has occurred in the San Luis Valley over the past century. Since 1890, the average annual surface water flows of the Rio Grande (near Del Norte) have averaged about 700,000 ac-ft (863 million m^3). Annual flows peaked in 1920 with a flow of 1 million ac-ft (1.2 billion m^3), about 143% of the average. The lowest annual flows were recorded in 2002 at

TABLE 10.1.22.3-2 Population Change in the San Luis Valley Counties and Colorado from 2000 to 2006, with Population Forecast to 2016

	Population			Population Forecast		
	2000	2006	Percentage Increase 2000 to 2006	2011	2016	Percentage Increase 2006 to 2016
San Luis Valley	46,190	48,291	4.5	51,293	54,765	18.6
Colorado	4,301,261	4,812,289	11.9	5,308,500	5,308,300	23.4
Counties						
Alamosa	14,966	15,765	5.3	16,948	18,326	22.5
Conejos	8,400	8,587	2.2	8,966	9,373	11.6
Saguache	5,917	6,568	11.0	7,078	7,582	28.1

Source: SLV Development Resources Group (2007).

154,000 ac-ft (190 million m^3), about 24% of the average. Three of the five years between 2003 and 2007 have been below the average; although flows in 2007 have measured slightly above it (710,000 ac-ft, or 876 million m^3). A comparison of streamflows across the valley shows a similar trend; with both surface water and groundwater data in 2002 indicating extreme to exceptional drought severity. However, data from 2007 suggest a possible easing of the drought (Thompson 2002; SLV Development Resources Group 2007).

Water in the San Luis Valley is used predominantly for crop irrigation; including both center pivot and flood irrigation techniques. For a typical potato farm, a sprinkler system on a 125-acre (0.5-km^2) circle applies about 210 ac-ft (259,000 m^3) during a 100-day growing season, 70% of which (146 ac-ft, or 180,000 m^3) is consumed in the growing crop. In comparison, flood irrigation (not common for potato farming) draws 290 ac-ft (358,000 m^3) during a 100-day growing season and consumes about 50% (144 ac-ft, or 178,000 m^3). An alfalfa farm requires about one and a half times the water required by a typical potato or barley farm. Table 10.1.22.3-3 compares daily water use by sector. Total daily water withdrawals and consumptive use are highest in Conejos County, a county that has a large share of its crops in alfalfa (accounting for more than one-third of its water consumption) (SLV Development Resources Group 2007).

Over the past 20 years, groundwater consumption in the San Luis Valley has increased. This increase is attributed mainly to changes in crop patterns from less water-consumptive crops to more water-consumptive crops; changes in the type and frequency of irrigation; the increasing number of acres under irrigation; and more heavy reliance on wells that were formerly only used sporadically for irrigation. These changes, combined with a declining water supply due to prolonged drought conditions over the past decade, have reduced the groundwater supply available for crop irrigation. Since 1976, it is estimated that the unconfined aquifer has lost more than 1 million ac-ft (1.2 billion m^3) (RGWCD 2009; SLV Development Resources Group 2007).

TABLE 10.1.22.3-3 Daily Water Use by Sector in Colorado, 1995

	Withdrawals					
			Sector (Mgal)			
Region	Total (Mgal)	Percentage Groundwater	Irrigation	Public Supply	Industrial	Consumptive Use (Mgal)
Alamosa	414	29	411 (109)[a]	2	2	171
Conejos	732	3.9	727 (111)	3	–[b]	264
Saguache	426	34	423 (210)	2	–	66
San Luis Valley	2,176	19	2,159	15	4	843
Colorado	13,840	16	12,735 (3,404)	705	123	5,235

[a] Numbers in parentheses represent the number of irrigated acres (in thousands) in the region (USGS 2000).

[b] A dash indicates no water use for the sector.

Source: SLV Development Resources Group (2007).

The severe drought recorded in 2002 marked an unparalleled situation in the San Luis Valley in terms of the lack of surface water supplies, a lack of precipitation, a lack of residual soil moisture, and poor vegetation health. Well production decreased significantly, with declining groundwater levels in the unconfined aquifer and decreasing artesian pressure in the confined aquifer. In response, water conservation and irrigation strategies (including crop abandonment) were considered by area farmers to minimize water usage (and evapotranspiration rates) and to reduce the risk of over-irrigating crops (Thompson 2002).

Most of the cities in the San Luis Valley draw their water from deep wells in the confined aquifer. Water used for the public supply is only a small fraction of that used for agriculture (Table 10.1.22.2-5). Because of drought conditions over the past decade, some residential wells in the San Luis Valley are drying up. Since 1972, the State Engineer has not allowed any new high-capacity wells (i.e., wells with yields greater than 300 gpm, or 1,136 L/min) to be constructed in the confined aquifer (SLV Development Resources Group 2007).

The San Luis Valley has about 230,000 acres (931 km^2) of wetlands that provide important wildlife habitat. Only about 10% of the wetlands in the valley occur on public land; conservation efforts with landowner cooperation are becoming popular through the use of land trusts and similar alternatives. Streams, reservoirs, and lakes within the San Luis Valley provide high-quality water and, when sufficient water levels are present, support trout fisheries. Boating in the valley's streams, reservoirs, and lakes has declined in recent years. Drought impacts over the past decade have reduced the depths of surface water bodies in the valley; many are completely dry (SLV Development Resources Group 2007).

10.1.22.3.4 Climate Change

According to a recent report prepared for the CWCB (Ray et al. 2008), temperatures in Colorado increased by about 2°F (1.1°C) between 1977 and 2006. Climate models project continued increasing temperatures in Colorado—as much as 2.5°F (1.4°C) by 2025 and 4°F (2.2°C) by 2050 (relative to the 1950 to 1999 baseline temperature). By 2050, seasonal increases in temperature could rise as much as 5°F (2.8°C) in summer and 3°F (1.7°C) in winter. These changes in temperature would have the effect of shifting the climate typical of the Eastern Plains of Colorado westward and upslope, bringing temperature regimes that currently occur near the Colorado–Kansas border into the Front Range.

Because of the high variability in precipitation across the state, current climate models have not been able to identify consistent long-term trends in annual precipitation. However, projections do indicate a seasonal shift in precipitation, with a significant increase in the proportion of precipitation falling as rain rather than snow. A precipitous decline in snowpack at lower elevations (below 8,200 ft [2,499 m]) is expected by 2050.

In the past 30 years, the onset of streamflows from melting snow (called the "spring pulse") has shifted to earlier in the season by 2 weeks. This trend is expected to continue as spring temperatures warm. Projections also suggest a decline in runoff for most of the river basins in Colorado by 2050. Hydrologic studies of the Upper Colorado River Basin estimate average decreases in runoff of 6 to 20% by 2050 (as compared to the twentieth century average).[26] These changes in the water cycle, combined with increasing temperatures and related changes in groundwater recharge rates and soil moisture and evaporation rates, will increase the potential for severe drought and reduce the total water supply, while creating greater demand pressures on water resources.

In general, the physical effects of climate change in the western United States include warmer springs (with earlier snowmelt), melting glaciers, longer summer drought, and increased wildland fire activity (Westerling et al. 2006). All these factors contribute to detrimental changes to ecosystems (e.g., increases in insect and disease infestations, shifts in species distribution, and changing in the timing of natural events). Adverse impacts on human health, agriculture (crops and livestock), infrastructure, water supplies, energy demand (due to increased intensity of extreme weather and reduced water for hydropower), and fishing, ranching, and other resource-use activities are also predicted (GAO 2007; NSTC 2008; Backlund et al. 2008).

The State of Colorado has plans to reduce its GHG emissions by 80% over the next 40 years (Ritter 2007). Initiatives to accomplish this goal will focus on modifying farm practices (e.g., less frequent tilling, improving storage and management of livestock manure, and capturing livestock-produced methane), improving standards in the transportation sector, providing reliable and sustainable energy supplies (e.g., small-scale hydropower, solar, wind, and geothermal energy), and joining the Climate Registry of North American GHG emissions, among others.

10.1.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Antonito Southeast SEZ on the basis of the following assumptions: (1) because of the relatively small size of the proposed SEZ (less than 10,000 acres [40.5 km^2]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 7,783 acres (31 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 (1.01 km^2) monthly on the basis of construction schedules planned in current applications. In addition, about 4 mi (6 km) of new transmission line will be needed to reach the nearest existing line, a 69-kV transmission line located to the north of the Antonito Southeast SEZ. Further, it is likely that a line upgrade will be needed, considering that the existing line is less than the 230 kV assumed to be needed for utility-scale solar facilities and that its available capacity is unknown. Regarding site access, because a major road (U.S. 285) passes directly to the west of the proposed SEZ, no major road construction activities outside of the SEZ would be needed for development to occur in the SEZ.

Cumulative impacts that would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ when added to

[26] The effects of climate change are not as well studied in the Rio Grande Basin as in the Upper Colorado River Basin.

other past, present, and reasonably foreseeable future actions described in the previous section in each resource area are discussed below. At this stage of development, because of the uncertain nature of 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 semi-quantitatively, 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.

10.1.22.4.1 Lands and Realty

The area covered by the proposed Antonito Southeast SEZ is largely undeveloped. Just to the north and northwest of the SEZ are some private agricultural lands. In general, the areas surrounding the SEZ are rural in nature. Numerous dirt/ranch roads provide access throughout the SEZ. The SEZ also has numerous livestock management facilities, including fences and water projects, within it.

Construction of utility-scale solar energy facilities within the SEZ would preclude use of those areas occupied by the solar energy facilities for other purposes. The areas that would be occupied by the solar facilities would be fenced, and access to those areas by both the general public and wildlife would be eliminated. Traditional uses of public lands (there is no agriculture on these sites) would no longer be allowed.

If the area is developed as an SEZ, it is likely that improvements to the infrastructure and increased availability of energy from the solar facilities could attract other users to the area. As a result, the area could acquire more industry. Development of the SEZs could introduce a highly contrasting industrialized land use into areas that are largely rural. As a result, the contribution to cumulative impacts of utility-scale solar projects on public lands on and around the Antonito Southeast SEZ could be significant, particularly if the SEZ is fully developed with solar projects.

10.1.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are no specially designated areas within the SEZ but there are such areas in the general vicinity. These areas include four ACECs, two WSAs, two WAs, a scenic byway, a NHA, and a historic trail. Construction of utility-scale solar energy facilities within the SEZ would have the potential for cumulatively contributing to the visual impacts on these specially designated areas. The exact nature of impacts would depend on the specific technologies employed and the locations selected within the SEZ. These impacts would be in addition to impacts from any other ongoing or future activities. However, development of the SEZ, especially full development, would be a dominant factor in the viewshed from large portions of these specially designated areas.

10.1.22.4.3 Rangeland Resources

The main current land use of the BLM-administered public lands in the SEZ is grazing. If utility-scale solar facilities are 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 rangers 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 dryland uses.

Because the closest wild horse HMA is about 75 mi (120 km) from the proposed SEZ, solar energy development would not contribute to cumulative impacts on wild horses and burros managed by the BLM.

10.1.22.4.4 Recreation

It is likely that 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 surrounding specially designated areas (Section 10.1.22.3.2). The overall cumulative impacts on recreation could be large for the users of the areas affected by the solar projects, but would be relatively small for users of areas outside of the affected areas.

10.1.22.4.5 Military and Civilian Aviation

The SEZ is located under two MTRs. There are no civilian facilities in the vicinity of the SEZ. Recent information from the DoD indicates that there are no concerns about solar development in the SEZ. Considering other ongoing and reasonably foreseeable future actions discussed in Section 10.1.22.2, the cumulative impacts from the solar energy development in the proposed SEZ would be small.

10.1.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including any associated transmission lines, would contribute to the soil loss due to wind erosion. Construction of new roads within the SEZ, or improvements to existing roads would also contribute to soil erosion. During construction, operations, and decommissioning of the solar facilities, travel back and forth by the workers at the facilities, visitors and delivery personnel to the facilities, or waste haulers from the facilities would also contribute to soil loss. These losses would be in addition to losses occurring as a result of disturbance caused by other users in the area, including from construction of other renewable energy facilities, recreational users, and agricultural users. Erosion of exposed soils could also lead to the generation of fugitive dust, which could affect local air quality (see Section 10.1.22.3.12). As discussed in Section 10.1.7.3, design features would be employed to minimize erosion and loss of soil during the construction, operation, and decommissioning phases of the solar facilities and any associated transmission lines. Overall, solar energy facility contributions to cumulative impacts on soil resources would be small and temporary during the construction and decommissioning of the facilities.

Landscaping of solar energy facility areas could alter drainage patterns and lead to increased siltation of surface water streambeds, in addition to that from other development activities and agriculture. However, with the required design features in place, cumulative impacts would be small.

10.1.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

There are no mining claims or oil and gas leases in the SEZ. Lands in the SEZ were recently closed to "locatable mineral" entry, pending the outcome of this PEIS. These lands would continue to be closed to all incompatible forms of mineral development if the area is designated as an SEZ. However, some mineral uses might be allowed. For example, oil and gas development utilizing directional drilling techniques would still be possible. Also, 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. No geothermal development has occurred within or adjacent to the SEZ, nor is there any known or expected future development of geothermal resources in the same area.

10.1.22.4.8 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 Sections 10.1.9.2. It is stated that 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 686 to 964 ac-ft (846,200 to 1.2 million m^3). During operations, the amount of water needed for all evaluated solar technologies would range from 43 to 23,371 ac-ft/yr (53,000 to 28.8 million m^3). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. These numbers would compare with 1,100 ac-ft/day (402,680 ac-ft/yr) in Conejos County that was withdrawn from primarily surface waters in 2005. Therefore, cumulatively the additional water resource needed for solar facilities in the SEZ would constitute a relatively small increment (up to 6%, the ratio of the annual operations water requirement to the annual amount withdrawn in Conejos County). However, as discussed in Sections 10.1.9.1.3, the water resources in the area are fully appropriated, and any new users would have to purchase a more senior water right (e.g., an old irrigation right), retire that historic consumptive use, and transfer that amount of historic consumptive use to the new project. Additionally, the proposed water management rules being developed for the Rio Grande Basin will impose limits on groundwater withdrawals and set requirements for augmentation water plans that can affect the process of securing water supplies (see Sections 10.1.9.1.3 and 10.1.9.2.4). The strict management of water resources in the Rio Grande Basin act to ensure that any impacts from a new, water use would continue to be equivalent to or less than those from current uses and that no net increase or decrease in the total amount of water used would occur.

Small quantities of sanitary wastewater would be generated during the construction and operation of the potential utility-scale solar energy facilities. The amount generated from solar facilities would be in the range of 9 to 74 ac-ft (11,100 to 91,300 m^3) during the peak construction year and would range from less than 1 to 22 ac-ft/yr (up to 27,100 m^3/yr) during operations. Because of the small quantity, the sanitary wastewater generated by the solar energy facilities would not be expected to put undue strain on available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that rely on conventional wet- or dry-cooling systems, there would also be 246 to 442 ac-ft/yr (303,200 to 545,200 m^3/yr) of blowdown water from cooling towers. This water would be treated on-site (e.g., in settling ponds) and injected into the ground, released to surface water bodies, or reused.

10.1.22.4.9 Vegetation

The proposed Antonito Southeast SEZ is located primarily within the San Luis Shrublands and Hills ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands. These plant community types generally have a wide distribution within the San Luis Valley area, and thus other ongoing and reasonably foreseeable future actions would have a cumulative effect on them. Because of the long history of livestock grazing, the plant communities present within the SEZ 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. In addition, any wetlands within the footprint of the facility would need to be avoided or impacts mitigated. Wetland or riparian habitats outside of the SEZ that are supported by groundwater discharge could be affected by hydrologic changes resulting from 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, which could result in reduced productivity or changes in plant community composition. Similarly, surface runoff from project areas after heavy rains could increase sedimentation and siltation in areas downstream. Other activities that would contribute to the overall dust generation in the area would include construction of new solar facilities or other facilities, agriculture, recreation, and transportation. Programmatic and SEZ-specific design features would be used to reduce the impacts from solar energy projects and thus the overall cumulative impacts on plant communities and habitats.

10.1.22.4.10 Wildlife and Aquatic Biota

More than 325 species of amphibians (over 10 species), reptiles (over 10 species), birds (over 235 species), and mammals (over 70 species) occur in and around the proposed Antonito Southeast SEZ (CDOW 2009). The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, and wildlife injury or mortality. Unless mitigated, these impacts, when added to impacts that would result from other activities in the general area, could be moderate to large. In general, impacted species with broad distributions and occurring in a variety of habitats would be less affected than species with a narrowly defined habitat within a restricted area. The required programmatic and SEZ-specific design features would reduce the severity of impacts on wildlife. The design features include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats (e.g., wetlands such as Alta Lake in the proposed Antonito Southeast SEZ or areas of crucial habitat such as severe winter range for elk).

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ are smaller areas, and likely too far away from the Antonito Southeast to have cumulative impacts on wildlife and aquatic biota. However, the proposed Los Mogotes SEZ is only about 7 mi (11 km) from the Antonito Southeast SEZ. Additionally, there are other ongoing and reasonably foreseeable future actions (Section 10.1.22.2) occurring in the vicinity of the Antonito Southeast SEZ. If development of solar facilities occurred at both proposed SEZs in the future or if other actions occurred in the vicinity, there could be cumulative impacts on wildlife and aquatic biota habitat. However, many of the wildlife species have extensive available habitat within the affected counties (e.g., elk and pronghorn). Nonetheless, several new solar facilities and the other actions would have a cumulative impact on wildlife. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

For example, solar energy development in the proposed Antonito Southeast SEZ would encompass an area of severe winter range for elk. The implementation of programmatic and SEZ-specific design features would reduce the impacts from solar energy projects and thus the overall cumulative impacts on wildlife.

The only surface water body on the proposed SEZ is Alta Lake, a wetland depression located in the northwestern corner of the SEZ. Because the lake can periodically dry up, no fish are present. Impacts on Alta Lake are discussed in Section 10.1.11.4.2 Cumulative impacts on aquatic biota and habitats resulting from solar facilities within the SEZ and other reasonably foreseeable activities would most likely occur as a result of groundwater drawdown or sedimentation of downgradient streams. Since net groundwater use should not change because of regulations governing use in the San Luis Valley, cumulative impacts on aquatic biota and habitats from groundwater drawdown should not occur. Design features to prevent erosion and sedimentation would reduce cumulative impacts on stream habitat and aquatic biota.

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

One species listed under the ESA (southwestern willow flycatcher) has the potential to occur within the affected area of the SEZ. The Gunnison's prairie dog is the only species that is a candidate for listing as threatened or endangered under the ESA that may occur near the proposed Antonito Southeast SEZ. Numerous additional species occurring on or in the vicinity of the SEZ are listed as threatened or endangered by the States of Colorado or New Mexico, or listed as a sensitive species by the BLM. Design features to be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy projects include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. The impacts of full-scale solar energy development on threatened, endangered, and sensitive species would be minimized if design features were implemented, including avoidance of occupied or suitable habitats, avoidance of occupied areas, and translocation of individuals. This approach would also minimize the contribution of potential solar energy projects to cumulative impacts on protected species. Depending on other projects occurring in the area at the time, there may still be some cumulative impacts on protected species. However, other projects would likely also employ mitigation measures to reduce or eliminate the impacts on protected species as required by the ESA and other applicable federal and state laws and regulations.

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ, are smaller areas and likely too far away from the Antonito Southeast SEZ to have cumulative impacts on special status species. However, the proposed Los Mogotes SEZ is only about 7 mi (11 km) from the Antonito Southeast SEZ. Special status species with potential habitat impacts from solar development that are common to both the Los Mogotes SEZ and the Antonito Southeast SEZ are the Bodin milkvetch, grassy slope sedge, least moonwort, northern moonwort, Rocky Mountain blazing-star, western moonwort, short-eared owl, Rio Grande chub, Rio Grande sucker, and southwestern willow flycatcher.

There are also other ongoing and reasonably foreseeable future actions (Section 10.1.22.2) occurring in the vicinity of the proposed Antonito Southeast SEZ. Together, several new solar facilities and the other actions would have a cumulative impact on wildlife. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

10.1.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other projects near solar energy development or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency, or road paving or treatment.

Other planned energy production and distribution activities in the San Luis Valley include construction and operation of two smaller (less than 300 acres [1.2 km^2]) PV facilities near the Fourmile East SEZ, and construction of a power line running east from Alamosa to Walsenburg. Construction of these projects would result in a temporary increase in particulate emissions. In addition, since the Los Mogotes East and Antonito Southeast SEZs are within about 12 mi (19 km) of each other, construction of solar facilities at the two SEZs could have cumulative impacts. However, because of the limited duration of construction activities and the likelihood that those activities would occur at different times, adverse cumulative air quality impacts are not expected. If two solar facilities were being constructed at approximately the same time at the two SEZs, specific schedules could be managed to reduce air quality impacts.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need for energy production that results in higher levels of emissions, such as coal, oil, and natural gas. As discussed in Section 10.1.13, during operations of solar energy facilities, only a few sources of air emissions exist, and their emissions would typically be relatively small. However, the amount of criteria air pollutant, VOCs, TAP, and GHG emissions that would be avoided if the solar facilities were to displace the energy that otherwise would have been generated from fossil fuels could be relative large. For example, if the Antonito Southeast SEZ were fully developed with solar facilities up to 80% of its size, the quantity of pollutants avoided could be as large as 5.7% of all emissions from the current electric power systems in Colorado.

10.1.22.4.13 Visual Resources

The San Luis Valley floor is very flat and is characterized by wide open views. Generally good air quality and a lack of obstructions allow visibility for 50 mi (80 km) or more under favorable atmospheric conditions. The proposed SEZ is a generally flat to gently rolling, largely treeless plain, with the strong horizon line being the dominant visual feature. The visual resource inventory (VRI) values for the SEZ and immediate surroundings are VRI Class III, indicating moderate relative visual values. The inventory indicates relatively low levels of use and public interest; however, the site is within the viewshed of the West Fork of the North Branch of the Old Spanish Trail, indicating high visual sensitivity. Aside from high sensitivity associated with the viewshed of the Old Spanish Trail, the site is also visible from several ACECs and in general is close to other specially designated areas.

Development of utility-scale solar energy projects within the SEZ would contribute to the cumulative visual impacts in the general vicinity of the SEZ and in the San Luis Valley. However, the exact nature of the visual impact and the mitigation measures that would be appropriate would depend on the specific project locations within the SEZ and on the solar technologies used for the project. Such impacts and potential mitigation measures would be considered in visual analyses conducted for future specific projects. In general, large visual impacts on the SEZ would be expected to occur as a result of the construction, operation, and decommissioning of utility-scale solar energy projects. These impacts would be expected to involve major modification of the existing character of the landscape and could dominate the views for some nearby viewers. Additional impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines.

Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy facilities. Some of the affected lands outside the SEZ would include potentially sensitive scenic resource areas, including the West Fork of the North Branch of the Old Spanish Trail, the San Luis Hills and San Antonio WSAs; the San Luis Hills, San Antonio Gorge, and Cumbres & Toltec Scenic Railroad scenic ACECs; the Los Caminos Antiguos Scenic Byway, the Cumbres & Toltec Scenic Railroad and its historic depot, and the communities of Antonito and Conejos. Other sensitive visual resource areas, including congressionally designated wilderness areas, WSRs, national scenic trails, and scenic highways would also be subject to minor or minimal visual impacts. Visual impacts resulting from solar energy development within the SEZ would be in addition to impacts caused by other potential projects in the area such as other solar facilities on private lands, transmission lines, and other renewable energy facilities, like wind mills. The presence of new facilities would normally be accompanied by increased numbers of workers in the area, traffic on local roadways, and support facilities, all of which would add to cumulative visual impacts.

In addition to cumulative visual impacts associated with views of particular future development, as additional facilities are added several projects might become visible from one location, or in succession, as viewers move through the landscape, such as driving on local roads. In general, the new projects would likely vary in appearance, and depending on the number and type of facilities, the resulting visual disharmony could exceed the visual absorption capability of the landscape and add significantly to the cumulative visual impact.

10.1.22.4.14 Acoustic Environment

The areas around the proposed Antonito Southeast SEZ and in the San Luis Valley area, in general, are relatively quiet. The existing noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal noise, industrial activities, and community activities and events, along with OHV use across the SEZ. The construction of solar energy facilities could increase the noise levels over short durations because of the noise generated by construction equipment during the day. After the facilities are constructed and begin operating, there would be little or minor noise impacts for any of the technologies except from solar dish engine facilities and from parabolic trough or power tower facilities using TES. If one or more of these types of facilities were to be constructed close to the boundaries of an SEZ or on different SEZs relatively close to each other (i.e., Antonito Southeast and Los Mogotes East), residents living nearby could be affected by the noise generated by these machines, particularly at night when the noise is more discernable due to relatively low background levels.

10.1.22.4.15 Paleontological Resources

Little surveying for paleontological resources has been conducted in the San Luis Valley. For reasons described in Section 10.1.16, few, if any, impacts on significant paleontological resources are likely to occur in the proposed SEZ. However, the specific sites selected for future projects would be surveyed if determined necessary by the BLM, and any paleontological resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. No significant cumulative impacts on paleontological resources are expected.

10.1.22.4.16 Cultural Resources

The San Luis Valley is rich in cultural history with settlements dating as far back as 11,000 years. Several geographic features in the valley may have cultural significance. However, as the area occupied by the proposed Antonito Southeast SEZ has not been surveyed for cultural resources, no archeological sites, historic structures or features, or traditional cultural properties have been formally recorded within the SEZ. There are, however, several historic properties, including a scenic railroad and a historic trail, located in close proximity to the SEZ. 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, could contribute cumulatively to cultural resource impacts. However, the specific sites selected for future projects would be surveyed, and any cultural resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. Similarly, through ongoing consultation with the Colorado SHPO and appropriate Native American governments, it is likely that most adverse effects on significant resources in the San Luis Valley could be mitigated to some degree, but not necessarily eliminated.

10.1.22.4.17 Native American Concerns

Government-to-government consultation is under way with Native American governments with possible traditional ties to the San Luis Valley. To date no specific concerns regarding the proposed Antonito Southeast SEZ have been raised to the BLM. The Jicarilla Apache have judicially established a tribal land claim in proximity to the SEZ, but on the basis of available maps, the claim does not appear to include any portions of the SEZ and should not contribute to any impacts on that claim. Blanca Peak has been identified as a culturally significant mountain for the Navajo, the Jicarilla Apache, and possibly the people of the Taos Pueblo. 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, could contribute cumulatively to visual impacts in the valley as viewed from Blanca Peak and to the loss of traditionally important plant species and animal habitat. Continued discussions with the area Tribes through government-to-government consultation is necessary to effectively consider and mitigate the Tribes' concern tied to solar energy development in the San Luis Valley.

10.1.22.4.18 Socioeconomics

Solar energy development projects in the proposed Antonito Southeast 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 projects 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 120 to 1,600 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 220 (solar PV) to as high as 3,000 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar facilities would occur to the extent that multiple construction projects of any type were ongoing at the same time. It is a reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ occasionally over the 20-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 projects in the area. The number of workers needed at the solar facilities would be in the range of 17 to 340, with approximately 24 to 530 total jobs created in the region. Population increases would contribute to general upward trends in the region in recent years. The socioeconomic impacts overall would be positive, through the creation of additional jobs and income. The negative impacts, including some short-term disruption of rural community quality of life, would not likely be considered large enough to require specific mitigation measures.

10.1.22.4.19 Environmental Justice

Minority populations have been identified within 50 mi (80 km) of the proposed SEZ in both Colorado and New Mexico; no low-income populations are present. Any impacts from solar development could have cumulative impacts on minority 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, fugitive dust, and loss of agricultural jobs from conversion of lands. However, these impacts are not expected to be disproportionately high on the minority populations. If needed, mitigation measures can be employed to reduce the impacts on the population in the vicinity of the SEZ, including the minority populations. As the overall scale and environmental impacts of potential projects within the ROI are expected to be generally low, it is not expected that the proposed Antonito Southeast SEZ would contribute to cumulative impacts on minority and low income populations.

10.1.22.4.20 Transportation

A two-lane highway (U.S. 285) passes by the proposed Antonito Southeast SEZ. CO 17 is approximately 2 mi (3 km) northwest of the SEZ. The SLRG Railroad also serves the area. The AADT on these highways currently ranges from about 1,300 to 3,900. During construction activities, there could be up to 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT on these highways 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 additional future projects in the area. However, if construction were occurring concurrently in the proposed Antonito Southeast and Los Mogotes East SEZs, which are relatively close to each other and are both served by U.S. 285, the increase in traffic during shift changes could be significant. Local road improvements may be necessary near site access points. Any impacts during construction activities would be temporary. The impacts could be mitigated to some degree by having different work hours within an SEZ or between two SEZs. Traffic increases during operation would be relatively small because of the low number of workers needed to operate solar facilities and would have little contribution to cumulative impacts.

10.1.23 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.

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